ARIZONA STATE ACTION PLAN UPDATED September 2023

For

Implementation of Department of the Interior Secretarial Order 3362: "Improving Habitat Quality in Western Big Game Winter Range and Migration Corridors"



Table of Contents

Introduction	3
Arizona Game and Fish Department's Priority Big Game Corridors	4
1) Grand Canyon to Prescott Corridor Complex	4
2) Flagstaff to Sedona Corridor	15
3) Paunsaugunt to Kaibab Plateau Corridor	20
4) Proposed Interstate 11 Corridor	28
5) Game Management Unit 18A	31
Research Needs	35
1) Interstate 11 Mule Deer Research	35
2) Spatial and Temporal Distribution of Mule Deer in Game Management Units 1 and 27	36
3) Impacts of Alternative Energy on Big Game Movements	37
Literature Cited	38
Appendix A - Acronym Glossary	39



INTRODUCTION

Human encroachment from agriculture (Donald and Evans 2006), development and urban sprawl (Johnson et al. 2017), roadway and railway expansion (Coe et al. 2015), energy development (Sawyer et al. 2020, 2022), and barrier fences (Jakes et al. 2018) are increasingly fragmenting the landscape necessary to maintain ungulate winter range and migration routes in the western United States. In response to these changing landscape conditions, agencies within the United States Department of the Interior (USDI) including the US Fish and Wildlife Service (USFWS), National Park Service (NPS), United States Geological Survey (USGS), and Bureau of Land Management (BLM) are directed to work in close partnership with the State of Arizona through Secretarial Order 3362 (SO3362). In addition, The United States Department of Agriculture (USDA), through the USDA Forest Service (USFS) and USDA Natural Resource Conservation Service (NRCS), collaborates with USDI, the states, and other natural resource managers across the broader landscape. These partners aim to enhance and improve the quality of big game winter range and migration corridors for Rocky Mountain elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), and many other species through research, mapping, planning, and management for ecological resources.

Within this Action Plan are Arizona Game and Fish Department's (AZGFD) highest priority movement corridors and winter range areas based on the best available science. Also included are AZGFD's priority research needs for ungulate movement and migration research.

ARIZONA GAME AND FISH DEPARTMENT'S PRIORITY BIG GAME CORRIDORS

1) GRAND CANYON TO PRESCOTT CORRIDOR COMPLEX

This corridor complex contains high variation in elevation, ranging from 12,600 feet near Flagstaff, to as low as 3,100 feet in the Verde River Valley. Winter conditions in the high country induce migration for mule deer, pronghorn, and elk to lower elevations. Ongoing research and mapping efforts have revealed several important migration corridors for mule deer, elk, and pronghorn (Figures 1-3). For example, since federal fiscal year (FY) 2019 (i.e., October 2018–October 2019), AZGFD has placed global positioning system (GPS) collars on 87 mule deer near the San Francisco Peaks (Game Management Units [GMU] 7 & 9). Some individual mule deer travel distances up to 80 miles to reach winter range. This migratory population must cross highways such as US Highway (US) 180, US 89, and State Route (SR) 64. Further, elk and pronghorn GPS data within this corridor complex suggests strong human influences directing seasonal movement and habitat selection. Typically, elk and pronghorn that reside north of Interstate (I) 40 remain north of the interstate and animals that reside south of I-40 remain south of the interstate (Figure 2 and 3). Elk rarely cross I-40 successfully and when crossings are attempted, elk collisions pose a danger for motorists. Within this complex, there are more than 65 vehicle collisions with elk each year (Gagnon et al. 2012). In addition to the effect of I-40, US 89 is a barrier to pronghorn north of Flagstaff. Northern Arizona University and AZGFD documented genetic differences between pronghorn populations separated by US 89 and SR 64, indicating movement has been restricted by these highways (Theimer et al. 2012).

The Grand Canyon to Prescott Corridor is primarily dominated by ponderosa pine (*Pinus ponderosa*) in the Petran Montane Coniferous Forest biotic community. The land ownership/management in this corridor ranges from NPS at the Grand Canyon on the north end through USFS, BLM, and state-owned and private land (Figure 4, Table 1).



Figure 1. San Francisco Peaks mule deer and elk migration corridors within the Grand Canyon to Prescott Corridor Complex. Low use, medium use, and high use corridors are based on the relative number of individuals using the same migration corridor.



Figure 2. North of I-40 pronghorn and elk migration corridors within the Grand Canyon to Prescott Corridor Complex. Low use, medium use, and high use corridors are based on the relative number of individuals using the same migration corridor.



Figure 3. South of I-40 mule deer, pronghorn, and elk migration corridors within the Grand Canyon to Prescott Corridor Complex. Low use, medium use, and high use corridors are based on the relative number of individuals using the same migration corridor.



Figure 4. Land ownership/management within the Grand Canyon to Prescott Corridor Complex. **Table 1.** Land ownership/management for the Grand Canyon to Prescott Corridor Complex.

Category	Area (acres)	%
US Forest Service	1,953,023	43.48
Private	1,551,696	34.55
State Trust Land	903,000	20.10
National Park Service	38,934	0.87
Department of Defense	28,873	0.64
Bureau of Land Management	5,646	0.13
Tribal Lands	4,552	0.10
Bureau of Reclamation	4,064	0.09
State and Regional Parks	1,173	0.03

Completed State and Federal Agency Activities in Federal Fiscal Year 2023

Completed Vegetation Management Treatments

Over the last 100 years, juniper encroachment into grasslands has caused habitat deterioration within the Grand Canyon to Prescott Corridor Complex. Private and public land managers are currently engaging in mastication, thinning, and prescribed fire efforts to restore historic migration patterns and habitat. Multiple state and federal initiatives are currently underway to restore these ecosystems. From FY18–23, AZGFD, along with private and public partners, has restored over 34,700 acres of grassland for pronghorn, mule deer, and additional species within the corridor. Grassland restoration projects within the corridor have also led to benefits for the Gunnison's prairie dog (*Cynomys gunnisoni*), black-footed ferret (*Mustela nigripes*), Stephen's woodrat (*Neotoma stephensi*), northern grasshopper mouse (*Onychomys leucogaster*), Arizona pocket mouse (*Perognathus amplus*), and grassland birds such as the burrowing owl (*Athene cunicularia*) and Cassin's sparrow (*Peucaea cassinii*). Completed restoration projects within the corridor include:

- *Perrin Ranch Grassland Restoration:* From FY20–23 6,216 acres of grassland restoration were completed on the Perrin Ranch.
- *I-40 Overpass Thinning:* In FY23, approximately 100 acres of woody vegetation were thinned on the north side of the future I-40 overpass location to facilitate use of the overpass by pronghorn.
- *Curley Wallace Project:* The Tusayan District on the Kaibab National Forest (KNF) treated 1,156 acres on the Curley Wallace Phase 1 project via mastication in FY23. An additional 150 acres were treated via dozer push.

Completed Barrier/Fragmentation Mitigation Projects

- *Movement Studies*: Through the USGS, AZGFD and Mule Deer Foundation (MDF) published Ungulate Migrations of the Western United States, Volume 3.
- Wildlife-Friendly Fence Modifications:
 - In August 2023, AZGFD worked with Arizona Antelope Foundation (AAF) and KNF to modify fences at the future I-40 overpass site. In total, over 100 miles of fence have been removed or modified both north and south of I-40.
 - In FY23, AZGFD applied for National Fish and Wildlife Foundation (NFWF)
 America the Beautiful funds and Wildlife Crossing Pilot Program funds for

helping to mitigate barrier and fragmentation effects.

- Maintaining Habitat Connectivity Through Landowner Partnerships:
 - Orme Ranch Conservation Easement: Conservation Easement established on approximately 1000 acres, permanently conserving corridor and associated habitats along Ash Creek and Arizona's central highlands, as part of partnership through renewable Aqua Fria Renewable energy project.

Ongoing State and Federal Agency Activities in Federal Fiscal Year 2023

Ongoing Vegetation Management Treatments

- Clark Project Grassland Restoration (Planned, Funding UNK, Arch UNK, EA UNK): In FY23, contract work began to complete 1,400 acres of grassland restoration in the Clark project area on the KNF. This work will connect previously treated areas to create more movement connectivity and foraging habitat for pronghorn and other grassland obligate species.
- South Zone (SZ) Grassland Restoration (Planned, Funding UNK, Arch UNK, EA Complete): In partnership with AZGFD, Habitat Partnership Committee (HPC), NRCS and permittees, USFS has mechanically treated 4,000–5,000 acres annually under the SZ Grassland EA. Treatment methods include using agra-ax, mastication, fuel wood sales, and dozer piling. Thousands of acres of grassland restoration are also ready for implementation on the KNF under the SZ Grasslands Restoration EA. Additionally, starting with the SZ Grassland prescription footprint, the KNF is developing a geodatabase to better track project implementation with an interest to expand this effort forest-wide.
- Additional KNF Projects (Planned, Funding UNK, Arch UNK, EA UNK): The KNF plans to treat 438 acres via dozer push on the 4 Rd Dozer project in the Williams District in FY23. Additional projects include the Irishman Dam (123 acres), Hat Allotment (770 acres), Cowboy Tank (504 acres), Juan Tank (235 acres), and Pine Creek (691 acres). Each of these projects will include lop and scatter treatment.

Ongoing Barrier/Fragmentation Mitigation Projects

- Movement Studies (Planned, Funded, Arch Not Needed, EA Complete):
 - o Each year, the AZGFD aims to deploy collars on mule deer, pronghorn, and/or elk

in the Grand Canyon to Prescott Corridor to further assess movements related to highways and the landscape. In FY23, AZGFD deployed GPS collars on 24 pronghorn and 25 mule deer. In FY24, AZGFD will redeploy GPS collars on pronghorn, mule deer, and elk.

- The Northern Arizona Landscape Connectivity Alliance (NALCA) continues to collaborate with partners to realize the extensive benefits from landscape connectivity for the Southwestern Region's valuable natural resources. The next steps are to coordinate with external stakeholders to implement priorities.
- Wildlife-Friendly Fence Modifications (Planned, Partially Funded, Arch TBD, EA TBD): The Prescott National Forest (PNF) partnered with AZGFD to access the AZGFD's fence collecting application. This allows for consistency in data collection across partnerships and will help prioritize fences that require wildlife modification to allow for more permeability. In FY23, PNF surveyed over 7 miles of fences in pronghorn habitat and modified 0.25 miles of fence along the Drake Pronghorn Corridor. As of July 2023, over 90 miles of fence had been inventoried, with additional inventories planned. Further, the Coconino National Forest (CNF) continues to remove old dilapidated fences to reduce the negative effects that these hazards pose to big game and other wildlife.

Ongoing Wildlife Water Developments

• *Rain Trick Tank Rebuild (Planned, Funded, Arch UNK, EA UNK):* The KNF and AZGFD were awarded funds via Rocky Mountain Elk Foundation (RMEF) to rebuild Rain Tank, which is a key water source for big game and other wildlife moving between seasonal ranges in the Sycamore Canyon Area. The tank was severely damaged by the 2021 Rafael fire. Completion is expected in FY24.

Future State and Federal Agency Activities

Future Vegetation Management Treatments

Approximately 10,000 acres of private and State Trust land and 20,000 acres of the KNF and PNF land could benefit from treatment within the Grand Canyon to Prescott Corridor. AZGFD will work with partners to focus efforts within and adjacent to the corridor to allow for a landscape-level improvement for ungulates.

• Clarkdale Vegetation Clearing (Proposed, Funding UNK, Arch UNK, EA UNK):

Inter-agency collaboration (i.e., PNF, CNF, and AZGFD) has led to the current drafting of a Categorical Exclusion and project proposal for a key pronghorn crossing across the Verde River near Clarkdale. Once complete, it will allow for approximately 40 acres of vegetative clearing that will help to reestablish a corridor that historically connected the pronghorn herd on the Red Rock Ranger District to the pronghorn herds on the Chino Valley Ranger District.

- *Clarkdale Grassland Restoration (Proposed, Funding UNK, Arch in Progress, EA UNK):* Archaeological surveys are near completion that will allow for implementation of several thousands of acres of grassland restoration on the PNF near Clarkdale, AZ. Collar data indicates that this area is an important movement corridor used by pronghorn moving from the KNF to the Prescott area.
- *Slate Mountain Grassland Restoration (Proposed, Funding UNK, Arch Needed, EA Complete):* Currently, archeological surveys are needed in the Slate Mountain area on the CNF to continue future grassland treatments. This work is permitted under the North Forest Grasslands EA.
- Drake Pronghorn Corridor Vegetation Treatment (Planned, Partially Funded, Arch in Progress, EA Needed): The PNF and AZGFD are planning the Drake Area Pronghorn Corridor Project on 15,950 acres within the Chino Valley Ranger District. This corridor was identified as high priority by NALCA and the project will allow pronghorn to move across the landscape between the PNF, KNF, and CNF. The project will reduce juniper through a combination of masticator, hydraulic shears, hand thinning, and piling and burning. Currently, the AZGFD is working to contract cultural surveys on 9,630 acres, which is part of the Chino Landscape National Environmental Policy Act (NEPA) completed by PNF. In FY23, AZGFD funded 4,000 acres for Heritage survey and treatment. Heritage surveys were completed in the summer of 2023 and implementation is expected to start in FY24. AZGFD also secured funding for an additional 5,000 acres of Heritage survey, which are expected to be completed by the end of FY24.

Future Barrier/Fragmentation Mitigation Projects

• *Wildlife-Friendly Fence Modifications (Proposed, Unfunded, Arch TBD, EA TBD):* The AZGFD, USFS, WCOs, nonprofit conservation organizations, and local ranchers are collaborating to inventory, modify, or remove barrier fences south of I-40. It is estimated

that approximately 75 miles of fence modifications are needed to facilitate migratory pronghorn movement south of I-40.

- Wildlife Crossings:
 - *I-40 Wildlife Crossings (Proposed, Unfunded, Arch UNK, EA UNK):* I-40
 represents the biggest impediment to migration within the Grand Canyon to
 Prescott Corridor Complex. After various studies were conducted by the AZGFD
 and Arizona Department of Transportation (ADOT; Gagnon et al. 2012), a section
 along I-40 near Parks, AZ (mileposts 171-175) was identified as the best location
 for a wildlife overpass. AZGFD, ADOT, CNF, and KNF are in the preliminary
 planning stages for the overpass. While implementation may take several years,
 constructing the overpass and connecting it with 8' woven-wire fencing will
 provide a safer passage for large and small wildlife across I-40 and enhance road
 safety for the public. This is a key link in the GC to Prescott corridor.
 - US 89, SR 64, and US 180 (Proposed, Unfunded, Arch UNK, EA UNK): Additional wildlife crossings, including at least some overpasses on US 89, SR 64, and US 180 would connect these fragmented populations leading to more robust population growth and resilience to additional stressors such as prolonged drought and habitat fragmentation caused by human development. AZGFD has conducted wildlife movement studies and provided similar recommendations as I-40 to wildlife crossings along US 89 and SR 64 (Dodd et al. 2011, Dodd et al. 2012).
- *Maintaining Habitat Connectivity Through Landowner Partnerships:* Within the Grand Canyon to Prescott Corridor, AZGFD aims to identify and prioritize key parcels that support long term partnership and conservation of habitat connectivity.
 - Yavapai Ranch and Surrounding Area (Proposed, Unfunded, Arch TBD, EA TBD): AZGFD is collaborating with partners and landowners to identify and prioritize conservation opportunities, such as conservation easements on private lands and land exchanges through USFS LWCF program. Their efforts are focused on the protection of wildlife habitats and connectivity across approximately 100,000 acres for long-term benefits.

Future Wildlife Water Developments

- *PNF Trick Tank Rebuild (Planned, Funded, Arch UNK, EA in Progress):* AZGFD and its partners are collaborating with the PNF to rebuild five trick tanks, and are currently working on obtaining NEPA clearance. Three of the wildlife waters are located on the northwest portion of the forest and two waters are on the southwest portion of the forest north of the Cleator area. A NEPA decision is expected in FY24.
- *Riparian Restoration (Proposed, Unfunded, Arch TBD, EA TBD):* Wetland and riparian habitats are rare in northern Arizona and provide key habitat within big game migration corridors and winter range. Although AZGFD and WCOs have restored some riparian areas, many additional riparian areas are impacted by livestock and/or have been hydrologically altered and could benefit from restoration.
- *New Wildlife Water Developments and Redevelopments in the Corridor (Proposed, Unfunded, Arch TBD, EA TBD):* AZGFD has identified several wildlife water developments to be built or redeveloped to provide the necessary water to support big game corridor movements during drought periods. Water redevelopments restore functionality on an existing water development that no longer provides year-round water. Typically, this involves the replacement of the old system with a newer, higher capacity system.

2) FLAGSTAFF TO SEDONA CORRIDOR

The Flagstaff to Sedona Corridor contains 50 miles of I-17, which is a four-lane divided highway that connects Phoenix and Flagstaff. I-17 is traveled by millions of people each year (>20,000 vehicles/day in some sections). The 31-mile section between the Verde Valley to Flagstaff is particularly notable for its rapidly-changing elevation and its passage through summer and winter range for mule deer and elk. Along this segment of I-17, elk account for 75% of all WVCs with >85 elk mortalities per year (Gagnon et al. 2013). Despite high incidence of elk-vehicle collisions along I-17, the highway's high traffic volumes generally prevent crossing attempts (Figure 5). Analysis of GPS collar data show elk migration and winter range availability is highly influenced by I-17 (Figure 5). When winter conditions push elk out of summer range, they face the choice of crossing I-17, or following the interstate south to lower elevation winter range. Therefore, AZGFD recognizes this area as a priority to focus efforts on mitigation to enhance connectivity of critical migration patterns and reduce WVCs.

Vegetation is primarily dominated by ponderosa pine (*Pinus ponderosa*) within the Petran Montane Coniferous Forest biotic community. The land management in this corridor is primarily USFS, with small private parcels (Figure 6, Table 2).



Figure 5. Elk locations associated with I-17 highway crossing study illustrate that 70% of the GPS collared population (represented here) were never located on the opposite side of I-17 from where they were collared.



Figure 6. Land ownership/management within the Flagstaff to Sedona Corridor. **Table 2.** Land ownership/management for the Flagstaff to Sedona Corridor.

Category	Area (acres)	%
US Forest Service	686,040	93.62
Private	39,470	5.39
State Trust Land	4,821	0.66
National Park Service	995	0.14
Tribal Lands	630	0.09
State and Regional Parks	296	0.04
Mixed/Other	238	0.03
Arizona Game and Fish Dept.	199	0.03

Completed State and Federal Agency Activities in Federal Fiscal Year 2023

Completed Barrier/Fragmentation Mitigation Projects

• *Wildlife-Friendly Fence Modifications:* In FY23, AZGFD entered into a new agreement with the CNF to improve fences for landscape permeability and to monitor wildlife friendly fences using a standardized approach. Additional funds were allocated for connectivity work on the CNF in the Mogollon Rim District.

Ongoing State and Federal Agency Activities in Federal Fiscal Year 2023

Ongoing Vegetation Management Treatments

- *Black Hills Project (Planned, Funding UNK, Arch UNK, EA UNK):* The Black Hills project is located north and west of the I-17 corridor and stretches west of Clarkdale to the intersection of I-17 and the PNF. The main purpose of this project is to improve vegetation conditions in the project area, which would improve habitat and forage for both mule deer and elk. Treatments include mechanical thinning, hand thinning, and prescribed fire.
- Agua Fria Grasslands Project (Planned, Funding UNK, Arch UNK, EA UNK): The AZGFD is working with partners to improve habitat connectivity for pronghorn and mule deer by improving grassland habitat and forage in the Agua Fria project area.
 Specifically, this project thins juniper and reduces thickets of catclaw and mesquite.
- *Cedar Flat Grassland Restoration (Planned, Funding UNK, Arch UNK, EA UNK):* In FY23, the Red Rock Ranger District entered into an agreement with Salt River Project and AZGFD to complete grassland restoration work in the Cedar Flats area. This project will treat thousands of acres over the next few years, which will improve habitat and open movement corridors for large ungulates.

Future State and Federal Agency Activities

Future Barrier/Fragmentation Mitigation Projects

- Wildlife Crossings:
 - *I-17 Wildlife Overpasses (Proposed, Unfunded, Arch UNK, EA UNK):* I-17
 represents the biggest impediment to migration in the Flagstaff to Sedona
 Corridor. A priority for this linkage is the design and construction of several

wildlife crossing structures across and under I-17, along with wildlife exclusion fencing to make these crossing structures effective. ADOT and USFS have coordinated closely with AZGFD to plan for crossings in key areas through the I-17 Elk Movement Studies Report (Gagnon et al. 2015). ADOT, AZGFD, and USFS continue to work with partners and stakeholders to seek and obtain available funding to complete the crossings. In FY23, ADOT and AZGFD applied for Wildlife Crossing Pilot Program funds to implement this large scale project in the near future.

 I-17 Woods Canyon to Munds Canyon Fencing Retrofit (Proposed, Unfunded, Arch TBD, EA TBD): In 2011, ADOT and AZGFD collaborated to retrofit the right-of-way fence along I-17 from Woods Canyon to Munds Park (MP 316-322), resulting in a 97% reduction in WVCs. However, over time, these retrofit fences have degraded and WVCs have become problematic once again. ADOT has prioritized upgrading the fence to a permanent woven-wire design to more effectively reduce deer and elk collisions within this priority corridor. In FY23, AZGFD applied for NFWF America The Beautiful Funds to support the fence upgrade.

3) PAUNSAUGUNT TO KAIBAB PLATEAU CORRIDOR

The mule deer herds of the North Kaibab Plateau (Arizona) and Paunsaugunt Plateau (Utah) are among the most treasured big game in North America. The AZGFD and Utah Division of Wildlife Resources (UDWR) have identified migration corridors and winter range for mule deer herds in this priority corridor by collecting GPS data from 248 mule deer (Figure 7). Mule deer of the North Kaibab and Paunsaugunt are representative migrants, traveling documented distances of 100 miles between summer and winter range. The general patterns of mule deer locations have indicated that the lower elevation area between the Kaibab Plateau and the Paunsaugunt Plateau is critical wintering range for herds migrating from summer range in both states (Figure 7).

Fire suppression, grazing practices, and climatic changes have led to an increase in conifer on much of Arizona's mid-elevation mule deer winter range and migration corridors. As a result, large expanses of monotypic high-density conifer stands have developed. This has caused a decrease in browse quality and quantity, reducing the carrying capacity for mule deer. Studies have shown that masticating existing conifer stands is effective in increasing browse production for wintering mule deer. The winter range of the Kaibab Plateau currently faces the threat of increased fire cycles and aggressive invasion of cheatgrass (*Bromus tectorum*). Additionally, mule deer populations across the corridor are also limited by water availability due to prolonged drought, a lack of natural water, and unreliable existing dirt tanks.

The higher elevation areas are NPS and USFS lands with oaks (*Quercus spp.*), ponderosa pine (*Pinus ponderosa*), and mixed conifer. The surrounding lowlands are dominated by big sagebrush (*Artemisia tridentata*) and cliffrose (*Purshia stansburiana*) on BLM, National Monument (Vermillion Cliffs), and some tribal lands (Figure 8, Table 3).



Figure 7. Migration corridors and winter range for the Kaibab Plateau and Paunsaugunt Plateau mule deer herds based on GPS locations collected from two research studies. Low, medium and high use represent the relative number of individuals using the same migration corridor.



Figure 8. Land ownership/management within the Paunsaugunt to Kaibab Plateau Corridor.

Category	Area (acres)	% in Utah	% in Arizona	% of Total
Bureau of Land Management	735,271	25.57	20.98	46.55
US Forest Service	423,957	14.74	22.61	37.35
Private	285,369	9.38	0.54	9.92
State Trust Land	48,112	1.50	1.67	3.17
National Park Service	28,148	1.35	0.98	2.32
Tribal Lands	13,370	0.00	0.46	0.46

Completed State and Federal Agency Activities in Federal Fiscal Year 2023

Completed Vegetation Management Treatments

• *Pine Hollow Emergency Stabilization and Restoration (ES&R) Project:* On the Pine Hollow ES&R project 6,212 acres of aerial seeding were completed. Mule deer, pollinators, and migratory birds are expected to benefit from this project.

Completed Barrier/Fragmentation Mitigation Projects

 Wildlife-Friendly Fence Modifications: In the Pine Hollow Project Area, a wildlife friendly fence (~5 miles long) was completed. This project is being monitored for treatment effectiveness using the Assessment, Inventory, and Monitoring Strategy and other resource trend data collection.

Ongoing State and Federal Agency Activities in Federal Fiscal Year 2023

The BLM, USFS, AZGFD, and livestock permittees have been undertaking numerous cooperative projects to enhance the corridor and wintering range through habitat treatments, fence modifications, and water projects.

Ongoing Vegetation Management Treatments

- Kanab Creek Landscape Planning Area: The BLM Arizona Strip District continues to focus on an Integrated Vegetation Management process to align implementation of vegetation treatments in cooperation with their partners. In FY23, work continued in the Paunsaugunt to Kaibab Plateau Priority Corridor and winter range, within the Kanab Creek Landscape Planning area. This area covers the Shuttleworth and Suicide Allotments Vegetation Treatment, Kanab Creek Riparian Restoration Project, and the Pine Hollow ES&R project areas.
 - Shuttleworth-Suicide Allotments Vegetation Treatment (Planned, Funded, Arch Complete, EA Complete): In FY19, BLM signed a Decision Record for the Shuttleworth-Suicide Wildlife Habitat project. NFWF funding through SO3362 provided \$200,000 towards vegetation treatments and since the start of this project, approximately 14,267 acres of conifer have been treated with a mix of mastication, lop and scatter methods, and seeding. The AZGFD oversaw the successful implementation of 1,661 acres of conifer mastication as a portion of the Shuttleworth-Suicide Wildlife Habitat Project. The remaining 255 acres of lop

and scatter are expected to be completed by the end of FY23. These treatments will increase the production of browse species for wintering mule deer.

- *Kanab Creek Riparian Restoration Project (Planned, Funded, Arch Complete, EA Complete):* The Kanab Creek Riparian Restoration is a multi-year restoration project in southwestern willow flycatcher (*Empidonax traillii extimus*) and yellow-billed cuckoo habitat (*Coccyzus americanus*), which treats 10 acres of invasive Saltcedar (*Tamarix sp.*) and Russian Olive (*Elaeagnus angustifolia*) per year by cutting and piling the debris for prescribed fire. Stumps are treated with herbicide to prevent re-sprouting of the invasive species. As of FY23, 450 acres in the riparian corridor have been treated and 10 more acres are planned for FY24. Mule deer, desert bighorn sheep (*Ovis canadensis nelsoni*), raptors (e.g., golden eagles; *Aquila chrysaetos*), and migratory birds will benefit from this project.
- Westside Cliffrose Rejuvenation Project (Planned, Funded, Arch Complete, EA Complete): Approximately 2,000 acres of cliffrose will be manually treated to stimulate sprouting and continue growth at a height that can be reached by mule deer. All clearances have been obtained for this project (KNF & AZGFD) and approximately 800 acres have been completed. Dramatic new growth was observed in areas that were treated. The remaining 1,140 acres will be treated in FY23–24.
- *Kaibab Plateau Ecological Restoration Project (Planned, Funded, Arch UNK, EA Complete):* A diverse set of habitat enhancement tools are being assessed by the Kaibab Plateau Ecological Restoration Project (KPERP) to treat approximately 518,000 acres in the North KNF, including approximately 30,000 acres of mule deer winter range within the corridor. In October of 2020, the KNF released a Decision Notice and Finding of No Significant Impact for the final EA. This clearance covers a substantial portion of the Paunsaugunt to Kaibab Corridor and will facilitate future enhancement projects. The AZGFD, in cooperation with the MDF and the Arizona Deer Association, has developed a management plan for approximately 23,000 acres of mule deer winter range covered under the KPERP NEPA. KNF and MDF are identifying specific treatment polygons using previous recommendations. The MDF will begin contracting for hand thinning work within the treatment polygons, with implementation beginning in FY23.

Ongoing Barrier/Fragmentation Mitigation Projects

• US 89 Fencing Retrofit (Planned, Partially Funded, Arch TBD, EA TBD): UDWR, in collaboration with AZGFD, is leading efforts to monitor movements in this corridor through GPS collars. In FY23, UDWR and Utah Department of Transportation applied for funding to extend the existing US 89 funnel fencing. The extension will include seven miles of fencing, upgrades to two existing underpasses, a new underpass, and escape ramps.

Ongoing Wildlife Water Developments

- *Development of Wildlife Waters in GMU 12A:* These projects will help to ensure water availability for mule deer on >100 square miles of migratory, transition, and winter range habitats within the corridor.
 - Winter Range Wildlife Waters (Planned, Partially Funded, Arch UNK, EA Complete): In FY23, the Cutler Pockets and Jacob Canyon wildlife waters will be upgraded to a new 10,000-gallon system design. In addition, in FY24, Summit Valley Wildlife Apron and Round Valley Wildlife Apron will be upgraded to 10,000-gallon systems. An HPC grant application and funds from MDF are currently being sought to fund several additional waters.
 - Magnum Fire Water Redevelopment (Planned, Funded, Arch UNK, EA UNK): Five cooperative livestock water projects have been funded with completion anticipated by the end of FY25.
- *Guzzler Refurbishment (Planned, Partially Funded, Arch UNK, EA UNK):* Sixty-two summer range wildlife guzzlers have been identified for refurbishment with initial funding secured to begin work. Drinkers and polymer liners have been purchased and a contractor has been identified. Work for this effort began in FY23.
- *Fire Recovery (Planned, Funded, Arch UNK, EA UNK):* In Arizona, the Mangum, Pine Hollow, and Wire Pass fires damaged or destroyed 11 wildlife and cooperative livestock water catchment facilities. Seven of these facilities have been repaired or replaced. The additional four facilities are scheduled to be repaired by the end of FY25.

Future State and Federal Agency Activities

Future Vegetation Management Treatments

- Vegetation Management in GMU 12B (Planned, Funding UNK, Arch in Progress, EA in Progress): Conifer thinning in the Buckskin Mountains on the west side of the Kaibab Plateau along Buck Pasture, and in the Old AZ Catchment area, would create a mosaic of conifer density. Seeding these areas would also allow for improved understory growth, which would help to restore this landscape to its historic function. Additionally, mule deer heavily use this area during fall and spring migrations and all winter months. The BLM Arizona Strip District is working on an EA that will include approximately 9,535 acres of conifer and cliffrose treatments within a 35,411-acre project area on the Buckskin Mountain within the Paunsaugunt to Kaibab Plateau Corridor and Winter Range priority area. Completion of the EA is expected in FY23. To inform the planning process, archeological inventories and sensitive species (e.g. pinyon jay; *Gymnorhinus cyanocephalus*) surveys have begun within the treatment areas.
- Vegetation Management on the North Kaibab Forest (Planned, Funding UNK, Arch UNK, EA in Progress): The KNF and additional partners have identified a combination of mechanical treatment in juniper habitats and application of prescribed fire to ponderosa pine habitats within 28,060 acres of the North KNF Burnt Corral EA. They are currently working through the EA process and are likely to issue a decision notice by FY26. These projects will enhance undergrowth species for wintering and migrating mule deer within the corridor.
- *East Kanab Creek/Buckskin Mountain Strategic Focus Area (Proposed, Funding UNK, Arch UNK, EA Needed):* The BLM is currently gathering data for the Kanab Creek Healthy Lands Project Area, which includes 213,900 acres on BLM lands and 12,400 acres on private lands. The project's objectives are to identify priorities for enhancing ecosystem function for the Paunsaugunt and North Kaibab mule deer herds. The NEPA has not been completed yet.

Future Barrier/Fragmentation Mitigation Projects

• *Maintaining Habitat Connectivity Through Landowner Partnerships (Proposed, Unfunded, Arch TBD, EA TBD)*: Through coordination with Utah DWR, the AZGFD has identified and prioritized opportunities to partner with landowners along the

Arizona/Utah border on conservation practices to maintain habitat connectivity, which include fence modifications and habitat treatments.

Future Wildlife Water Developments

- *Burro Allotment Waters (Proposed, Funding UNK, Arch UNK, EA Needed):* Six livestock waters on the Burro Allotment have been identified for refurbishment and conversion to cooperative waters. In addition, two locations for new cooperative waters have been identified on the HouseRock Allotment. NEPA has not been completed for these projects.
- Development of New Wildlife Water Developments on USDI Lands in GMU 12B (Planned, Funding UNK, Arch UNK, EA in Progress): On USDI lands within GMU 12B, and within winter range habitats identified within the corridor, 14 wildlife water developments have been identified for new construction. These wildlife water developments will enhance water availability and distribution for all wildlife species within the corridor. The EA for this effort is underway.
- Fence Modifications at Cooperative-Wildlife Waters (Proposed, Unfunded, Arch TBD, EA TBD): AZGFD and permittees regularly maintain fencing around wildlife-only water troughs, which are heavily used by wintering mule deer. Replacing the current barbed-wire fences with pipe-rail fences would improve long-term functionality and wildlife access to the waters, while also eliminating or reducing maintenance requirements.

4) PROPOSED INTERSTATE 11 CORRIDOR

As human populations and economies expand in the West, the demand for high volume transportation corridors, such as interstate highways, has increased. Unfortunately, high volume transportation corridors often serve as impermeable barriers to migrating ungulates (Gagnon et al. 2013) and may constrain their set of possible routes and seasonal ranges, ultimately leading to loss of access to productive habitats (Sawyer et al. 2013). In 2014, Arizona and Nevada Departments of Transportation completed the I-11 & Intermountain West Corridor Study. The study report identified co-location with US 93 as the only "Recommended Corridor Alternative" to be carried forward for a potential I-11 from Wickenburg, Arizona to the Nevada border. Subsequently, ADOT began to work on a multi-tiered Environmental Impact Statement (EIS) process for the potential I-11 roadway from Nogales to Wickenburg.

AZGFD is a Cooperating Agency for ADOT's tiered impact study for I-11 and has been working with ADOT to understand the potential impacts that the proposed I-11 highway would have on wildlife. AZGFD has worked with ADOT throughout the NEPA process to provide input on routing and design considerations that would conserve important ungulate movement corridors. As of FY23, there has been no official announcement of the Tier 2 process being initiated for any component segment of I-11 covered by the Tier 1 EIS. However, given the prioritization of the I-11 effort, it is a possibility that the Tier 2 process could be forthcoming within FY24.

The ecosystem in this corridor is Sonoran Desert, with vegetation types dominated by saguaro cactus (*Carnegiea gigantean*), yellow palo verde (*Parkinsonia microphylla*), velvet mesquite (*Prosopis velutina*), ocotillo (*Fouquieria splendens*), and various other cacti species. Land ownership and management is primarily BLM, Private, and State Trust Land (Figure 9, Table 4).



Figure 9. Land ownership/management within the Proposed I-11 Corridor.

Category	Area (acres)	%
Bureau of Land Management	1,490,903	34.96
Private	1,405,478	32.96
State Trust Land	1,061,015	24.88
US Forest Service	175,288	4.11
State and Regional Parks	75,574	1.77
National Park Service	21,736	0.51
Department of Defense	14,355	0.34
Bureau of Reclamation	12,835	0.30
Arizona Game and Fish Dept.	4,973	0.12
Tribal Lands	1,273	0.03

Ongoing State and Federal Agency Activities in Federal Fiscal Year 2023

Ongoing Barrier/Fragmentation Mitigation Projects

• *BLM Access and Transportation Management Plan (Planned, Funding UNK, Arch TBD, EA TBD):* In FY23, the BLM Tucson Field Office has prepared an Access and Transportation Management Plan (TMP) for 701.1 miles of existing travel routes on public lands administered by the BLM in the Middle Gila South TMP planning area. The TMP establishes route designations, use limitations, and maintenance requirements. TMP travel route and maintenance designation will provide BLM a regulatory framework to manage route use and maintenance for resource protection and public access. The TMP addresses how public land may impact landscape level wildlife movement corridors.

Future State and Federal Agency Activities

Future Barrier/Fragmentation Mitigation Projects

• *Fence Inventories (Proposed, Unfunded, Arch TBD, EA TBD):* GPS collar data along the I-11 proposed corridor alternative has allowed AZGFD to gain an understanding of several movement corridors. To understand existing barriers to movement and to identify measures to support mule deer movement, AZGFD is seeking funding for fence inventories in these areas.

5) GAME MANAGEMENT UNIT 18A

AZGFD has focused on increasing habitat quality and availability in GMU 18A to benefit multiple wildlife species including mule deer, elk, and pronghorn. The area, which extends north and south of I-40 between Kingman and Seligman (Figure 10), has experienced a decline in mule deer and pronghorn populations for several decades due to various factors such as human disturbance, livestock grazing, fence design and densities, habitat loss, and drought. Natural surface water is limited, as most water is provided through earthen tanks and well-fed pipelines designed for livestock grazing operations. GMU 18A also contains hundreds of miles of pasture fences, which can restrict movement of wildlife, particularly that of pronghorn. The combination of these factors has reduced the availability and quality of habitat, led to decreased fawn recruitment rates, and resulted in a decline in total population numbers.

GMU 18A is composed primarily of pinon (*Pinus sp.*) and juniper (*Juniperus sp.*) trees, as well as bursage shrubs (*Ambrosia sp.*) and grama grasses (*Bouteloua sp.*). Land ownership is complex and includes checker-boarded lands with 40% Arizona State Land Department (ASLD) lands, 49% private lands, and 11% BLM lands (Figure 10, Table 5).



Figure 10. Land ownership/management within the Game Management Unit 18A Corridor.

Table 5. Land ownership/management for the Game Management Unit 18A Corridor.

Category	Area (acres)	%
Private	377,542	48.07
State Trust Land	317,542	40.43
Bureau of Land Mgmt.	89,214	11.38

Completed State and Federal Agency Activities in Federal Fiscal Year 2023

Completed Vegetation Management Treatments

Management efforts within GMU 18A include:

• *Habitat Treatments:* From FY20–23 a total of 25,449 acres of juniper mastication were completed for the restoration of grasslands and/or the enhancement of browse communities.

Completed Barrier/Fragmentation Mitigation Projects

• *Wildlife-Friendly Fence Modifications:* In FY23 on the Double O ranch, 9.75 miles of four-strand pasture fence were converted to a wildlife-friendly fence design within pronghorn corridors.

Completed Wildlife Water Developments

• *Water Maintenance and Construction:* In FY23, ten dirt tanks had sediment removed, three waters were converted from windmills to solar pumping systems with drinker and storage improvements, and a new wildlife water was constructed in fringe pronghorn habitat to increase distribution.

Ongoing State and Federal Agency Activities in Federal Fiscal Year 2023

Ongoing Vegetation Management Treatments

- *Grassland and Browse Treatments (Planned, Partially Funded, Arch UNK, EA UNK):* In FY23, 7,000 acres of grassland and browse treatments are planned. If land permit authorizations and additional funding are secured, additional treatments will be completed in FY24.
- Northern Migration Corridor (Planned, Funded, Arch Complete, EA Complete): Between FY22–24, treatment clearances are underway for the northern migration corridor from the central portion of GMU 18A, to the north, and then across westward to BLM land.

Ongoing Barrier/Fragmentation Mitigation Projects

• *Movement Studies (Planned, Funded, Arch Not Needed, EA Complete):* The AZGFD continued to collect GPS data from 51 mule deer in 61 pronghorn. In FY24, AZGFD will redeploy GPS collars on pronghorn and mule deer that were initially deployed in FY21.

Ongoing Wildlife Water Developments

Wildlife Water Developments (Planned, Funded, Arch UNK, EA UNK): AZGFD Region 3
has identified the need for as many as 20 new or redeveloped water sources within GMU
18A. These waters are in various stages of development ranging from planning to
implementation.

Future State and Federal Agency Activities

Future Vegetation Management Treatments

 Conifer Habitat Treatments (Planned, Partially Funded, Arch UNK, EA in Progress): The BLM Kingman Field Office has been working with AZGFD to complete conifer treatments in the GMU 18A project area. AZGFD was awarded a NFWF Grant for this project and AZGFD has also been collaborating with the Colorado River District BLM Fuels Unit Manager toward completion of the environmental compliance needed for these treatments.

Future Barrier/Fragmentation Mitigation Projects

- Wildlife-Friendly Fence Modifications (Proposed, Unfunded, Arch UNK, EA UNK):
 - o In FY24, two miles of woven wire ranch boundary fencing will be modified.
 - On the Cross Mountain Ranch, there are approximately 36 miles of woven wire boundary fence and six miles of interior pasture fence that require modification. The ranch will work with WCOs to remove and replace the existing fence with wildlife friendly fence. Boundary fencing material provided to lease holders and installation expenses will be shared between ranches. Cross Mountain Ranch will apply for NRCS (EQIP) assistance to realign and replace interior pasture fencing to allow for more managed livestock rotation. To prioritize fence modification in this and other areas, AZGFD is seeking funding for fence inventories.

Research Needs

1) Interstate 11 Mule Deer Research

Since FY19, AZGFD has initiated a large-scale research project along the I-11 proposed route. Research efforts have included individually tagging and GPS tracking 124 mule deer and 24 bighorn sheep. In FY19, 77 of the 124 mule deer collars were deployed across 190 miles in 4 study areas, which included the Hassayampa Plains, Tucson Mountains, Rainbow Valley, and Buckeye Hills. The deployment of collars within each study area was prioritized by concern of mule deer habitat fragmentation, where the Hassayampa Plains and Tucson Mountains were of high priority, followed by Rainbow Valley and Buckeye Hills. Collars from the first deployment terminated in FY22. However, data collection continues at the north and south ends of the I-11 corridor, but will end in FY24. Data from these collars have highlighted several important areas for continued research.

AZGFD is seeking funding to deploy an additional 80 mule deer GPS collars, prioritized by study area. The timing of each deployment will depend on available funds and capture windows. Ideal timing for the Hassayampa Plains and Tucson Mountains deployment is January/February of 2024. Collecting additional movement data will allow AZGFD to have a more comprehensive understanding of mule deer movements prior to I-11 construction, which will provide the opportunity to share data-driven recommendations for cost effective mitigation options.

Project Budget:

Estimated project budget for deployment of 80 mule deer collars in priority area 1 (Hassayampa Plains and Tucson Mountains) and priority area 2 (Rainbow Valley and Buckeye Hills Mule Deer).

Item/Activity	# of Individuals	Cost per Individual	Total
Capture Costs	40	\$1,250	\$50,000
Collars and Airtime	40	\$2,600	\$104,000
Personnel			\$40,000
		Project Total:	\$194,000

2) Spatial and Temporal Distribution of Mule Deer in Game Management Units 1 and 27

In recent years, AZGFD managers in GMUs 1 and 27 have noticed apparent deer density fluctuations on a seasonal basis. The annual variation in detection of mule deer during the December-January survey period suggests immigration and/or emigration is affecting the variance in numbers of animals seen, rather than demographic processes such as recruitment and mortality. Despite the importance of this herd, AZGFD currently lacks information on seasonal movements to identify important winter range and migration corridors for mule deer in this area.

Regular deer movements across boundaries could have serious implications on the effectiveness of the management strategies for this deer population. For example, to date, Chronic Wasting Disease (CWD) has not been detected in Arizona. However, free-ranging elk and deer in New Mexico have tested positive for CWD. This is a concern for AZGFD and knowing more about interstate deer movements in this area will help inform disease management.

Between FY23–24, AZGFD will deploy 20 mule deer collars in GMU 1. After the initial 20 are deployed and additional funding is secured, AZGFD will deploy an additional 25 collars to bolster sample size. To capture mule deer before possible migration to winter range, AZGFD will capture animals no later than September 2024. Knowledge of seasonal movement patterns for the GMUs 1 and 27 mule deer population would: 1) serve as a foundation for directing efforts to maintain and improve priority winter range and migration corridors, 2) allow AZGFD to provide recommendations for transportation infrastructure to improve wildlife permeability, 3) allow AZGFD to prescribe season dates and permit levels that are appropriate for the portion of the population in those GMUs during the fall hunts, and 4) give AZGFD an understanding of interstate deer movement patterns to better manage risks associated with CWD.

Item/Activity	# of Individuals	Cost per Individual	Total
Mule Deer Capture	25	\$1,250	\$31,250
Collars and Airtime	25	\$2,600	\$65,000
Personnel			\$30,000
		Project Total:	\$126,250

Project Budget:

3) Impacts of Alternative Energy on Big Game Movements

Alternative energy sources such as solar and wind are being deployed rapidly across the United States. Arizona has been a focus for solar developers, ranking second in the nation in solar energy potential, and fourth in net generation from solar. Unfortunately, with rapid deployment of solar and wind energy comes challenges to habitats used by big game (Sawyer et al. 2022). For example, solar facilities require security fences around project perimeters that completely prevent entry for large animals such as elk, pronghorn, and mule deer. Thus, habitat and connectivity are diminished or lost. Agencies tasked with management and conservation of migratory ungulate populations are faced with a current lack of information on appropriate layout designs, placement, and corridor widths of alternative energy sources. There are several alternative energy projects in the planning and implementation stages in Arizona that will overlap with ungulate habitat. This is a unique opportunity to learn about project design and ungulate movements. Research using GPS collars and remote cameras will allow AZGFD to provide quantitative energy projects that overlap with ungulate habitat.

Item/Activity	# of Individuals	Cost per Individual	Total
Capture Costs	40	\$1,250	\$50,000
Collars and Airtime	40	\$2,600	\$104,000
Personnel			\$40,000
		Project Total:	\$194,000

Project Budget:

LITERATURE CITED

- Coe, P. K., R. M. Nielson, D. H. Jackson, J. B. Cupples, N. E. Seidel, B. K. Johnson, S. C. Gregory, G. A. Bjornstrom, A. N. Larkins, and D. A. Speten. 2015. Identifying migration corridors of mule deer threatened by highway development. Wildlife Society Bulletin 39:256-267.
- Dodd, N., J. Gagnon, S. Sprague, S. Boe, and R. Schweinsburg. 2012. Wildlife Accident Reduction Study and Monitoring: Arizona State Route 64.
- Dodd, N. L., J. W. Gagnon, S. C. Sprague, S. Boe, and R. E. Schweinsburg. 2011. Assessment of pronghorn movements and strategies to promote highway permeability: U.S. Highway 89. Final project report 619, Arizona Department of Transportation Research Center, Phoenix, AZ.
- Donald, P. F., and A. D. Evans. 2006. Habitat connectivity and matrix restoration: The wider implications of agri-environment schemes. Pages 209-218 *in*.
- Gagnon, J. W., N. L. Dodd, S. C. Sprague, R. Nelson, C. Loberger, S. Boe, and R. E. Schweinsburg. 2013. Elk Movements Associated with a High-traffic Highway: Interstate 17.
- Gagnon, J. W., C. D. Loberger, S. C. Sprague, K. S. Ogren, S. L. Boe, and R. E. Schweinsburg. 2015. Cost-effective approach to reducing collisions with elk by fencing between existing highway structures. Human-Wildlife Interactions 9:248-264.
- Gagnon, J. W., S. C. Sprague, N. L. Dodd, R. E. Nelson III, S. R. Boe, and R. E. Schweinsburg. 2012. Research report prepared by Arizona Game and Fish Department on elk movements associated with Interstate 40 (Williams to Winona) for Design Concept Study and Environmental Assessment I-40 Bellemont to Winona PRoject No. NH 040-C(211)S 40 CN 183 H7586 01L.
- Jakes, A. F., P. F. Jones, L. C. Paige, R. G. Seidler, and M. P. Huijser. 2018. A fence runs through it: A call for greater attention to the influence of fences on wildlife and ecosystems. Biological Conservation 227:310-318.
- Johnson, H. E., J. R. Sushinsky, A. Holland, E. J. Bergman, T. Balzer, J. Garner, and S. E. Reed. 2017. Increases in residential and energy development are associated with reductions in recruitment for a large ungulate. Global Change Biology 23:578-591.
- Sawyer, H., M. J. Kauffman, A. D. Middleton, T. A. Morrison, R. M. Nielson, and T. B. Wyckoff. 2013. A framework for understanding semi-permeable barrier effects on migratory ungulates. Journal of Applied Ecology 50:68-78.
- Sawyer, H., M. S. Lambert, and J. A. Merkle. 2020. Migratory disturbance thresholds with mule deer and energy development. The Journal of Wildlife Management 84:930-937.
- Sawyer, H., N. M. Korfanta, M. J. Kauffman, B. S. Robb, A. C. Telander, and T. Mattson. 2022. Trade-offs between utility-scale solar development and ungulates on western rangelands. Frontiers in Ecology and the Environment n/a.
- Theimer, T., S. C. Sprague, E. Eddy, and R. Benford. 2012. Genetic Variation of Pronghorn across US Route 89 and State Route 64.

Acronym	Definition	Acronym	Definition
AAF	Arizona Antelope Foundation	NEPA	National Environmental Policy
ADOT	Arizona Department of	NFWF	National Fish and Wildlife
	Transportation		Foundation
ASLD	Arizona State Land	NPS	National Park Service
	Department		
AZGFD	Arizona Game and Fish	NRCS	Natural Resource Conservation
	Department		Service
BLM	Bureau of Land Management	PNF	Prescott National Forest
CNF	Coconino National Forest	RMEF	Rocky Mountain Elk Foundation
CWD	Chronic Wasting Disease	SO3362	Secretarial Order 3362
EA	Environmental Assessment	SR	State Route
EAC	Environmental Assessment	SZ	South Zone
	Checklist		
EIS	Environmental Impact	TMP	Access and Transportation
	Statement		Management Plan
ES&R	Emergency Stabilization and	UDWR	Utah Division of Wildlife
	Restoration		Resources
FY	Federal fiscal year (ex:	US	US Highway
	October 2018–October 2019)		
GMU	Game Management Unit	USDA	United States Department of
ana		LICEL	Agriculture
GPS	Global Positioning Systems	USDI	United States Department of the
LIDC		LIGEO	Interior
HPC	Habitat Partnership	USFS	United States Forest Service
т	Interstate	LICEWS	United States Fish and Wildlife
1	Interstate	USF WS	Service
KNF	Kaibab National Forest	USGS	United States Geological Survey
KINI	Kaibab National Forest	WCO	Wildlife concernation
NPEKP	Raibab Plateau Ecological Restoration Project	wco	organization
MDF	Mule Deer Foundation	WVC	Wildlife-vehicle collision
	Northorn Arizona Landsonna	** * C	whente-venicle conision
INALUA	Connectivity Alliance		

Appendix A – acronym Glossary