FINAL

Nevada Department of Wildlife

PREDATION MANAGEMENT PLAN

FISCAL YEAR 2015

1 July 2014 to 30 June 2015

30 JUNE 2014

STATE OF NEVADA

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Nevada Department of Wildlife

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COVER ART NDOW FILE PHOTO – RED FOX, 20 JANUARY 2006, JARBIDGE WILDERNESS, 8,376 FT.

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EXECUTIVE SUMMARY

The goal of the Nevada Department of Wildlife's (NDOW's) Predation Management Program is to conduct projects consistent with the terrestrial portion of the Department's Mission "to preserve, protect, manage and restore wildlife and its habitat for the aesthetic, scientific, educational, recreational and economic benefits to citizens of Nevada and the United States." In addition, provisions outlined in NRS 502.253 authorize the collection of a $3 fee for each big game tag application, depositing the revenue from such a fee collection into the Wildlife Fund Account and used by the Department to 1) manage and control predatory wildlife, 2) pay for management activities relating to the protection of non-predatory game animals and sensitive wildlife species and related wildlife habitat, 3) conduct research, as needed, to determine successful techniques for managing and controlling predatory wildlife, including studies necessary to ensure effective programs for the management and control of predatory wildlife; 4) fund education of the general public concerning the management and control of predatory wildlife. Expending a portion of the money collected to enable the State Department of Agriculture and other Contractors and Grantees to develop and carry out programs designed as described above; developing and conducting predator management activities under the guidance of the Wildlife Commission; and a provision that the $3 fee monies "remain in the Wildlife Fund Account" and do not revert to State General Funds at the end of any fiscal year, are additional provisions of the Statute.

Nine of 10 FY14 projects have been recommended for continuation in FY15. Four new projects are proposed for FY15. Approximately $558,266 will be available from the $3 Fee in FY15. Matching funds that may also be used to implement some of the projects include WSFR federal aid grant funds, NGOs, and other State funding mechanisms (Upland Game Stamp, Heritage, Wildlife Reserve Account, etc).

NDOW maintains a philosophy that predation management is a tool to be applied deliberately and strategically. Predation management may include lethal removal of predators or corvids, nonlethal management of predator or corvid populations, habitat management to promote more robust prey populations which are better able to sustain natural levels of predation, monitoring and modeling select predator populations, managing for healthy predator populations, habitat restoration to benefit wildlife populations, public education and/or analyzing predator-prey relationships to better understand ecosystem function. Predation management should be applied on a location specific, case-by-case basis, with clear goals, and based on an objective scientific analysis of available data. It should be applied with proper intensity and at a focused scale. Equally important, projects should be monitored to determine whether desired results are achieved.

NDOW is committed to using all available tools and the most up-to-date science, including strategic use of predation management, to preserve our wildlife heritage for the long term.

FY 2015 PROPOSED PROJECTS

Project 21: Greater Sage-Grouse Protection

Project 21 at a Glance

Shawn Espinosa

GOAL: Increase populations of Greater Sage-Grouse.
PROJECT AREA: High Priority Greater Sage-Grouse breeding, nesting and brood-rearing habitat throughout northern Nevada.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS and HABITATS:
1) The removal of corvids and predators is intended to result in long-term protection for greater sage-grouse populations. 2) Further data collection and analysis will determine effectiveness of this project and direct wildlife management policy in the future in priority sage-grouse habitats statewide.
PRELIMINARY CONCLUSIONS: Although some short-term benefits were probably realized, long-term benefits have not yet been shown.
PROJECT DURATION: 2007-2015.
TARGET SPECIES: (Corvidae- Common Raven, Carnivora- Coyote, American Badger).
TIME PERIOD: March-May.

TOTAL REMOVAL 2007-2013:	**9,460 Predators: [9,243 Common Ravens, 217 Predators (113 Coyotes, 104 American Badgers)]**
FY13 TOTAL REMOVAL:	**2,610 Predators: [2,500 Common Ravens, 110 Predators (69 Coyotes, 41 American Badgers)].**
TOTAL EXPENDITURES (2007-2013):	**$108,771 + $91,885(Heritage) = $200,656**
FY14 APPROVED BUDGET:	**$ 40,000**
FY15 PROPOSED BUDGET:	**$ 10,000**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Continue to evaluate and implement as appropriate.**

Introduction

Common raven control projects were first initiated in the spring of 2007. Most raven control work was conducted in association with greater sage-grouse strutting grounds in 8 counties of northern and central Nevada (Churchill, Elko, Humboldt, Lander, Lincoln, Nye, Washoe and White Pine).

Methods

Methodology for killing ravens was to deploy chicken eggs treated with the poison "3-chloro-*p*-toluidine hydrochloride" (CPTH) (DRC-1339). Estimates of raven losses were based on previous work and published literature (Coates et al 2007). Eggs were placed at treatment sites from late March through mid June 2007-2012. To reduce non-target species exposure, no eggs were left in the environment for over 168 hours. No leftover eggs were used on subsequent treatments. All remaining eggs and any dead ravens found were collected and disposed of properly as per poison control protocol. Depending on the species and situation, coyotes and American badgers were also removed by aerial gunning, calling, shooting, the gassing of natal dens, leg-hold traps and/or snares in high priority sage-grouse habitat. Additional detail can be found in the Appendix.

Conclusion

While some short-term benefits were probably realized, long-term benefits have yet to be documented. According to a study in northern Nevada, raven numbers rebounded each spring to abundances seen prior to CPTH application (Coates et al 2007). This study also indicated providing sage-grouse with high quality habitat and reducing and/or making food and nesting structure unavailable for common ravens (i.e. open landfill dumps, road-kill carrion, power and phone line nesting structures) are likely the best long-term solutions to managing balanced Great Basin ecosystems (Coates et al 2007).

Still greater analytical tools are being deployed in 2014 and 2015 to analyze statistically, the effect of predator removal on nest success of greater sage-grouse in select areas across the Great Basin. This work along with the rehabilitation and preservation of greater sage-grouse habitats should help in efforts to preserve the grouse over the long term.

Recommendations

Game Division staff should evaluate proposals with regional game supervisors and biologists prior to contacting a permitted contractor to initiate control efforts.

Continue to use Project 21 for emergency projects or to complete previously identified ones.

Coordinate with Wildlife Services to continue predator removal work in high priority greater sage-grouse habitats throughout the state. Evaluate each sub-project on its own merits annually.

Fund Project 21 through FY 2015. Evaluate efficacy of Project 21 annually.

Reporting requirements for FY2015 projects will be reflective of language in Commission Policy #23.

Sub Project 21-02: Sage-Grouse Nest Survival in Virginia Mountains

Sub Project 21-02 at a Glance

Shawn Espinosa

GOAL: Remove common ravens through lethal means. Analyze greater sage-grouse nest survival in control/treatment setting in the Virginia Range (Unit 022).
PROJECT AREA: Tule and Vinegar Peak areas of the Virginia Mountains west of Pyramid Lake in northwest Nevada.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) The targeted lethal removal of corvids is intended to result in short-term increases in nest survival of greater sage-grouse. 2) Analysis of data from control and treatment study areas in the Virginia Mountains would determine the effectiveness of this project and help direct wildlife management policy in the future in priority greater sage-grouse habitats statewide.
PROJECT DURATION: 2014-2016.

FY14 APPROVED BUDGET:	**$20,000**
FY15 PROPOSED BUDGET:	**$50,000**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Fund project through FY 2016.**

Introduction

Greater sage-grouse nest survival and avian predator abundance data have been gathered recently by USGS and NDOW in the absence of Corvid removal in the Virginia Mountains (see map). Common raven lethal control projects are being initiated in select sites to provide before/after as well as control/treatment nest survival data comparisons in FY2015.

Methods

Methodology for killing common ravens would be to deploy chicken eggs treated with a registered corvicide. Eggs would be placed at treatment sites from late March through April 2015. To reduce non-target species exposure, no eggs would be left in the environment for over 168 hours. No leftover eggs would be used on subsequent treatments. All remaining eggs and any dead ravens found would be collected and disposed of properly as per poison control protocol. No lethal predator control would be conducted in association with this project. Additional detail can be found in the Appendix.

The sage-grouse monitoring component will be conducted by USGS.

Conclusion

This project is an attempt to deploy more sophisticated analytical tools in analyzing the effect of lethal predator removal on nest success of greater sage-grouse in select areas across the

Great Basin. This work along with the rehabilitation and preservation of greater sage-grouse habitats may help in efforts to preserve the grouse over the long term.

Recommendations

Reporting requirements for FY 2015 projects will be reflective of language in Commission Policy #23.

Sub Project 21-02 Map (Virginia Mountains Project Area -Turquoise).

Project 22: Mule Deer/Game Enhancement – Statewide

Project 22 at a Glance

Mike Cox

GOAL: Enhance mule deer and other game populations where they may be at risk, experiencing chronic low carrying capacity and/or catastrophic decline.
PROJECT AREA: Statewide.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) The removal of predators is intended to result in enhancement of mule deer and other game populations. 2) Further data collection and analysis will determine the effectiveness of this project and direct wildlife management policy in the future statewide.
PROJECT DURATION: 2010-2015.

TOTAL KILL TO DATE:	**941 predators (922 coyotes, 19 cougars).**
FY13 TOTAL KILL:	**62 predators (60 coyotes, 2 cougars).**
TOTAL EXPENDITURES (2010-2013):	**$365,495 +$271,166 Heritage = $636,661**
FY14 APPROVED BUDGET:	**$110,000**
FY15 PROPOSED BUDGET:	**$ 40,000**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Terminate Project 30 June 2015.**

Introduction

In 2009, Project 22 was initiated statewide to provide flexibility and opportunity to respond quickly to conditions on the ground that biologists believe could be adversely affecting population viability of select mule deer herds and other game populations. Project area selection criteria were developed to define where and when a predator control policy would be deployed to enhance or protect sensitive game populations.

Methods

NDOW funds supported Wildlife Services to remove as many predators as was possible given the constraints of weather, time and available funding using aerial gunning, dogs, calling, call boxes, shooting, leg-hold traps, snares and gassing of natal dens to accomplish the treatment. Selective and timely control work identified by NDOW biologists focused on critical seasonal big game ranges. The timing of control work was in accordance with individual project criteria, but occurred primarily on critical winter ranges and summer fawning areas and/or in big game release/augmentation areas. Project 22 may also be used to redirect/augment funds in additional sub-projects (below) where an at-risk ungulate herd may be experiencing a reoccurring predation issue that may be limiting its ability to attain population viability in a particular mountain range or hunt unit. Additional detail can be found in the Appendix.

Conclusion

Targeted lethal predator removal that focuses efforts on specific problem areas (i.e. reintroduction efforts, catastrophic habitat loss, catastrophic fawn/lamb loss, sustained below-average recruitment, etc) is being used to attempt to protect and enhance big game resources in Nevada. Monitoring the success of bighorn releases and of herd performance in these areas will be used to determine if it is an effective and efficient use of sportsmens' dollars.

Recommendations

Game Division staff should evaluate proposals with regional game supervisors and biologists prior to contacting a contractor to initiate control efforts.

Use Project 22 for emergency projects or to complete previously identified ones.

Coordinate with contractors to continue predator removal work in targeted game population units. Evaluate each sub-project on its own merits annually.

Fund Project 22 through FY 2015. Evaluate efficacy of Project 22 annually.

Reporting requirements for FY 2015 projects will be reflective of language in Commission Policy #23.

Sub Project 22-14 Diamond Roberts Mule Deer Fawns - Area 14

Sub Project 22-14 At a Glance

Chad Bliss

GOALS: Conduct an integrated predation management project in the Diamond – Roberts Mountain Complex. Evaluate impacts to mule deer, greater sage-grouse and other wildlife species of an integrated approach to predation management including on-going sagebrush habitat restoration efforts, targeted lethal and/or non-lethal control of coyotes and common ravens and a public education campaign aimed at reducing manmade resource subsidies in the area.
PROJECT AREA: Diamond, Roberts Creek, Sulphur Springs and Whistler Mountains; Newark, Diamond and Kobeh Valleys.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) An integrated approach to predation management is intended to result in enhancement of mule deer, greater sage-grouse and other wildlife species in the Project Area. 2) Data collection and analysis would determine the effectiveness of this project and direct wildlife management policy in the future statewide.
PROJECT DURATION: 2014-2017.

FY14 APPROVED BUDGET:	**$40,000**
FY15 PROPOSED BUDGET:	**$60,000**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Fund project through FY 2017.**

Introduction

Sub Project 22-14 is an attempt to understand the complexity in managing wildlife species in a recovering sagebrush ecosystem in central Nevada. Work is currently being conducted in the Project Area to restore the native sagebrush steppe ecosystem to good or excellent condition. To that end, nearly 1,000 feral horses have been removed recently from a portion of the Project Area and there is work being conducted to restore sage-grouse brood habitat in and near water sources through targeted removal of piñon-juniper woodlands in historical sagebrush and stringer meadow habitats. We intend through this project to insert targeted, site specific predator removal/management in a time sequence over the landscape in an attempt to illicit positive responses in game and other wildlife populations over time. Specifically, changes in mule deer fawn recruitment, greater sage-grouse brood survival and the success of habitat restoration efforts would be monitored over the course of the project.

Methods

NDOW would continue to help fund sagebrush habitat restoration efforts in the Project Area. NDOW also plans to fund a Contractor to conduct lethal removal of coyotes from specific deer winter ranges in Project Area A (see map) during FY 2014 and FY 2015. NDOW also plans to fund carrion removal (non-lethal predation management) and lethal raven removal

efforts coupled with public education efforts to reduce manmade food subsidies in Project Area A during this same time period. Project Area B would be scheduled to receive these same treatments during a time period from FY 2016 to FY 2017.

For the purposes of data analysis, both A and B Project Areas, as well as adjacent untreated hunt units would serve as control areas during the years when no treatment is being conducted within their borders. Aside from normal game population monitoring efforts, indices of pre and post treatment predator numbers would also be generated through track counts, scent station monitoring, etc.

Pre and post corvid numbers would be assessed through breeding bird survey techniques. This work along with removal/management of raven resource subsidies will be conducted under Projects 29 and 30.

Lethal treatment would include aerial gunning, dogs, calling, call boxes, shooting, leg-hold traps, snares, poison (Corvicide) eggs. Coyote carcasses will be processed to determine weight, length, age, sex, reproductive condition, and fetus counts, and a portion of tongue will be removed for DNA analysis, whisker samples removed for isotope analysis, and teeth removed for age confirmation. In keeping with the increased focus on removal of man-made resource subsidies, all corvid and predator carcasses would be removed from the landscape when feasible and deposited in local animal pits and covered immediately.

With the exception of raven population monitoring, all predator population monitoring, processing and disposal work will be conducted by the same Contractor awarded the Contract for lethal removal. Additional detail can be found in the Appendix.

Conclusion

Area 14 may provide a unique opportunity to monitor recovery of wildlife populations in the context of habitat recovery and targeted predation management over time. A targeted approach to predation management that integrates habitat restoration, nonlethal and lethal predator management as well as public education may prove a useful prescription in areas where game populations are experiencing sustained below-average recruitment.

Recommendations

Fund Sub Project 22-14 through FY 2017.

Evaluate efficacy of Sub Project 22-14 annually.

Reporting requirements for FY 2014 projects will be reflective of language in Commission Policy #23.

Sub Project 22-14 Map (Project Area A – Diamond Mountains -Blue)
(Project Area B Roberts Creek Mountains - Ocher)

Sub Project 22-01 Massacre Rim / Hays Canyon / Coleman Canyon

California Bighorn Protection: Northern Washoe Area Units 011,012,013

Mike Cox and Chris Hampson

Project Inception: 1 July 2014

Project Conclusion: 30 June 2017

Project Area: Washoe County within Units 011, 012 and 013. Massacre Rim, Coleman Canyon and Hays Canyon Range would be the primary focus areas.

Target Predator: Mountain Lion.

Predator Removal Action: Remove lions that are in close proximity to recently released bighorn populations. Additional detail can be found in the Appendix.

Removal Period: Year-round but will be directed during periods when lions are thought to be impacting bighorn sheep.

Beneficiary Species: California Bighorn Sheep.

Desired Result (OBJECTIVE): Decrease mortality due to predation to all age classes of bighorn sheep which will allow the population to reach a threshold where predation no longer limits the population.

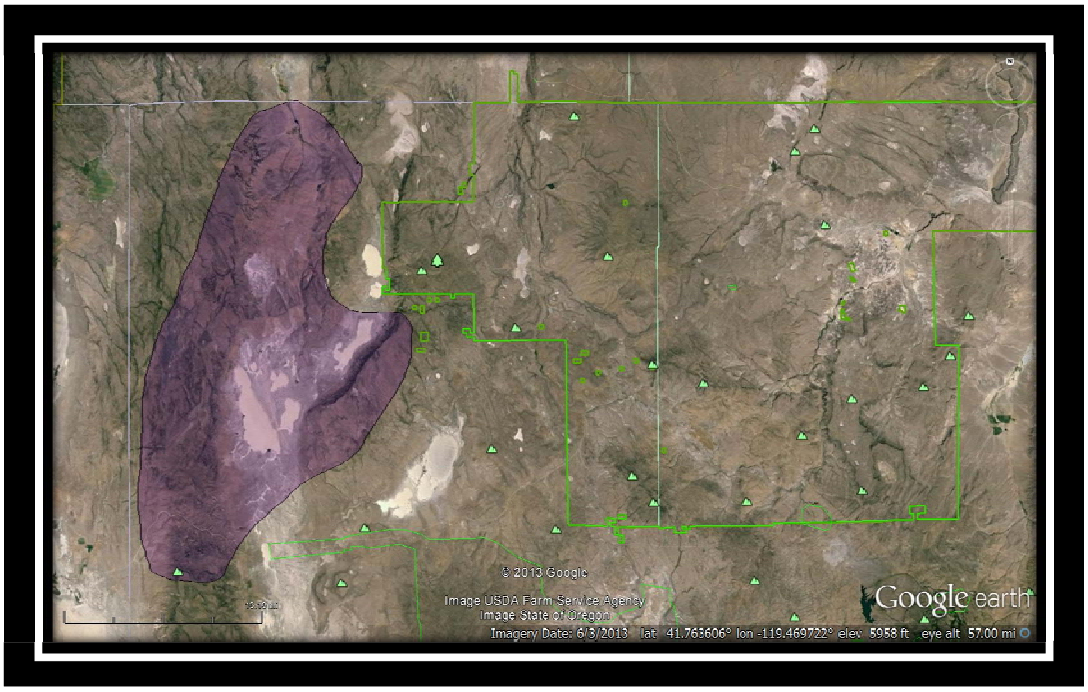
Evaluation Period: Year-round.

FY2015 Projected Expenditures: The total costs for FY 2015 would be $25,000.00 to conduct lethal mountain lion removal.

Justification for Proposal: These newly released California Bighorn Sheep Herds may need assistance in reaching a minimum level of population viability after which, no further predator removal efforts would be warranted.

Proposed Budget for FY2015:	$25,000
Lethal Removal Portion of Budget for FY2015:	$25,000

Additional Background: The three releases mentioned above are designed to establish a viable California bighorn population throughout the eastern half of hunt unit 011 and in the Hays Canyon Range of hunt unit 013. Additional augmentations may be made in the near future to bolster these populations.



Sub Project 22-01 Map – Massacre Project)

Massacre Rim (Unit 011) – this release occurred on January 3, 2012 with the release of 29 bighorn. The release site was located on the southern end of the Massacre Rim near Big Point. The complement was made up of 2 rams, 19 ewes and 8 lambs. The augmentation was made in an effort to bolster the small population of bighorn that remained along the Massacre/Long Valley Rim from a previous release of bighorn on the west side of the Little Sheldon . This release occurred on public lands to the south the Little Sheldon that one day could provide additional hunting opportunity to Nevada's sportsmen.

Hays Canyon (Unit 013) – this release followed a die-off that occurred in 2007. The release complement was made up of 3 rams, 21 ewes and 6 lambs and occurred on January 15, 2013. The release site was located at the bottom of Hays Canyon. The release was made in an effort to restore bighorn to the Hays Canyon Range.

Coleman Canyon (Unit 011) – this release occurred on January 18, 2014 on the south end of the Coleman Rim. The release complement was made up of 2 rams, 13 ewes, and 5 lambs and will bolster a population of bighorn first established by the Oregon Fish and Game back in 1995. Current population estimates for the Coleman Rim population (Oregon and Nevada) is estimate at between 60 - 80 animals). A big game guzzler was built on the south end of the rim during the summer of 2013. The release occurred immediately to the west of the new guzzler. This effort was made in an effort to establish a larger population of bighorn along the Nevada portion of the Coleman Rim. The bighorn are also expected to expand and explore sheep habitat on the north end of the Massacre Rim.

Sub Project 22-074 Protection of Rocky Mountain Bighorn Sheep

In Badlands - Contact Area- Unit 074

Mike Cox and Kari Huebner

Project Inception: 1 July 2014

Project Conclusion: 30 June 2017

Project Area: Elko County, within Unit 074. Ellen D Mountain, Black Mountain and the Badlands would be the primary focus areas.

Target Predator: Mountain Lion.

Predator Removal Action: Remove lions that are in close proximity to bighorn populations. In the first year, satellite radio collars would be deployed on five bighorns which would assist in directing lion removal efforts, finding lion kill sites and in understanding the relationship between mule deer, bighorn and cougar in the Badlands. Radio collars would also facilitate follow-up monitoring efforts on the bighorn sheep population. Additional detail can be found in the Appendix.

Removal Period: Year-round but will be directed during periods when lions are thought to be impacting bighorn sheep.

Beneficiary Species: Rocky Mountain Bighorn Sheep, Mule Deer.

Desired Result (OBJECTIVE): Decrease mortality due to predation to all age classes of bighorn sheep which will allow the population to reach a threshold where predation no longer limits the population.

Evaluation Period: Year-round.

FY2015 Projected Expenditures: The total costs for FY 2015 would be $25,000.00. This would include $15,000 to conduct lethal mountain lion removal and $10,000.00 for the capture and collaring of five bighorn sheep.

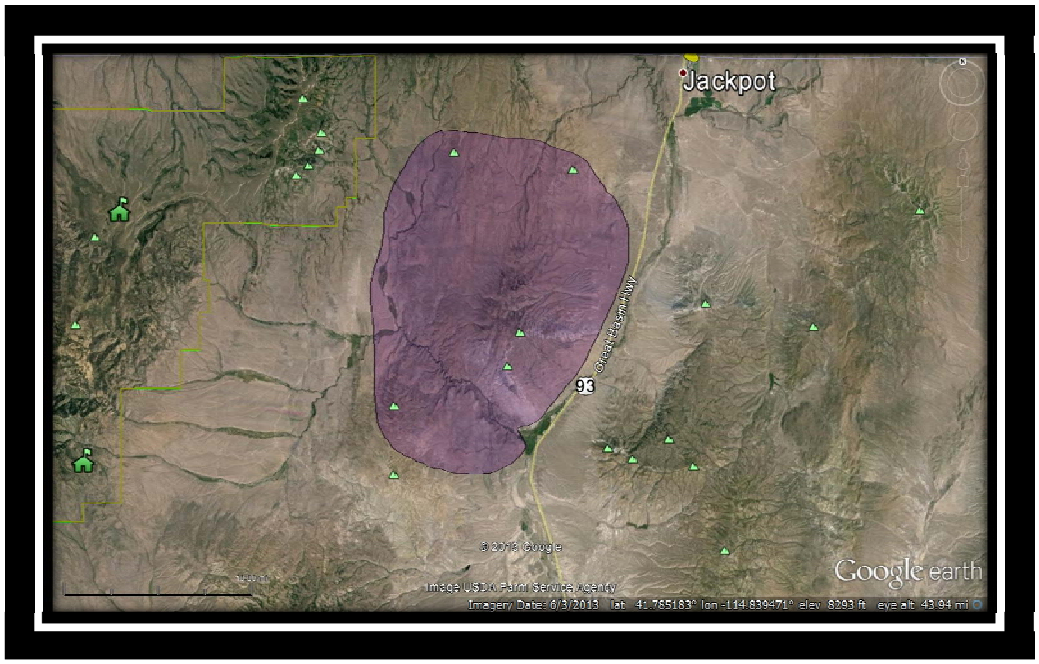
Justification for Proposal: The Contact Bighorn Sheep Herd experienced a die-off in 1999. Two years following the die-off the lamb recruitment was low which is consistent with bighorn die-offs. Since then the average lamb recruitment (surveyed in the winter) has been 48 lambs/100 ewes. This level of recruitment should have resulted in an increasing sheep herd; however sheep numbers have remained stagnant.

The Contact area is a major deer winter range. It is possible that mountain lions following the deer herd to winter range from the nearby Jarbidge Mountains are remaining after the deer have left in the spring and switching their diet to bighorn. Some lions may be staying in the area on a year-round basis with their primary food source being bighorn sheep.

In the last ten years sportsmen have harvested 16 mountain lions, of which seven were harvested in 2003 from the Contact area. If the lion harvest of 2003 is excluded then an average of less than one lion has been harvested from this area per year. This is a relatively low harvest rate given the high lion densities that are thought to reside in the area at least on a seasonal basis.

As stated, radio collars would be used to assist in finding lion kill sites, in directing predator removal efforts and monitoring efforts. Any telemetry-detected kill sites and/or reported kill sites or discovered mortality of bighorn and/or mule deer would be investigated to try to determine cause of death (predation, disease, etc.) in a timely manner.

Proposed Budget for FY2015: $25,000
Lethal Removal Portion of Budget for FY2015: $15,000



Sub Project 22-074 Map - Badlands Project

Note: New developments and revelations call into question the timeliness of this particular project:

1) A 500% increase in sport cougar harvest over 2012.
2) Positive tests for *Mycoplasma ovipneumoniae* in recent weeks in the herd unit.
3) Livestock trespass issues that maintain the allotment in poor to fair range condition.
4) No conclusive evidence of what cougars in the area actually prey upon.

Sub Project 22-205-207 Gabbs Valley Range Desert Bighorn

Release Protection: Mineral County Units 205,207

Mike Cox and Jason Salisbury

Project Inception: 1 July 2014

Project Conclusion: 30 June 2017

Project Area: Mineral County in the Gabbs Valley Range within Units 205 and 207.

Target Predator: Mountain Lion.

Predator Removal Action: Remove lions that are in close proximity to recently released bighorn populations. Additional detail can be found in the Appendix.

Removal Period: Year-round but will be directed during periods when lions are thought to be impacting bighorn sheep.

Beneficiary Species: Desert Bighorn Sheep.

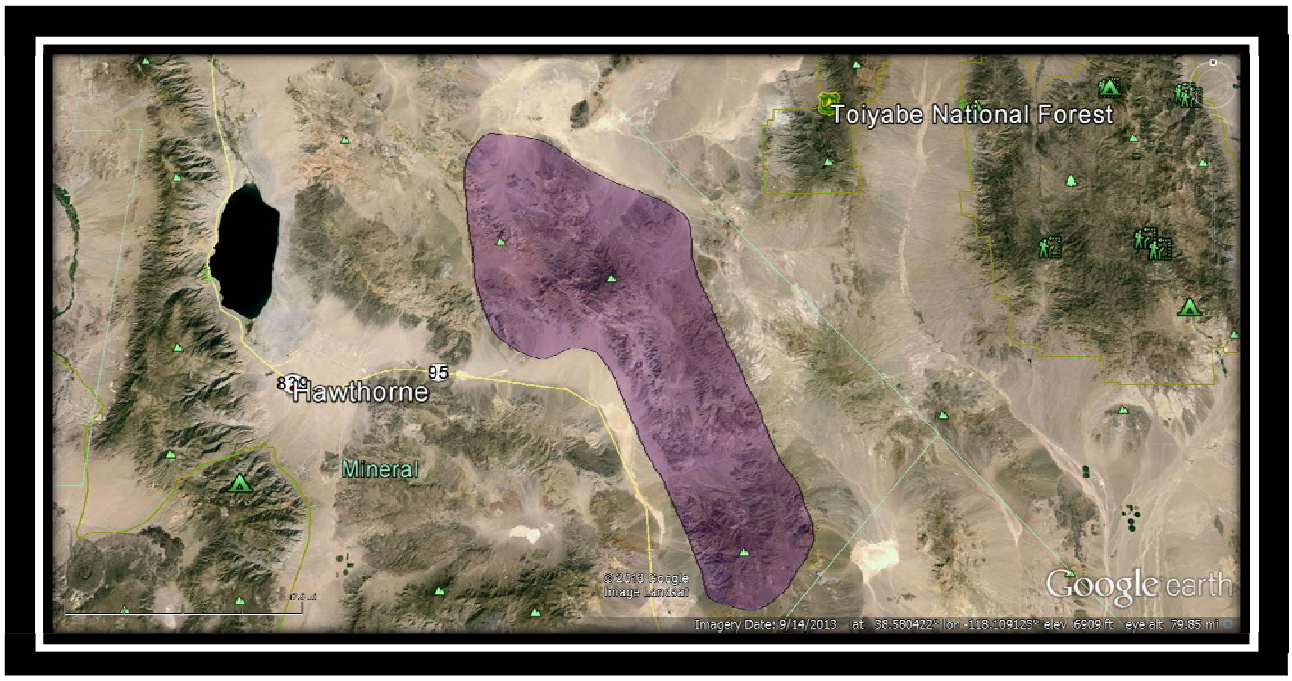
Desired Result (OBJECTIVE): Decrease mortality due to predation to all age classes of bighorn sheep which will allow the population to reach a threshold where predation no longer limits the population.

Evaluation Period: Year-round.

FY2015 Projected Expenditures: The total costs for FY 2015 would be $15,000.00 to conduct lethal mountain lion removal.

Justification for Proposal: These newly released Desert Bighorn Sheep Herds may need assistance in reaching a minimum level of population viability after which, no further predator removal efforts would be warranted.

Proposed Budget for FY2015:	$15,000
Lethal Removal Portion of Budget for FY2015:	$15,000



Sub Project 22-205/207 Map – Gabbs Valley Range Project

Project 25: Coyote Ecology Analysis – USU – Areas 16 and 17

Project 25 at a Glance

Pat Jackson

GOAL: Understand effects of food availability on abundance, home range size and litter size of coyotes.
PROJECT AREA: Toquima, Monitor and Toiyabe Mountain Ranges in Nye, Lander and Eureka Counties.
TARGET QUESTIONS: 1) How does availability of lagomorphs and small mammals influence coyote abundance, diet, and home range size? 2) What is the productivity of coyotes in central Nevada and how do these levels differ among 4 project sites?
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) Improved success of game population management is a potential result of an improved understanding of coyote dietary preference, coyote productivity and prey switching capabilities. 2) Improved understanding of coyote population dynamics and resource partitioning could improve our ability to manage wildlife habitats for optimum wildlife productivity statewide.
DURATION: 2010-2015.

TOTAL EXPENDITURES 2010-2013:	**$300,976 ($168K $3 Fee + $133K PR Aid)**
FY14 APPROVED BUDGET:	**$ 25,000 ($3 Fee) + $75,000 P-R Match**
FY15 PROPOSED BUDGET:	**$ 23,000 ($3 Fee) + $69,000 P-R Match**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Terminate project 12 August 2015.**

Introduction

PhD candidate Patrick Jackson (USU) began evaluating coyote ecology in the Monitor, Toiyabe, and Toquima ranges in central Nevada on 15 May 2011 (FY10) (See map). The project was designed to assess effects of food availability on abundance, home range size and litter size of coyotes. Radio-collar data will continue to provide data to facilitate understanding of how coyotes utilize available prey resources, habitats, and terrain throughout the year during all 4 seasons and relative to the effects of weather.

Methods

Coyotes were live-trapped year round and immobilized with a ketamine/xylazine injection. Animals were weighed, measured, ear-tagged and fitted with telemetry. Tagged coyotes were monitored year round. During summer, coyote scat, Lagomorph, passive-tracking and small mammal prey abundance surveys were conducted in the area as well (Clark 1972, Engeman et al 2000, Gantz and Knowlton 2005, Gese et al 1996, Hamlin et al 1984). Additional detail can be found in the Appendix.

Project 25 Coyote Project Area (Nye, Lander, Eureka County Interface).
(Blue scribbles are 2 of many coyote home ranges identified to date).

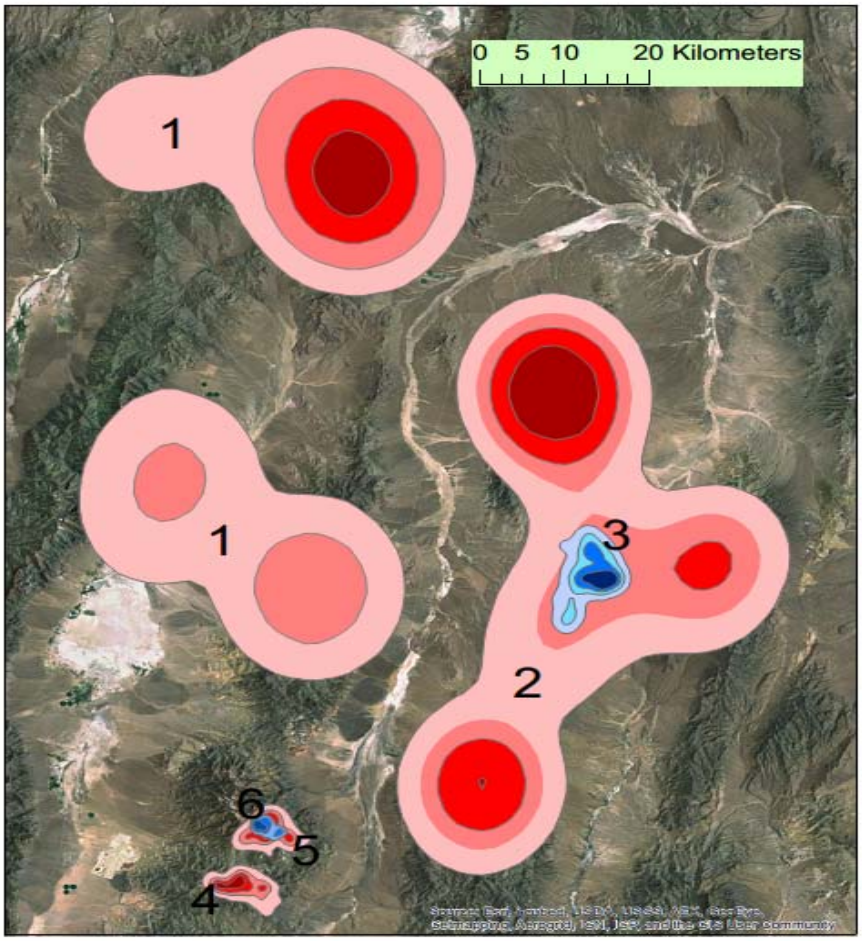
Conclusion

USU student personnel are conducting predator investigations successfully in relatively harsh field conditions. NDOW biologists will continue to coordinate with project proponents to manage financial assistance through $3 Predator Fee Program commitments to this project. The contracted end date for this project is 12 August 2015. All final reports, a PhD Dissertation, and peer-reviewed journal articles are due by this date.

Recommendation

Fund Project 25 through FY 2015. Evaluate efficacy of Project 25 annually.

Reporting requirements for FY 2015 projects will be reflective of language in Commission Policy #23.



Additional Project 25 data from Fiscal 2013. Adaptive kernel home range estimations of six coyotes wearing ATS IRIDIUM GPS collars in central Nevada, 2013. From west to east, Grass Valley and the Toiyabe Range to Big Smoky Valley, the Toquima Range, Monitor Valley, the Monitor Range and Hot Creek Range.

Project 29: Roadway Carrion Management to Enhance Sage-grouse Populations

Project 29 at a Glance

Kelli McKeegan and Kelly Horn

GOALS: 1) Reduce manmade food resource subsidy availability to Common Ravens along roads in northern Nevada and along Common Raven migration corridors in southern Nevada. 2) Evaluate effects of resource subsidy availability on Greater Sage-Grouse recruitment and Common Raven abundance, home range size and clutch size.
PROJECT AREA: Greater Sage-Grouse range in northern Nevada and Common Raven migration corridors in central and southern Nevada.
TARGET QUESTIONS: 1) How does sage-grouse recruitment, common raven clutch size and home range size differ between 3 treatment/ control areas before and after manmade resource subsidies have been removed permanently? 2) Determine common raven migration corridors.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) In areas where manmade resource subsidies for resident common raven populations are found to be a dietary factor, greater sage-grouse nest success and brood survival may be optimized by strategic removal of these subsidies. 2) In areas where seasonal common raven migration corridors are found to link manmade resource subsidies to high priority resident sage-grouse populations, greater sage-grouse nest success and brood survival may be optimized in priority sage-grouse habitats by strategic removal of these raven migration corridor food subsidies. Depending on the extent of raven migration, some of these food subsidies could be found tens or even hundreds of miles away from priority sage-grouse habitat. 3) Better road-carrion management has been identified by the USFWS as a non-lethal tool to help return common raven populations to more natural levels in the American West in the context of protection for greater sage-grouse populations.
PROJECT DURATION: 2013-2022.

TOTAL EXPENDITURES TO DATE:	**$18,468**
FY14 APPROVED BUDGET:	**$25,000 ($3 Fee)**
FY15 PROPOSED BUDGET:	**$25,000 ($3 Fee) + $30,000 (match)**
FY15 APPROVED BUDGET:	
RECOMMENDATION:	**Fund project through FY 2022.**

Introduction

Common raven populations have increased in Nevada since ornithologists first documented relative abundance of passerines in the Great Basin. Robert Ridgeway, for example, made little mention of raven sightings on a USGS bird survey through northern Nevada in 1867 (Ridgeway 1877). Manmade resource subsidies like road-kill carrion have, over the last 135 years, helped expand distribution and increase relative abundance of the species in the Great Basin. Some ground-nesting bird species have experienced increased nest predation by ravens in recent years (Coates et al 2007). This project is an attempt to reduce manmade

resource subsidies in the Great Basin and to bring common raven populations in to balance with the rest of the ecosystem using non-lethal population control methods.

Methods

In cooperation with NDOT, County Road crews, USFWS and UNR, NDOW hired wildlife technicians (Techs) to remove road carrion from six study areas in northern Nevada, in and around priority greater sage-grouse nesting habitat. Carrion was deposited underground on sight or in designated animal pits. Techs will also be responsible for monitoring known raven nests in treatment and control areas as well as conducting raven population surveys, raven capture and telemetry follow-up as well as sage-grouse lek and brood surveys in treatment and control areas. Additional detail can be found in the Appendix.

Raven work will be conducted in Churchill, Douglas, Elko, Esmeralda, Eureka, Humboldt, Lander, Lincoln, Lyon and Mineral, Nye, Washoe and White Pine counties.

Conclusion

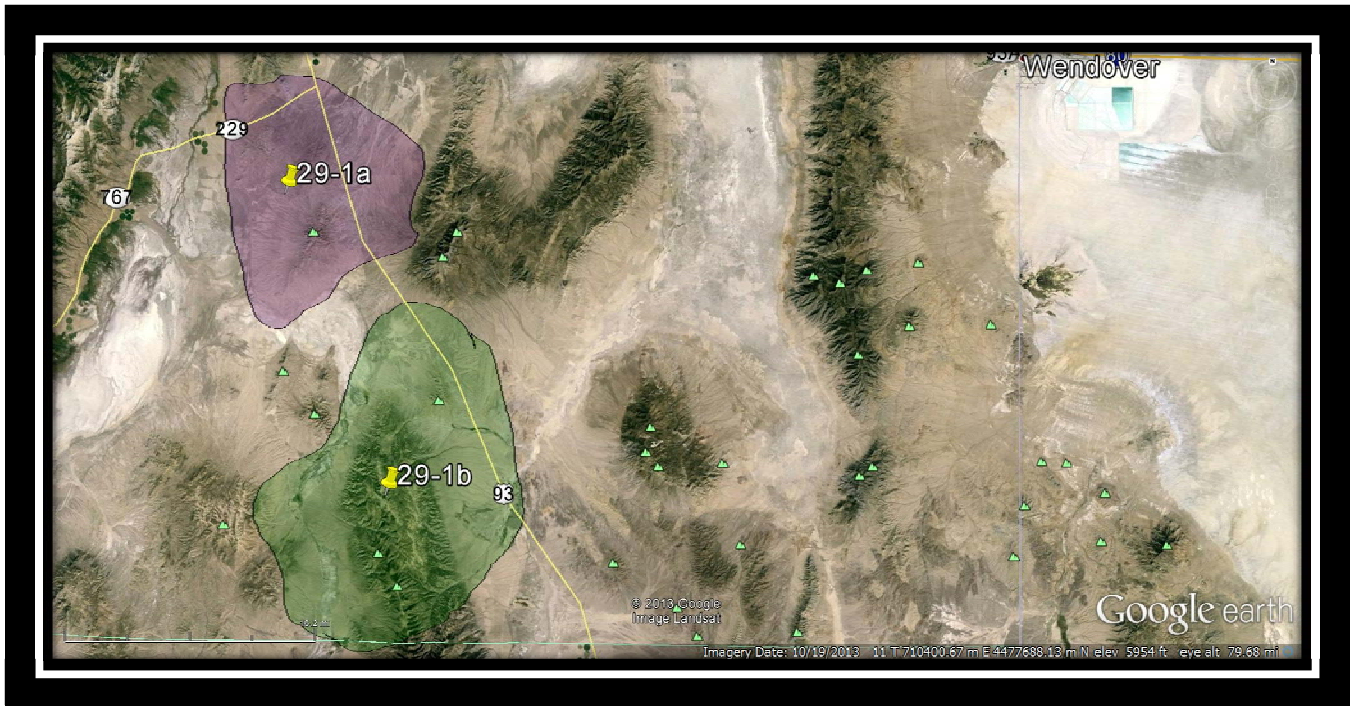
The value of healthy, abundant sage-grouse nesting habitat, free of manmade resource subsidies and artificial nesting structures for ravens, needs to be evaluated and documented. While progress has been made to reduce manmade resource subsidy availability to common raven populations, a sustained multi-year effort and cultural shift will be required to reduce and/or eliminate these artificial resources from high priority greater sage-grouse landscapes over the long term. The relative value of these actions for sage-grouse will be measured using NDOW's long-term sage-grouse population demographics data base and data generated as a spin-off benefit of this project.

Recommendation

Coordinate with contractors or cooperators to expand road carrion removal efforts in high priority greater sage-grouse habitats statewide.

Fund Project 29 through FY 2022. Evaluate efficacy of Project 29 annually.

Reporting requirements for FY 2015 projects will be reflective of language in Commission Policy #23.



Project 29 Map - Common Raven Resource Subsidy (Road Carrion) Management Project Areas 1a (No Treatment) and 1b (Road Carrion Removal) (Elko - White Pine County Border).

Project 30: Landfill Waste Stream Management to Enhance Sage-grouse

Project 30 at a Glance

Kelli McKeegan and Kelly Horn

GOAL: Reduce manmade resource subsidy availability to Common Ravens at public landfills and public dead animal pits across Nevada.
PROJECT AREA: Statewide with special focus on Greater Sage-Grouse nesting habitat.
TARGET OBJECTIVES: 1) Short Term - Reduce number of public landfills and dead animal pits in priority sage-grouse nesting habitat that remain desirable foraging areas for common ravens by 50% in five years. 2) Long Term - Reduce number of public landfills and dead animal pits in priority sage-grouse nesting habitat that remain desirable foraging areas for common ravens by 100% in ten years.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) In areas where manmade resource subsidies for resident common raven populations are found to be a dietary factor, greater sage-grouse nest success and brood survival may be optimized by strategic removal of these subsidies. 2) In areas where seasonal common raven migration corridors are found to link manmade resource subsidies to high priority resident sage-grouse populations, greater sage-grouse nest success and brood survival may be optimized in priority sage-grouse habitats by strategic removal of these raven migration corridor food subsidies. Depending on the extent of raven migration, some of these food subsidies could be found tens and even hundreds of miles away from priority sage-grouse habitat. 3. Better waste-stream management has been identified by the USFWS as a non-lethal tool to help return common raven populations to more natural levels in the American West in the context of protection for greater sage-grouse populations.
PROJECT DURATION: 2013-2022.

TOTAL EXPENDITURES TO DATE:	**$15,950**
FY14 APPROVED BUDGET:	**$25,000($3 Fee)**
FY15 PROPOSED BUDGET:	**$30,000($3 Fee) + $30,000 (Match Pending)**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Fund project through FY 2022.**

Introduction

Common raven populations have increased in Nevada since ornithologists first documented relative abundance of passerines in the Great Basin. Robert Ridgeway, for example, made little mention of raven sightings on a USGS bird survey through northern Nevada in 1867 (Ridgeway 1877). Manmade resource subsidies like household food waste and dead animal pits have, over the last 135 years, helped expand distribution and increase relative abundance of the species in the Great Basin. Some ground nesting bird species have experienced increased nest predation by ravens in recent years (Coates et al 2007). This project is an attempt to reduce manmade resource subsidies in the Great Basin and to bring

common raven populations in to balance with the rest of the ecosystem using non-lethal population control methods.

Methods

In cooperation with City and County Municipalities and the USFWS, NDOW plans to work to change waste stream policies to include changes in food waste collection, the addition of special covered pits specifically for household/commercial food waste separate from the normal household/commercial garbage pits as well as increases in the frequency of food waste and dead animal pit burial at these sites. NDOW will use conservation education messages or direct contact with private landowners to encourage them to cover their dead-animal pits and other sources of manmade resource subsidies on the landscape that commonly attract ravens.

In the project's inaugural year (FY13), NDOW budgeted $6,000 to go toward municipal fuel and personnel charges to increase burial frequency at five landfills and dead animal pits in priority greater sage-grouse habitats in Humboldt, Eureka and Lander Counties. NDOW is also coordinating specifically with and supports efforts at the Midas Transfer Station and other Transfer Stations to make waste material inaccessible to ravens. This may include alternative containers for disposal. Additional detail can be found in the Appendix.

Conclusion

The value of healthy, abundant sage-grouse nesting habitat, free of manmade resource subsidies and artificial nesting structures for ravens, needs to be evaluated and documented. While progress has been made to reduce manmade resource subsidy availability to common raven populations, a sustained multiyear effort and cultural shift will be required to reduce and/or eliminate these artificial resources from high priority greater sage-grouse landscapes over the long term. The relative value of these actions for sage-grouse will be measured using NDOW's long-term sage-grouse population demographics data base and data generated as a spin-off benefit of this project.

Recommendation

Coordinate with contractors or cooperators to expand waste stream management efforts in high priority greater sage-grouse habitats statewide.

Fund Project 30 through FY 2022. Evaluate efficacy of Project 30 annually.

Reporting requirements for FY 2014 projects will be reflective of language in Commission Policy #23.

Project 32: Cougar-Black Bear-Mule Deer Interaction – Areas 19,20,29

Project 32 at a Glance

Alyson Andreasen, Carl Lackey, Cody Schroeder

GOALS: 1) Elucidate Apex predator resource partitioning/ competition/ commensalism in desert ranges immediately east of Sierra/Carson Front where Black Bear have established territories recently that overlap those of Cougars.
PROJECT AREA: Douglas, Lyon, Mineral and possibly Esmeralda counties (Areas 20, 29 and possibly 21).
TARGET QUESTIONS: 1) Does cougar home range size differ between areas with and without black bear home range overlap? 2) How do diets of the two sympatric predators compare? 3) Do mule deer experience increased predation by cougars in desert ranges where black bears and cougars are sympatrics.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) Improved success of big game population management, both ungulate and predator big game, is a potential result of improved understanding of lion/bear dietary preference, dietary overlap and prey switching capabilities. 2) Improved and targeted predator population management in these desert ranges could potentially improve attendant big game population management which has implications for improved big game tag allocation and wildlife viewing opportunities in these desert ranges adjacent the Sierra Nevada. 3) Improved mule deer population/habitat management could result from this project.
PROJECT DURATION: 2014-2018.

TOTAL EXPENDITURES TO DATE:	**$40,838**
FY14 APPROVED BUDGET:	**$15,000 ($3 Fee) + $ 45,000 (P-R)**
FY15 PROPOSED BUDGET:	**$25,000 ($3 Fee) + $320,000 (P-R, SCI, WCS,NBU)**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Fund project through FY 2018.**

Introduction

The black bear population has expanded its distribution in western Nevada recently to include historical bear habitat in desert mountain ranges east of the Sierra/Carson Front (Beckmann and Berger 2003; NDOW 2004a) (See Map). Natural diet overlap of bears and cougars (Hornocker and Negri 2010), and the recent range expansion by bears provide an opportunity to evaluate resource partitioning in these two Apex predators.

Methods

In cooperation with the Wildlife Conservation Society (WCS) and UNR, NDOW plans to monitor black bear and cougar movement patterns in 3 areas of western Nevada. Through the analysis of location data, kill-site follow-up, tissue analysis, prey availability and habitat conditions we hope to begin to understand the relationship between the 2 predator species

and how this relationship may impact prey species in the areas. Differences in seasonal diet patterns, home ranges, movement patterns, population linkages and reported interspecific interaction behaviors such as kleptoparasitism, where bears take over and scavenge cougar kills will be studied. Over a 5-year period, NDOW, WCS and UNR plan to satellite collar 15 cougars and 15 black bears in the 3 areas (30 Vectronic collars). Additional detail can be found in the Appendix.

Conclusion

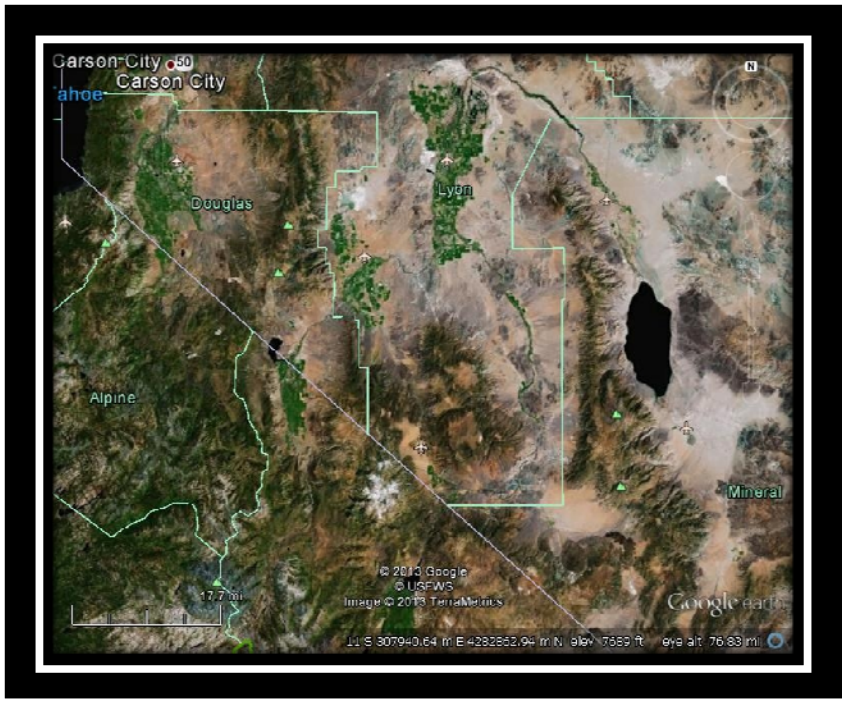
Well-designed predator-prey investigations would improve success of big game releases, mule deer population management and improve our understanding of trophic cascade, lion/bear dietary preferences, prey switching capabilities and various other interspecific interactions.

Recommendation

Coordinate with contractors and cooperators to design and implement investigative efforts in Areas 19,20 and 29.

Fund Project 32 through FY 2018. Evaluate efficacy of Project 32 annually.

Reporting requirements for FY2015 projects will be reflective of language in Commission Policy #23.



PROJECT 32 GENERAL PROJECT AREA MAP
(DOUGLAS, LYON, MINERAL COUNTY, NEVADA REGION)

Project 33: Greater Sage-Grouse Nesting Habitat Restoration –Area 20

Project 33 At a Glance

Shawn Espinosa, Mark Freese, Lee Turner

GOAL: Increase carrying capacity and reduce predation via restoration of several hundred acres of high priority Bi-State Greater Sage-Grouse nesting habitat to good or excellent condition.
PROJECT AREA: Sweetwater, Pine Grove and Wassuk Ranges of Lyon, Douglas and Mineral Counties (Area 20).
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS: Bi-State Sage-Grouse populations would benefit from a greater abundance and higher quality of unfragmented sagebrush steppe habitat in the Pine Grove, Sweetwater and Wassuk Ranges of western Nevada.
PROJECT DURATION: 2014-2018.

TOTAL EXPENDITURES TO DATE:	**$75,000**
FY14 APPROVED BUDGET:	**$25,000 ($3 Fee) + $50,000 (Wildl Res Acct)**
FY15 PROPOSED BUDGET:	**$50,000 ($3 Fee) + $50,000 (Wildl Res Acct)**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Fund project through FY 2018.**

Introduction

Sage-Grouse populations in Nevada have been compromised by decades of habitat fragmentation, habitat deterioration and outright habitat loss. This project is an attempt to restore key high priority sagebrush habitats in the hopes of making the Bi-State Population more robust and able to handle the vagaries of changing environmental conditions over time.

Methods

With minimum tools, contractors would remove young piñon-juniper vegetation from areas within roadless portions of the Bald Mountain, Sweetwater and Wassuk Ranges which have been identified as former high-quality nesting habitat for the greater sage-grouse. Crews would focus on areas adjacent native sagebrush, perennial grass and forb seed sources. Additional detail can be found in the Appendix.

Conclusion

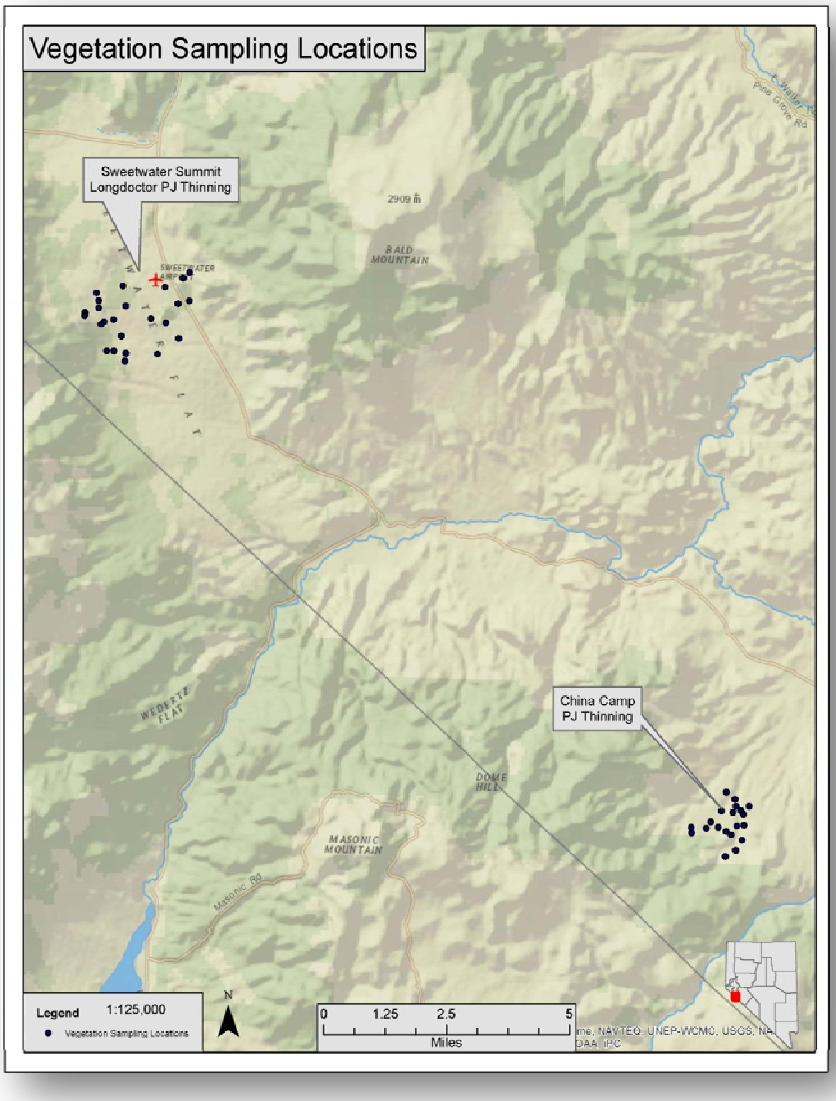
The importance of healthy, abundant sage-grouse nesting habitat cannot be overstated. When one compares sage-grouse nest success for example in the Sheldon National Wildlife Refuge (Unit 033) to adjacent units, it becomes readily apparent that abundant sagebrush habitat with a healthy understory of native perennial grasses and forbs provides the best possible security cover and forage availability to nesting and brooding sage-grouse.

Recommendation

Coordinate with contractors, cooperators and Habitat Division to expand and accelerate sagebrush steppe ecosystem restoration in high priority Bi-State Greater Sage-Grouse habitats in Lyon, Douglas and Mineral Counties.

Fund Project 33 through FY 2018. Evaluate efficacy of Project 33 annually.

Reporting requirements for FY2015 projects will be reflective of language in Commission Policy #23.



Project 33 - Bi-State Sage-Grouse Nesting Habitat Restoration Project Area

Project 35: Using genetic testing to identify origin of red fox populations in the Great Basin (Areas 7-12)

Project 35 at a Glance

Russell Woolstenhulme

GOALS: 1) Determine origin(s) of red fox population expanding into high priority greater sage-grouse habitat in the Great Basin. 2) Assess degree of hybridization between native and non-native red foxes in the Great Basin.
PROJECT AREA: Elko, White Pine, Lander, and Eureka counties (Areas 7, 8, 9, 10, 11, 12).
TARGET QUESTIONS: 1) Distributions of non-native and native red foxes. 2) Population genetic distinctiveness of native and non-native red foxes.
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS/HABITATS:
1) Improved understanding of influences of meso-carnivores on native ecosystems will give managers more and better tools to manage predation issues and wildlife populations in the future.
PROJECT DURATION: FY 2015 ONLY.

TOTAL EXPENDITURES TO DATE:	**$ 0**
FY15 PROPOSED BUDGET:	**$9,750 ($3 Fee)**
FY15 APPROVED BUDGET:	**$**
RECOMMENDATION:	**Fund project through FY 2015.**

Introduction

In March of 2010, the greater sage-grouse (*Centrocercus urophasianus*) was designated a candidate species for listing under the US Endangered Species Act, currently pending decision to be rendered by September 2015. Sagebrush habitat loss and conversion (through fire, grazing, invasive nonnative vegetation and piñon-juniper expansion) may be the most significant factor threatening sage-grouse, both directly and potentially by exposing sage-grouse to novel sources of predation. Both ravens and terrestrial predators can be locally significant predators of sage grouse. Among the terrestrial predators in the Great Basin, coyotes (*Canis latrans*) are the most numerous. However, coyotes tend to prey preferentially on small mammals and rarely pose a significant threat to threatened and endangered ground-nesting birds (Lockyer et al. 2013).

In contrast, the red fox (*Vulpes vulpes*) can be a significant predator of ground-nesting birds and is known to impact several endangered ground-nesting bird species, including greater sage-grouse in the western US (Sargeant et al. 1984; Lewis et al. 1999; Bunnell et al. 2000). As of 1996, red fox numbers appeared to be expanding in northeast Nevada and were presumed to be non-native in origin (Kamler and Ballard 2003). Recent trapping activity in this part of the state suggests that expansion has increased rapidly in the past 2 years and

preliminary data from some locations support the suggestion that these may be of a non-native origin (R. Stoeberl, personal communication; B. N. Sacks, unpublished data).

An alternative and perhaps parallel hypothesis that may explain apparent range expansion of red fox in the Great Basin involves the coyote. Because of avoidance behavior by red foxes of coyote home ranges, and because coyotes tend to function as apex predators in association with red foxes, chasing and eating them on occasion, (Goldman 1930; Dekker 1983; Voigt and Earle 1983; Major and Sherburne 1987; Young and Jackson 1951:93), coyotes are believed to influence the distribution and abundance of red foxes (Sargeant 1982). Examples of inverse relations in abundance of the two predators are numerous (Dekker 1983; Goldman 1930; Johnson and Sargeant 1977; Linhart and Robinson 1972; Schmidt 1986). Thus, if for example, sustained lethal removal of coyotes is suppressing coyote populations in some areas, red foxes may be taking advantage of empty territories and thus expanding their own species range through relatively coyote-empty dispersal corridors. A few studies seem to suggest more overlap in sympatric populations of coyotes and red foxes (Sargeant et al 1987; Sargeant and Allen 1989; Allen 1996). However, most of this work was conducted in prairie pothole/agri-business/industrial landscapes and it is unclear how applicable the results would be to a wild basin and range province. Also, in at least one of these studies, Sargeant et al (1987) presented a hypothesis for coyote-induced fox population declines, based largely on red fox avoidance mechanisms, corroborating earlier findings.

Red foxes occurred historically at low abundance among “sky island” mountain ranges of the Great Basin (Hall 1946; Heaton 1990). However, red foxes have increased significantly in abundance and range, and currently occur in many areas of Nevada that overlap sage-grouse lekking and nesting habitat where they were not formerly known to occur. Thus, it is likely that this novel and efficient avian predator could pose a significant and growing threat to greater sage-grouse in Nevada. The genetic origin of these foxes is currently unknown.

Most native red foxes of western North America occur in relictual populations in high montane zones of the Rocky, Cascade, Sierra Nevada, and high-elevation Great Basin Mountain ranges, where cooler habitats more closely resemble those that were widespread during the Pleistocene (Hall 1946; Sacks et al. 2010; Fig. 1). Two of the three native western subspecies of montane red fox (Washington Cascade, Sierra Nevada) also are in decline, imperiled, and are either currently listed or under review for listing by state and/or federal agencies. The Rocky Mountain red fox appears stable. The systematics of the native sky-island Nevada foxes are poorly resolved and these foxes could themselves be a series of isolated relictual populations threatened by climatic warming (Sacks et al. 2010).

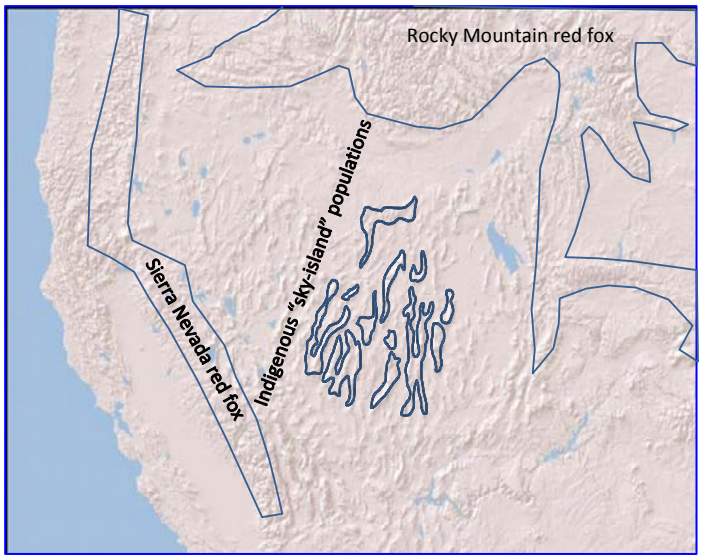


Figure 1. Historical ranges of Sierra Nevada and Rocky Mountain red fox subspecies, along with putative historical range of Great Basin sky-island red fox populations (Washington Cascade red fox not shown). Systematics of indigenous sky-island red foxes remain unresolved, but are probably more closely related to Rocky Mountain than to Sierra Nevada red foxes (Sacks et al. 2010).

Defining the problem

In contrast, non-native red foxes originating from released or escaped fur-farm stock are typically found at lower elevations primarily around urban areas and human-dominated agricultural landscapes (Fig. 2; Statham et al. 2012).

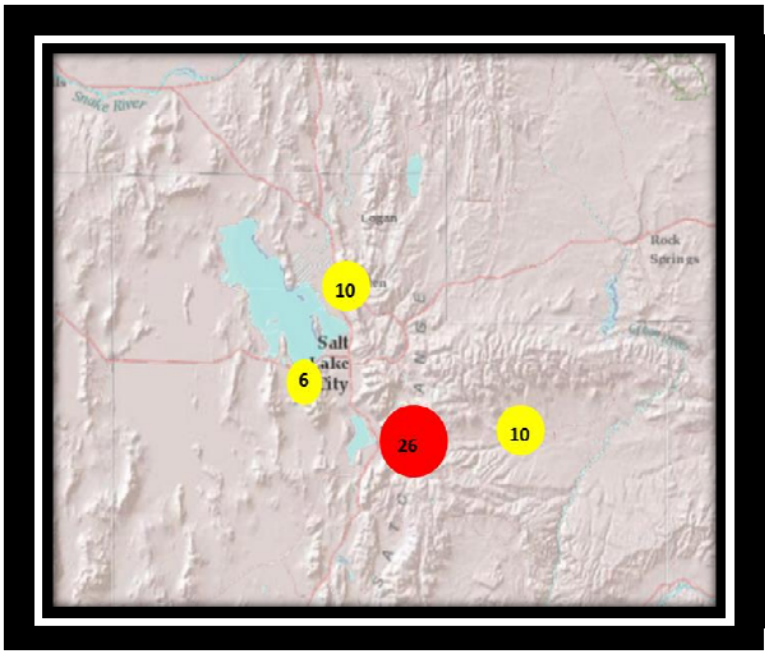


Figure 2. Locations of red fox samples, illustrating 6, 10, and 10 nonnative (yellow) red foxes (total n = 26) near urban or human dominated lowlands and 26 native (red) Rocky Mountain red foxes from the highest elevations of the Wasatch Mountains, illustrating clear distinction between habitat affinities of adjacent native and nonnative red foxes in Utah (Sacks et al., unpublished genetic data).

Therefore, it is important to determine whether the increasing and expanding red foxes in Nevada represent an invasive non-native predator, a natural range expansion of native Rocky Mountain red foxes, or increasing abundance of local, indigenous Great Basin red foxes. If this is an invasive non-native predator, then it is important to determine the origin and route of ingress into the state (e.g., western Utah or southern Idaho). Second, it is important to assess whether non-native foxes are hybridizing with native ones, which could exacerbate the problem in 3 significant ways: (1) Most non-native red fox populations are closely associated with human development, which limits their invasiveness to wildlands, but if nonnative foxes hybridize with native ones, this could enhance their invasiveness into remote locations, where impacts on ground nesting birds could be most significant. (2) Native red foxes were historically rare and isolated in the high montane sky islands of Nevada and in the western mountains adjacent to the Sierra Nevada Range. Interbreeding with non-native foxes could threaten this long-standing native species with extirpation through genetic swamping. (3) Because of their dominant nature, interbreeding of native and non-native red foxes could also threaten other native fox populations in the Great Basin, including the kit fox (*Vulpes macrotis*) and the gray fox (*Urocyon cinereoargenteus*) (Feldhamer et al 2003).

We have mapped reports of red fox occurrences communicated to the Nevada Department of Wildlife (NDOW) on sage-grouse nesting habitat to identify putative predation hotspots. We also have worked with a variety of private and public land administrators, who have provided direct information on sage-grouse predation (Fig. 3).
In fall 2013, cooperating trappers, coordinated by R. Stoeberl, focused efforts in putative predation hotspots in northeast NV and surrounding potential source populations in Utah and Idaho (Fig. 4). Genetic samples and associated data were collected as per protocols of the UC Davis Mammalian Ecology and Conservation Unit (MECU) and transferred to that laboratory, where they await analysis and testing.

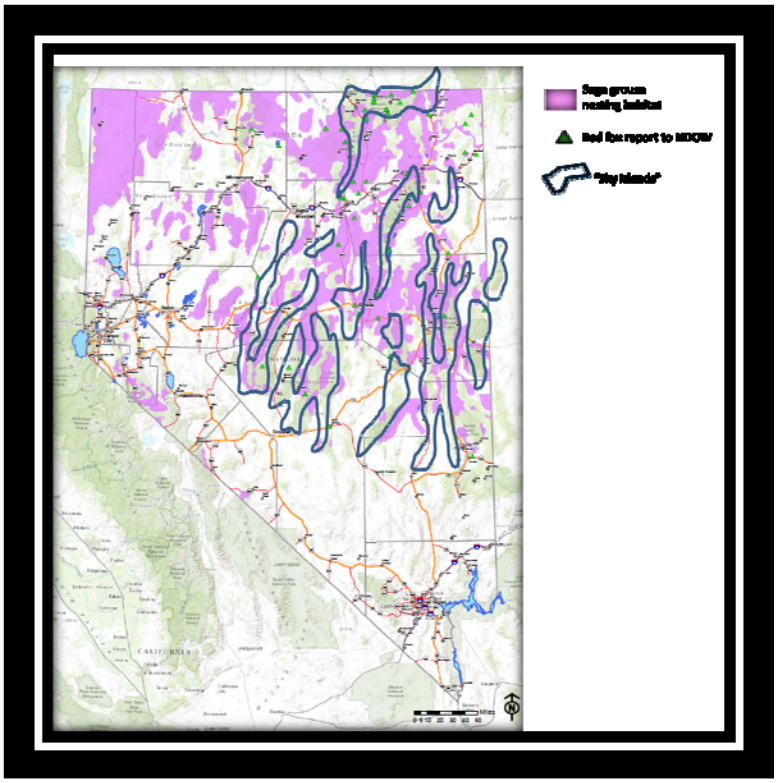


Figure 3. Relationship between sage-grouse nesting habitat, reports of red fox occurrence in Nevada, and sky-islands composing the putative historical range of rare, indigenous Nevada red foxes.

Methods

We will genotype these fox samples with 33 high-resolution nuclear loci to compare among these samples and with historical and modern reference samples previously published (Sacks and Louie 2008; Sacks et al. 2009, 2010, 2011; Statham et al. 2012a,b). We will analyze genotypes to determine (1) native vs. non-native ancestry, (2) genetic affinities of native and non-native samples to assess hybridization, (3) genetic affinities of non-native northeast Nevada genotypes with those from populations in western Utah and southern Idaho to assess source of origin. Additional detail can be found in the Appendix.

Budget

65 samples @ $150/sample for a 33-locus genotype = $9,750

Potential Contractors:

Benjamin N. Sacks
Adjunct Asst. Professor, Director Canid Diversity and Conservation Lab
Dept. Population Health and Reproduction
Veterinary Genetics Laboratory
University of California, Davis

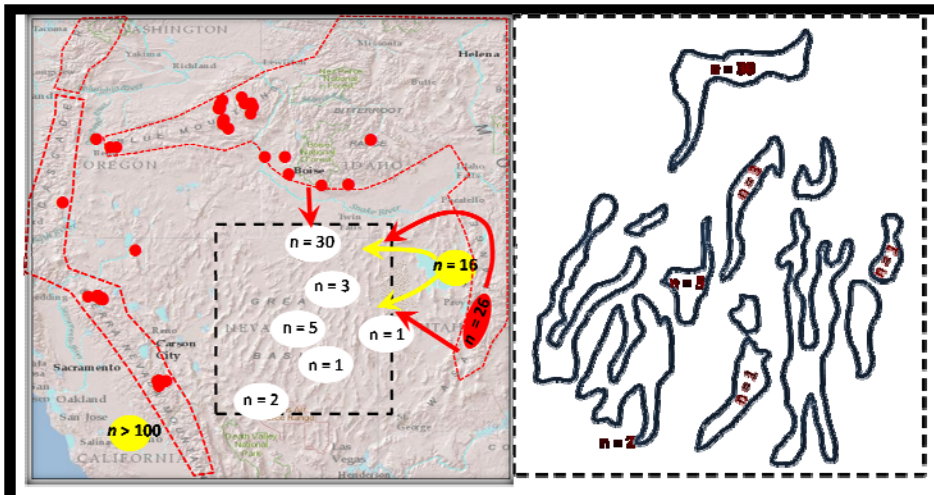


Figure 4. Red fox genetic samples, including 93 native western and >116 nonnative (feral fur-farm foxes) foxes bordering the Great Basin and 42 samples of mostly unknown ancestry in and around "sky islands" within the Great Basin. Dashed box encloses the Nevada populations targeted for intensive field sampling. Right: inset showing current sample distribution within Nevada relative to sky islands where native red fox may have historically occurred at low density. Red dotted polygons circumscribe three native subspecies of western montane red fox. Arrows indicate hypothetical sources of expansion as alternatives to demographic increases to explain the recent increases in abundance of red fox in Nevada.

References

Allen, Steve. 1996. Coyotes on the move: Changes in distribution of coyotes and red fox in North Dakota. North Dakota Outdoors 58(7):6-11.

Bunnell, . D., D. J. Bambough, J. T. Flinders. 2000. Strawberry Valley sage grouse recovery project. Utah Division of Wildlife Resources, Salt Lake City.

Dekker, D. 1983. Denning and foraging habits of red foxes, *Vulpes vulpes*, and their interaction with coyotes, *Canis latrans*, in central Alberta, 1972-1981. Canadian Field-Nat., 97:303-306.

Feldhamer, George A.; Thompson, Bruce Carlyle; Chapman, Joseph A. (2003). Wild mammals of North America: biology, management, and conservation. JHU Press. ISBN 0-8018-7416-5.

Goldman, E. A. 1930. The coyote—archpredator. J. Mamm., 11:325-334.

Heaton T.H. 1990. Quaternary mammals of the great basin: extinct giants, Pleistocene relicts, and recent immigrants. Chapter 15 in Causes of Evolution: a Paleontological Perspective, Ross, R. M., and Allmon, W. D. (eds.), Univ. Chicago Press, pp. 422-465.

Johnson, D. H., and A. B. Sargeant. 1977. Impact of red fox predation on the sex ratio of prairie mallards. U.S. Fish and Wildl. Serv. Wildl. Res. Rept., 6:1-56.

Kamler, J. F., W. B. Ballard. 2003. Range expansion of red foxes in eastern Nevada and western Utah. *Journal of the Arizona-Nevada Academy of Science* 36:18-20.

Linhart, S. B., and W. B. Robinson. 1972. Some relative carnivore densities in areas under sustained coyote control. J. Mamm., 53:880-884.

Lockyer, Z. B., Coates, P. S., Casazza, M. L., Espinosa, S., Delehanty, D. J. 2013. Greater Sage-Grouse Nest Predators in the Virginia Mountains of Northwestern Nevada. *Journal of Fish and Wildlife Management* 4:242-255.

Major, J. T., and J. A. Sherburne. 1987. Interspecific relationships of coyotes, bobcats, and red foxes in western Maine. J. Wildl. Mgmt., 51:606-616.

Moore M., S. K. Brown, B. N. Sacks. 2010. Thirty-one short red fox (*Vulpes vulpes*) microsatellite markers. *Molecular Ecology Resources* 10:404-408.

Sacks, B. N., and S. Louie. 2008. Using the dog genome to find SNPs in red foxes and other distantly related members of the Canidae. *Molecular Ecology Resources* 8:35-49.

Sacks, B. N., Moore M., Statham, M. J., Wittmer H. U. 2011. A restricted hybrid zone between native and introduced red fox (*Vulpes vulpes*) populations suggests reproductive barriers and competitive exclusion. *Molecular Ecology* 20:326-341.

Sacks, B. N., M. J, Statham, J. D. Perrine, S.M. Wisely, Aubry, K. A. 2010. North American montane red foxes: expansion, fragmentation, and the origin of the Sacramento Valley red fox. *Conservation Genetics* 11:1523-1539.

Sacks, B. N., D. I. Våge, M. J, Statham. 2009. A medium-throughput SNP assay for detecting genetic variation in coding and non-coding portions of the red fox genome. *Conservation Genetics Resources* 1:459-463.

Sargeant, A. B.1982. A case history of a dynamic resource - the red fox. Pp. 121-137,*in* Midwest fur-bearer management (G. C. Sanderson, ed.). Proc. 1981 Symp., Midwest Fish Wildl. Conf., Wichita, Kansas, 195 pp.

Sargeant, A. B., S. H. Allen, and R. T. Eberhard. 1984. Red fox predation on breeding ducks in midcontinent North America. *Wildlife Monographs* 89.

Sargeant, A. B., S. H. Allen, and J.O. Hastings. 1987. Spatial relations between sympatric coyotes and red foxes in North Dakota. J Wildl Manage 51: 285-293.

Sargeant, A. B. and S. H. Allen. 1989. Observed interactions between coyotes and red foxes. Journal of Mammalogy 70(3):631-633.

Schmidt, R. H. 1986. Community-level effects of coyote population reduction. Pp. 49-65, *in* Community toxicity testing (J. Cairnes, Jr., ed.). Amer. Soc. Testing Materials Spec. Tech. Publ, 920:1-350.

Statham, M. J., Sacks, B. N., Aubry, K. A., Perrine, J. D., Wisely, S.M. 2012a. The origin of recently established red fox populations in the contiguous United States: Translocations or natural range expansions? *Journal of Mammalogy*, 93:52-65.

Statham, M. J., Rich, A. C., Lisius, S. K., Sacks, B. N. 2012b. Discovery of a remnant population of Sierra Nevada red fox (*Vulpes vulpes necator*). *Northwest Science* 86:122-132.

Voigt, D. R., and B. D. Earle. 1983. Avoidance of coyotes by red fox families. J. Wildl. Mgmt., 47:852-857.

Young, S. P., and H. H. T. Jackson. 1951. The clever coyote. Univ. Nebraska Press, Lincoln, 411 pp.

CANCELED PROJECTS

Project 18: Protection of Mule Deer - Unit 014

Project 18 at a Glance

GOAL: Enhance existing mule deer population in northern Washoe County.
PROJECT AREA: Treatment Area (Predator removal)- Granite Range (Unit 014); Control Areas (No or limited predator removal) – Surrounding Mountain Ranges (Units 011, 012, 013, 015 and 033).
IMPLICATIONS FOR MANAGEMENT OF WILDLIFE POPULATIONS and HABITATS:
1) The removal of predators was intended to result in enhancement of the 014 mule deer herd. 2) Final data collection and analysis would determine overall effectiveness of this project and direct wildlife management policy in the future in Unit 014 and across the State.
PRELIMINARY CONCLUSION: Although a positive population response can be documented when comparing published population estimates, comparison of population response in other areas of the state and specific population and harvest data for Unit 014 do not appear to be significantly different than adjacent areas or past deer population trends in Unit 014 itself. This analysis brings into question the cost effectiveness of this project with significant expenditures of sportsmen's dollars for limited benefits.
PROJECT DURATION: 2004-2014.
TARGET SPECIES: Carnivora - Coyote, Cougar.
TIME PERIOD: Year round.

TOTAL KILL 2004-2013:	**1,251 predators (52 lions, 1,199 coyotes).**
FY13 TOTAL KILL:	**47 predators (6 lions, 41 coyotes).**
TOTAL EXPENDITURES TO DATE:	**$644,459 + $162,851 (Other) = $807,310**
FY14 APPROVED BUDGET:	**$ 85,000**
FY15 PROPOSED BUDGET:	**$ 0**
RECOMMENDATION:	**Terminate Project 18 as of 30 June 2014.**

Introduction

From early 2004 to 2013, in an effort to protect and enhance a mule deer population in northern Washoe County, NDOW killed over 1200 predators in the Granite Mountain Range, Unit 014. NDOW funded Wildlife Services to remove as many predators as was possible given the constraints of weather, time and available funding. Surrounding mountain ranges received limited predator control during the same study period and included those portions of northern Washoe, Humboldt and Pershing Counties in Units 011, 012, 013, 015 and 033. Limited predator kill in control areas was associated either with agriculture, legal hunting and/or poaching.

In 2010, an extensive analysis was conducted in cooperation with UNR attempting to identify benefits or differences in performance of Unit 014 treatment area mule deer and California bighorn populations in comparison to adjacent northern Washoe-Humboldt-Pershing County control units in relation to different levels of predator removal. Those data continue to be analyzed.

Results and Discussion

There was no statistical difference in recruitment as measured by spring deer surveys between areas with or without predator control. Other metrics used over the years to assess effects of predator control on the Unit 014 mule deer herd included hunter success, total harvest, and greater than or equal to 4 antler points in the harvest. All were independently regressed against both cougar and coyote kill and none of these metrics resulted in statistically significant correlations. Published deer population estimates were the only metric that showed some potential positive correlation with predator control but unfortunately did so in spite of fawn recruitment which was not significantly different from adjacent areas. Although the 014 deer population did increase over the life of this project, similar patterns in deer population changes in the absence of predator control in other units suggests mule deer production and recruitment were also driven by landscape scale phenomena such as climate, ecological carrying capacity and nutritional availability and have little or no correlation to numbers of Apex predators removed in a given area (Ballard et al 2001; NDOW 2004b; Hurley et al 2011).

A final analysis at the end of FY14 will represent a decade of predator control and will include a cost-benefit analysis.

Conclusion

This project was designed to protect a mule deer population from predation in hopes of enhancing the deer population to improve hunter opportunity in the Granite Mountain Range of northern Washoe County. Analysis of the associated data indicates population dynamics and harvest data did not show positive correlations that would support this hypothesis. When evaluated in the context of the larger northern Washoe mule deer population, deer in the 014 Project Area do not require extra or targeted predator removal in order to maintain robust population viability over the long term. Even if all of the 014 deer population increase could be attributed to predator control, the cost/benefit ratio does not support continued expenditure of sportsmen's dollars at this time in this project area.

Recommendation

Terminate Project 18 as of 30 June 2014.

Tentative FY15 Budget* (*Last Revised 19 January 2014*)

PROPOSED PREDATION MANAGEMENT PROGRAM BUDGET FY15				
July 1, 2014 Projected Beginning Balance				$558,266
Item	**Unit**	**Day**	**2015 Budget**	**TOTALS**
Predation Management Projects:				
Project 21 Common Raven Control for Greater Sage-Grouse	Statewide		$10,000	
Sub-Project 21-02 Virginia Mtns Sage-Grouse Nests	Area 2		$50,000	
Project 22 Mule Deer/Game Enhancement	Statewide		$40,000	
Sub-Project 22-14 Diamond-Roberts Mule Deer Fawns	Areas 14/16		$60,000	
Sub-Project 22-01 Massacre Rim California Bighorn	Areas 1		$25,000	
Sub-Project 22-074 Badlands Rocky Mountain Bighorn	Unit 074		$15,000	
Sub-Project 22-205/207 Gabbs V.Range Desert Bighorn	Units 205/207		$15,000	
Project 25 Coyote Ecology Study	Areas 16/17		$23,000	
Project 29 Road Carrion Management in Gr Sage-Grouse Habitat	Statewide		$25,000	
Project 30 Landfill Management in Greater Sage-Grouse Habitat	Statewide		$30,000	
Project 32 Cougar-Mule Deer- Black Bear Predator/Prey Analysis	Areas 20/29		$25,000	
Project 33 Bi-State Greater Sage-Grouse Habitat Restoration	Areas 20		$50,000	
Project 35 Red Fox Genetics Study	Statewide		$10,000	
			Project Total	**$378,000**
NDOW Budget: Salary	*Productive Hrly Rt.			
Game Division Chief	$62.61	10	$5,009	
Staff Biologist	$54.02	180	$77,789	
Field Biologists	$48.83	15	$5,860	
Administrative Assistants	$35.65	10	$2,852	
Total Salary			**$91,510**	
Operating				
Aerial Surveys			$35,000	
Other Operating			$ 5,000	
Total Operating			**$40,000**	
Travel (In-State and Out-of-State)			**$27,900**	
Mileage (Vehicle use)	$0.55	5000	**$ 2,750**	
Fixed Costs (Uniforms etc.)			**$ 200**	
			NDOW Total	**$162,360**
TOTAL EXPECTED FY15 PROGRAM EXPENDITURES:				**$540,360**
LEFTOVER FROM FY15:	Beginning Balance - Fy15 Expenditures =		**$17,906**	(projected)
REVENUE 2014-15:	Fees collected from Tag Applications*		**$456,926**	(projected)
	Donations through Tag Application processes		**$9,000**	(projected)
June 30, 2015 Ending Balance (Beginning Balance for FY16): ESTIMATE.				**$48,832**

**A Final FY15 budget will be available when all contract receipts are reconciled with available funds.*

Literature Cited

Ballard, W. B.; D. Lutz; T. W. Keegan; L. H. Carpenter and J. C. deVos Jr. 2001. Deer-predator relationships: a review of recent North American studies with emphasis on mule and black-tailed deer. Wildl. Soc. Bulletin 29(1):99-115.

Beckmann, J.P. and J. Berger. 2003. Rapid ecological and behavioural changes in carnivores: the responses of black bears (*Ursus americanus*) to altered food. J. Zool. Lond. 261:207-212.

Clark, F. W. 1972. Influence of jackrabbit density on coyote population change. Journal of Wildlife Management 36:343–356.

Coates, P.S. and D. J. Delehanty. 2004. The effects of raven removal on sage grouse nest success. Proc of Vert Pest Conf. 21:17-20.

Coates, P.S.; J. O. Spenser and D. J. Delahanty. 2007. Efficacy of CPTH-treated egg baits for removing ravens. Human-Wildlife Conflicts 1(2):224-234.

Engeman R. M., M. J. Pipas, K. S. Gruver, and L. Allen. 2000. Monitoring coyote population changes with a passive activity index. Wildlife Research 27:553–557.

Gantz, G. F., and F. F. Knowlton. 2005. Seasonal activity areas of coyotes in the Bear River Mountains of Utah and Idaho. Journal of Wildlife Management 69:1652–1659.

Gese, E. M., Ruff, R. L. and R. L. Crabtree. 1996. Foraging ecology of coyotes (*Canis latrans*): the influence of extrinsic factors and a dominance hierarchy. Canadian Journal of Zoology 74:769–783.

Hamlin, K. L., S. J. Riley, D. Pyrah, A. R. Dood, and R. J. Mackie. 1984. Relationships among mule deer fawn mortality, coyotes, and alternate prey species during summer. Journal of Wildlife Management 48:489–499.

Hornocker, M.G. and S. Negri (eds). 2010. Cougar: ecology and conservation. 306pp.

Hurley, W.M.; J.W. Unsworth; P. Zager; M. Hebblewhite; E.O. Garton; D.M. Montgomery; J.R. Skalski and C.L. Maycock. 2011. Demographic response of mule deer to experimental reduction of coyotes and mountain lions in SE Idaho. Wildl Monogr 178. 33p.

Nevada Department of Wildlife 2004a. Nevada's black bear: ecology and conservation of a charismatic omnivore. Nevada Department of Wildlife. Biological Bulletin #15. 46pp.

Nevada Department of Wildlife. 2004b. Nevada's mule deer population dynamics: issues and influences. Nev Dept of Wildl. Biol Bulletin # 14. 70pp.

Ridgeway, R. 1877. Part III – Ornithology [in] Clarence King Survey - Report of the 1867 geological exploration of the fortieth parallel. United States Geological Survey.

U.S. Dept of Agriculture. 1969. Humboldt National Forest Timber Management Plan. Unpub. Doc. Humboldt National Forest, U.S. Forest Service, Elko, NV.