

**ARIZONA GAME AND FISH DEPARTMENT
HABITAT PARTNERSHIP PROGRAM
HABITAT ENHANCEMENT AND WILDLIFE MANAGEMENT PROPOSAL**

PROJECT INFORMATION

Project Title: Elk Movements Associated with Interstate-40, Williams to Winona, Arizona

Project No. 09-701

Region/GMU: Region II / GMU's 5B, 6B, 7, 8

HPC: Flagstaff-Williams

Project Type: Research

Project Description: This project will partner with ADOT to determine need and location of wildlife underpasses and overpasses along Interstate-40 for its impending upgrade from a 4-lane to a 6-lane divided highway. Research along State Route 260 has shown that these structures and fencing are extremely effective in reducing elk-vehicle collisions and maintaining habitat connectivity. Along State Route 260 accidents have been reduced by 85-96% and more than 10,000 animals have used the underpasses. Similar structures will benefit wildlife and motorists along Interstate-40. Comparable results on I-40 will greatly benefit elk and other wildlife. We will use 70-80 elk collars to obtain elk movement data between Williams and Winona that will identify proper locations of structures and extent of fencing while also evaluating the effects of high traffic volumes on elk movements.

The problem of wildlife vehicle collisions is not only one for AGFD as wildlife management and conservation Agency but also for our external customers, including but not limited to the hunters, motorists and Arizona Department of Transportation. The project outcome will resolve external critical customer needs and will provide an ongoing outstanding partnership with ADOT that can lead to wildlife habitat connectivity conservation and wildlife-vehicle collision reduction efforts for years to come.

The outcome of the findings from this project will specifically address needs in the "Wildlife 2012 Strategic Plan", not only through addressing concerns of "Habitat fragmentation and degradation from networks of roads and utility lines" but also by "Working with partners to improve and preserve wildlife habitat and minimize impacts to wildlife resources". The outcome of this project once findings are implemented will also help to meet missions identified by RMEF and AES.

This multi-partner project began in Spring 2009 with the capture of around 40 elk and the remaining elk captures will be completed upon acquisition of funds. \$220,000 was required to complete the project and obtain the match needed for \$197,000 of ADOT/FHWA funds. RMEF and AES funded \$110,000 in 2009 through the HPC process and offered the remaining \$110,000 in 2009-2010 with the agreement that AGFD would seek other funds between cycles. AGFD has obtained \$28,000 through the RMEF PAC funding process, leaving the remaining funding requirement at \$82,000. There are verbal agreements pending that may further reduce the required funds. The final amount needed will be contingent upon funds received between now and the final HPC project selection date. If AGFD acquires the needed funds they will withdraw this proposal from the HPC process.

Wildlife Species to Benefit: Elk and other wildlife that will utilize future wildlife-passage structures. Elk-vehicle collisions will be reduced dramatically following implementation of the wildlife passage structures defined by this project.

Possible Funding Partners:

Implementation Schedule:

NEPA Compliance: (if applicable)

Beginning: Began Spring 2009	Completed: Yes ___ No ___
Completed: Final Report Due 2013	Projected Completion Date:
PROJECT FUNDING	
SBG Funds Requested: \$82,000	
Cost Share Funds: (>3:1 match) \$197,580 from ADOT, \$28,000 from RMEF, \$20,000 from AGFD, \$7,000 Traffic counter provided and installed by ADOT	
Total Project Costs: \$ 420,000	
PARTICIPANT INFORMATION	
Applicant: Jeff Gagnon Research Biologist Arizona Game and Fish Department Telephone: 928-814-8925	Address: Arizona Game and Fish Department 5000 W. Carefree Highway Phoenix, AZ 85086
AGFD Contact and Phone No. (If applicant is not AGFD personnel) Same as above	
Coordinated with: Chuck Howe, ADOT Environmental Coord.	Date: 7-26-09
Applicant's signature:	Date:

SEND COMPLETED APPLICATIONS TO:
 AZ Game and Fish Department
 Attn: Game Branch
 5000 W. Carefree Highway
 Phoenix, AZ 85086
rgregory@azgfd.gov

WAS PROJECT PRESENTED TO THE LOCAL HPC? YES _____ NO ___x___
 Inquired about possibility of presenting at local HPC

HAS PROJECT BEEN SUBMITTED IN PREVIOUS YEARS? IF SO WAS IT FUNDED?
 Yes, partially funded last with agreement to complete funding this year with amount depending on funds acquired between cycles.

NEED STATEMENT/PROBLEM ANALYSIS:

The direct impact of collisions with motor vehicles is a significant source of mortality affecting wildlife populations. An estimated 500,000 to 700,000 deer alone are killed annually on U.S. highways. Interstate-40 accounts for as many as 60 elk and deer-vehicle collisions/ year including the loss of over 700 elk since 2000. These collisions are detrimental not only to the wildlife populations directly but are also a threat to human safety. Based on average cost of elk and deer-collisions to society as estimated by Western Transportation Institute, the accidents within the proposed study area (see Study Area) cost society close to \$1 million/ year. This area also includes the location of the Booth vs State of Arizona where the State was paid out over \$3 million dollars to a gentleman that hit a dead elk in the road.

Wildlife-vehicle collisions cause human injuries and deaths, tremendous property damage and substantial loss of recreational opportunity and revenue associated with sport, and disproportionately affect threatened or endangered species

Several studies have addressed the effects of roads and highways on elk. Roads can negatively impact elk and other ungulates by altering habitat use, restricting movements and fragmenting populations, and increasing mortality through collisions with vehicles. The magnitude of all of these factors likely increase with increasing traffic volume. Wildlife passage structures have shown tremendous benefit in promoting wildlife passage for a variety of wildlife species, and in conjunction with fencing have reduced the incidence of wildlife-vehicle collisions and promoted permeability. Conversely, traffic levels do not appear to deter elk crossings at below-grade underpasses as documented along SR 260.

Previous studies have examined elk movements and distributions along roads focused on relatively low use forest roads, and very few studies have examined the effects of roads with high traffic levels on elk movement and distribution. Theoretical models suggest that highways with 4,000-10,000 AADT would present a strong barrier to wildlife that would repel animals away from the highway and > 10,000 AADT highways would become impermeable to wildlife, though this has never been tested experimentally. This data would supplement the research on elk-traffic level interactions simultaneously being studied by AGFD and ADOT along several other highways in the state.

PROJECT OBJECTIVES AND STRATEGIES:

This research project will add greatly to our understanding of elk movements along high-traffic highways (>15,000 AADT), a relatively unknown topic. The overall goal of this research project is to apply insights we have gained on the long-term State Route 260 project combined with data that will be obtained from this project will help to address the current elk-vehicle collision problem along I-40. The specific objectives and associated procedures of our research include:

- 1) Assess elk movement patterns and distribution relative to I-40, and determine the location of high-frequency crossing zones and assess elk permeability across the highway corridor.
- 2) Investigate the spatial and temporal relationships of elk highway crossing and distribution patterns to vehicular traffic volume.
- 3) Evaluate elk movements associated with water sources located in close proximity to I-40
- 4) Investigate wildlife-vehicle collision patterns along I-40.
- 5) Develop recommendations both for the retrofitting of existing and reconstruction of new wildlife passage structures and other mitigations to reduce elk-vehicle collisions while maintaining or promoting highway permeability along I-40.

location of high-frequency crossing zones and assess elk permeability across the highway corridor.

This is the primary objective of this research project and we will rely on the application of GPS telemetry. We will assess movements, distribution, and measure elk permeability. To collect the most data with available funding while simultaneously meeting needs for immediate data in specific project area we will use a mix of Store-on-board, spread-spectrum and satellite GPS collars.

Task 1.1. Instrument elk with GPS receiver collars.

Task 1.1.2. In the first year of the project, the research team will instrument 70-80 elk with a combination of new store-on-board GPS receiver collars, downloadable “spread-spectrum” collars and satellite collars along I-40 from Williams to Twin Arrows, encompassing the entire Design Concept Report (DCR; the long-term plan for the future upgrade of a roadway that includes environmental requirements for that project) study area and providing movement data between herds to the east and west of the study area. Collars will be installed on elk as close as possible to the highway corridor (preferably within ½ mile of the highway), and distributed primarily in areas with water or meadows and in close proximity to I-40, and other major peaks in elk-vehicle collisions. Elk will primarily be captured using Clover traps, along with darting and use of a drop net. As elk are generally crepuscular/nocturnal in their habits, for direct comparison of elk movements along other northern Arizona highways, GPS collars will be programmed to receive 8 fixes/day between 1600–0800 hours (1 fix every 120 minutes), equivalent to the data collection regimen of the current collars associated with the State Route 64, I-17 pilot study, and I-17 Elk Movements Study. This time interval between fixes is also sufficient to determine highway crossings and assess relationships to traffic volume (see Objective 2). Operational battery life of the collars is projected to be approximately 22 months, and should yield >10,000 GPS fixes/animal (>200,000 total/ elk). We will focus the spread-spectrum and satellite collars in the areas immediately within and in close proximity to the study area (MP 184-212) to provide immediate results to begin the decision making process for wildlife-vehicle collision mitigation options. The remainder of the collars will be distributed evenly along the entire I-40 elk-vehicle collision hotspot area MP 165-MP217. This will not only provide data for the current DCR but also for any future upgrades along I-40 in elk country.

Task 1.2. Use Geographic Information System (GIS) analysis to determine elk movements, highway crossing patterns, distribution relative to the highway, and to assess permeability across the highway corridor.

Task 1.2.1. GPS data will be downloaded to a computer after collars drop from elk on pre-programmed release dates. After downloading, GPS data will be analyzed by GIS using ArcGIS.

Task 1.2.2. To determine the frequency of crossings by elk, the length of the study section of highway will be delineated into sequentially numbered 0.10-mile segments. Crossings will be determined where successive GPS fixes occur on each side of the highway, with the crossing segment determined to be the one in which the line between the successive fixes falls. Passage rate, as a measure of permeability, is determined from the ratio of highway crossings to approaches. An approach is considered to have occurred when an animal travels toward the highway and enters the 0.15-mile buffer zone; it ultimately may cross or repel from the highway.

Objective 2. Investigate the spatial and temporal relationships of elk highway crossing and distribution
(revised 7-02-2007)

patterns to vehicular traffic volume.

Along SR 260 we addressed the relationships of elk distribution and highway crossings to traffic volume along SR 260, with traffic affecting both animal distribution and timing of crossings of elk accessing preferred foraging areas adjacent to State Route 260. Recent theoretical models assume that the potential for traffic to act as an impermeable moving fence increases with traffic volume, although this theoretical model has yet to be tested for elk along a high traffic volume highway such as I-40.

We hypothesize that the high traffic volumes along I-40 will have even more of an impact on elk movement across the highway than along State Route 260; however the level of this influence may be dependent upon locations of preferred foraging sites, water sources, and migration routes. The insights we gain from conducting studies of this nature are extremely valuable in finding solutions to wildlife-highway conflicts.

This data will supplement the research being conducted along I-17 to further investigate elk movements associated with traffic levels along a high-traffic highway.

Task 2.1. Install a permanent traffic counter along I-40 within our study area.

Task 2.1.1. The research team will work with ADOT's data management section to install a traffic counting in the study section, likely in the Bellemont area, which will also supplement traffic count coverage needs for ADOT and are already planned. These counters will have automated data transmission capabilities. Traffic data (number of vehicles, average speed, and vehicle types) will be recorded in 1-hour intervals. (Completed Winter 2009).

ADOT personnel have recognized the lack of traffic counting equipment along this stretch of I-40 and support our decision to install one here to supplement the one east of Flagstaff. AGFD along with ADOT personnel will conduct a preliminary assessment of the I-40 study area and locate a suitable site for installing a traffic counting station that is able to obtain cellular phone coverage for automated data transmission. ADOT will most likely use a loop-type system cut into the pavement. ADOT has committed to installing a traffic counter for the purposes of this study and covered these costs.

Task 2.2. Assess the relationship between traffic volume and elk distribution and crossing patterns.

Task 2.2.1. Assess the relationship between traffic volume and elk distribution and crossing patterns as determined in Task 1.2., using the same approach as Gagnon. Both elk highway crossing and distance from the highway will be linked to average traffic volumes for the GPS fix interval period. Relationships between traffic volume and elk movements will be assessed using logistic regression, as per Gagnon (2006).

6) Objective 3. Evaluate elk movements associated with water sources located in close proximity to I-40

Previous studies have examined the effects of environmental parameters (slope, aspect, canopy cover, etc.) on elk-vehicle collision rates. Prior to our State Route 260 project, no studies had examined the influence of environmental parameters on elk highway crossing patterns. We found that distance to meadow and water were the most important factors contributing to the aggregated highway crossing pattern along State Route 260.

We hypothesize that these factors will also play a significant role in influencing elk crossing and distribution patterns along I-40. ADOT is currently documenting use of these water sources via trail cameras.

Task 3.1. Identify meadow and water sources adjacent to I-40 with GIS, aerial photos, and ground validation. Develop a GIS layer of existing meadows and water sources.

Task 3.2. Capture elk in the vicinity of these water sources to document movements associated with water along the highway.

Task 3.3. Potentially remove elk access to water sources adjacent to the highway and document elk movements and crossing patterns following this treatment (future funding).

Objective 4. Investigate wildlife-vehicle collision patterns along I-40.

Interstate-40 represents a high elk-vehicle collision hotspots in Arizona. Data from 1989-2006 show definite elk-vehicle collision peaks. However most of this data is coarse in nature, rounded to the nearest milepost, and provides little site-specific information to support highway mitigation efforts. In 2006 AGFD met with ADOT and DPS to address a more detailed approach to collecting wildlife-vehicle collisions data for future mitigation efforts. These meetings led to modified forms for DPS personnel to include more wildlife related details. This objective will include all wildlife species.

Along State Route 260, AGFD and ADOT were able to use collision data as a supplement to GPS crossing data to make recommendations on the extent of fencing needed to reduce elk-vehicle collisions by intercepting elk and funneling them to crossing structures. This information will be a valuable supplement to the GPS data gathered along I-40 in making recommendations for retrofitting opportunities along this stretch of roadway.

Task 4.1. Document all wildlife-vehicle collisions along I-40.

Task 4.1.1. The research team will coordinate with AGFD Flagstaff Region, ADOT, and DPS Highway Patrol to document all wildlife-vehicle accidents and roadkills along the study length of I-40.

Task 4.1.2. Research project personnel will regularly search the study area for evidence of wildlife-vehicle collisions and roadkills that otherwise may not be reported on the ADOT database or by the *Wildlife Vehicle Collision Report* cards.

Task 4.1.3. All wildlife-vehicle collision and roadkill data will be entered into a spreadsheet database, compiled, and analyzed.

Objective 5. Develop recommendations both for the retrofitting of existing and reconstruction of new wildlife passage structures and other mitigations to reduce elk-vehicle collisions while maintaining or promoting highway permeability along I-40.

Task 5.1. Using all available data and information, develop recommendations on the need for retrofitting, locations of future passage structures and other mitigations efforts to reduce elk-vehicle collisions while maintaining elk permeability across I-40. This information will be valuable in making decisions for retrofitting I-40 to reduce immediate elk-vehicle collision problems as well as the future plans of upgrading I-40.

PROJECT LOCATION:

I-40 is the main highway artery across Arizona and supports the transport of goods between southern California and a large portion of the United States. I-40 is traveled by >6.5 million motorists each year. As the southwest continues to grow, traffic on I-40 will also increase.

ADOT wildlife-vehicle collisions data indicates that 60 collisions/year on I-40 (milepost 155-217) with elk and deer. Insights gained from our research project will help determine the best strategies of mitigating elk-vehicle collisions while maintaining connectivity and permeability for elk and other wildlife species. ADOT has awarded a contract for the development of a Design Concept Report (DCR) for the stretch of I-40 from MP 184 – MP 212, Bellemont to Winona. Information from this proposed research project could be used in the DCR process to provide a more integrated and comprehensive analysis of transportation improvements along I-40 that will help address wildlife-vehicle collisions that affect highway safety as well as promoting wildlife permeability.

ADOT has began efforts to document wildlife use of bridges and culverts and their potential for increased future wildlife use (e.g., with fencing). Along State Route 260 we found elk were drawn to the presence of riparian meadow and water sources, this may also be the case along I-40. Flagstaff ADOT Natural Resource Management Group is also documenting use of the water sources along I-40. Our proposed study area will be focused on the planned upgrade of I-40 from Bellemont (MP 184) to Winona (MP 212) but will encompass all areas within and adjacent to the study area and encompass all of the areas along I-40 exhibiting high incidences of elk-vehicle collision. Due to the migratory nature of the elk associated with I-40, we will expand the geographic study area to include elk movements of herds on either side of the DCR study area west to Williams and to the north and south. This study area will also encompass the location of the elk-vehicle accident that resulted in the landmark Booth versus the State of Arizona case, where the State of Arizona was found negligent.

LAND OWNERSHIP AT PROJECT SITE (Please state specifically if PRIVATE PROPERTY and provide landowner's name): The 50-mile study area will include mixes of City, State, Federal, Military and private lands. Any elk captures that occur on private lands or otherwise will be completed only with approval of owners.

IF PRIVATE PROPERTY, IS THERE A STEWARDSHIP AGREEMENT BETWEEN THE LANDOWNER AND THE DEPARTMENT? In This case a stewardship agreement is not necessary.

HABITAT DESCRIPTION: The study area from west to east gradually and slightly decreases in elevation and changes from a ponderosa pine forest west of Flagstaff to primarily pinyon-juniper east of Flagstaff

ITEMIZED USE OF FUNDS:

- 1) elk collars and associated data recovery methods
- 2) elk bait (alfalfa and salt)
- 3) elk traps and repairs

LIST COOPERATORS AND DESCRIBE POTENTIAL PARTICIPATION: Currently Arizona Department of Transportation, Federal Highway Administration and Arizona Game and Fish Department are cooperating to complete the study, other partners are RMEF and AES with the potential of Department of Defense and US Forest Service joining as partners.

PROJECT MAINTENANCE:

AGFD will monitor welfare of elk and oversee data recovery. AGFD will meet with ADOT and FHWA on a

monthly basis to ensure future highway plans consider elk movement.

PROJECT COMPLETION REPORT TO BE FILED BY:

The overall project report is due in 2013, however bi-annual reports and an interim report will be completed and provided to all partners including the HPC and will be filed by AGFD Research Branch until the final report is completed.