

National Golden Eagle Colloquium

March 2-3, 2010: Carlsbad Fish and Wildlife Office, Carlsbad, California
Organized by: Dr. Jeep Pagel, Dr. Eric Kershner, Diana Whittington and Dr. George Allen

85 participants from various agencies across the country attended the National Golden Eagle Colloquium on March 2-3, 2010 at the Carlsbad Fish and Wildlife Office. Goals of the workshop:

- Gain a better understanding of golden eagle ecology and conservation issues
- Formulate considerations necessary for impacts analysis
- Achieve coordination consistency among Federal and State agencies



Guest Speakers From:

- University California, Davis
- The Peregrine Fund
- Hawkwatch International
- Wildlife Research Institute
- Bloom Biological
- United States Fish and Wildlife Service
- United States Bureau of Land Management



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**National Golden Eagle Colloquium
Minutes and Notes¹
March 2-3, 2010
Carlsbad, California**

Goals:

1. Gain better understanding of Golden Eagle ecology and conservation issues.
2. Formulate considerations necessary for impacts analysis.
3. Achieve coordination consistency among Federal and State agencies.

Dr. Eric Kershner

Migratory Bird Biologist, Pacific Southwest Region (Region 8), USFWS

Welcome and housekeeping.

Marie Strassburger

Migratory Birds Division Chief, Pacific Southwest Region (Region 8), USFWS

Issues at Hand

1. The colloquium was developed to bring together state and federal agencies from west of the 100th meridian to discuss Golden Eagle and stems from the recent Federal Eagle rules published in the federal register, and last year's BLM Fast-Track project list. How do Federal and State agencies address migratory birds, especially impacts on eagles; and how specifically will the agencies protect and conserve Golden Eagles under the new rule?
2. How do we address migratory bird impacts and Golden Eagle impacts associated with the fast-track renewable energy projects? What is needed right now (in absence of some finalized documents)? How do we incorporate Golden Eagle field experience into the solution?
3. Per Golden Eagle ecology and biology; what do we know/don't know? Current guiding policy approaches are based on Bald Eagles; Golden Eagle specific approaches are important to develop.
4. The agencies need a standardized monitoring protocols and overall conservation strategy to address current year projects and concerns during this breeding season. This is much larger than the U.S. Fish and Wildlife Service (Service); we need expertise and collaboration among a variety of stakeholders.
5. The Service is developing Avian and Bat Protection Plan (ABPP) Guidelines for Wind Energy Projects for Region 8, and a National Golden Eagle Conservation and Management Plan, though these are not finalized yet. The Interim Inventory and Monitoring protocol will be released as a draft to the agencies for use at this meeting and this field season.
6. The colloquium was intended as an informational meeting where the intent was to provide basic information, discuss implications, and develop methods to work together to benefit Golden Eagles. This colloquium is not to develop policy.

¹ Notes contributed by: Ms. Jennifer Brown, Dr. Eric Kershner, Ms. Michelle Moreno, Dr. Robert Murphy, Dr. Jeep Pagel, Ms. Marie Strassburger, Ms. Janet Stuckrath and Ms. Diana Whittington. **These minutes were collated from handwritten and typed notes, and are not intended to be a stenographic account, or complete transcription of the presentations.**

7. Thanks to Dr. Pagel and Dr. Kershner for leading this interagency effort to convene national experts and multiple agencies to this colloquium to generate good science.

Diana Whittington,
National Raptor Lead, Division of Migratory Bird Management, USFWS, Washington Office,

Bald and Golden Eagle Protection Act (BGEPA/Final Rule/Eagle Act)

1. Need for site specific, regional and national information is critical.
2. Federal agencies have responsibilities under Executive Order 13186 to ensure that Federal actions do not have adverse effects on avian populations.
3. The Final Rule (74 FR 46835) includes definitions for mitigation, take, and cumulative impacts.
4. The Eagle Act is a preservation standard; this does not mean determining how low the populations can get before eagles are listed under the Endangered Species Act.
 - a. Authorize take only where it is compatible with the preservation of eagles.
 - b. Stable or increasing populations are important.
 - c. The regulations will improve our ability to maintain stable populations in light of current lethal and sub-lethal effects.
5. The Bald and Golden Eagle Act uses NEPA definitions for cumulative effects and mitigation; not Endangered Species Act. National Environmental Policy Act (NEPA) analysis needs to determine whether or not projects are consistent with supporting a stable or increasing bald and Golden Eagle population.
6. Our management goal is to prevent the decline of breeding populations.
7. The Final Rule's definition of disturb is defined in regulations at 50 CFR 5226; 22.3 as: "to agitate or bother a bald or Golden Eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."
8. Implementation guidance on the regulations should be released shortly, and will be made available for public comment.
9. The USFWS will encourage partnering with other agencies to work through the NEPA analysis, as well as coordinate and consult with each other.
10. Under the regulations, programmatic permits will only be authorized where the use of Advanced Conservation Practices (scientifically supportable measures that are approved by the Service and represent the best available techniques) have reduced eagle disturbance and ongoing mortalities to a level where remaining take is unavoidable. For golden Eagles, programmatic permits would also have to achieve "no net loss" to the breeding population. Programmatic take means take that is recurring, and that occurs over the long term or in location/locations that cannot be predicted.
 - a. Refer to rule for hierarchical order of permit allocation.
11. The Service can currently only authorize permits that result in "no net loss to the breeding population" of Golden Eagles. This is due to the zero-take threshold for

Golden Eagles. “No net loss to the breeding” can be obtained by reducing existing ongoing unauthorized take. However, we must also take into consideration the Service’s responsibilities to the rights of Native American religious practitioners under the Religious Freedom and Restoration Act.

12. At this time, the Service will only issue Golden Eagle individual permits for safety emergencies, and other permits that will result in a reduction of ongoing take or “no net loss to the breeding population,” and for previously authorized activities such as Indian religious purposes, scientific or exhibition purposes, and take of depredating eagles.
13. The Service can only issue Golden Eagle individual permits if there is no net loss to the breeding population, which may be reached through mitigation. At this time, the USFWS is issuing limited individual permits, with mitigation measures, for disturbance of Golden Eagles or relocation of nests.
14. Applicants for a permit will need to demonstrate that they have already incorporated into their project designs all practicable (individual permits) or maximum degree technically achievable (programmatic permits) avoidance and minimization measures to avoid take, and can show the short and long term effects of their actions; this will include the best available information, as well as pro-actively acquiring data regarding current surveys, analysis of forage habitat used and degraded via a rigorous cumulative effects analysis, etc.
15. Mitigation; avoid and minimize take to the degree practicable first.
 - a. When applying for a permit, the project proponent and/or action agency will need considerable documentation to support their position; this may include inventory and monitoring, telemetry, wintering studies, and analysis of forage habitat.
 - b. Must demonstrate that they have implemented all practicable avoidance and conservation measures for a project before getting a permit.
 - c. Pro-active compensatory mitigation is allowed and may be necessary.
 - d. These permits come with additional tribal trust responsibilities; Agencies must coordinate with tribes regarding take of eagles, and when permits are limited, ensure that authorized take of birds necessary to meet the religious need of a Native American Tribe will not be denied due to other take being authorized for another purpose.
16. The Final Rule includes a section specific to eagle nest take. 22.27 – nest take – permits to allow the intentional take of eagle nests for the following reasons: human health and safety, safety of eagles, nests built on human-engineered structures where the nest interferes with the intended use of the structure, or where there is a net benefit to eagles (including projects where the net benefit is the result of compensatory mitigation measures).
 - a. Agencies will need to evaluate the relationship of an individual nest to the cluster of nests in that territory. For example, if the nest in question is the one nest out of ten alternate nests that has been occupied the majority of the last fifteen years, actions that would disturb eagles at that location, or actions that would result in the loss of that nest, would likely have a greater impact to the

territory than if they occurred at another nest that had not been routinely occupied.

17. We need to track cumulative effects for eagles across all USFWS regions. Cumulative effects analysis for individual projects is currently set at the average natal dispersal distance for Golden Eagles of 140 miles radius extending out from the project footprint.

Erica Craig Raptor Ecologist, Bureau of Land Management, Fairbanks, Alaska

Ecology of the Golden Eagle

1. Erica served as one of the four authors of the Birds of North America Online Golden Eagle species account (Kochert *et al.* 2002 was provided as a handout), which to date is one of the key Golden Eagle references.
2. Raptors are more susceptible to bioaccumulation due to their predatory status and their trophic position. Due to their trophic position, raptors are representative of ecological change, and can be compared to the "*canary in the mineshaft*" by reflecting environmental change.
3. Golden Eagles are found in a variety of habitats, and are dependent upon native vegetation and intact native habitats. Mostly found nesting west of the 100th meridian (Alaska to central Mexico). Few found in eastern United States. Have been found in the winter throughout all of North America.
4. Golden Eagles have a large range both spatially and temporally, and are important to indigenous people and cultures.
5. There are practical reasons for conserving Golden Eagles; they are long-lived raptors, and large ranging. They are representative of ecological change throughout their range. Land managers must understand distribution and abundance of Golden Eagles to implement management actions.
 - a) Drought (short and long term) has consequences; non-native invasives cause encroachment, and increasing fire frequency.
 - b) Many other challenges; energy development, fragmentation due to urban development and degradation of habitat caused by more people.
 - c) Increases in human population, new energy developments, and habitat loss and fragmentation negatively affect eagle populations.
6. Golden Eagles are found worldwide in the Northern Hemisphere; there are six subspecies worldwide. May be found in open mesic to xeric habitats, and will nest on cliffs, in trees, and occasionally on human made structures.
7. They are slightly smaller than bald eagles, and take advantage of thermals and wind drafts along ridges.
8. Reversed sexual size dimorphism; females are larger than males; the size difference is especially noticeable in the feet.
9. Very large bird; 6.5-7.5 foot wingspan (which is the source of their increased risk of electrocution and powerline impacts), 8-13 lbs.

10. Golden Eagles are a lighter brown around the neck, and their legs are feathered down to the toes. Bald Eagles have a naked (non-feathered) tarsus.
11. Sub-adult Golden Eagles have white on the tail and wings in a distinct pattern, bald eagle sub-adult white areas are splotchier.
12. North American Golden Eagles have the least variety of prey species, 90% of their diet consists of mammal species, including jackrabbits, marmots, ground squirrels, snowshoe hares. They can switch and feed on other prey items such as gallinaceous birds (sage grouse), owls, snakes, tortoises, and fish.
13. They hunt from a perch, from a soar, or via “contour hunting” – which involves one bird flying above and one bird flying below to flush the prey.
14. Sub-adults eat a wider variety of prey species than the adults; sub-adults will eat whatever they can get.
15. They will also eat carrion, un-retrieved carcasses, and gut piles left from hunters. Road-kill may comprise up to 60% of their diet, especially in winter.
16. Ingestion of lead pellets or lead fragments in wounded wildlife, carrion and gut piles can cause lead poisoning in eagles, and is a concern internationally.
17. Golden Eagles have roosted communally when prey is plentiful, and have even roosted with bald eagles.
18. Golden Eagle home range size can vary tremendously with habitat richness and stochastic environmental events (such as fire). Home range can differ tremendously among geographic regions and even from year to year within the same region.
19. Territories have little overlap; boundaries are demonstrated by displays, including panoramic, undulating flight. Golden Eagles can display year-round, though displays are less frequent during the winter (non-breeding season).
20. New pairs will form when one bird is lost. Pair formation begins upon return to breeding areas if the Golden Eagles are migratory; territories may be occupied year round, and in those instances pair formation is maintained throughout year.
21. They have little defense behavior against other species, including humans. Human disturbance caused by people entering a Golden Eagle territory can result in nest failure. The pair leaves the nest and the eggs are exposed, it doesn't take much time or human disturbance to cause the nest to fail, or a site to be abandoned. This is why some recreation activities cause considerable difficulties to nesting Golden Eagles.
22. Timing of courtship and nest building may be influenced by latitude. Courtship and nest selection in southern California and Texas occurs between December-January, chronology a little later in northern latitudes or higher elevations.
23. The nest is a huge pile of sticks laid on a ledge or in a shallow cave. Up to 14 nests have been found in one territory. Nests are usually built on overhangs or in protected places on cliffs, though they sometimes nest in trees or on the ground. Greenery is usually placed in active and in some alternate nests.
24. Golden Eagle nests can become enormous. They have strong site fidelity and their territories are persistent over long periods of time.
25. Two egg clutches; incubation takes about 45 days. Female does most of the incubation and the male captures most of the food. Female will remain near nest for two weeks during brooding and then when young can thermoregulate, will begin hunting for food.

- Male survival (and his contribution to overall nesting success via ample food provision) extremely important. Siblicide occurs in low prey years.
26. Golden Eagles may not nest every year due to low prey availability, however they will still maintain their territories even if they are not nesting.
 27. The female does most of the incubation and the male captures most of the food. Nesting duties are divided between the sexes.
 28. Usually fewer than two young hatch per nest unless prey is really abundant. The female stays near the nest for several weeks after the young hatch, and then she begins to hunt.
 29. The siblicide rate is high when prey are not abundant— 80%, the larger nestling eats the smaller nestling.
 30. The young may continue to need parental care for months; males provide continued parental care much more than females.
 31. Birds north of 55 degrees latitude migrate southward for the winter. Birds further south may migrate regionally, move locally, or may be year-round residents.
 32. There is a positive association between public lands, especially BLM managed lands (but also to a lesser degree USFWS, NPS, USFS) and eagle wintering grounds. Golden Eagles tend to be in places with high densities of prey AND in locations with fewer people. They may be found in higher elevations with good solar exposure and low precipitation (i.e. snow).
 33. Winter ecology of Golden Eagles has been long neglected as an important conservation factor; breeding areas protected, but not wintering areas. Winter season factors influence the sustainability of the population. It is imperative to identify CORE wintering areas which will be regional specific.
 34. Non-resident Golden Eagles show annual site fidelity to preferred wintering areas, and need those areas to maintain reproductive condition.
 35. Migratory Golden Eagles from northern latitudes are negatively affected by distant human activities because they winter in southern areas.
 36. Each region is different; it is important that we do not use a one-size-fits-all approach for breeding and wintering Golden Eagle management.
 37. Floating population of Golden Eagles are an important portion of the Golden Eagle population; takes up to 5 years before they breed, and during this time they either take up residence in an area with favorable prey density, or move around favorable habitat. Subadults have a larger winter range than adults. Mortality during this time as floaters may be affecting long term population stability.
 38. Home range size is highly variable; may be as low as 6.5 - 25 sq. km in areas with high prey density (Idaho), to at least 518 sq. km.
 39. Humans cause more than 70% of recorded deaths from accidental collisions, electrocution, impact with wind turbines and power lines, poisoning, gunshot, etc. 30 – 50 % of Golden Eagles have elevated blood lead levels.
 40. Golden Eagle populations throughout the intermountain west may be declining due to increasing threats and causes of mortality/loss of habitat.

Dr. Jeff Smith

Science Director, HawkWatch International, Salt Lake City, UT

Golden Eagle Migration Ecology and Count Trends in North America

1. Many studies of Golden Eagles migration count and banding studies are ongoing. See *State of North America's Birds of Prey* (Bildstein et al. 2008) for recent synopsis of current levels of raptor migration. Currently 20 long term sites in western North America where raptor migration monitoring (counts and banding) have occurred.
2. Golden Eagles have residents, wanderers, long and short distant migrants, and altitudinal migrants.
3. Golden Eagle autumn migration timing: August 20-November 27 (captures aggregate 95% bulk of passage periods). Peak is September and October.
4. Spring migration timing: February 25-May 3
5. Sub-adults move earlier than adults during the autumn migration.
6. Adults move earlier than the young-adults during the spring migration; migration is protracted in spring.
7. Highly variable movements based on age, resident birds and birds from northern latitudes.
8. Golden Eagle autumn migration timing has a relationship to regional drought severity – there is a trend in delayed migration due to droughts in the west, there is an opposite effect in other areas of the country. This warrants caution for using migration counts for population trends due to variability of some movement patterns between years.
9. Movement of juvenile Golden Eagles from southwest Idaho – they disperse in almost all directions and travel great distances. Golden Eagles comprise most of raptor migrants in Alberta and Montana. Large numbers of Golden Eagles move through Manitoba and Alberta in spring and fall. Few Golden Eagles appear to migrate along west coast.
10. Movement in Utah – most birds stayed relatively near the natal area; 62% stayed within the Great Basin; 31% were long distance migrants. This may be the case in more xeric and warmer habitat that is lower latitude. Movements in Utah appeared to be correlated with later passage when wetter weather occurred.
11. Little movement for California Golden Eagles; work from central California suggested that most stayed within 100-150 km of the natal area, however some birds moved up to 1400 km away from the natal area.
12. Satellite tracking from Alaska shows that most birds moved more than 250 km from their natal areas, with most wintering in north western Great Plains. Youngest Golden Eagles traveled the furthest.
13. Movement patterns are highly variable but most Golden Eagles do not travel large distances from natal sites if they can help it (prey and availability of nest sites are often limiting factors); rarely do Golden Eagles in the west cross the Continental Divide.
14. May be shifts in movement patterns due to global climate change; some birds may be staying further north each year. However, in the past Golden eagles that remain further north in the winter have lower survival rates.

15. HWI Golden Eagle satellite tracking from 1999-2009 showed that there are some regional residents in all areas and there are some long-distance migrants in most areas.
16. Golden Eagles don't have migration route or winter range fidelity. Golden Eagle winter ranges are variable, and tend to shift northward as Golden Eagles age.
17. Golden Eagle regional movement patterns: primarily migratory in Alaska and western Canada, medium/long distance migrations (1000s of km).
18. Raptor Population Index (RPI) – <http://www.rpi-project.org>
19. Snowshoe hare population lows are associated with drought.
20. Golden Eagle population fluctuations in the northern Rocky Mountains are associated with snowshoe hare population highs and lows.
21. Vehicle collisions and electrocutions are the primary causes of mortality during migration, as noted by band returns. There are still considerable electrocutions due to inappropriate design of facilities and places where electrocution hazards have not been remediated by the power companies. In one location in Wyoming, there was mortality of over 200 Golden Eagles due to lack of appropriate 'raptor safe' designs on power lines.
22. There is a high use, i.e. "popular" Golden Eagle winter range in south/southeast New Mexico, west Texas, and the northern Sonoran Desert. Golden Eagles arrive here from multiple regions.
23. There is a slight rebounding of Golden Eagle migration counts in few smaller regional areas, which could be associated with cyclical jackrabbit populations. However all of the trend data for a variety of migration monitoring sites showing a decline in incidence of Golden Eagle.
24. Many high use or "popular" Golden Eagle winter range areas correspond to areas of ongoing or planned energy development on federal lands, and military land. These open habitats offer many advantages to migrating and wintering eagles.
25. There is a mix of regional residents and northern migrants at most migration monitoring sites.
26. Long term migration monitoring will require sub-continental scale monitoring in addition to regional approaches. Some individuals will annually follow a very distinct migration route south and north, and show route fidelity. Others are more diverse in their actual migration routes. The short message is that Golden Eagle populations are showing a significant downward trend at migration counting locations in the west.

Dr. Terra Kelly

Veterinarian, UC Davis Wildlife Health Center, University of California, Davis

Lead Exposure in Golden Eagles

1. Scavengers are exposed to lead bullets, pellets and fragments found in carcasses and offal piles left by hunters (Hunt et al. 2006). Lead ammunition is designed to fragment upon impact; small lead fragments may be found up to six inches from the entry wound. The source of exposure of raptors to lead is lead ammunition.

2. In Wyoming 50% of ravens had elevated lead levels during hunting season. There is a correlation between local hunting pressure and elevated lead levels in scavenging birds. 74% of eagles had elevated lead levels (47 bald eagles and 16 Golden Eagles).
3. In Montana 85% of migrant Golden Eagles in the spring had elevated blood lead levels and 56% of migrant Golden Eagles in the autumn had elevated blood lead levels.
4. Lead levels (blood lead level) in raptors are elevated with the hunting season, and correlated with local hunting pressures. Highest lead levels in raptors associated with deer season.
5. In California, Golden Eagles and California Condors; 36% had elevated lead levels. Lead accumulation in the California condor led to non-lead ammunition legislation. California banned lead ammunition in the range of the California Condor in 2008 which was very controversial. More data is necessary prior to expansion of the ban to other areas in the state.
6. The Fish and Game Commissioner in California approached the UC Davis Wildlife Health Center with research questions, and asked if the Wildlife Health Center could look for a correlation between hunting intensity and lead exposure in scavenging birds.
7. The study compared lead exposure levels during the hunting season and during the off-season. It was found that a scavenger (Turkey Vultures) blood lead levels were higher during deer hunting season than during the off-season.
8. A correlation was found between hunting intensity and scavenger bird lead exposure levels. When hunting intensity was low, blood lead levels were low in scavenger birds. When hunting intensity was at a medium level, blood lead levels were also at a medium level. When hunting intensity was high, blood lead levels were high in scavenger birds.
9. The study also included pre- and post-lead ammunition ban sampling. Fifteen birds that had been captured pre-ban were recaptured post-ban.
10. Post-ban blood lead levels were significantly lower than pre-ban blood lead levels; recaptures showed 36% vs 6 % post ban (turkey vultures), and 53% vs 18% post ban for Golden Eagles. Preliminary results suggest 50% of Golden Eagles (n=13) and Turkey Vultures (n=26), and 100% of Ravens (n=2) have elevated lead levels. Lead caused death is being documented.
11. Golden Eagle post-ban blood lead levels were found to be lower than pre-ban blood lead levels.
12. The Wildlife Health Center has been working with wildlife rehabilitation centers to document lead exposure, rodenticide exposure, and deaths of predatory birds that arrive at rehabilitation centers. Tissue lead levels are measured and cause of death is determined.
13. Impacts of lead on Golden Eagle populations are unknown, as well as long-term subclinical effects of lead.
14. More data is needed on cause-specific mortality, including primary and secondary causes. Rotenticides were also present at toxic levels in all species sampled.

There appears to be widespread exposure to lead and rodenticides for Turkey Vultures, Golden Eagle and Ravens. More information is needed on how these problems and other undetected diseases impact avian populations.

15. Blood lead levels increase a day or two after ingestion, and begin to decrease after two weeks if the lead fragments or bullet is passed out of its system. Absorbed lead can remain in the blood a long time, and can be found in bones. Long term effects of lead are unknown.
16. More information is available regarding the effects that lead has on humans than for birds. In humans lead is known to reduce reproductive success and cause neurological problems. If the effects of lead exposure in raptors is comparable to humans, elevated lead levels may impact flight ability and the ability to avoid collisions. Golden Eagles with lead poisoning may be weaker and more susceptible to other threats.

Dave Bittner, Director, Wildlife Research Institute, Ramona CA

Disturbance Issues Affecting Golden Eagles in Western North America

1. Territorial pairs of Golden Eagles in San Diego County, California have been declining over the years.
2. Used work from Dixon, who conducted his work in late 1800's. Currently 53% decline since the late 1800's (49 pairs remained in 2009). Correlative decline of Golden Eagles observed in California.
3. The Wildlife Research Institute has banded 382 Golden Eagles and has been attaching transmitters to track their movements.
4. In the 1990's rock climbing began at Corte Madera, causing the resident Golden Eagles to abandon the site.
5. Many adults were lost during the catastrophic fires in San Diego County. 14 out of 47 Golden Eagle pairs were affected by the fires in 2007, only one of the 14 pairs reproduced the following year.
6. Golden Eagle reproduction declines during drought and fire years, and increases during El Niño years.
7. In San Diego County 4% of Golden Eagle pairs nest in oak trees, 79% of pairs nest on cliffs, and a few pairs nest on Douglas fir trees.
8. Almost all pairs lay two eggs, typically only one egg hatches.
9. There is almost no overlap between territories. Golden Eagles will kill each other at territory boundaries.
10. Habitat loss and human disturbance are primary threat to Golden Eagles; this results in lost productivity or abandoned nests.
11. For example; new trails were built to cliff tops where Golden Eagles nest. Eagles stopped nesting on those cliffs due to human disturbance. Rock climbers also disturb nesting eagles, which results in nest abandonment.

12. New housing developments have been built near cliffs, increasing the number of people that explore cliff areas.
13. Recreation (OHV and Rock Climbing) are causing significant negative impacts to Golden Eagles. Rock climbing activities are expanding. The Wildlife Research Institute has been working with the Forest Service to close cliffs to climbing during the breeding season. Climbers trespass and climb up to the eagle nests anyway, resulting in nest failure. One nesting pair has a housing development within a half mile of the nest. People have begun frequenting the cliff for hiking, graffiti, and other reasons. There is also a large transmission line passing close to the nest that may result in collisions. OHV recreation appears to be causing site abandonment.
14. An example is the Mohave nesting area on BLM habitat in 2003 and 2008; only one Golden Eagle nesting success for each of those years out of 27 nest sites. Most failures probably related to OHV recreation. OHV areas are expanding illegally.
15. Satellite tracking is probably the way to go to get good data on Golden Eagle movement and habitat use. Satellite telemetry can also provide information about altitude which would provide additional information for wind power generation.
16. Drought has a negative effect on Golden Eagle productivity. The year 2003 was the end of a five year drought in southern California. Out of a total of 112 Golden Eagle nests, there were only 10 successful nests.
17. Electrocutation is also a cause of mortality in Golden Eagles, and could be prevented. Man-made perches (power poles and towers) are often fatal; the power industry is slow to retrofit existing poles to prevent avian electrocutions.
18. Another cause of Golden Eagle mortality is secondary poisoning. Ground squirrels and prairie dogs are frequently poisoned, and Golden Eagles ingest the poison by eating carcasses.
19. Golden Eagles make long-distance migrations. Birds tagged in San Diego County were retrieved after collisions at Altamont Pass and Tehachapi Pass Wind Resource Areas.
20. Golden Eagle number 91 migrated between San Diego and San Mateo Counties, demonstrating that these birds can move long-distances.
21. "Gopher" eradication has reduced the Golden Eagle winter food supply significantly.
22. Another risk that eagles face is lead poisoning from big game hunting gut piles; i.e. lead poisoning.
23. The Wildlife Research Institute has found that some Golden Eagles always use the same migration route; route fidelity.
24. There are proposed wind projects in the Granite Mountain area and Daggett Ridge in the Mojave Desert. Juvenile Golden Eagles are likely to be negatively affected by wind projects, and breeding pairs may also be negatively affected. The proposed Daggett Ridge wind development would completely surround an existing Golden Eagle nest with wind turbines, likely resulting in collisions.
25. Human disturbance early in the nesting season prevents Golden Eagle use of nests.
26. It's important to thoroughly review the reports that agencies receive from project proponents. Not all information is being presented for the projects. Project proponents may incorrectly report the number of nests in the vicinity of the project

- area, or by through inexperience or via misleading statements misidentify Golden Eagle nests as raven nests.
27. Solar developments result in large losses of foraging habitat.
 28. Mining activity can also cause Golden Eagles to abandon their nests.
 29. Golden Eagles will nest on transmission towers. The Bureau of Land Management was directed to open more lands to recreation, increasing nest disturbance. An abandoned nest was found on a transmission tower with a large number of empty shells at the base of the tower.
 30. More surveys with tracking and monitoring are required in order to understand how Golden Eagles use each area. Inadequate or poorly conceived inventory surveys can result in more Golden Eagle deaths that could have been prevented.
 31. Golden Eagles are an umbrella species; they require large areas of land and a decent prey-base to support them.
 32. It is important to preserve productive territories. A supply of floaters is necessary to replace all the birds lost at Altamont Pass and at other wind development projects.
 33. Birds not accustomed to human activity will flush if people go within a half mile of the nest; often the eggs die due to lack of an incubating adult. The adults may go back to sit on the nest, but the eggs are no longer viable.

Dr. Grainger Hunt Senior Scientist, The Peregrine Fund, Boise, ID
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Current Trends in Eagle Take from Energy Development and Utilities

1. Dr. Hunt conducted a 10 year mortality study of Golden Eagles at Altamont Pass Wind Resource Area.
 - a. At least 50 eagles killed/year at this site (this is likely a very low estimate). Highest estimate was 117/year which is probably high. To date, an estimated 500 total Golden Eagles killed at Altamont.
 - b. None of the recommendations to federal and state agencies to reduce the kill have been followed.
 - c. Facility commenced in 1982 and became fully operational 1987.
 - d. ~5000 turbines over 35,000 acres.
 - e. Soon after operation commenced, dead raptors were being reported.
2. The habitat at Altamont Pass consists of non-native annual grasses. Cattle graze there and ground squirrels are abundant.
 - a. It is an ideal place for GOEA to forage due to large prey base (squirrels) and good for contour hunting
 - b. It is difficult for birds to control their flight through the turbine areas at Altamont because of how fast the wind rushes through that area.
3. The Altamont Wind Resource Area is full of ground squirrels. The County requires protection of ground squirrels around the turbines because they are one of the prey species for the Federally-endangered San Joaquin kit fox.
4. Altamont pass is lethal trap for Golden Eagles and is baited with squirrels (G Hunt)

- i. Ground squirrels are a keystone species for other species in the area
 - ii. Need to keep the population of ground squirrels low but not eliminate
5. Golden Eagle populations are very sensitive to adult mortality – long lived and mature slowly.
6. Golden Eagles around the Altamont Wind Resource Area produce an average of 0.64 young per pair (ranges between 0.46-0.90 young/pair).
7. Floaters interfere with breeding pairs early during the nesting season, and participate in the population density feedback cycle. The more floaters there are, the more interference there is with breeding pair nesting attempts. If there aren't enough floaters available to fill empty positions in breeding territories, the number of breeding pairs will decline.
8. 115 Golden Eagles were tagged as itinerants, primarily in winter. 108 survived long enough to indicate their origin. 83% stayed in the area – these are resident birds.
9. Very few breeding Golden Eagles were killed by wind turbines, only two died. Few breeders are killed by turbines due to tight territories during the breeding season
10. Mostly juveniles and sub-adults were killed by wind turbines. Hunting birds tend to get hit by wind turbines. Golden Eagles do not seem to be too sensitive to the actual blades of a wind tower.
11. Subadults and juveniles are not good contour hunters and this may be a reason why they are getting hit by turbines; floaters are hit hard by turbines; (i.e. increased mortality versus local Golden Eagles).
12. Annual survival rates: Juv. 0.84, Subadults and floaters 0.79, breeders 0.91
13. Fledgling females per occupied territory = 0.231, Standard Error=0.040
14. Potential growth rate of population at Altamont: $\lambda=1.0047$
15. 77 Golden Eagle pairs (and their breeding territories) were found within 30 km of the wind development.
16. Lots of oak nesting eagles in the Altamont area – very high densities of eagles in this area.
17. Unexplained empty territories in Altamont area is chalked up to lack of recruitment.
18. During the 2005 occupancy survey, they looked for the same pairs they surveyed in 2000. If fewer breeding pairs were found in the 2005 survey than during the 2000 survey and there was no obvious reason (such as a new development in the area), they would determine that there was a floater deficiency. The 2005 occupancy survey found the same number of occupied territories as the 2000 occupancy survey, a total of 58 breeding pairs.
19. Concluded from study that floaters provide a population buffer and maintain the breeding population, but wind turbines continue to remove birds, reducing the breeding population buffer. Floaters are essential as they provide the available birds to sustain pairs at territories when one or both of the pair is lost to mortality.
20. Should we worry about Golden Eagles? Yes, because 68-89% of Golden Eagle mortality is human-related according to Grainger Hunt's data. Consider the effects of 50 turbine-strike kills: the reproductive rate=0.638 fledglings per pair, 50 kills

- consume much of the productivity for that year. Bottom line is 167 pairs are required to sustain ~50 fatalities/year caused by Altamont turbine strikes alone.
21. Rapid urban development threaten eagles at this site, any increase in mortality may tip the balance on GOEA sustainability. Golden Eagle mortality: turbine strike – 42%, electrocution – 12%, wire strike – 4%, unknown – 21%, shooting – 1%, fledgling mishap – 6%, lead poisoning – 3%, car/train strike – 5%, botulism – 1%, brodifacoum – 1%.
 22. Grainger has a developed a working model to predict population trends.
 - a. Wind farms have long reaching impacts to the population,
 23. Maximize diversity outside of the wind farm
 - a. Wind farms should not draw other vulnerable species into the trap.
 24. Other raptor species are annually struck by wind turbines (at Altamont and elsewhere) and include Golden Eagle, burrowing owl, ferruginous hawk, and red-tailed hawk, as well as many other raptor species.
 25. The turbines at the Altamont Wind Resource Area resulted in habitat loss for a number of species, including Federally-listed species such as the San Joaquin kit fox, California tiger salamander, California red-legged frog. Non-listed species affected by the loss of this habitat type include American badger and cottontail, as well as many others.
 26. Dr. Hunt recommends keeping the ground squirrel population down by shooting them with non-toxic bullets (i.e., copper). Concurrently, he recommends purchasing land off-site for conservation easements, and managing those lands for ground squirrels, rather than protecting ground squirrels at Altamont Pass and luring more predatory birds into the turbine area. Ground squirrels act as bait to lure raptors into the turbine area, which causes many to die.

<p>Robert Mesta, Coordinator, Sonoran Joint Venture, Binational Bird Conservation, U.S. Fish and Wildlife Service, Tuscon, AZ http://sonoranjv.org</p>

Golden Eagles in Mexico

1. The Sonoran Joint Venture includes southern California, southern Arizona, and the Mexican States of Sonora, Sinaloa, Baja California, and Baja California Sur, as well as the Gulf of California and its endemic islands. GOEA is a priority species for the Sonoran Joint Venture.
2. The Golden Eagle is a National Emblem in Mexico. However, little is known about eagles in Mexico
3. SEMARNAT is the Secretary of Environment and Natural Resources in Mexico, similar to the U.S. Department of the Interior.
4. Trilateral Committee for Wildlife and Ecosystem Conservation and Management includes the wildlife agencies of the U.S., Mexico, and Canada.
 - a. The Trilateral Committee takes a continental/cooperative approach to conservation of shared species and habitats

- b. The Trilateral Committee has working tables for different issues, such as Species of Common Concern, Law Enforcement, Ecosystem Conservation, Migratory Birds, CITES, Program/Product Endorsement, and the Executive Committee
- 5. Mexico T&E 101
 - a. Status in MX – listed in 1994 as T&E– listed En Peligro de Extincion (endangered species list), Lista de Especies en Riesgo del NOM-059-ECOL-1994 (established list and ranking of special status species for special protection)
 - b. 1998 down-listed to threatened
 - c. 2007 – National Priority Species – 30 species were selected for action in 2007.
 - d. PROCER – Programa de Conservacion de Especies en Riesgo.
 - e. Criteria for inclusion among the 30 species: listed under NOM-059-ECOL-2001; Five species were chosen to start with, including the Golden Eagle; recovery plans were developed for these species.
 - i. Develop and implement recovery plans between 2007 and 2012
 - f. 2008 – Recovery plan for GOEA completed
 - i. Document to guide recovery of GOEA in Mexico
 - g. Northern Mx is southern extent of GOEA
 - h. It appears the range of GOEA has contracted over time
- 6. We know very little about GOEA winter range in Mexico
 - a. Greatest threat is the loss and degradation of habitat
 - i. 98% of land in Mexico is privately owned
 - ii. Action plans developed in US do not always translate to Mexico conservation due to lack of public lands
 - iii. Lots of conversion of grazing lands to agricultural lands – very problematic
 - b. Human persecution
 - i. Shooting, poisoning, etc
 - c. Electrocutations likely very big threat – but level of impact is unknown
 - i. Most of the poles are of the old pole designs which are not raptor ‘safe.’
 - ii. Mexico lacks retro-fit programs and resources to accomplish these tasks.
- 7. La Rumorosa – large wind farm south of the border
 - i. One of three operating currently; very large areas with unknown impact to Golden Eagles.
 - ii. More are planned, but they lack the data on wind areas
- b. Cultural threats – Eagles used for ceremonial purposes.
 - i. Small impact but an impact nonetheless
- 8. Tri-lateral committee approach to conserve shared species and habitats
 - a. Important to get buy in by Tri-lateral committee before you get anywhere in Mexico.
- 9. Biggest priority in Mexico is to conduct a national survey due to the current lack of data.

Dr. Bob Murphy
Migratory Bird Biologist, Region 2, USFWS, Albuquerque, NM

WEST Transect Surveys in 4 U.S. Bird Conservation Regions

1. Surveys due to uncertainty in the population levels.
2. Some evidence suggests current population declines in Golden Eagle populations.
3. Major threats looming (global warming, wind and solar power)
4. The USFWS needed a scientifically based assessment
5. There were conflicting population assessments in literature
6. 2003 USFWS contracted WEST to design and implement survey of GOEA across western US
 - a. 2003 was a pilot year for testing methods and estimating population size and trends
 - b. Goal was to be able to detect a 3% change with 90% confidence over 20 year period
7. <http://www.west-inc.com>
8. Protocols followed Fuller et al 2001, and surveys were systematic across 4 BCRs in western United States.
9. Excluded some areas due to water or military training areas; this amounted to 7% of habitat
10. Methods used DISTANCE sampling
11. Analyzed data similar to BBS
12. Results
 - a. 21,000 GOEA were estimated in combined BCRs
 - b. 2009 – 176 birds were seen on 34% of the transects
 - c. Density highest in the Northern Rocky Mountains and nearby badlands and prairies (2009)
 - d. No significant trend evident for population decline or increase; however large error bars exist.
 - e. BCR 16 needs to be looked at a little closer, based on the lack of juveniles and low numbers over the course of the four year survey
13. What level of take is consistent with goal of maintaining a stable or increasing breeding pop?
14. Key demographic parameters for Golden Eagles appear to be;
 - a. Fecundity
 - b. Survival
 - c. # of suitable breeding areas
15. Future work will be to continue the surveys, as well as analyze extant numbers on the ground at nest sites to ground-truth the flight surveys.
16. See the Moffat's equilibrium paper by Dr. Grainger Hunt for population modeling.

Dr. Jeep Pagel
Wildlife Biologist (Raptor Ecologist), USFWS, Carlsbad, CA

Interim National Golden Eagle Inventory and Monitoring Protocols

1. These interim guidelines are what we are recommending for use during 2010 breeding season for Golden Eagles.
2. This is a living document, and has undergone three iterations of eagle specialist peer review.
3. Presentation to assist biologists and managers understand survey results when they receive them.
4. Interim inventory and monitoring protocols are meant to provide a baseline where it has not previously existed. Inventory and monitoring of Golden Eagles will provide information on effects to Golden eagles and baseline circumstances for evaluation of permit applications and permit conditions, and preparation of an Avian and Bat Protection Plan.
5. Disturb is defined at 72 FR 31132. Important to recognize that “disturb means to agitate or bother a Bald or Golden Eagle to the degree that causes, or is likely to cause, based on the best scientific information available...
6. An applicant for an Eagle Act permit request must
 - a. Collect and synthesize data,
 - b. Identify activities that might result in take,
 - c. Provide avoidance and minimization measures,
 - d. Quantify the anticipated take.
 - i. Number of eagles within the activity area,
 - ii. Use of that area by the eagles,
 - iii. Potential to take eagles,
 - iv. Scale of activity,
 - v. Measures to avoid and minimize take.
7. Distances for inventory and monitoring;
 - a. All suitable habitat within 4 - +10 miles of project footprint (or action area).
 - b. Cumulative effects analysis out to at least 140 air miles from project footprint.
 - c. Linear projects 2 – 4+ miles each side of project boundary.
8. All preceding talks are a part of protocol; Natural history, lead, OHV, Migration, additive mortality, wind electrocution, power line impact, potential mortality south of US/Mexico border, WEST surveys.
9. Prior to any survey, find out what has already been done. This may include past inventory, monitoring and research efforts, examination of past data in museum records or scientific papers.
10. Interim protocol is designed to cause essentially no disturbance if conducted by qualified biologists.
11. Work beyond what is outlined in this survey protocol for this field season is recommended;

- a. Satellite telemetry
 - b. VHF telemetry (not as highly recommended as satellite telemetry)
 - c. Foraging habitat analysis
 - d. Wintering habitat analysis
 - e. Winter surveys
 - f. Migration surveys
12. Aerial surveys recommended; most efficient for large areas.
- a. Be cautious of safety; mortalities doing aerial surveys for wildlife do happen.
13. Qualified observers
- a. All surveyors will have at least 2 seasons of Golden Eagle and/or cliff dwelling raptor work prior to surveys.
 - b. Aerial surveys will be done by raptor specialists with at least 3 field seasons in helicopter surveys on cliff ecosystems.
 - c. Above work experience accomplished prior to present year surveys will be confirmed by references (all references should be called by the agencies when reviewing reports).
14. Inexperienced surveyors will;
- a. Attend a 2 day training session conducted by a Golden Eagle Specialist (who has 5 + years of experience, peer reviewed scientific publishing experience with the species and/or a Golden Eagle banding permit).
15. At least two aerial surveys, no less than 30 days apart. Surveys timed to be most efficient per the local chronology of Golden Eagles.
16. Inventory all potential nesting habitat
- a. 4- +10 miles
 - b. 20-40 knots during flight
 - c. No closer than 10 – 20 meters from nest
 - d. < 30 second hover
 - e. Divide labor during flight.
 - f. Doors on or off is a personal decision. Dr. Pagel prefers doing aerial surveys with the door off.
17. Multiple passes on large cliffs; use GPS flight following equipment to show complete route during survey to assure coverage of the habitat.
18. No helicopter surveys in bighorn sheep lambing areas.
19. Ground surveys may be substituted for aerial surveys
20. Nesting chronology important to know prior to surveys.
21. Data to be considered for surveys include at least;
- a. Weather
 - b. Time of year
 - c. Time of day
 - d. Duration of stay at observation point
22. When observing large, long cliffs (i.e. rimrock)
- a. 1 observation point per 1.6 km.
 - b. Walking slowly along the cliff is allowed
 - c. At least 4 hours spent per 1.6 km

- d. Observation point should provide a clear view of the cliff.
 - e. Be close enough for you to identify the species
 - f. Break large cliffs down into observable parts
 - g. Examine all habitat
 - h. Observation points 300 – 1600 meters, but generally no further
 - i. At least two observation periods per season
 - j. At least 4 hours observation per visit
 - k. At least 30 days apart
23. Minimum data (every observation)
- a. Date of observation
 - b. Time of observation(s)
 - c. Weather during observation
 - d. Duration of observation
 - e. Name of observer(s)
 - f. Location of observation
 - g. Description of observation
24. Data collected during inventory and monitoring
- a. Nesting status
 - b. Nest location
 - c. Nest elevation
 - d. Age class of Golden Eagles observed
 - e. Document nesting chronology
 - i. Clutch complete
 - ii. Hatch date
 - iii. Fledge date
 - iv. Date nesting failure first observed
 - v. Number of young at each visit
 - vi. Digital photographs [landscape of area, landscape view of territory, and nest(s)]
 - f. Collect additional data if possible (not required, but helpful)
 - i. Bands
 - ii. Forage locations
 - iii. Prey items
 - iv. Height of nest on cliff or tree
 - v. Overall cliff height
 - vi. Nest aspect
 - vii. Other nesting raptors present
25. If the data is collected and reported honestly, it will provide pertinent information useful for management and permit applications.
26. Inventory and monitoring is relatively easy when to contrast to other data which will also be necessary for long term Golden Eagle conservation.
27. Golden Eagle conservation is complex; but not a Gordian Knot, nor will it go away.
28. Peregrine Falcon monitoring and management efforts have created a positive and practicable model to follow. Efforts to conserve peregrine falcons were aided by;

- a. Standardized observation protocol
 - b. Site specific management plans
 - c. Data collation and sharing
 - d. Sampling methodology, and other work (eggshell, prey and addled egg collection)
29. Difficulties of 'rescuing' or Golden Eagles if their population level crashes, or recovery if Golden Eagles are ever listed, will make the Peregrine Falcon effort look easy. It may not be possible to recover Golden Eagles if their population level gets too low because of their complex natural history and biology.

Pete Bloom President, Bloom Biological, Santa Ana, CA
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Data gaps

1. Who is most effective for GOEA conservation
 - a. State and feds have the rules and regulations – but little enforcement
 - b. County – has permitting responsibilities
 - c. Consultants – tied to clients
 - d. NGOs – has the biggest hammer, “lawsuits” – can hold up projects
 - i. Can have an immediate impact, by forcing the enforcement of the regulations
2. There is less work going into pre-siting wind project than previous
3. Power of MBTA
 - a. Trickle down from Altamont has severely weakened the enforcement of illegal take
 - b. Trickled down to AC-8 shooting (condor) – reduced penalties
 - c. This weakening has given project proponents more power to do what they want
4. We know very little about any other wind farms besides Altamont
 - a. There is a lack of reporting from all other operational sites
 - b. Lack of post-construction monitoring
5. Lots of threats: habitat loss, human persecution, electrocution, poisoning, collisions, renewable energy, climate change
6. Electrocution is a VERY serious issue in California
 - a. How can we change this with power companies in our region?
7. Consulting agreements and non-disclosure agreements
 - a. Consultants are hired to provide their opinion to client, thus there is less information that flows out to agencies
 - b. Many times the consultants opinion is ignored or buried
 - c. How does USFWS see the data being collected?
 - i. Require the information be reported – but sometimes the reporting is distorted

8. Riverside County solution – the actual contract is with the county, consultants sign agreement that means they provide the data to the county itself
 - a. This works for USFWS only when they have regulatory authority
9. How specific should information be – disclosure of nest site locations?
 - a. Creates a different set of issues
 - b. Release of data causes new disturbances and presents a real risk.
10. Workload Analysis
 - a. Solar – deserts and foraging habitat
 - b. Wind – nesting habitat
 - c. Distribution lines – positive and negative
 - d. Land development – nesting and foraging habitat
 - e. Pure research – productivity, population dynamics, natal dispersal, prey density dynamics
 - i. Population level studies are needed, especially prey information and natal dispersal (no published data at this time)
11. Satellite Telemetry – fast data gathering technique, but need to couple with ground survey/monitoring information
 - a. Home range use
 - b. Post-fledging movements
 - c. Long-distance migration
 - d. \$4000/transmitter, \$1000 data analysis/year
12. Expectations of energy project proponents
 - a. Eagles should be considered a high priority by projects
 - b. Perceived license to take eagles - Altamont
13. We need to think outside the box
 - a. Many birds move long distances
 - b. There is a lot of information we don't have on eagle movements – this needs to be explored

Questions Posed at the Golden Eagle Colloquium 2-3 March 2010 Carlsbad Fish and Wildlife Office

- 1. Does the definition of “disturb” include loss or degradation of an eagle’s wintering habitat (e.g., foraging or roost sites)?** There is a difference between protecting habitat per se, and protecting eagles in their habitat. The definition of disturb protects eagles from certain effects to the eagles themselves that are likely to occur as the result of various activities, including some habitat manipulation. The BGEPA contains no provisions that directly protect habitat except for nests; however, manipulation of important eagle use areas, including nests and communal roosts, that result in a prohibited “take” under the Eagle Act would constitute a violation of the Act. Therefore, roost sites are accorded protection under the definition to the degree that their loss would result in eagle disturbance. For example, if destruction of an important bald eagle winter roost site would agitate the eagles that roost there and interfere with feeding and/or sheltering significantly enough to decreasing productivity, then the roost destruction could constitute a violation. **If yes what compensatory measures would Migratory Birds Division recommend to offset impacts to wintering eagles and their habitat?** For bald eagles: the same kind of measures used under ESA for compensatory mitigation. For golden eagles: measures can include ensuring that all utility infrastructure employs or is retrofitted to employ standard practices per the APLIC guidelines, ensuring protections for and avoidance of areas that have been identified as winter concentration areas, protection and enhancement of prey populations.

Another key point for federal agencies is that Executive Order 13186, which is in furtherance of the purposes of, among other bird-related statutes, the Bald and Golden Eagle Protection Act (16 U.S.C. 668–668d), defines migratory bird resources as "migratory birds and the habitats upon which they depend". Implicit in this is the understanding that restoration and enhancement (Section 3 (e)(2) of eagle habitat is included.

- 2. How can the new BGEPA regulations help with protection of GOEA that are threatened by disturbance that *doesn't* go through NEPA analysis (e.g., on-going recreational activity)?** Entities that disturb Golden Eagles may be subject to prosecution by USFWS Law Enforcement. In addition, in the Final Environmental Assessment on the regulations, we identified multiple sources of unregulated take that are likely to be contributing to population pressures. To address those sources of unregulated take we committed to a national golden eagle-specific conservation and management plan that would lay out a roadmap for reducing currently occurring take.

3. With all the pressures impacting GOEA, is “no net loss to the breeding population” realistic? In many areas, yes, however it will require creative methods to achieve. In some areas, measures may be expanded outside of the Bird Conservation Region, but only when a population connection with those other areas is demonstrated. In addition, getting to "no net loss to the breeding population" may only be achievable through cooperative, landscape-scale efforts of multiple parties. Piece-mealing mitigation and conservation, one project at a time, will likely be ineffective, and place a disproportionate burden on individual proponents.

4. **What is the best biopolitical strategy to start addressing technical and management oriented issues, such as the winter ecology of the GOEA and its relevance to golden eagle life history and survival?** The Service will soon begin to develop winter/migration monitoring protocol which may be used in Golden Eagle winter habitat. The action and regulatory agencies will need to be aware and vigilant in remembering that wintering habitat may be as important to a segment of Golden Eagles as breeding habitat, and may comparably require conservation and protection. The Service encourages entities to evaluate their existing policies, guidance, and comprehensive plans (including land use plans) to ensure they have provisions for managing Golden Eagles in a manner 'compatible with the preservation of eagles', which the Service has interpreted to mean, "compatible with the goal of stable or increasing breeding populations". We also encourage development of geographic area Golden Eagle conservation plans as step-down plans to the National Golden Eagle Conservation and Management Plan, once it is completed.

5. **What are appropriate data to collect to inform a suitable risk analysis?** Please refer to the Interim Golden Eagle Inventory and Monitoring Protocol for a list of the basic data to collect during inventory to search for territories, and information recommended to be collected during monitoring of known territories. Beyond that, information informing the decision makers on foraging habitat and prey condition would assist in establishing the potential effect of projects which may be proposed in Golden Eagle habitat(s).

6. **What are the thresholds that represent too much loss (e.g., habitat, birds, nests, etc)?** Loss of a territory that had been known to be used for a considerable period of time may be a prime indicator. An example of this could be observed decline in reproductive success on a previously productive territory. If the Golden Eagles are observed off of their territories more, or are observed flying great distances in search of prey could also be indicative of too much loss of habitat by a project.

However, these kinds of observations are after-the-fact, and, if they are the sole methods employed for determining thresholds, they will likely result in further population declines. Regarding numeric thresholds for loss of territories and individual birds, see the FEA on the regulations. From a strictly common-sense biological standpoint, if we have either a declining or stable population, we can assume there are some limiting factors preventing the population from expanding. For Golden Eagles, it is usually limitations to either prey or suitable nest locations, or a combination of both. Annual variations in weather can also affect, productivity, and climate change effects may depress some populations. In addition, managing for "number of nests" ignores the basic ecology of Golden Eagles, which may have many alternate nests (and some of the nests not used for rearing young may be used during the mating ritual).

We do not have a complete understanding of why a pair may change from which nest or another, but it may relate to prey cycles, microclimate conditions as sites, or disturbance. Because of this, and because as long as a nest is readily identifiable, a permit is required to 'take' the nest, you should protect all nests in a territory. When considering applications for take of nests, the Service will consider any information available to determine the relative value of a nest to the productivity of a breeding pair and whether loss of that nest may result in abandonment of a territory.

Therefore, inventories for nests, delineation of territories, monitoring for occupancy and productivity, may be highly useful for obtaining permits and establishing appropriate mitigation. When considering loss of habitat for a species for which we have little on-the-ground data, and which we are managing for preservation, evaluation of both quality **and** quantity of habitat being lost is a key consideration, e.g., loss of 500 acres of high quality habitat may have a greater impact than the loss of ten times that of poor habitat, both in the short term and the long term. The conditions leading to high quality habitat may be due as much to underlying hydrology and soils as to management prescriptions, and the ability to recreate those conditions is limited. Probably the best way to estimate thresholds for loss of habitat for breeding pairs is by tracking over several years the size, dimensions, and configuration of breeding pair home ranges in relation to rainfall patterns, habitat quality, and prey base. Barring that, we do not recommend trying to manage by thresholds for lost habitat. Rather, we recommend management by use of habitat quality and habitat enhancement goals.

- 7. If a wind developer came to you with plans to develop a wind farm and they were willing to place buffers around the turbines (no turbine development within the buffer), what would you tell them to use for the buffer?** Buffers we currently recommend are at least 4 - 10 air miles from a golden eagle territory. However, this buffer is in lieu of a home range analysis (over up to 4 years, to document the area used 97% percent of the

time, identify foraging areas, and airspace use (e.g., how much do they use the ridgelines compared to distance set back from the ridge?). However, this does not address considerations for sub-adult and adult non-breeding birds, which may be at highest risk of collisions, nor does it address the potential for take of migrating or wintering birds, which would need different analyses.

8. **What are good avoidance and minimization measures to reduce impacts on site at energy developments?** The Service is currently preparing project design criteria which may provide action agencies with avoidance and minimization measures suitable for a wide variety of projects.

9. **What are the most useful/effective off-site mitigation measures for impacts to GOEA?** Depending on the cumulative development scenario, off-site mitigation measures may be limited. However, partnering with entities that are currently taking Golden Eagles within the local area population, to help them reduce their take, may be a good first step.

10. **How will the Service respond to GOEA take by power companies who kill eagles both by electrocution and line strikes but do not qualify for permits under the new regulations?** Power companies who do not develop and implement effects APPs for reducing take will continue to be subject to prosecution. APPs or other mitigation agreements can also serve as part of the application process should a programmatic permit be sought by the developer at a future date. The programmatic permit can build from the APP, reducing coordination time. If, at a future date, a programmatic permit is deemed to be appropriate, further information may be needed for the given development and/or area.

11. **Will the Service put pressure on wind development companies to change the design to turbines to kill much fewer birds/bats (e.g., vertical axis turbines instead of current horizontal turbines)?** The Service will coordinate with the industry to encourage development of turbine designs that reduce or eliminate take of birds and loss of bats.

12. **What is the best way to evaluate foraging habitat in the desert to determine mitigation?** Many land management agencies have existing tools for evaluating range conditions, which, although developed for gazing purposes, can still provide some estimation of the ability of the habitat to support prey species for golden Eagles. Methods for gathering information on which foraging habitat areas are used and when can include radio or satellite telemetry survey techniques, but also can include comprehensive, observer-based studies. There are other available tools that can help agencies estimate likely foraging areas.

For example, the BLM could develop a coarse analysis of potential foraging areas within estimated home ranges of breeding pairs of golden eagles using Soil Survey Geographic (SSURGO) Database soils data and the vegetation associations included in the SSURGO GIS information, or other comparable or better available vegetation or soils data (e.g. some field offices may have higher resolution vegetation layers), and could use appropriate multispectral satellite imagery. Because the locations supporting prey in an arid environment likely vary from year-to-year, based largely upon rainfall occurrences, the BLM could also explore the historical climate data available through the national Climatic Data Center (<http://www.ncdc.noaa.gov/oa/climate/stationlocator.html>), using stations available within or adjacent to the cumulative impacts area to determine rainfall frequency and patterns over time.

13. What types of data should be collected to demonstrate “disturbance” associated with loss of foraging habitat under the new BGEPA rule?

For summer foraging, low productivity at area nest sites, dispersal of eagles to other sites, increased competition, leading to injury, poor condition due to loss of foraging. If eagles can be tracked, low productivity during subsequent breeding season

14. Appropriate regional population scales are to be used for management under the Eagle Act. What are these management units? Are they based on Bird Conservation Region (BCR) or something else? When will they be available? The management units were provided in the FEA. For bald eagles, we used natal populations (eagles within the median natal dispersal range of each other, estimated at 43 miles) in our evaluation in order to look at distribution across the landscape. Being able to see where natal populations appear sparser, rather than concentrated, allows us to determine natural boundaries between regional eagle populations. Because the management populations delineated by this approach roughly corresponds to the Service’s organizational structure made up of eight Service Regional Offices, we will manage bald eagles based on populations within the eight Service Regions, with some shared populations.

For golden eagles, available data on distribution are not as spatially precise as data for bald eagles. We will manage take of golden eagles according to thresholds set at the Bird Conservation Region (BCR) level because the only range-wide estimates available for golden eagles are BCR-scale population estimates. BCRs are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. Developed by a mapping team at the first international meeting of the North American Bird Conservation Initiative (NABCI) in 1998, BCRs are an application of the framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC).

15. **How can agencies and conservation groups develop a baseline survey and follow-up long-term monitoring program that verifies/validates population trends and the no net loss objective?** The interim protocols provide good first steps towards that goal. They will be followed with protocols for monitoring wintering and migrating birds, as well as a statistically rigorous, cost-effective sampling strategy to facilitate a landscape-scale approach to Golden Eagle conservation and reduce the burden on individual proponents as well as land-management agencies. These monitoring protocols will then be incorporated into a comprehensive strategy within the National Golden Eagle Conservation and Management Plan.

16. **Will the Service be leading efforts to establish a range-wide survey using agreed upon protocols, including Mexico?** The Service has released Interim protocol via the Colloquium to inventory and monitor near proposed project footprints. The Service will also embark on developing a range-wide monitoring strategy that will use statistically sound sampling methods to ascertain short and long-term trends of Golden Eagles.

17. **What is a model of a mechanism for multiple agencies and industry to pool money and resources to address basic resource (bird/habitat) inventory questions on a landscape scale?** The peregrine falcon effort in the Pacific Northwest did this for over a decade to support inventory, site specific monitoring, and adaptive management for all agencies.

18. **Altamont WRA was and is a major source of mortality for GOEA. What makes us think that the Tehachapi and San Gorgonio WRA are not?** At Tehachapi Wind Resource Area, several golden eagles with satellite telemetry devices have been reported dead. We are unsure of the level of lethal take which have occurred at San Gorgonio Wind Resource Area.

19. **Is there a plan for issuance of guidance? When would other federal agency comments be incorporated?** The Implementation Guidance for the new regulations should be available to the public later this year, and we encourage other federal agencies to comment at that time.

20. ~~What are the future impacts of wind energy on the population with a take policy?~~ **Will the new permit program ameliorate the deleterious effects of wind energy on eagles? What effect will the new permit system have on the wind industry?** Although the statutory prohibition against killing eagles has been in effect for over half a century, the new regulations have brought renewed attention to the law. Various industries, including wind developers

- are now more aware of the need to comply with the BGEPA, and should seek innovative means to reduce and/or offset the take they cause and develop ABPPs that will help protect eagles, other birds, and bats. APPs or other mitigation agreements also have the potential to serve as part of the application process should a programmatic permit be sought by the developer at a future date. The programmatic permit may be able to build from the APP, reducing coordination time. If, at a future date, a programmatic permit is deemed to be appropriate, further information may be needed for the given development and/or area.
21. **Are there any concerns that you would like brought to the attention of FWS Office of Law Enforcement?** We already dialogue with FWS OLE, and are working to improve coordination regarding take of eagles.
 22. **Who has jackrabbit data? Are there jack rabbit surveys underway?** We in the WO are unaware of any jack rabbit surveys underway. That information should be sought (or gathered) in coordination with your State or Tribal jurisdictional wildlife agencies.
 23. **How can we pull together the existing data that has been discussed so far today, particularly the non-fed data?** We need this information to help in environmental reviews, without revealing the exact nest locations. One of the goals of the Service is to work towards a national Golden Eagle database, but would we need to receive additional FOIA protections for that data to ensure its confidentiality. In the meantime, we encourage parties to submit data to State Natural Heritage programs.
 24. **What would satellite tracking units and a study cost?** \$3,500-4,250 per unit. ARGOS satellite time is \$1,000 - 1,500/year. Costs to capture Golden Eagles vary per the biologist and habitat where Golden Eagles are sought; however capture could range from 1-4 weeks of biologist time. During this time, one to multiple eagles could be caught. Nest entry to band or put patagial tags on Golden Eagles would be much less; i.e. monitoring time, plus a single day for the nest entry (for an average approach hike).
 25. **Based on data presented, it doesn't look like the Mojave Desert is a migration or over-wintering area for GOEA. Agree or limited data?** Limited data, however because of low prey densities during the current drought, it is likely that few Golden Eagles currently use the Mohave Desert for wintering habitat.

26. **If a seasonal closure were to be implemented for a possible nesting area, what would be the best dates for the closure...December/January through when?** This would be latitude and elevation dependent, however the range would be from mid December through late August.
27. **How can the BGEPA/MBTA prohibitions be better enforced (or utilized) as we deal with wind energy generation?** It may be a mitigation option to request funds to support federal or state law enforcement.
28. **What can we do about ORV/OHV/ATV and climbing activities?** Action agencies should work with their cooperators to restrict these recreational activities near known Golden Eagle territories to reduce and eliminate unintended take of Golden Eagles, applying buffers of at least 0.5 miles or more from nests; buffers would need to eliminate disturbance to Golden Eagles per 72 FR 31132. Follow-up enforcement may be necessary. In addition, some recreational groups may be interested in participating in eagle conservation, as well as education/outreach and self-policing. We encourage the development and implementation of a Golden Eagle education program.
29. **How should we be dealing with existing infrastructure that is injuring and killing eagles and other migratory birds?** Same as #10? We should notify the entities responsible for the infrastructure about the issue, and offer to work collaboratively with them to remedy the problem (and copying FWS OLE on all correspondence). If the infrastructure is on federal land, we recommend that the approach to the entities be a collaborative one combining efforts of both the Service and the land management agency.

Additional topics that were of importance to the participants

- a. Wind turbines in the Sierra Nevada Mountains
- b. Habitat loss due to urbanization
- c. Increased disturbance due to recreation
- d. Effects of wildfire
- e. Effects of exotic vegetation
- f. Climate change
- g. Golden Eagle population dynamics
- h. Mortality agents
 - i. Identify primary and secondary causes of mortality - full work up of dead birds
- i. Lead poisoning
 - i. Increasing the lead shot ban (possibly nationwide) and facilitate outreach to hunters
 - ii. Suggest providing free ammunition in selected areas for one season

- j. Evaluation of ground squirrel policy at Altamont
- k. Getting better idea of how Brodifacoum is getting into the ecosystem
- l. Establish standardized disease surveillance system
- m. Create a network of communication for people working on eagles to share ideas, samples, for research, etc.
- n. Establish regional archives for eagle blood/tissue for monitoring programs
- o. Religious take of GOEA – thresholds, permitting
- p. Human health risk from lead in bone whistles

For questions regarding these notes, please do not hesitate to contact Dr. Jeep Pagel (joel_pagel@fws.gov) or Dr. Eric Kershner (eric_kershner@fws.gov).