An Assessment of the Mack's Canyon Fire Revegetation Project.

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Abstract

The Spring Mountains National Recreation Area, a district of the Humboldt-Toiyabe National Forest, is an area that experiences wildland fires. Changes in management practices have caused a post wildland fire revegetation project to be evaluated for effectiveness. Information from the project area was collected, the area was mapped and transects were surveyed to determine field conditions. Compiled information was compared and combined for analysis. Burn area compiled maps, aerial photography, elk and wild horse and burro populations, vegetation comparisons are presented with the aid of using Geographic Information Systems, to give land managers a concise report to help formulate decisions. An assessment of management practices, past and current, are presented to give land managers a scope for decision making. It appears that if current conditions continue, the revegetation project success will be compromised. Improvements in interagency communication and cooperation are needed for successful implementation of this and future projects.

Introduction

In July 1981, a human caused wildland fire burned 6,000 acres of federally managed lands. The majority of the burn was confined to public lands. Approximately one half of the burned area was under the administration of the United States Department of Agriculture, Forest Service (FS). United States Department of Interior, Bureau of Land Management (BLM) administrated the remainder of public land. About 90 acres of private land was also involved. The area burned is located within the Spring Mountains, an area approximately 60 miles west and North of Las Vegas, Nevada. The study area was examined to determine the success of revegetation by agency methods, and to compare earlier management strategies. The final outcome is to identify the impact of each management strategy. Historically, analysis of this type has not taken place on the Spring Mountains National Recreation Area (SMNRA) of the Humboldt-Toiyabe (H-T) National Forest (NF). Land managers can use the data as a reference for future decision making. At the time of the burn, concerns for watershed and erosion were of utmost importance, because the Las Vegas valley receives a majority of its watershed recharge from this mountain range.

Area History

The Spring Mountains have several peaks over 10,000 feet in elevation. The area is surrounded by the Mojave Desert and is strongly influenced by the Great Basin and the Grand Canyon regions. The mountain range has been isolated from similar ranges for the last 10,000 years. The ecosystem is an island in the desert. All these elements have helped create a refuge within the Spring Mountains for 58 sensitive species, including 24 endemic species. 2.5 million visitors per year use the area to seek refuge from desert temperatures and engage in recreational pursuits. The Lands Acquisition Act of 1984 expanded the Las Vegas district (currently SMNRA) to include the area of the Mack's Canyon fire. In 1996, the U.S. Congress designated the SMNRA. The language of the legislation encouraged the FS to protect the rare and unique environments within the Spring Mountains. (Mayben, 1998)

Public land management philosophy differs for each government agency assigned as public land steward. Agency mission statements dictate the role the individual agency shall pursue, when managing public lands. Government agencies have dynamic mission statements, as a result of new technology, advancements in education, and the changing nature of political views.

In 1981, the FS had a mission statement that managed lands to include wood, recreation, wildlife, and watershed. The BLM's mission statement was in place to provide range management for livestock and wildlife grazing. Currently, ecosystem management is the present vogue for agencies involved with public land stewardship. Since the Lands Acquisition Act of 1984, the entire study area (Mack's Canyon Fire), falls under FS management.

Former Chief of the FS, Jack Ward Thomas, announced the agency's adoption of ecosystem management on June 4, 1992, saying that national forest management would never be the same. The Chief wrote:

> "By ecosystem management, we mean that an ecological approach will be used to achieve the multiple-use management of the National Forests…that we must blend the needs of people and environmental values in such a way that the National Forests and Grasslands represent diverse, healthy, productive, and sustainable ecosystems." (Anonymous, 1998).

One of the Principles of ecosystem management includes working within the ecological potential of sites and landscapes, maintaining native diversity, and employing nature's processes to the greatest degree possible. Ecosystem management encourages increased emphasis on understanding ecological relationships, more citizen involvement in planning the future of the national forest, and on-the-ground forest management, which reflect ecological goals.

Importance of Ecosystem Management

On November 4, 2000, the U.S. House of Representatives passed a major restoration project for Florida's Everglades. The bill (HR 5121) authorized $1.4 billion for the first phase of an eventual $7.8 billion federal-state project. The project intends to restore the natural flow of water in the Everglades National Park (ENP). ENP is located at the southern tip of Florida.

Covering about 4,000 square miles, of which more than 2,300 are National Park land, the Everglades is the largest remaining subtropical wilderness in the United States. The wetland supports a vast array of plant and animal species, some of which, such as the American Crocodile, Florida Panther and West Indian Manatee, which are endangered. HR 5121 is seen as a significant step toward curing the ailing Everglades, a shallow, slow-moving river that once covered some four million acres, virtually the entire southern end of Florida. Once considered a swamp to be drained and filled, it was "replumbed" with levees and canals five decades ago to allow water managers to control flooding and enable residents to use land otherwise covered by water. The controls on flooding damaged natural water cycles, disrupting the feeding and reproduction of birds and other creatures. The 30-Year Plan is led by the Army Corps of Engineers, and will remove some of the manmade structures that have obstructed natural water flow. Hailed by politicians and environmentalists HR 5121 represents the largest environmental restoration project ever attempted.

HR 5121 represents a change in management philosophy. Federal and state land management agencies must examine past management practices. Agencies and environmentalists have come to realize that previous practices did not emphasize ecosystems. Resolving past oversights can be costly. The result can be irreversible long- term effects. HR 5121 is an example.

A comparison can be made between HR 5121 and the Mack's Canyon burn revegetation results. The Everglades restoration is necessary as a result of the realization that ecosystem management is important. It will attempt to correct the oversights of past management practices such as those experienced by the Everglades. The Mack's Canyon project is experiencing similar ramifications on the ecosystem. The initial concept of revegatating the Mack's Canyon project for erosion inhibition was successful. Considerations of ecosystem management were not in place at the time. The introduction of the re-seed species may yet prove to have an impact on the existence of endemic, threatened and endangered species present in the SMNRA. Continued attention and funding is necessary to make the Everglades project successful. The unforeseen changes and failure to take action has made the success of the Mack's Canyon re-vegetation project questionable. This re-vegetation project is not unique. Thousand of previous fires throughout the U.S. have been re-seeded for erosion inhibition. The unexpected utilization problem and the concern for introduced plant species compromising endemic species have made the Mack's Canyon project unique regarding ecosystem management. During the initial concept of the re-vegetation project these problems could not have been predicted, therefore funding to maintain the expected results was not allocated. The change to ecosystem management and the failure to control the cause of current vegetation reduction have created a challenge for the SMNRA. Adjustments need to be made to adjust the Mack's Canyon burn project to make it effective. Preliminary fact-finding indicated the FS had not re-seeded that area of the burn. However, examining historic documentation, it was discovered that the FS did indeed revegetate by aerial reseeding.

Comparative analysis could then be performed on re-seeding methods.

Prior to the 1981 fire, the study area was vegetated with Blackbrush (*Coleogyne ramosissima*) at the lower elevations, Pinion (*Pinus monophylla)* and Juniper (*Juniperus osteosperma)* at elevations between 5,000 and 7,000 feet, and Ponderosa Pine (*Pinus ponderosa),* and White Fir *(Abies concolor)* above 7,000 feet. The presence of grasses for forage was minimal, as the biomes were in climax succession. Natural or lightening caused fire is part of the forest ecosystem. With ecosystem management, policies are in place for allowing natural fires to be present. On the contrary, unplanned human caused fires are suppressed. In the aftermath of such a burn, the landscape undergoes change. Exposed vegetation is reduced to ash or in the case of larger fuels, charred wood. The area is prone to invasion species, some of which are exotic species, in this case specifically, cheat grass *(Bromus tectorum)*, an exotic species. To inhibit the invasive species, re-seeding is done with selected species.

Erosion inhibition is a primary goal in the rehabilitation stage of post fire. The Mack's Canyon fire underwent re-seeding using several methods. Keep in mind, the Mack's Canyon fire burned both FS and BLM managed lands. While the both agencies used aerial re-seeding, the BLM also chose to implement the techniques of chaining and drill seeding. The initial phase of rehabilitation was to create a fuel wood sale (firewood) open to the public. The public was allowed to harvest the burned trees for a price-per-cord basis. After the harvest period ended, the BLM chained their portion of the burn. Chaining consists of towing a large chain (usually anchor chain from ocean vessels) between two dozers. Stumps and brush are removed from the ground. Soils are also disturbed, allowing for a larger area and more suitable conditions for re-seeding. Chaining is limited by slope, as dozers cannot operate safely on grades greater than 45 percent. Much of the area administrated by the BLM did not experience severe gradient, so chaining was performed on a majority of that area. Portions of the fire were also drill seeded. Machinery towed behind a dozer plants the seed mix. The drill-seeded areas of the burn occurred where slopes were less than five percent.

Methods

Methods included the acquisition of data, the manipulation and adjustment of that data, and creating new data (Figure 1).

Vegetation cover

Two 1978 Digital Orthoquads (DOQ's) of vegetation type for the study area were manually digitized and converted to a shapefile. Soils DOQ's that have a direct correlation to vegetation and preferred soil types, were unavailable. A table, of the type of vegetation that was occurring at the study area prior to the burn was created.

Transects

Areas within the burn location were selected for type of seeding performed. Three areas within the old FS boundary were chosen for transects. By overlaying the old FS boundary on the burn area, FS jurisdiction at the time of re-seeding was determined. Two transects would be representative of aerial seeding. The third transect was

placed in an unburned area adjacent to the burn as a control, and to determine if seed species have spread. Areas that were drill seeded and chained were selected for the same transect configuration. Post burn aerial photos were consulted to determine chained areas. Evidence of drag lines is visible in photos, along with remnants of removed stumps in the field. Drill seeded area locations were determined by reference to historic re-seed plan maps. Transects of 100 feet were measured and locations recorded using GPS. Slope and aspect were noted. Each transect was examined for seeded species presence. A botanist was consulted for field identification of plants.

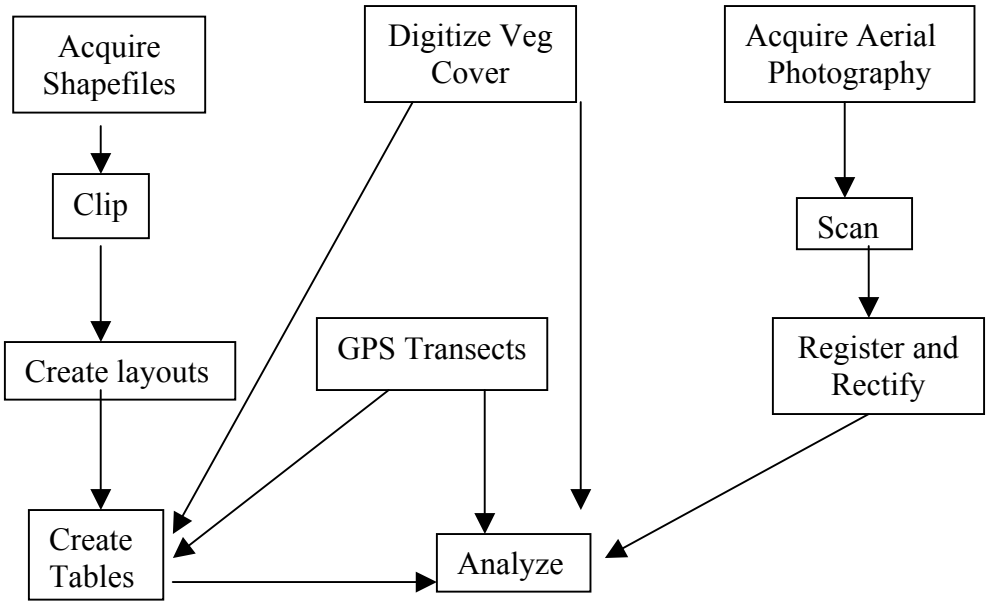

Figure 1. Project organizational chart.

Acquisition and Manipulation of Shapefiles

The FS and the BLM provided Shapefiles used in the project. Others were digitized or acquired through field GPS data. The shapefiles were clipped to include only data pertaining to the study area. The shapefiles used included the burn area, ownership status, old FS boundary, roads, sections, township and range, and lattice from which contours and hillshade were generated. These coverages will provide land managers with a map of the area for consultation, for future management planning.

Acquisition and Manipulation of Aerial Photography

Pre fire aerial photographs from 1978 were provided by the BLM. Post fire study area photographs from 1999 were provided by the SMNRA. Both agencies contract aerial photo companies to provide services. Photos were scanned at 300 dpi. Photos were used to reference areas of the burn, and to aid in correctly placing transects. Comparison of pre and post fire photos revealed erosion problem areas.

Results and Discussion

The objective of erosion inhibition and providing range forage by revegetation in a post wildland fire situation is still a viable management tool. In the specific case of the study area, maximum benefit is not being achieved.

Re-seeding

Two different seed mixes were applied. The FS aerial seeded with Norden Crested Wheatgrass *(agropyron cristatum),* Russian Wild Rye *(Psathyrostachys juncea)*, Yellow Sweetclover (*Melilotus officinalis),* and Smooth Brome *(Bromus inermis)*. The BLM used aerial and drill seeding applications, with pre seeding preparation done in some areas through chaining. The BLM seeded with Luna Pubescent Wheatgrass *(Elymus subsecundus)*, Norden Crested Wheatgrass *(Agropyron cristatum)*, Russian Wild Rye (*Psathyrostachys juncea)*, Yellow Sweetclover (*Melilotus officinalis)*, Ladak Alfalfa *(Cuscuta indecura)*, and Bitterbrush *(Purshia DC ex Poir)* (Mack's Canyon Fire Rehabilitation Proposal, 1981).

Each transect was examined for seeded species presence. Because of the time of year and over utilization of vegetation, complete individual plants did not exist. Identification was made with what was in occurrence resulting in "suspected" species identification.

The presence of horses and elk has had an unchecked impact on the presence of the remaining re-seeded species. A decrease of the re-seeded vegetation cover is in direct correlation to the increase of the feral horse and elk population. The feral horse population has its origins from the late 1800's and early 1900's as silver prospectors abandoned animals. Currently there are domestic animals released from area horse owners who have decided that an individual horse is unwanted. Horse population history data was not made available. From personal observation, there were 39 horses removed from the area, in 1994, after the vegetation utilization rate exceeded 80 percent. The management goal for horse population is 25 individuals. The FS did an aerial census in October 2000. Unfortunately, the data also was not made available.

An aerial elk survey done by NDOW, in the fall of 2000 counted 126 horses in the study area. Like the horses, elk are not native to the SMNRA. In 1935, 21 animals from Yellowstone National Park were released at the study area site. Most over-utilization occurs from the presence of horses, rather than from elk. Horses are present in the area year round. Seasonal movements of the elk population locate them in other areas of the forest especially in the summer months. Traditionally, elk would rely on the re-seeded area in winter and spring because of seasonal precipitation. The re-seeded species still present are found only under shrubs like Cliff Rose *(Pershia Mexicanais),* and Gamble Oak *(Quercus gambelii)*, as it is difficult for the grazers to reach. An absence of any vegetation in the open areas has been noted.

Presently, the FS is conducting a forage use survey in the study area. Elk and horse forage exclosure cages (utilization cages) have been placed at the study area to determine what kind and how much vegetation re-establishes. These cages measure four feet by four feet and are anchored in place to prevent tipping by grazing animals. Cages are

relocated each year in the spring to monitor new growth. The results of the 2000 season's data are 19 cages in place, and seven cages disturbed by human intervention (tipped over causing an interruption of data). Out of the remaining 12 cages, four show growth of re-seeded species with brome or wheatgrass present. By comparing growth within the cage and the growth in adjacent areas, the percent of forage utilization is determined. Also recorded is the occurrence of horse and elk droppings surrounding the cages. Horse droppings occur 2.57 times more than elk droppings. Although there is a larger population of elk than horses, elk have different forage habits and do not rely as heavily on the forage present in the study area as horses.

Erosion

Aerial photographs were contracted by the BLM in 1976 (Figure 2) and again by the FS in 1999 (Figure 3). Comparison of pre and post burn can be made to assess erosion. Figures 2 and 3 show an area of the burn that is bisected by a road. About one half mile of road is visible. Figure 2 is pre-burn. Figure 3 is of the same area 18 years after the burn event. The difference in vegetation cover is apparent. Also noticeable at the top of Figure 3, west of the road, is an area of gravel that has appeared. This is the lower end of a drainage that has increased in size since the burn event. It is unknown if this area of erosion has stabilized or continues to increase. What is evident is that the area has experienced erosion since burning.

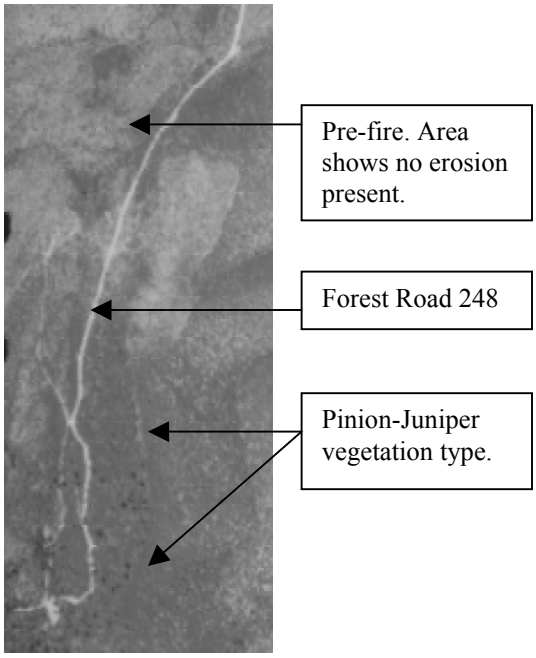

Figure 2. Mack's Canyon fire Area Pre-burn. Aerial Photo 1978.

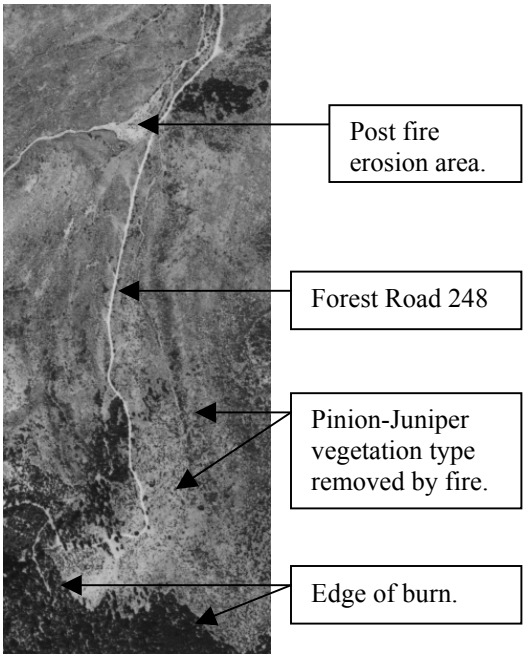

Figure 3. Mack's Canyon Fire. Same View. Post Burn. Aerial Photo 1999.

Modern ecosystem management uses a different process to handle erosion inhibition. Prior to the fire being called out, a Burn Area Rehabilitation Team (BARE Team) would be dispatched to the incident. The team members included a hydrologist, ecologist, soil scientist, and botanist. The team evaluates erosion potential, burn intensity and effect on soils, and potential for revegetation. If reseeding is recommended, the SMNRA plan calls for native species to be re-seeded. Unfortunately, distributors of seed native to a specific area are rare at a national level. In the absence of native seed, a policy of no seeding is followed. This is due to the fear of introduction of exotic or non-native species that may compete with the endemic and threatened and endangered species. However, if erosion potential is deemed severe enough, the plan allows for seeding with non-persistent, non-native species.

Analysis

Transect Results

Yellow Sweetclover *(Melilotis officinalis)*, Ladak Alfalfa *(Cuscuta indecura)*, and Bitterbrush *(Purshia DC ex Poir)* are absent along transect lines (Table 1). From field observation, absence of these species is also noted when traveling through the burn area. Transect line #2 shows the highest numbers observed of species present. A factor of 25 percent slope may be a reason for speculation, as grazers prefer areas with less slope to utilize initially. Ease of availability and the natural path of least resistance for energy conservation are reasons. This transect line does have a west aspect, indicative of a drier and warmer microclimate. Given that the seeded species do require adequate rainfall for survival, aspect would not seem to be a factor of abundance for this transect. Most species are observed in the FS transect lines, followed by chained lines, with the least occurring in the drill seeded areas. The method of seeding is probably not the factor leading to these findings observed along the transects. The FS seeded area is the part of the burn with the highest elevation, with drill seeding taking place in the lower flatter part of the burn. Speculation of more precipitation at higher elevations may be the determining factor in this case. Control transects were created in unburned areas adjacent to the burn. There is noted absence of species in the control transects. This is likely due to the community being climax Pinion-Juniper *(Pinus monophylla -Juniperus osteosperma)*, or Blackbrush *(Coleogyne ramosissima)*, and undisturbed. One example of suspected Luna Pubescent Wheatgrass *(Elymus subsecundus)* does occur in control transect line 8. Control transect line 10 was then created for continuity.

Elk Population

Elk population information was first compiled from hunter daily hunt record cards (Figure 4) (NDOW 1975). Information from figure 5 is a computer generated population estimate based on aerial surveys (NDOW 1996). NDOW data from 1975 through 1983 was unavailable because it does not exist. Elk population prior to the burn (Figure 4) was variable. Factors to consider for cause of variability are hunter success and range condition. Post burn elk population (Figure 5) shows a steady increase. The increase in elk population

coincides with the increase in utilization of the re-vegetated area. Although horse population data was unavailable, it was revealed that the management population goal is 25 individuals (SMNRA Amendment, 1994). This number is based on a determination of what the post burn range can support. The NDOW survey from the fall of 2000 counted 126 horses. With 101 individuals above the set management level, over-utilization can be expected.

LINE		ASPECT	SLOPE %	RYE	S.BROME	C.WHEAT	P.WHEAT	METHOD
FS	1	E	5	5	1	5	0	AERIAL
FS	2	W	25	4	10	13	0	AERIAL
BLM	3	N	4	3	0	8	2	CHAINED
BLM	4	NW	5	4	0	7	1	CHAINED
BLM	5	NE	10	0	0	0	0	CONTROL
FS	6	NW	10	0	0	0	0	CONTROL
BLM	7	SE	1	1	0	3	1	DRILLED
BLM	8	SW	1	0	0	0	1	CONTROL
BLM	9	N	1	3	0	2	2	DRILLED
BLM 10		NE	1	0	0	0	0	CONTROL

Table 1. Re-seeded species occurring along transects. Individual plants are represented. Control transects located in unburned areas adjacent to seeded area. Chained transects aerial seeded.

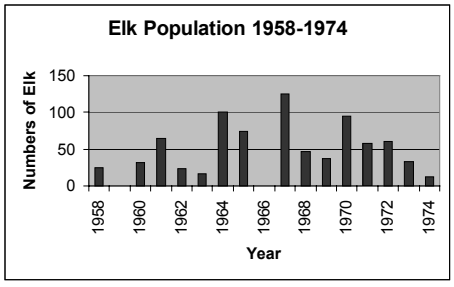

Figure 4. Elk population of the Spring Mountains National Recreation Area from 1958 – 1974. These populations compiled from data collected by elk hunters in the field. The years with no data indicate no elk hunt season for that year. Re-vegetation did not take place until 1981.

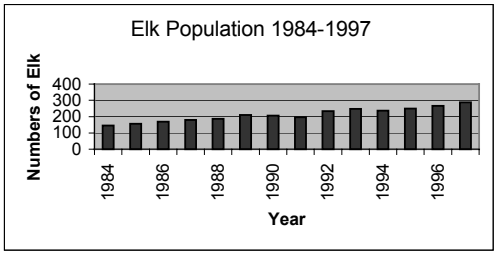

Figure 5. Elk population of the Spring Mountains National Recreation Area 1984 – 1997. These populations compiled from aerial surveys performed by Nevada Division of Wildlife. Re-vegetation took place in 1981.

Problems

Few problems were encountered throughout this project. Included were the difficulty in acquiring historical information due to unknown locations. Accessibility to persons with support knowledge was occasionally difficult. Some information was not made available for unknown reasons. Accuracy of fire coverage data was limited.

Soils coverages were unavailable from the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). The H-T NF covers portions of two counties in Nevada. Soils coverages of the forest are available for the portion of the forest that is in Nye County, but none of the coverages for that portion of the NF that is in Clark County are available. Nye County funded the NRCS to survey that county, while Clark County and the BLM have funded the NRCS to survey the prospective land jurisdictions in Clark County. The USDA FS has chosen not to fund the USDA NRCS to survey the H-T NF to date. There is a direct correlation between soils and vegetation coverages of which analysis could not be performed to determine the suitability of soils for re-seeded vegetation.

Conclusion

This project was intended to assess the success of revegetation of the Mack's Canyon burn using GIS to create and analyze the available data from the study area to give land managers a complied concise report reference evaluation. A combination of aerial photography, shapefiles, and field observation was used to determine if the revegetation was successful. Due to over-utilization by feral horses and elk, the degree of success has been compromised. Witness interviews gave testimony in reports that in the early years following seeding, there was an unidentified (suspected crested wheat and ryegrass) vegetation cover that was thick enough in areas to "move in the wind". The different techniques used for revegetation do not show if one technique was more successful compared to another. This is to say that at one point in time there may have been one method that showed better results, but with the current vegetation cover it is impossible to draw any conclusion.

A question that remains is whether or not the area can recover from its current state of over-utilization. In 1998, the utilization of forage was 70 percent. In 1999 utilization was 80 percent. In 2000, utilization increased to 90 percent, due to the increase in feral horse and elk populations. The SMNRA plan calls for a maximum of 50 percent utilization. The utilization cage study does show vegetation recovery at the 80 percent level. Without removal or increased harvest of horses and elk respectively, and current trends remaining, it is difficult to predict vegetation recovery for the future.

The BLM manages most lands that feral horses occupy. This is the agency that has the experience and personnel to manage the study area's population of horses. Currently the adopt-a-horse program is not having the success it did in its conception. The program was put in place as an alternative to pet food harvest. The agency speculates that the market for adoptive homes are approaching being met thus the lack of interest and drop in adoption numbers. The alternative now is to capture and relocate animals. Due

to lack of budgeting, this is not being done with the SMNRA herd. There are emergency measures available, but as of yet not being implemented.

Nevada Division of Wildlife (NDOW) is charged with the management of the introduced elk herd. There is direct competition between elk and horses in the area. The SMNRA lists NDOW as a "partner" in its management plan. Agency (FS, BLM, NDOW) specific goals and priorities, lack of interagency communication, and lack of funds seem to be the contributing factors that a resulting in the over-utilization of the revegetation area by both horses and elk.

Had this fire occurred at the present time, changes in management practices would have resulted in different erosion inhibition applications. In the process, it was noted that different land management agencies have had or have practices that continue to have impact on the site. Cooperation between the FS, BLM, NDOW, along with public input is necessary to correct the problems the Mack's Canyon re-vegetation project is experiencing. These problems are a threat to any continued success of the project. Interagency commitment to sustained cooperation and communication will insure project success in the event of further unforeseen factors that may cause problems, or future policy changes that effect management practices.

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