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A Pre-Paving Baseline Inventory of Vehicle-Related Mortality on Mule Deer along, Seep Ridge Road, Book Cliffs, Utah



Utah State University, Capstone Part I
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Prepared by:
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Abstract

The Seep Ridge road is the major route used to access the Book Cliffs from Uintah County. For many years the County has expressed interest in paving the road in order to improve access to this remote portion of the County. In 2011 Uintah County received Bureau of Land Management (BLM) approval for the project and began construction on the road. There have been many concerns expressed concerning the Seep Ridge Road paving project, including impacts to mule deer. The Utah Division of Wildlife, sportsmen and conservation groups are concerned that upgrading the road may lead to a decline in the Book Cliffs Deer herd. This paper will serve as Part I to my Capstone project and will detail the objectives and methods to be used in Part II. The objectives of this study include establishing baselines for deer vehicle mortality and vehicle volume and speed along the Seep Ridge Road pre-construction. In addition to this I have evaluated public perceptions, reviewed policies and assessed the economic impacts associated with the paving project.

Introduction

Mule deer (*Odocoileus hemionus*), a member of the Cervidae or deer family occur throughout the Western United States (de Vos 2003); they are an important big game species across the western states including Utah. The Utah Division of Wildlife Resources (UDWR) reports that the demand for hunting opportunities for mule deer exceeds all other game animals in the state (UDWR 2008). The high demand placed on the species and a population decline over the last thirty years has created concern in Utah and other western states. The UDWR has recognized a number of threats to mule deer populations including highway mortality and has subsequently developed a strategy to address these threats by working with the Utah Department of Transportation (UDOT) and local counties to mitigate road impacts (UDWR 2008).

In the spring of 2009 the Bureau of Land Management (BLM) released an Environmental Assessment (EA) (BLM 2011) to realign and pave the Seep Ridge Road (SRR) in the Book Cliffs of Northeastern Utah. The Seep Ridge road paving project has a long history in the Book Cliffs beginning with the proposal for what was known as the Book Cliffs Highway in the late 1980s. The original proposal involved both Uintah and Grand Counties. The two counties planned to improve and pave the road beginning from the town of Ouray, Utah and proceeding south to I-70, a total of about 133km (83 miles). According to the Moab Times Independent a Moab newspaper (1992), the original proposal fell apart when Grand County citizens ousted the County Commissioners for pushing the road and another controversial project. The currently proposed road improvement project is being undertaken by Uintah County with no involvement from Grand County.

One of the major wildlife concerns recognized by the UDWR for the SRR paving project is the potential for negative impacts to the Book Cliffs mule deer herd. The idea that road networks can cause environmental impacts is a serious problem affecting wildlife on a global scale (Bissonette and Adair 2008). The SRR project will widen and straighten the road, change it from

native dirt to asphalt, and increase the speed limit from 35 to 55 miles per hour. By increasing traffic speed and volume, and by widening the roadway, an increase in the number of animal vehicle collisions is to be expected (UDOT 2008). The area of greatest concern is a 29 km (18 mile) stretch that crosses through UDWR designated crucial mule deer winter range. Since the road bisects this crucial habitat, mule deer that winter in the area often cross the road as they utilize the winter range.

The UDWR is not alone in their concerns regarding deer mortality. Other concerned groups include; the United States Fish and Wildlife Service (USFWS), the Mule Deer Foundation (MDF), the Theodore Roosevelt Conservation Partnership (TRCP) and the Southern Utah Wilderness Alliance (SUWA), who all commented that the SRR EA did not properly address the impacts that the project presented to big game including mule deer. The USFWS went on to say that the baseline for animal collisions should be established prior to the commencement of the SRR improvement project. This capstone will address the concerns expressed over the lack of baseline data for vehicle related wildlife mortality by establishing a baseline deer vehicle collision rate (DVC) prior to the construction of the SRR.

Objectives

Ecological Objectives-

- 1) Determine the level of mule deer mortality along the SRR prior to realignment and paving.
- 2) Estimate the probability of detecting dead deer along the SRR and develop a correction factor that can be used to estimate mule deer mortality along the SRR.
- 3) Determine a pre-construction baseline for vehicle usage and speed along the SRR.

Human Dimensions Objectives-

- 1) Assess the public perceptions of the SRR project.

Policy Objectives-

- 1) Identify and discuss the Federal, State and local policies involved in the SRR paving project.

Economics Objectives-

- 1) Identify and discuss the positive and negative economic impacts created by the SRR paving project.

Administrative Objectives-

- 1) Make recommendations for mitigation measures.

This report is divided into sections representing the core competencies learned in the Master of Natural Resources (MNR) program. The Ecological Foundations section which includes Quantitative Methods; will outline the ecological impacts of the road on mule deer and describe the methods used to measure those impacts. The Human Dimensions section will explore the

SRR project from the perspective of different user groups and the possible impacts the project will have on the activities in which they participate. In the Policy section I will describe and discuss the laws and policies relevant to the SRR project with an emphasis on the National Environmental Policy Act (NEPA) which required an Environmental Assessment (EA) to be completed disclosing potential impacts. Also, an Interlocal Cooperative Agreement was established between Uintah County and the UDWR, which includes a five year study monitoring the impacts of the road to mule deer. The Economics section will discuss the economics behind the project as well as the positive and negative economic impacts the SRR project could have on the various user groups. The Administration section will focus on the implication of the Capstone study and the possible mitigating measures that could be used to prevent undo damage to the Book Cliffs mule deer population.

Study Area

The SRR is located in a portion of Northeastern Utah known as the Book Cliffs (Figure 1). The Book Cliffs is a mountain range nearly 200 miles in length extending West from Price Canyon to Colorado's Grand valley in the East with elevations ranging between 1,350 and 2,450 meters (4,500 and 8,000 feet) (BLM). Within the Book Cliffs exists a band of medium to low elevation habitat type with a major vegetative component that includes pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) forests interspersed with open sage-brush draws and flats (Figure 2). The major portion of this vegetative band has been designated as crucial winter range for mule deer by the UDWR. The importance of winter range for mule deer in the Book Cliffs cannot be understated; (Hanberg, Olsen and Cranney in a study published in 2000) demonstrated that even on relatively mild winters, mule deer occupied crucial winter ranges. A major portion of the SRR is contained within crucial winter range for mule deer.

The Book Cliffs mule deer herd unit (unit #10) is made up of approximately 1.6 million acres excluding Native American trust lands. Approximately 69% of the unit is classified as winter range, 19% as summer range and 12% as year-long range for mule deer (UDWR 2012). UDWR's herd unit management plan (UDWR 2012) for the area has a population objective of 15,000 deer with the most recent population estimate (post-season 2011) around 6,200 deer. It is the desire of the UDWR to increase the survival and recruitment of the Book Cliffs mule deer and any new threats including highway mortality are taken seriously.

The SRR is located adjacent to the Willow Creek drainage; it is approximately 46 miles in length of which about 44.5 miles are located within Uintah County with the remaining 1.5 miles entering Grand County. The study area focuses on the 18 mile segment of the SRR (in Uintah County) located within UDWR designated crucial mule deer winter range (Figure 1).

Ecology

The main objective of my Capstone project is to establish pre-paving baseline data for the portion of the SRR bisecting crucial mule deer winter range. This baseline data will include road kill sampling, vehicle counts and speeds and mule deer habitat usage along the SRR. This study will incorporate elements of a Before After Impact Control (BACI) design (Gotelli & Ellison

2004), with the purpose of comparing DVCs pre-construction to DVCs post-construction. Only the before portion of the study will be implemented as my capstone.

As the capstone will serve as an extension of a broader UDWR SRR deer study, it is important to describe the UDWR study. The study began in November of 2009 and is expected to continue for five years. The primary goal of the study is to evaluate the impacts that paving the SRR will have on mule deer survival in the Book Cliffs. Since 2009 UDWR biologists have conducted weekly winter road counts from the first of November through the end of April. Biologists record the total number of animal vehicle collisions and the number and locations of all deer observed from the SRR. This information can then be used to determine habitat utilization and deer density adjacent to the road at any given point along the corridor.

Along with the road counts mule deer survival will be determined using VHF radio collars. A total of 100 adult does were fitted with VHF radio collars, 50 of which were randomly placed on deer along the SRR corridor (treatment) and the remaining 50 (control) were randomly placed in areas other than along the SRR including Big Park, Rabbit Mt. and Long Draw. Following capture the deer are monitored by fixed-wing aircraft on a monthly basis during the winter with additional flights during the non-winter months. Upon detection of mortality the collars are recovered to be re-fitted to new does each winter. With this data UDWR biologists can compare mule deer mortality in the SRR to other areas of the Book Cliffs.

Baseline vehicle related mortality data will be collected in order to have a sound basis for comparison once road improvements have been made. Currently all detected vehicle related animal mortalities are being recorded by the UDWR during weekly road counts. As UDWR biologists travel the SRR during the weekly counts they look for any evidence of DVCs including deer carcasses along the road and or vehicle debris indicating a possible accident. In addition to this, UDWR biologists are looking for other evidence that might indicate the presence of deer or other carcasses including the presence of carrion eating animals such as birds.

A more intensive search for vehicle killed animals will be conducted as a part of this capstone project. These counts will follow the double sampling method used by graduate student Daniel Olsen under the direction of Dr. John A. Bissonette, Utah State University (Olsen and Bissonette 2009). In this case however the primary sampling effort will be made by UDWR biologists not the Utah Department of Transportation (UDOT) or its contractors. This is due to the fact that the SRR being a county road is not part of the Memorandum of Understanding (MOU) between UDWR and UDOT requiring UDOT to oversee the collection and removal of wildlife carcasses along the roadway. Use of this method will provide an estimate of detection probability for deer-vehicle collisions (DVCs) pre-paving and thereby establish a base line DVC prior to the completion of the SRR project. This factor will be a comparison between the carcasses detected from the road and those detected adjacent to the road. It is anticipated that this factor can be generated through the use of a regression estimator (Collins 2007). The resultant correction factor will be applied to DVC sampling efforts post-construction generating a more realistic estimate of actual DVCs.

One-mile long roadside transects will be centered at the approximate locations of the six crossing structures that were identified by the UDWR and Uintah County; I will conduct double sampling

of road-killed deer along these transects and in two additional floating random locations within the defined crucial mule deer winter range. This will represent the second level of double sampling with the first being done from a vehicle on the road. It is anticipated that the eight locations will be searched three separate times during the winter period between November and April 2012. The search will be a visual survey along both sides of the road either by foot or on horseback looking for indications of DVCs. Survey areas will parallel the SRR with a focus on those areas outside the view shed of the road. Typical surveys would begin at one end of the sample area where the observer will search one side of the road for one mile then cross the road to continue the search on the opposite side of the road until reaching the starting point. Once a carcass is located, its location will be recorded using a handheld Global Positioning device. Additionally the condition of the carcass will be noted and an effort will be made to determine whether a vehicle collision was responsible for the mortality.

Baseline vehicle counts will also be recorded using three separate vehicle counters along the SRR (see figure 2). Each of the three counters will be set up on two separate occasions for approximately seven day intervals during the mule deer wintering period between December 1st and April 15th. Two of the counters are radar equipped and will record the total number of vehicles, the vehicle direction, vehicle speed and the time of day. The third is an older model and is only capable of recording the number of vehicles that pass by. The first of the three counters will be placed at the lower (North) end of the crucial deer winter range near the Buck Canyon turnoff. This is a radar counter that will capture data for all vehicles passing by including those turning down or coming from Buck Canyon. The second is also radar equipped and will be placed just to the South of Kings Wells road at the approximate site of one of the proposed crossing structures. It will record data for vehicles that go beyond Buck Canyon and the Kings Well road. The significance of this is that the majority of the oil and gas traffic in the area using the SRR turns down or comes from Buck Canyon. Some additional oil and gas traffic travels the Kings Well road, which has the least amount of vehicle travel beyond this point to the south. The final counter will be placed at the approximate southern end of the crucial winter range near Pine Springs and will record vehicle count only. This should provide solid baseline data that can then be compared to vehicle use data after the completion of the road. Such a comparison could be measured statistically through the use of a paired t-test (Hayter 2002). Based on the comparison the argument could be made that the measured increase in vehicular speed and volume is statistically significant.

While this capstone project is by no means an exhaustive study of the problem it should provide useful information to the UDWR and the county and serve as a baseline for DVC occurrence, and traffic volumes prior to completion of the SRR project.

Human Dimensions

The Book Cliffs area is important to many different individuals and organizations for a variety of reasons. This was evident through the public comments received for the EA and as opinions were expressed in print and online media. As with any project the public perceptions involved with the SRR paving project vary and should be considered individually. However looking

through the comments I found that they could be categorized into the following four user values; recreational, industrial, agricultural and esthetic. Within these four user values we can examine the importance these groups place on the Book Cliffs area and what the SRR project might mean to them.

Recreation-

Some of the major recreational uses of the Book Cliffs include; hunting, camping, antler gathering, horse riding, wildlife viewing, hiking and ATV use. Of these recreational uses, wildlife related activities top the list with hunting being the most popular activity. As individual hunters and sportsman groups recognized the potential impacts of the project they began to grow concerned.

In response to the proposed paving project the MDF and TRCP sent a letter to Selma Sierra, the Utah State Director of the BLM at the time, touting the Book Cliffs as “one of the most beloved and sought-after trophy big-game hunting units, not only in Utah but in the entire United States.” To further illustrate the importance of big-game hunting in the Book Cliffs we can look at the interest in mule deer hunting as demonstrated by deer hunting applications. The Book Cliffs is managed as limited entry unit by the UDWR; as such the demand for hunting opportunities exceeds the availability of permits. From 2008-2011 the UDWR received 32,983 hunter applications for Book Cliffs deer tags; this is an average of about 8,246 applicants per year. Of those 8,246 applicants only 544 were able to draw a hunting permit. Those lucky or patient enough to draw a hunting permit generally visit the area on more than one occasion in order to scout and plan for their hunt. In addition, they often bring family and friends to participate in the event. With this level of enthusiasm and interest in the area hunters have a right to be concerned about the future of the Book Cliffs deer herd. However it seems that the majority of recreationists that I have talked to are uniformed about the scope of the project and the level of potential negative impacts to the deer herd.

Industry-

Oil and Gas exploration and production is a major industry in Uintah County; Uintah County commissioner, Mike Mckee stated in an interview with John Howe (KUED) that 50% of the county’s jobs were tied to the extraction industry. This level of economic incentive has certainly influenced the supporters of the paving project and can be evidenced by their comments. For example several individuals commenting on the EA favored the SRR improvement project based on the increased efficiency of extraction activities. The Utah Division of Oil Gas and Mining (UDOGM) also expressed support for the project in their comment letter addressing the EA. UDOGM stated that paving the SRR would be a benefit to the mineral extraction industry in Uintah County and would provide needed safety improvements to the road. Without a doubt those tied to the extraction industry have an interest in promoting the project in order to increase the efficiency of their operations in the Book Cliffs.

Agriculture-

Ranching and agricultural uses have a long history in the Book Cliffs and still occur today. Cattle and sheep allotments are held on public lands and the majority of private lands see agricultural use as well. With such practices occurring in close proximity to the SRR it is no

wonder that the Book Cliffs Landowner Association has expressed concern over the project. Burt DeLambert, president of the Landowner Association; responded to the SRR EA by saying that fencing and crossings for livestock and wildlife should be installed to prevent increased vehicle related mortalities. He went on to say that road mortalities would have a negative economic impact on Book Cliffs landowners through the loss of livestock and a reduction in the number of deer permits available to landowners. Mr. DeLambert also listed the locations and legal descriptions for the fencing, road crossing structures and other features he requested. With this level of concern from agriculture and the likelihood that livestock losses will increase due to the project, the argument can be made that fencing and crossing structures should be included as mitigation for the paving project.

Esthetics-

This user group is broader and contains a variety of users that may or may not be directly impacted by the SRR. This group contains those users who value the Book Cliffs for its remoteness and the current lack of major roads and development. As Field and Field (2009) put it some of these individuals have expressed their desire for conservation based on the following four nonuse values; 1) option to use (wanting conservation to preserve their option to one day use the resource), 2) existence values (just knowing the resource exists is good enough), 3) bequest value (desiring the continued conservation of the value for future generations) and 4) stewardship value (a desire to maintain the health of the environment).

Others in this group include those that favor the paving project so that they might enjoy the beauty of the Book Cliffs without having to endure the hardships of unimproved roads. One example of this was an individual that commented in favor of the project so that she might drive her handicapped husband to the area without fear of bad roads. No matter the user group or the motivations of those affected by the project we all have a right and responsibility to weigh in on public land issues, this process will be discussed in more detail in the next section.

Policy

The regulations and policies relating to this project include a mix of land and resource management agencies including Federal, State and local governments. These agencies include the BLM, USFWS, School Institutional Trust Lands (SITLA), UDWR, and Uintah County. Within the scope of this capstone project I examine the policies affecting the paving project including the National Environmental Policy Act (NEPA) and other relevant laws and policies. However the majority of the focus will be on the EA required by NEPA and the Interlocal Cooperative Agreement between Uintah County and the UDWR.

Since a portion of the road is located on federal lands and the project has the potential to impact federally protected species the SRR project was subject to NEPA requirements (DOE.gov). These requirements dictate that either an Environmental Impact Statement (EIS) or an EA be completed before the action can proceed. In this case the county elected to prepare an EA. The general purpose of an EA is to analyze and disclose the potential impacts of a given action. If the EA can determine that there are no significant impacts from the project then a Finding of No Significant Impacts (FONSI) can be issued allowing the project to proceed. However if the EA

finds significant impacts are likely to result from the proposed action then an EIS will be required.

The purpose and need for the EA as described in the document (BLM 2011) is to consider amending Uintah County's Right of Way (ROW). The proposed amendment would allow the county to realign the existing ROW and increase its width from 66 to 150 feet. These improvements along with an upgraded surface were designed to meet the requirements of the American Association of State Highway Transportation Officials for a 55 mph road an increase from 35mph. Along with realigning and increasing the width of the road the surface would be upgraded from native dirt to asphalt and climbing (passing) lanes would be added to approximately 30% of the road (BLM 2011).

The draft version of the document was released for comments in May 2009, followed by the final EA and a Finding of no Significance (FONSI) in April 2011. During the period between the release of the draft document and the signing of the FONSI the EA fell under fire from various groups for its inadequacies. The EPA listed concerns including; a lack of air quality analysis, the need to reduce environmental impacts from off-highway vehicles and the need to analyze the impacts of oil and gas development in the planning area on climate change. Public Lands Policy Coordination (PLPCO) under the office the Governor pointed out the absence of a wildlife collision analysis and any mitigation for habitat loss. The USFWS recommended animal vehicle collision studies, surveys for Graham Beardtongue, raptors and nesting habitat. Finally, SUWA responded with the largest list of concerns including; the lack of wildlife vehicle collision analysis, the need to conserve wilderness characteristics, the lack of adherence to the BLM's Resource Management Plan (RMP), the need to include and analyze alternative actions and the need to complete an EIS.

With this level of scrutiny the EA underwent significant revisions to address some of the most serious concerns. The final document was much more capable of addressing the concerns expressed by its opponents and included a new alternative terminating the upgrades at Buck Canyon. The new Buck Canyon terminus was proposed by SUWA and lessened the length of the road upgrades by more than half. However the alternative was eventually thrown out after the county insisted they would pave the entire road with or without the consent of the BLM. Commissioner Mike Mckee stated that they were preparing a lawsuit under Revised Statute (RS) 2477 to claim the road regardless, allowing the county to move forward with its plans. However this action proved unnecessary once the BLM signed the EA.

One of the major steps taken during the revision of the EA was the creation of an Interlocal Cooperative Agreement between the UDWR and Uintah County. This agreement (Utah DNR 2009) as permitted by the Utah Interlocal Co-Operation Act, Title 11, Chapter 13 of the Utah Code was forged for the purpose of allowing the improvement of the SRR without negatively impacting the mule deer herd. This agreement satisfied the charge of the UDWR as the regulatory authority for the management of wildlife within the state of Utah as granted by the Utah Legislature in Title 23 of the Utah Code Section 23-14-1 (UDWR 2008). In the agreement the UDWR committed to provide the county with a current estimate of road kills and determine a trigger amount of road kills that would indicate a detrimental loss to the mule deer population.

The county then agreed to fund a five year study (designed and proposed by the UDWR) to measure the impacts of the SRR on mule deer.

The agreement goes on to say that if road kills exceed the trigger amount the county will provide mutually agreed upon mitigation measures which may include speed reduction, seasonal adjustments, fencing, crossing structures or other measures as needed. The county also agrees to plan and install any required mule deer crossing structures with some fencing to encourage use during the construction phase of the project. This portion of the agreement was reinforced in the EA in section 2.1.5.5 wherein the county agrees to plan and install six mule deer crossing structures along the SRR at locations selected by UDWR and the county (USDOJ, BLM 2011). As UDWR and the County have worked together they have located six key areas along the 18 mile stretch of road within the UDWR designated mule deer winter range for the placement of wildlife crossing structures (Figure 3). Wildlife crossing structures are commonly used to safely pass wildlife under or over a road in order to avoid collision with vehicles (Cramer 2008). By placing these structures with combined fencing in ideal locations deer should be able to cross the road with minimal risk of being struck by vehicles.

Economics

According to Uintah County the SRR paving and realignment project is currently the largest road project in the state with an estimated completion cost of approximately \$80 million (Darlene Burns, Uintah County Commissioner, personal communication). The project is expected to take six years to complete and will involve the use of various contractors bringing temporary employment to the area. In the long term, however, the road has the potential to increase accessibility to mineral reserves including; oil, natural gas, tar sands and oil shale.

According to Utah Division of Oil Gas and Mining (UDOGM) Uintah County has had the highest number of Applications for Permit to Drill in the state for the last five years. Additionally there are various tar sands and oil shale projects in the Book Cliffs including the Red Leaf Resources project that was recently granted a large mine permit from UDOGM. All of these projects have been challenged by the relative inaccessibility of the Book Cliffs and the SRR paving project has the potential to change this. In 2008 former Uintah County Commissioner Dave Haslem was quoted in City Weekly, a Salt Lake City newspaper, (2008) as saying, “We had an oil tar sand company tell us they plan on 150 trailers per day on the road by the end of the summer”. While the current level of vehicle traffic is nowhere near this high, it can be expected that the greater accessibility offered by the road improvements will invite increased usage.

An increase in oil and gas activities represents a boost to the local economy in the form of increased employment and tax revenues. This potential increase in activity must be taken into account when analyzing the likely impacts to the local deer herd from vehicle related mortality.

Other economic considerations for the project include mitigating for the environmental impacts created by the project. Mitigating measures such as roadside fencing and wildlife crossing structures have the potential to prevent animal-vehicle collisions related to the improvements of

the SRR. While this sounds like an easy answer, it is very costly to construct and maintain fences and crossing structures. For example the cost of constructing one mile of wildlife proof fence along one side of a highway is around \$30,000. In addition, the fencing must be monitored and repaired as needed to maintain its effectiveness. While expensive, wildlife fencing and crossing structures are the most effective way to prevent wildlife-vehicle collisions (Hedlund et al., 2003). It can also be noted that the cost of wildlife mitigation is a small proportion of the overall SRR project cost.

Economic losses as a result of DVCs should also be considered when evaluating the economic impacts of the project. If not properly mitigated the project could contribute to a decline in lamda (the population growth rate) of mule deer. This can be problematic from many angles including the reduction in deer license sales influencing a decrease in hunters to the area. In 2006 the USFWS estimated that there were 87,000 deer hunters in Utah 16 years or older and the net economic value of deer hunting for Utah residents was \$88.00 per day (USFWS 2006). As an economist would put it the net economic value is equal to the total willingness to pay minus actual expenditures. In layman's terms this is the amount the average hunter would likely pay to participate in the sport. With this amount of money being spent on deer hunting in the form of licenses, gas, groceries, gear and services deer hunting should be considered a positive economic activity.

Another economic consideration related to DVCs is the cost of collisions to drivers. According to the Insurance Institute for Highway Safety (2003) the number of deer related vehicle collisions in the U.S. exceeds 1.5 million annually. They also estimate that these accidents are responsible for approximately \$1.1 billion in vehicle damages and 150 human fatalities each year. In the Book Cliffs however deer are not the only animals one can expect to find on the road. Other large animals include; cattle, sheep, horses, elk, pronghorn and bison. Any one of these animals can expect to cause as much or more vehicle damage and health risk than mule deer. Based on this evaluation it would be wise to pursue all reasonable methods to reduce animal vehicle collisions.

Administration

In order to prevent significant mule deer losses due to vehicle collisions some type of mitigation needs to be put in place. UDWR has recognized the need to consider all types of mitigation however, it has been determined that the most effective way to prevent deer-vehicle collisions is through the use of crossing structures and wildlife proof fencing (Hedlund et al., 2003). Wildlife crossing structures are those structures specifically designed to aid wildlife in the safe passage either over or under a roadway. In conjunction with these structures wildlife proof fencing should be installed in order to prevent access to the roadway and to direct wildlife to the crossings.

Uintah County has expressed a desire to be freed from the obligation to construct the crossing structures and has proposed alternative mitigation measures. These measures include; moving water sources away from to the SRR, reducing speed limits, installing deer crossing signs, providing funds for habitat improvements and coyote control. While these efforts may help

reduce the decline of the Book Cliffs mule deer population, the Utah Department of Transportation (UDOT) has concluded that overpasses and underpasses with properly constructed fencing will reduce the number of animal-vehicle collisions by 90-98% (UDOT 2008). As stated in the EA the county has committed to install a total of six crossing structures in those locations agreed upon by the UDWR and Uintah County (BLM 2011). The locations for these structures have been identified through the cooperative efforts of the county and UDWR. At the present time, the county is planning to construct three underpasses in the initial phases of construction. The next three crossings have been designed as overpasses and there seems to be a desire from the county to hold off on these structures until the time that the UDWR deer study can prove they are needed. It is therefore my opinion that the county should be held to the applicant committed measure of installing six crossing structures and do everything necessary to mitigate for the impacts created by the project.

This study should be able to demonstrate whether or not improvements to the road will contribute to the decline of the Book Cliffs deer herd. With this information the UDWR will be able to further understand the extent of the road impacts and make further recommendations for mitigation if needed.

Conclusion

As described in this paper the SRR paving project has the potential to cause a decline in the Book Cliffs mule deer population if the mitigating measures outlined herein are not followed. As the project progresses Uintah County and the UDWR will need to work together to ensure that appropriate mitigation is used at the right time and in the right situation. If these measures are overlooked or circumvented there exists a real possibility that the Book Cliffs deer herd will suffer additional decline.

It is my hope that the data collected and analyzed in this capstone along with information obtained from the UDWR study, will benefit the SRR paving project and the mitigation efforts to reduce the deer mortality associated with it. Since the main goal of this capstone project is to establish a baseline DVC rate and detectability factor along the SRR it will provide data and repeatable methods to be used after the completion of the paving project. With this data it will be possible to compare any changes in DVCs that can be attributed to the SRR paving project. If the data shows a significant increase in DVCs the UDWR will have the information to request additional mitigation for the impacts as outlined in the Interlocal Cooperative Agreement. With appropriate and timely mitigation the Book Cliffs deer herd should be able to provide a variety of opportunities for all those who enjoy it far into the future.

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Typical habitats along the Seep Ridge Road alignment

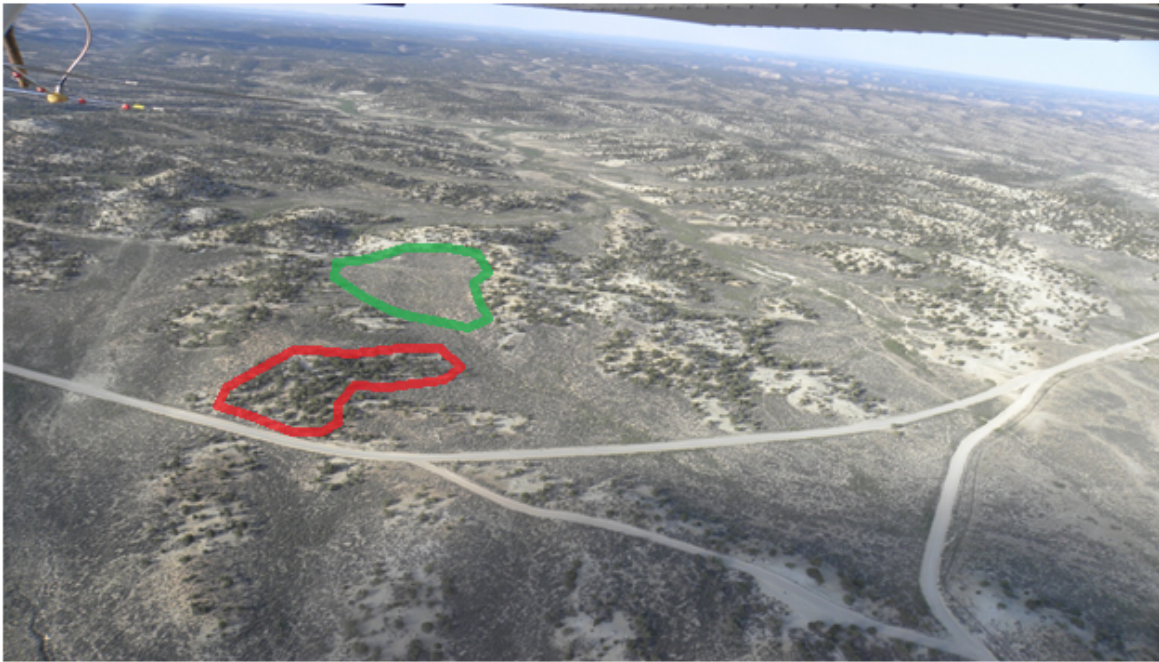


Figure 2 typical pinyon juniper habitat outlined in red and sagebrush flat outlined in green

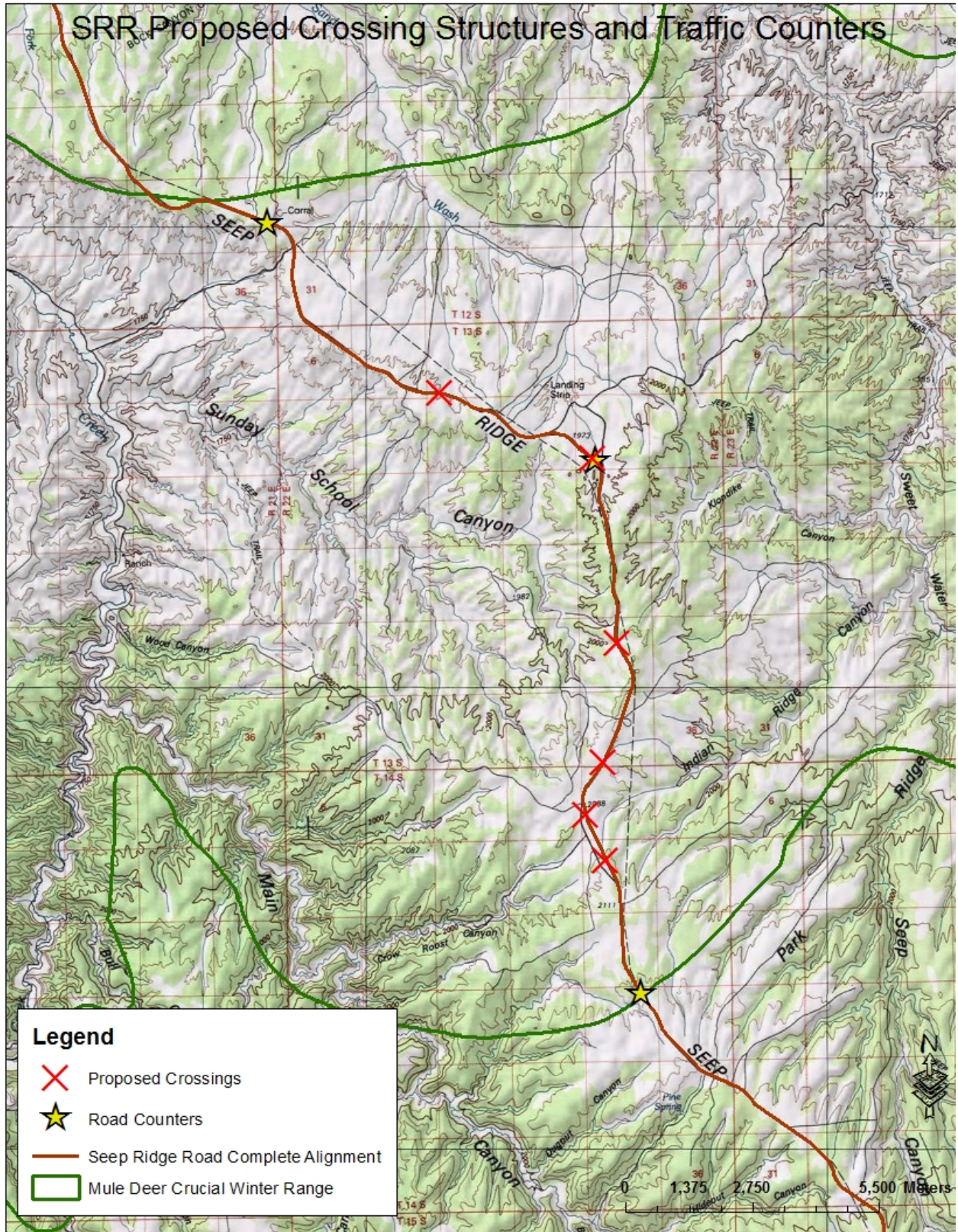


Figure 3

