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## Interactions between Rocky Mountain Bighorn Sheep *Ovis canadensis canadensis* and Domestic Sheep *Ovis aries* and the Biological, Social, Economic, and Legal Implications of these Interactions on USDA Forest Service Lands in the Evanston/Mt. View Ranger District

Ashly Nicole Herrera  
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**Master of Natural Resources Capstone**

**Interactions between Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*) and Domestic Sheep (*Ovis aries*), and the Biological, Social, Economic, and Legal Implications of these Interactions on USDA Forest Service Lands in the Evanston/Mt. View Ranger District**



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## **Introduction**

Strong evidence exists indicating domestic sheep (*Ovis aries*) can infect Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*), a United States Forest Service (USFS) Region 4 sensitive species, with pneumonia (Callan 1991; Foreyt 1989, 1992, 1994; Foreyt and Lagerquist 1996; George et al 2008; Wehausen et al. 2011). Since the transmission of the pneumonic bacteria between the domestic and wild sheep is a result of bighorn sheep coming into contact with the bacteria carried in the mucous membranes of the domestic sheep, bighorn sheep at risk of initially contracting the bacteria are those individuals that enter areas currently being grazed or that have been recently grazed by domestic sheep (Foreyt 1990; Jessup 1985; Martin et al. 1996; Monello et al. 2001; Rudolph et al. 2003). The issue is further compounded when infected bighorn sheep return to their herd and have the potential to spread the bacteria to other members, which can result in substantial mortality (Shackleton et al. 1999).

Throughout the western United States (U.S.), the USFS and various state wildlife agencies are struggling to protect and maintain the viability of Rocky Mountain bighorn sheep populations that coexist with domestic sheep being grazed on National Forest lands. This study reviews the biological, social, economic, and legal factors regarding Rocky Mountain bighorn sheep population protection and viability in the presence of domestic sheep, with special attention given to the Evanston/Mt. View Ranger District (EMVRD) on the Uinta-Wasatch-Cache National Forest (UWCNF). Additionally, possible solutions to the problem associated with the comingling of bighorn sheep and domestic sheep and the spread of pneumonia to bighorn sheep were investigated on the EMVRD. This included looking at ways to eliminate interactions between the domestic and wild sheep by identifying movement patterns of six satellite collared bighorn sheep of the Hoop Lake herd on the EMVRD.

## **Ecological/Biological Aspect**

Peer-reviewed articles were used to obtain information on habitat preferences of Rocky Mountain bighorn sheep, as well as information on the transmission of pneumonic bacteria from domestic sheep to bighorn sheep. The material obtained through this review was used to discuss the conflict between domestic sheep and bighorn sheep, as well as determine possible solutions to this conflict.

General habitat information for Rocky Mountain bighorn sheep was compiled to understand the overlap between domestic sheep grazing on National Forest lands and bighorn home ranges. These habitat preferences were used to identify potential overlap throughout the year between domestic sheep grazing allotments and occupied bighorn sheep habitat on the EMVRD. Having this information will provide an understanding on the possibility of comingling of domestic and bighorn sheep on the EMVRD.

In January 2010, the Utah Division of Wildlife Resources (UDWR), in conjunction with the EMVRD, placed satellite collars on six members of the Hoop Lake bighorn sheep herd. The

satellite collars were placed on the bighorn sheep to collect data on movement patterns throughout the year. The data collected from these collars were entered into ArcGIS to determine where, and when, the bighorn sheep travel to on the EMVRD. The information from the sheep allotments and the satellite collars will be used in ArcGIS to determine how much overlap, if any, there is between domestic sheep grazing and seasonal habitat usages of bighorn sheep of the Hoop Lake herd.

### **Human Dimensions Aspect**

Peer-reviewed articles and news articles regarding the conflict between bighorn and domestic sheep were reviewed to better understand the human dimensions of this issue. This type of conflict can be categorized as human-wildlife in which ranchers have conflict with bighorn sheep; human-human conflict in which the conflict is between individuals or groups with differing views regarding domestic sheep grazing on National Forest lands; and animal-wildlife conflict in which the conflict is between domestic sheep and bighorn sheep. All of these types of conflicts are derived from a singular source: the spread of deadly pneumonic bacteria from domestic sheep to wild bighorn sheep.

In addition to obtaining material from written articles, information was obtained through informal discussions with the EMV District Ranger, the EMV Range Specialist, local sheep grazing permittees, and Utah state biologists. Both sides of the conflict were examined to understand the main concerns for the various parties involved and to determine if collaboration is a possible option. Collaboration would be an important factor if, in the future, some law or policy is passed regarding the protection of bighorn sheep.

### **Policy/Law Aspect**

The main federal policies/laws involved with this issue are the *Taylor Grazing Act of 1934*, *Multiple-Use Sustained-Yield Act of 1960*, *National Environmental Policy Act of 1969*, *National Forest Management Act of 1976*, *Public Rangelands Improvement Act of 1978*, *Wilderness Act of 1964*, and *Forest and Rangeland Renewable Resources Planning Act of 1974*. The USFS must also comply with the Revised Wasatch-Cache National Forest Plan. As part of this project, these policies, laws, and plans, along with other relevant policies and laws, were reviewed to determine how they are relevant to the domestic sheep/bighorn sheep issue.

### **Economic Aspect**

The economic implications of continued domestic sheep grazing and the discontinuation of domestic sheep grazing on National Forest lands were evaluated with specific reference to the USFS, UDWR, and domestic sheep permittees on the EMVRD. This information was obtained through informal conversations with the EMVRD permittees, the EMV District Ranger, and UDWR biologists, as well as through peer-reviewed articles.



## **Rocky Mountain Bighorn Sheep Description and Natural History**

Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) are named for the massive horns that males, or rams, grow. The rams' horns form a curled shape at 8 to 10 years of age (UDWR 2008), and these horns can account for as much as 8 to 12 percent of their total body weight (Geist 1966). On the other hand, females, or ewes, grow horns that slightly curve backwards and are much smaller than those of rams.

Rocky Mountain bighorn sheep are relatively stocky ungulates whose pelage color varies, depending on season and/or geographic region, from almost white to dark brown with a dorsal midline of darker hair (Krausman and Bowyer 2003). The muzzle, rump patch, and back of the legs of Rocky Mountain bighorn sheep is generally white in color. Bighorn sheep grow between 3 and 3 ½ ft (.91 and 1.1 m) at shoulder height, 4 to 6 ft (1.2 to 1.8 m) long, and can weigh between 75 and 275 lbs (34-124 kg), with rams being larger than ewes (Reid 2006).

Prior to European settlement in western North America, this large ungulate ranged from southern British Columbia and southwestern Alberta, south through the Rocky Mountains to northern New Mexico, and east into Nebraska, the Black Hills of South Dakota and the badlands of North Dakota (Monson 1980). Rocky Mountain bighorn sheep are currently found in high mountainous terrain from Canada to New Mexico which is only a fraction of their historical range (Schommer and Woolever 2008).

Rocky Mountain bighorn sheep prefer habitats that consist of open or semi-open terrain characterized by an assortment of steep or gentle slopes, rocky outcrops, broken cliffs, and canyons neighboring mesas and river benches (Shackleton et al. 1999). The steepness of slopes appears to be significant in the selection of habitat by Rocky Mountain bighorn sheep. In Montana and Colorado it was determined that Rocky Mountain bighorn sheep utilize slopes of 36 to 80 percent, while avoiding slopes that were less than 20 percent (Frisina 1974; Pallister 1974; Fairbanks et al. 1987). Balance-aiding, split hooves, rough hoof bottoms for natural grip and keen eyesight allow bighorn sheep to inhabit these steep, rocky slopes.

The diet of the Rocky Mountain bighorn sheep generally varies by season and foraging areas are chosen in relation to escape cover (Lawson and Johnson 1982). Rocky Mountain bighorn sheep most frequently select forbs when they are available in the spring. Grasses dominate the bighorn's diet during the warm months, and shrubs are consumed during the fall and winter months (Beecham et al. 2007). While bighorns feed in open areas, they are rarely found more than 400 m (1,312 ft) from escape cover on talus slopes, rocky outcrops, and cliffs, where they are at an advantage over predators (Oldemeyer et al. 1971; Erickson 1972; Pallister 1974; Krausman and Leopold 1986; Krausman and Bowyer 2003).

The distribution of bighorn sheep throughout its range is naturally patchy due to the fragmented nature of the preferred habitat type (Valdez and Krausman 1999). The patchy habitat characteristics made bighorn sheep very vulnerable to numerous limiting factors, but most

notably unregulated hunting and the transmission of disease from the domestic sheep (*Ovis aries*) that were introduced into the bighorns native ranges in the mid-19<sup>th</sup> century (UDWR 2008). The transmission of disease resulted in massive die-offs and the extirpation of many bighorn herds (Valdez and Krausman 1999). As the number of domestic sheep grazed on bighorn habitat increased, the bighorn population numbers dramatically declined from approximately 500,000 before 1800 to about 15,000 to 20,000 in 1960 (Buechner 1960; Valdez 1988).

### **History of Rocky Mountain Bighorn Sheep in Utah**

Rocky Mountain bighorn sheep are native to Utah and were abundant historically throughout Utah prior to the European settlement (UDWR 2008). Settlement of the west resulted in the extirpation of several bighorn herds from Utah. State-wide, populations began declining in the late 1800s, and by the 1930s there were no remaining self-sustaining populations (Smith et al. 1988, 1991). However, as late as the 1960s, there were a few scattered Rocky Mountain bighorn sheep sightings in the northern part of Utah (UDWR 2008).

There are several factors that led to the near extirpation of the Rocky Mountain bighorn sheep in Utah. According to UDWR (2008), Beecham et al. 2007, and Shannon et al. (2008), these factors include the following:

- Loss of habitat due to human development
- Habitat conversions from excessive grazing and fire suppression
- Unregulated hunting
- Competition for forage and space with domestic livestock
- Vulnerability to domestic livestock-borne diseases (particularly from domestic sheep)

Due to the abundant anthropogenic changes to the historic and current habitat, the bighorn sheep have been forced to inhabit even more specialized habitat than they previously occupied (UDWR 2008). In general, habitat specialists are poor colonizers and thus are difficult to reintroduce. Despite the difficulty of reintroduction, the UDWR began reintroducing bighorn sheep to Utah in 1966, in an attempt to re-establish self-sustaining Rocky Mountain bighorn sheep populations to suitable portions of its historic range (Shannon et al. 2008). The initial reintroduction attempts were met with limited success, and several failed (Shannon et al. 2008). It was later discovered that the reintroductions were failing because introduced populations needed to be supplemented with additional specimens in the first few years following the reintroduction.

Since 1966, there have been 41 transplants of Rocky Mountain bighorn sheep at 14 different sites in Utah. Since 1988, Rocky Mountain bighorn sheep have increased in Utah due in part to these translocations, but also resulting from improved management efforts (Shannon et al. 2008). It is estimated that approximately 1,900 Rocky Mountain bighorn sheep currently occupy parts of the northern half of Utah, and all of these populations are a result of UDWR transplant efforts (UDWR 2008).

In 1989, the UDWR transplanted 23 Rocky Mountain bighorn sheep in the Hoop Lake area on the EMVRD located in northeastern Utah (Figure 1). The sheep that were transplanted into this area were selected from a source herd in Whiskey Basin, Wyoming. The population numbers for the Hoop Lake population have fluctuated in the years following the reintroduction. The fluctuations seen in the Hoop Lake population are potentially a result of low recruitment and ongoing contact with domestic sheep on and off National Forest lands. This ongoing contact has made UDWR biologists hesitant to augment the population with further translocations. In an attempt to understand the dynamics and movements of the Hoop Lake herd, the UDWR in January 2010, in collaboration with the USFS, captured and fitted satellite collars on four rams and two ewes.

### **History of Domestic Sheep Industry and Grazing**

The sheep industry in the U.S. is rooted deeply in history and tradition that dates back to the original colonists. The colonists primarily used domesticated sheep for wool and textiles. Although meat was not a priority in the sheep market, there was a slight demand for the product (Williams et al. 2008).

Changes in demand for sheep after World War II (WWII) brought about significant changes to the U.S. sheep industry in terms of the numbers of domestic sheep. Before the end of WWII in 1942, there were an estimated 56.2 million head of domestic sheep in the U.S. Since the end of WWII, sheep numbers have shown a steady decline. By 1950, the sheep total in the U.S. declined to fewer than 30 million head. During the 1950s, sheep numbers leveled off, and then showed a modest growth in the late 1950s and into 1960. This growth was only temporary, however, and sheep numbers decreased on a yearly basis in the 1960s and hovered just above 21 million head by the end of the decade. The decline continued throughout the 1970s with numbers totaling just over 12 million head by 1980, 11 million head by the end of the 1980s, and further declines from 1990 into the 2000s (USDA/NASS 2011). On January 1, 2007, the sheep industry hit a record low of 6.2 million head of sheep (Jones 2004).

Historically, wool was the main driver of the U.S. sheep industry, with lamb meat developed as a byproduct. Since WWII, however, production of wool has rapidly declined because the wool industry faced many challenges. The primary challenge the wool industry faced was the increased use of synthetic fibers instead of wool. Synthetic fibers are less expensive than wool, and when blended with natural fibers, they become more attractive to consumers (Jones 2004).

The decline of the wool industry caused a shift in the sheep industry, which resulted in an increase in the production of lamb meat. The increased emphasis on lamb meat production was an attempt by the sheep industry to offset the losses from the weakening wool industry. This attempt, however, was not as fruitful as the sheep industry had hoped. Lamb meat prices were very low and there was a large increase in the amount of lamb meat being imported, mainly from

Australia and New Zealand, hindering the sheep industry from recovering from the weak wool market (Jones 2004).

Lamb meat imports from Australia and New Zealand increased as the demand for wool from the U.S. sheep market decreased, because these two countries restructured their sheep industries to adjust to the low wool prices and the diminishing wool industry. The Australian and New Zealand sheep industries restructured their operations to focus on the production of quality lamb meat and mutton. In order to ensure the production of quality sheep meat, the Australian and New Zealand sheep industries altered the diet of the lambs to all grass, in order to reduce the fat content of the meat. This change, among others, resulted in a greater than 20% increase in sheep meat exports from 1994 to 2004, with 50% of the exports going to the U.S. (Jones 2004; Williams et al. 2008).

The operation of grazing domestic sheep on public lands in the western United States can be dated back to the days of western exploration and colonization. A boom in the production of livestock during the 1800s was the result of the California Gold Rush and the onset of the Civil War. During this time, public lands of the west were unmanaged, and run as a “free for all” by numerous large ranching operations. By 1890, it was estimated that over 26 million cattle and 20 million domestic sheep were grazed in the 17 western states (McGinty et al. 2009). The lack of land management resulted in the heavy overgrazing and depletion of the majority of public lands. The overgrazing and depleted resources of the land ignited many bitter struggles over the remaining resources between stockmen (Sampson 1952).

The condition of the public lands in the west grabbed the attention of the federal government. In response to the overgrazing in the west, the government established forest reserves to manage the grazing operations being run on public lands. Initially, the forest reserves were managed by the General Land Office, but were transferred to the Bureau of Forestry (later the USFS) in the Department of Agriculture in 1905 (McGinty et al. 2009). A year after the transfer, the Chief of the Forest Service, Gifford Pinchot, imposed grazing fees on ranchers and established a use-by-permit system (Prevedel and Johnson 2005).

At the onset of WWII, many ranchers made a push to expand the number of livestock grazed on National Forests. The USFS, however, resisted this because the agency was working to increase the quality of grazing lands on National Forests. Ultimately, the USFS reduced the number of livestock allowed to graze on forest lands. Therefore, by the end of the 1940s, the quantity of sheep being grazed in the U.S. greatly declined (Godfrey 2008).

Another cause for the decline in sheep numbers on National Forest lands was the passage of the Taylor Grazing Act of 1934 (as discussed in further detail in the policy/laws section). The Taylor Grazing Act, signed by President Roosevelt, was passed with the intention of “stopping injury to the public grazing lands (excluding Alaska) by preventing overgrazing and soil deterioration; to provide for their orderly use, improvement, and development, [and] to stabilize the livestock

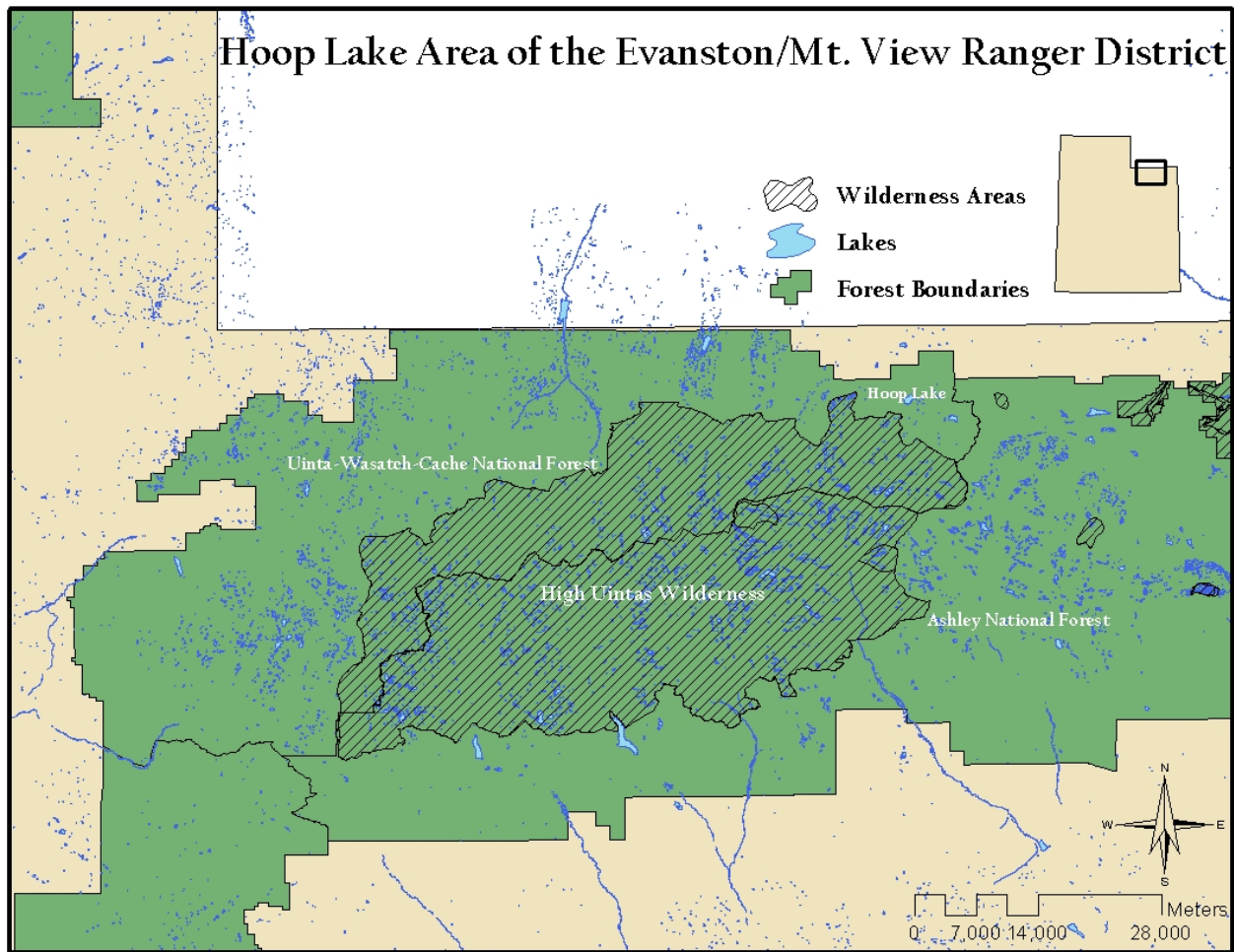
industry dependent upon the public range” (43 U.S.C. 315). In order for ranchers to qualify for a grazing permit, they had to own ranch-land, also known as base property, adjacent to National Forest lands (Moskowitz and Romaniello 2002).

Despite the changes imposed by the Taylor Grazing Act on ranching operations utilizing National Forest lands, grazing by privately owned domestic livestock is still the most extensive economic use of National Forest lands. Grazing on National Forest lands is principally directed through the issuance of permits for distinct grazing allotments. The terms of permits and establishment of grazing allotments were completed in compliance with the Taylor Grazing Act (Godfrey 2008).

The USFS manages 144 million acres in the 11 western states, outside of Alaska. Of these federal lands, 81 million acres are open to domestic livestock grazing (Vincent 2011). In accordance with the Multiple-Use Sustained-Yield Act of 1960, the USFS administers National Forest lands for outdoor recreation, range, timber, watershed, and wildlife and fish purposes (Sec. 1. 16 U.S.C. 528), while maintaining in perpetuity a high level annual or periodic output of the various renewable resources of the National Forests without impairment of the productivity of the land (Sec. 4. 16 U.S.C. 531 (b)).

### **Study Area**

The study area for the project is the Hoop Lake Area located on the EMVRD on the UWCNF in Utah (Figure 1). The Hoop Lake Area is located approximately 27 miles (42.5 km) southeast of Mountain View, Wyoming. The Lake is approximately 3 miles (4.8 km) from the border of the UWC and Ashley National Forests.



**Figure 1: Map of the Hoop Lake Area on the EMVRD of the UWCNF in Utah**

The EMVRD is located on the UWCNF and set in both Utah and Wyoming. The Hoop Lake area of the EMVRD is the study area for this project. The Hoop Lake area is located in Utah at townships 2 and 3N and ranges 15, 16, and 17E.

This Ranger District is very popular for its multiple recreation uses, such as, day hiking, mountain biking, horse riding, OHV trails, hunting, fishing wildlife viewing, snowmobiling, and cross-country skiing. This District is located at high elevations ranging from 8,000 to 13,500 feet (2,438 to 4,115 meters). The Hoop Lake area ranges in elevation from 8,202 to 12,447 feet (2,500 to 3,794 meters) (USDA Forest Service 2012).

### **Methods**

In January 2010, personnel from Leading Edge Aviation, a helicopter company contracted by the UDWR, were provided with coordinates of recent bighorn sheep sightings. Upon arriving on location, the bighorn herd was immediately located. The collars were placed on the bighorn sheep and data transmission began. Transmission of data began at different days, with each individual beginning transmission within a 7 day period.

Transmission data for collared bighorn sheep was obtained from the North Star Science and Technology, LLC Remote Access Satellite Sensor Link System website database. These data were transferred into Microsoft Excel 2010 and converted to a GIS shapefile for use in ArcGIS. Bighorn sheep location files were combined with shapefiles of the sheep grazing allotments on the EMVRD, the potential bighorn habitat, the UWCNF boundaries, and the High Unitas Wilderness boundaries. In addition, shapefiles of all bodies of water on the EMVRD were obtained from the USFS GIS database and the Utah Automated Geographic Reference Center (UAGRC 2012).

Numerous peer-reviewed articles were reviewed in order to complete much of the data collection for the human dimensions, policy/laws, and economics sections. In addition to peer-reviewed articles, data was collected from news articles as well as informal conversations with USFS range specialists, the EMV District Ranger, and permittees on sheep allotments that are within the occupied bighorn habitat.

### **Data Issues**

The data used to assess the movements of bighorn sheep and associated potential interactions with domestic sheep were incomplete. Much of the ecology section of this study was focused on the movements of six collared bighorn sheep of the Hoop Lake herd on the EMVRD. All of the collars were placed within a week of one another and were programmed to automatically drop off in March of 2012. Some of the collars stopped transmitting data prior to the drop off date. It is unknown why these collars stopped functioning.

**Table 1: Data transmission start date for the 6 satellite collared bighorn sheep of the Hoop Lake Area**

<b>Collared Bighorn Sheep Number</b>	<b>Collar Transmission Start Date</b>	<b>Last Transmission Date</b>
<b>Ewe 1</b>	January 8, 2010	May 24, 2012
<b>Ewe 2</b>	January 1, 2010	April 29, 2012
<b>Ram 1</b>	January 8, 2010	April 30, 2012
<b>Ram 2</b>	January 8, 2010	April 29, 2012
<b>Ram 3</b>	January 7, 2010	July 26, 2011
<b>Ram 4</b>	January 8, 2010	April 17, 2011

Some of the collars continued to transmit data well past the March drop off date, however, with one collar still transmitting as of May 24, 2012. This resulted in sufficient data to analyze the seasonal movements of bighorn sheep in relation to domestic sheep grazing allotments on the EMVRD, as some of the collars continued to transmit data well past the March drop off date.

### **Findings pertaining to Ecology/Biology**

Disease transmission from domestic sheep to bighorn sheep is considered a threat to the bighorn sheep of the North Slope of the Uinta Mountains, which include the Hoop Lake herd on the

EMVRD. There is a wide body of literature summarizing the information and concerns regarding the transmission of pneumonic bacteria to bighorn sheep. Scientific research has shown that when bighorn sheep and domestic sheep intermingle, large numbers of bighorns die from pneumonia (Ashmanskas 1995).

Domestic sheep were introduced into the western U.S. by settlers in the mid-19<sup>th</sup> century (Beecham et al. 2007). Large die-offs and herd extirpation of bighorn sheep were common soon after the domestic sheep moved into habitats that bighorn sheep occupied. Bighorn die-offs due to pneumonia have been documented as early as the mid-1800s.

Experimental studies, in which clinically healthy bighorn and domestic sheep were placed in contact with one another, have been conducted to understand the potential of transmission of pneumonic bacteria from domestic sheep to bighorn sheep. These experiments resulted in the deaths of bighorn sheep within days to weeks due to pneumonia (Wehausen et al 2011). Other studies have also been conducted to determine if there are other domestic animals will transmit diseases to bighorn sheep (Bessar et al. 2012) (



Table 2).

Although previous studies did establish that bighorn sheep mortality from pneumonia occurred after they commingled with domestic sheep, these studies did not conclusively prove that the responsible pathogens were transmitted from domestic to bighorn sheep. In order to prove that the pneumonic bacteria responsible for bighorn deaths came from domestic sheep after commingling, Lawrence et al. 2010 isolated *Mannheimia haemolytica* from the pharynx of two of the four domestic sheep used in the study and tagged a plasmid carrying the genes with green fluorescent protein. Upon conducting necropsies on the deceased bighorns, the lungs from all the bighorn sheep showed gross and histopathologic lesions characteristic of *M. haemolytica* pneumonia. From tissue samples taken from the lungs, the researchers isolated the tagged *M. haemolytica* proving unequivocally that domestic sheep transmit pneumonia causing bacteria to bighorn sheep after comingling (Lawrence et al. 2010).

**Table 2: Survival of bighorn sheep (BHS) experimentally commingled with other domestic or wild ungulates in previous studies (Bessar et al. 2012)**

Contact Species ( <i>n</i> ) <sup>a</sup>	BHS ( <i>n</i> ) <sup>b</sup>	Mortality (%)	Contact Day ( <i>n</i> BHS died)	Space ( <i>ha</i> )	Reference
<i>Ovis</i> sp.					
Dom. sheep (11)	14	93	26 (7), 72 (6)	2.5	Foreyt and Jessup, 1982
Dom. sheep (>100)	37	100	25 (8), 31 (5), 63 (24)	445	Foreyt and Jessup, 1982
Dom. sheep (2)	2	100	29 (2)	0.004	Onderka and Wishart, 1988
Dom. sheep (6)	6	100	4 (1), 27 (2), 29 (1), 36 (1), 71 (10)	2	Foreyt, 1989
Dom. sheep (2)	2	100	14 (2)	0.006	Foreyt, 1990
Dom. sheep/mouflon (30)	5	100	11 (1), 14 (1), 17 (1), 30 (1), 99 (1)	0.27	Callan et al., 1991
Dom. sheep (4)	6	83	26 (1), 33 (1), 34 (1), 35 (1), 40 (1)	2.5	Foreyt, 1992b
Mouflon (5)	6	100	41 (2), 42 (4)	0.4	Foreyt, 1994
Dom. sheep (2)	2	100	6 (1), 8 (1)	0.002	Foreyt, 1994
Dom. sheep (3)	6	100	20 (1), 30 (4), 32 (1), 61 (1)	0.6	Foreyt, 1998
Dom. sheep (4)	4	100	67 (1), 70 (2), 74 (1)	0.02	Lawrence et al., 2010
<b>Total</b>	90	98			
<b>Other Dom. spp.</b>					
Dom. goats (3)	3	0	NA	0.4	Foreyt, 1994
Llamas (3)	9	0	NA	0.8	Foreyt, 1994
Cattle (3)	4	0	NA	0.4	Foreyt, 1994
Horses (3)	6	17	22 (1)	0.5	Foreyt and Lagerquist, 1996
Cattle (3)	5	20	6 (1)	0.5	Foreyt and Lagerquist, 1996
Dom. goats (4)	7	29	“Third month” (2)	0.6	Foreyt et al., 2009
<b>Total</b>	34	12			
<b>Wild</b>					

<b>ungulates</b>					
<b>Mt. goats (2)</b>	9	0	NA	0.8	Foreyt, 1994
<b>Elk (4), deer (3)</b>	10	0	NA	0.72	Foreyt, 1992a
<b>Elk (4)</b>	3	0	NA	0.4	Foreyt, 1992a
<b>Total</b>	22	0			

<sup>a</sup> Contact species = animal species placed in contact with bighorn sheep in each experiment. n = No. of the contact species animals in each experiment. Dom. sheep (*Ovis aries*); mouflon (*O. aries orientalis*); Dom. goats (*Capra hircus*), llamas (*Lama glama*); cattle (*Bos taurus*); horses (*Equus caballus*); Mt. goats (*Oreamnos americanus*); elk (*Cervus elaphus*); deer (*Odocoileus hemionus* and *Odocoileus virginianus*). Dom. = domestic; Mt. = mountain.

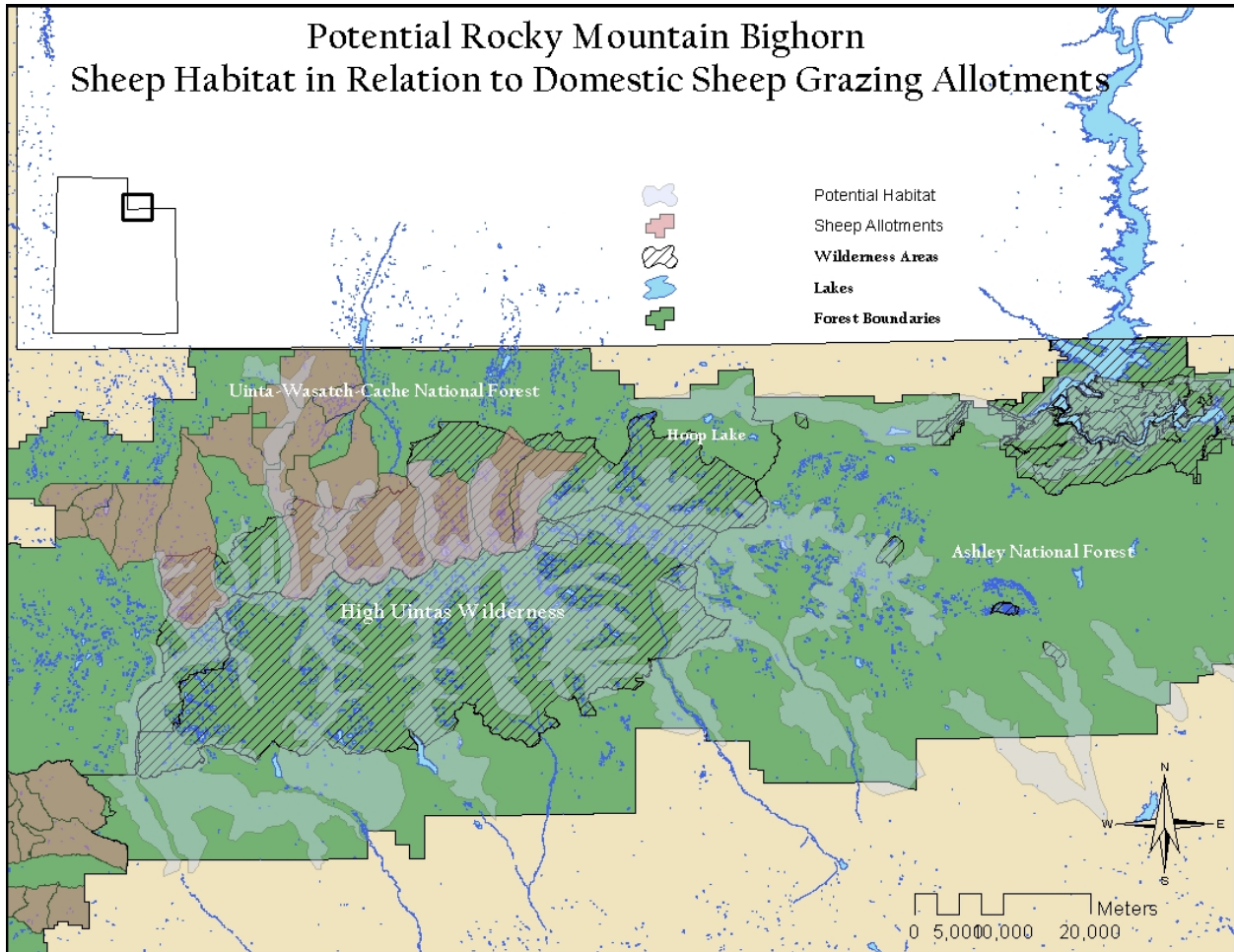
<sup>b</sup> No. of bighorn sheep included in each contact experiment.

<sup>c</sup> NA = Not applicable.

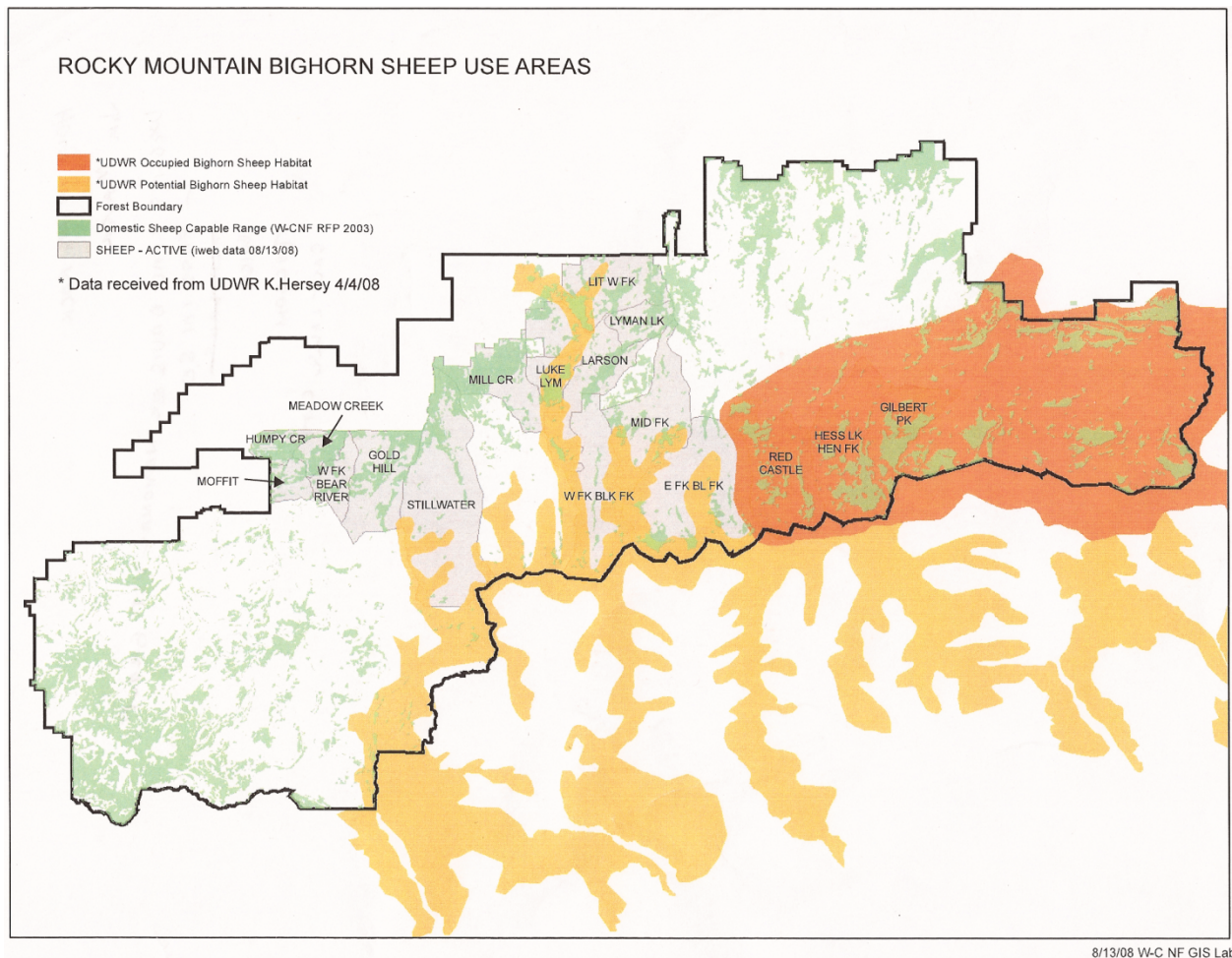
In response to the conclusive research regarding the transmission of pneumonia from domestic to bighorn sheep, a memorandum from Abigail Kimball, Chief of the Forest Service, and Mark Rey, Under Secretary of Natural Resources and Environment for the Department of Agriculture, directed the USFS “to provide effective separation between domestic sheep and goats and wild sheep to minimize the likelihood of disease transmission to wild sheep.” The UWCNF, however, had been taking actions in response to the concern of disease transmission prior to the release of this memorandum, including (USDA Forest Service 2009):

- In 1988, the Wasatch-Cache National Forest completed the Burnt Beaver Analysis. From this analysis, it was decided that 3 allotments located at high elevations on the east end of the EMVRD near the Hoop Lake Area were to not be restocked with domestic sheep. These three allotments, the West Beaver, Thompson Creek, and Burro Peaks, provide a large area that bighorns can range without coming into contact with domestic sheep permitted to graze on National Forest lands. The closing of these allotments led to the reintroduction of 23 bighorn sheep to the Hoop Lake area.
- In 1992, the *Utah Chapter of the Foundation for North American Wild Sheep* purchased a conservation easement on private land adjacent to the Hoop Lake Area. The conservation easement restricted the use of the private land for grazing to only cattle and horses. The intent of the conservation easement is to help preserve a disease free and healthy free ranging bighorn sheep population in the Hoop Lake Area.
- In 2003, the Wasatch-Cache National Forest revised their Forest Plan (USDA Forest Service 2003). This Plan closed three sheep allotments (West Beaver, Thompson Creek, and Burro Peaks) to provide bighorn sheep habitat. In addition to closing the three allotments, the Plan identified seven allotments (Gilbert Peak, Henry’s Fork-Hessie Lake, Red Castle, East Fork Blacks Fork, East Fork Bear River, West Fork Blacks Fork, and Stillwater) to be closed if the permits are voluntarily waved by the permittees without preference to expand bighorn sheep habitat on the North Slope of the Uintas.

Figure 2 shows the abundant suitable habitat on the EMVRD potentially available for the Hoop Lake herd to inhabit (Figure 2). However, the majority of the current use by the Hoop Lake herd occurs on the three closed allotments and Gilbert Peak, Henry's Fork-Hessie Lake, and Red Castle open allotments. Maps were created on ArcGIS using the satellite collar data (Figure 4), as well as information obtained from the UDWR (Figure 3), to show the use of the closed and currently open domestic sheep allotments.



**Figure 2: Potential bighorn sheep habitat on the EMVRD**



8/13/08 W-C NF GIS Lat

**Figure 3: Rocky Mountain bighorn sheep use areas on the EMVRD (USFS WCNF 2008)**

For the transplant in 1989, the UDWR released 23 bighorn sheep into the Hoop Lake Area. The population has fluctuated over the years, but has shown no large growth or decline. Currently the Hoop Lake herd population is between 25 and 30 bighorn sheep (personal communication, Dave Rich UDWR biologist) (Table 3).

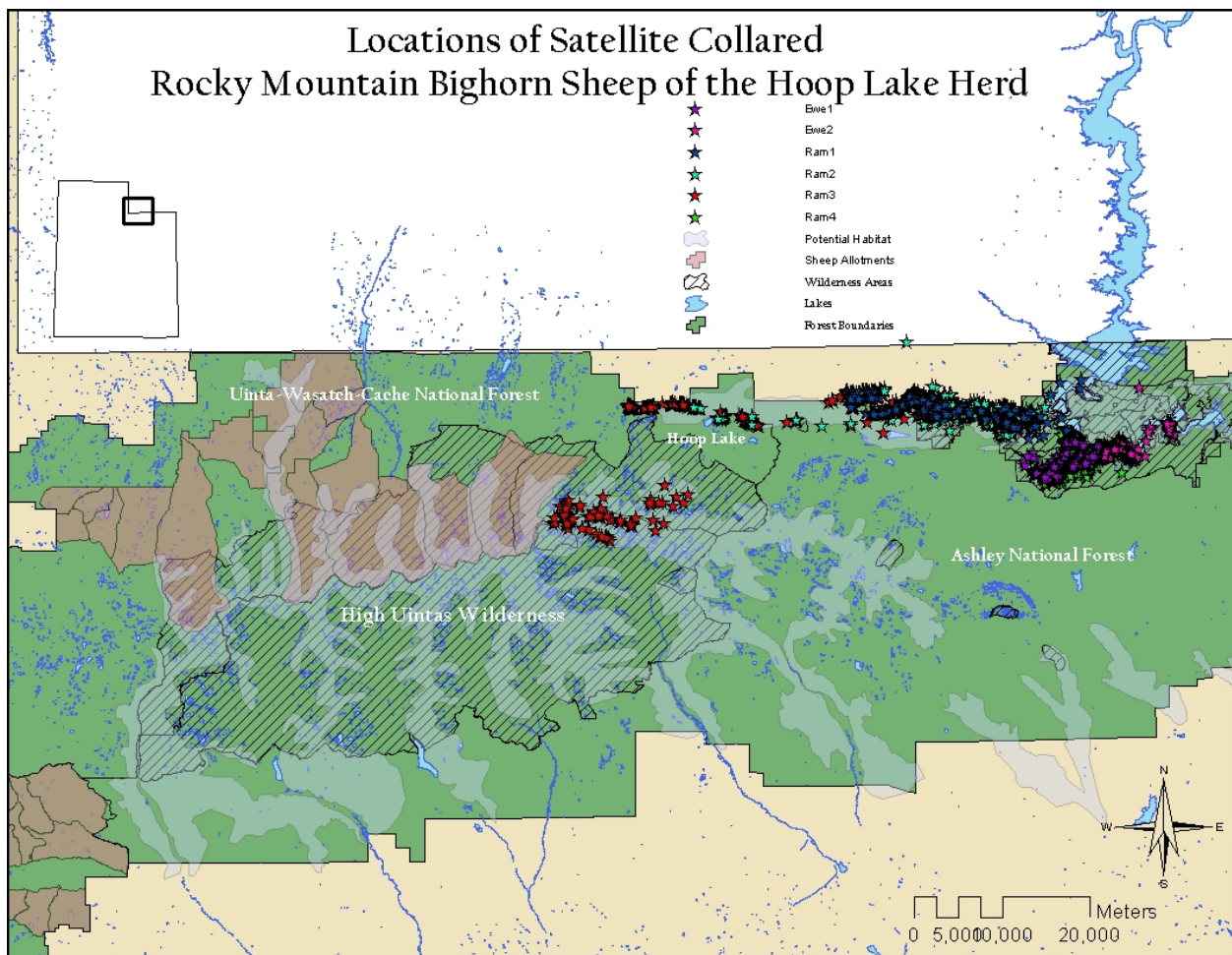
**Table 3: Transplant history and population status of Hoop Lake bighorn sheep herd**

Area Released	Year Released	Number Released	2000 Population Estimate	2004 Population Estimate	2007 Population Estimate	2008 Population Estimate	2011 Population Estimate	Trend
Hoop Lake	1989	23	35-45	15-20	15-20	20	25-30	Stable/decreasing

Biologists from the UDWR discussed the possibility of supplementing the Hoop Lake herd population after observing these trends. After gathering information about the variables that could be limiting the current population, the UDWR biologists decided against supplementing

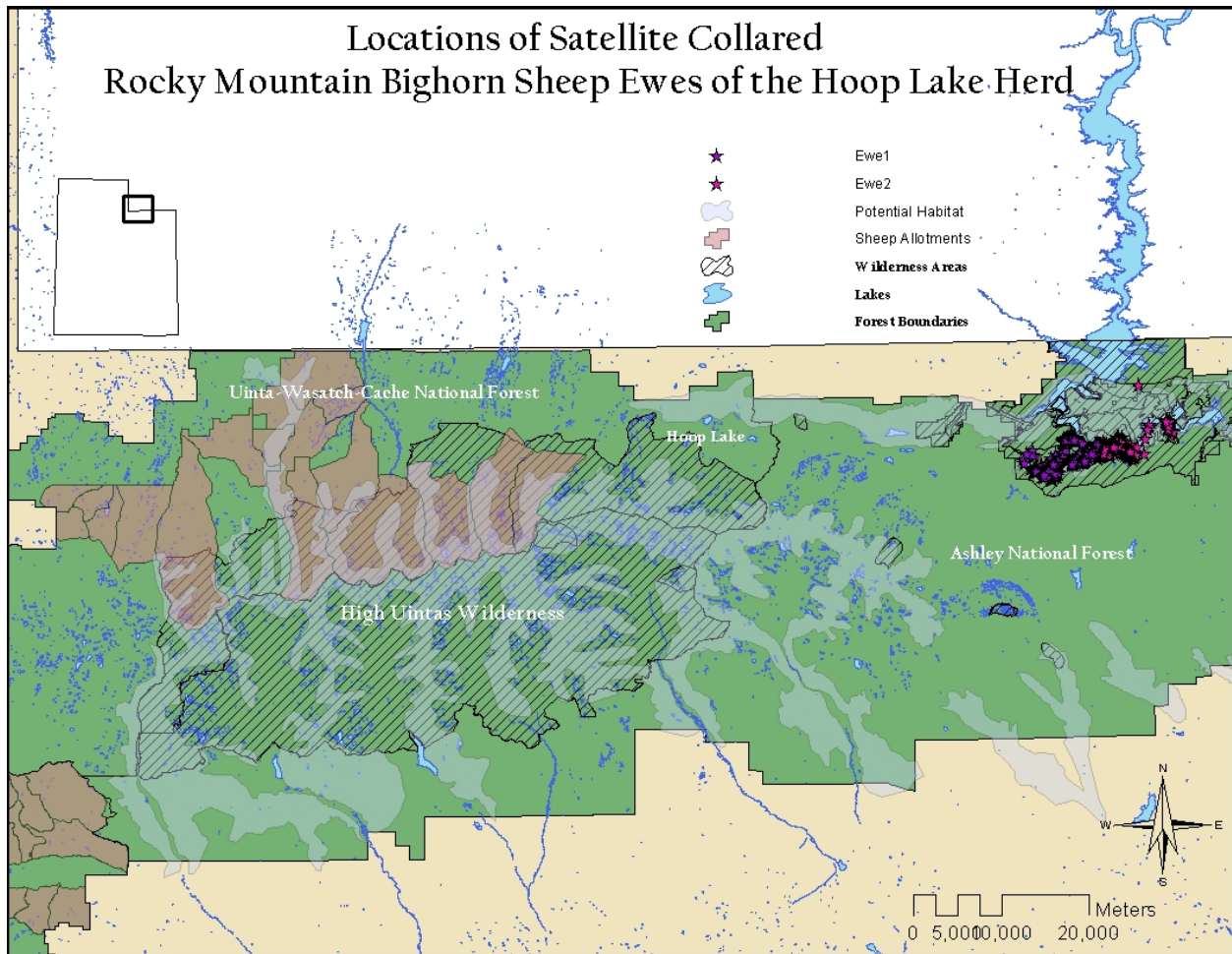
the population. The main reason the biologists decided against supplementation was the proximity of the bighorn population to and the possibility of bighorns commingling with herds of domestic sheep on National Forest and private lands. Based on past and current research, there is reason for the UDWR biologists to refrain from spending the money on transplants if there is a possibility of pneumonia spreading through the bighorn herd from the domestic sheep. To date, there has not been a confirmed pneumonia case in the Hoop Lake herd, but that could be because of the difficulty in locating and accessing the Hoop Lake herd in much of its range.

The movement patterns for the satellite collared bighorn sheep are shown in Figures 4-10. Various maps were created to determine where the bighorn sheep were travelling and at what time of year. Figure 4 shows the combined satellite points for all the satellite points of the collared bighorns.

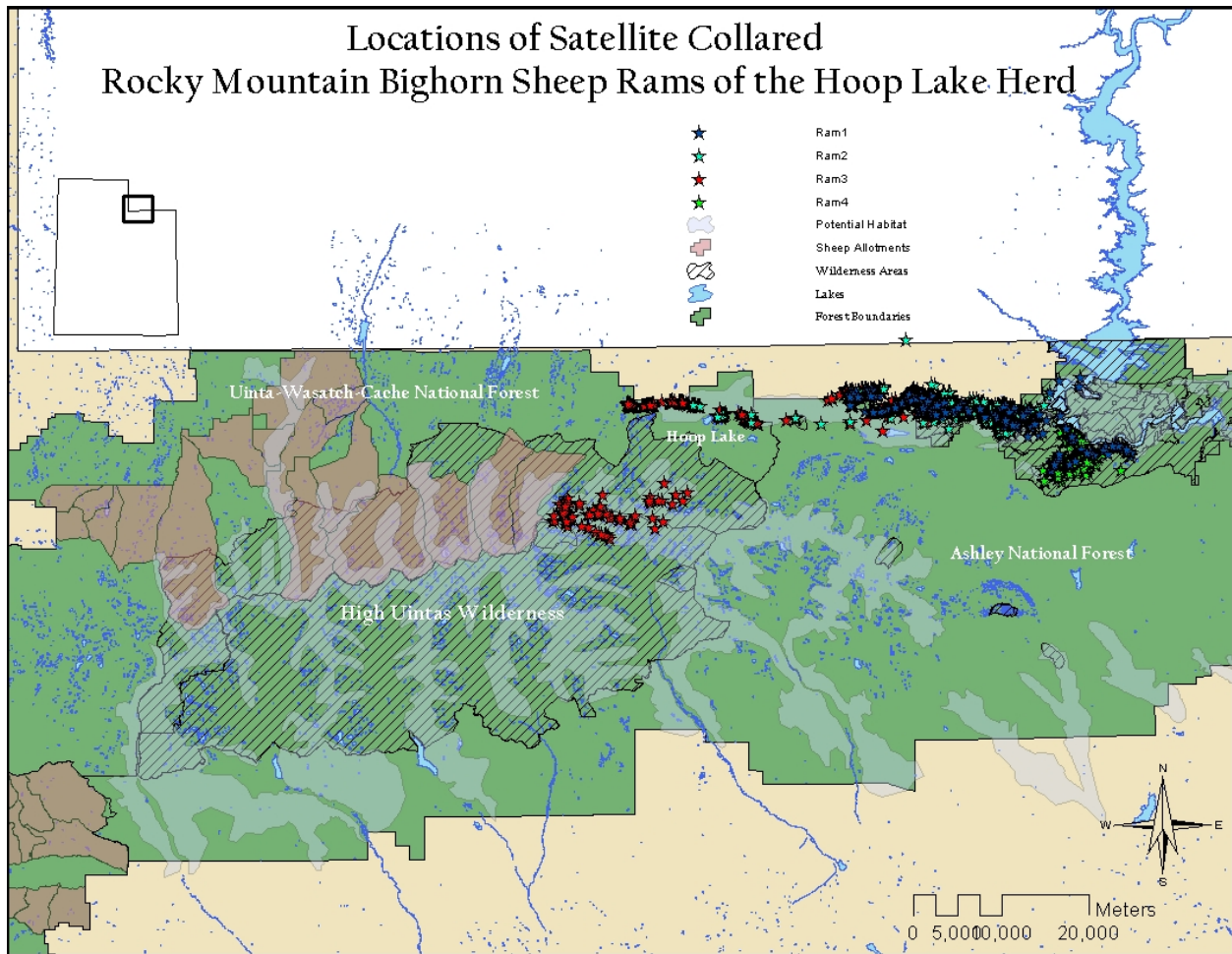


**Figure 4: All satellite point locations of 6 collared bighorn sheep of the Hoop Lake herd on the EMVRD from January 8, 2010 to January 31, 2012**

The maps in figures 5 and 6 were created to show only the ewe or ram satellite points respectively. This separation was done to determine which sex was traveling the furthest distances and thus be at greater risk of contracting pneumonia from domestic sheep.



**Figure 5: Satellite point locations for the 2 ewes collared from the Hoop Lake herd on the EMVRD from January 8, 2010 to January 31, 2012**

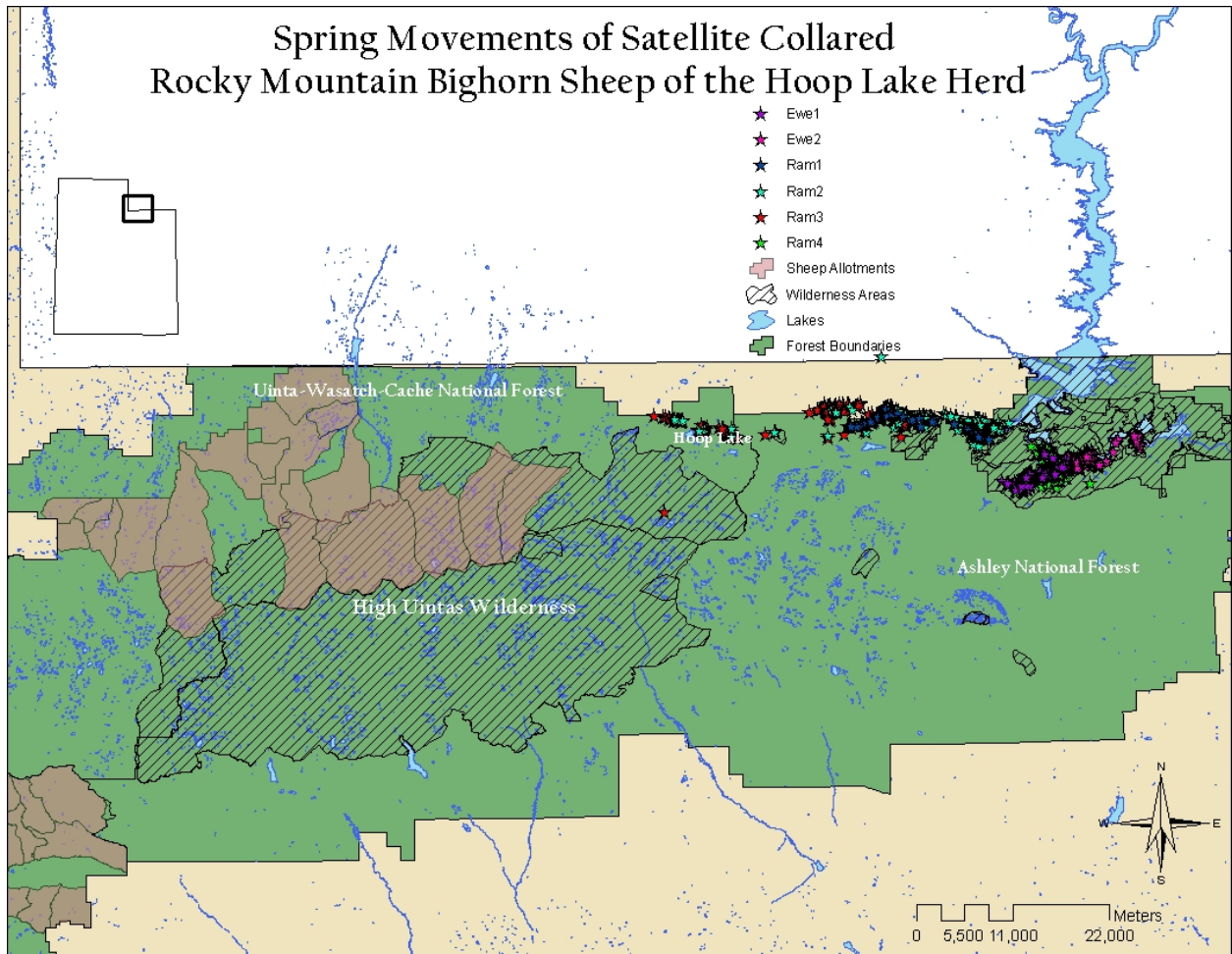


**Figure 6: Satellite point locations of the 4 collared rams of the Hoop Lake herd on the EMVRD from January 8, 2010 to January 31, 2012**

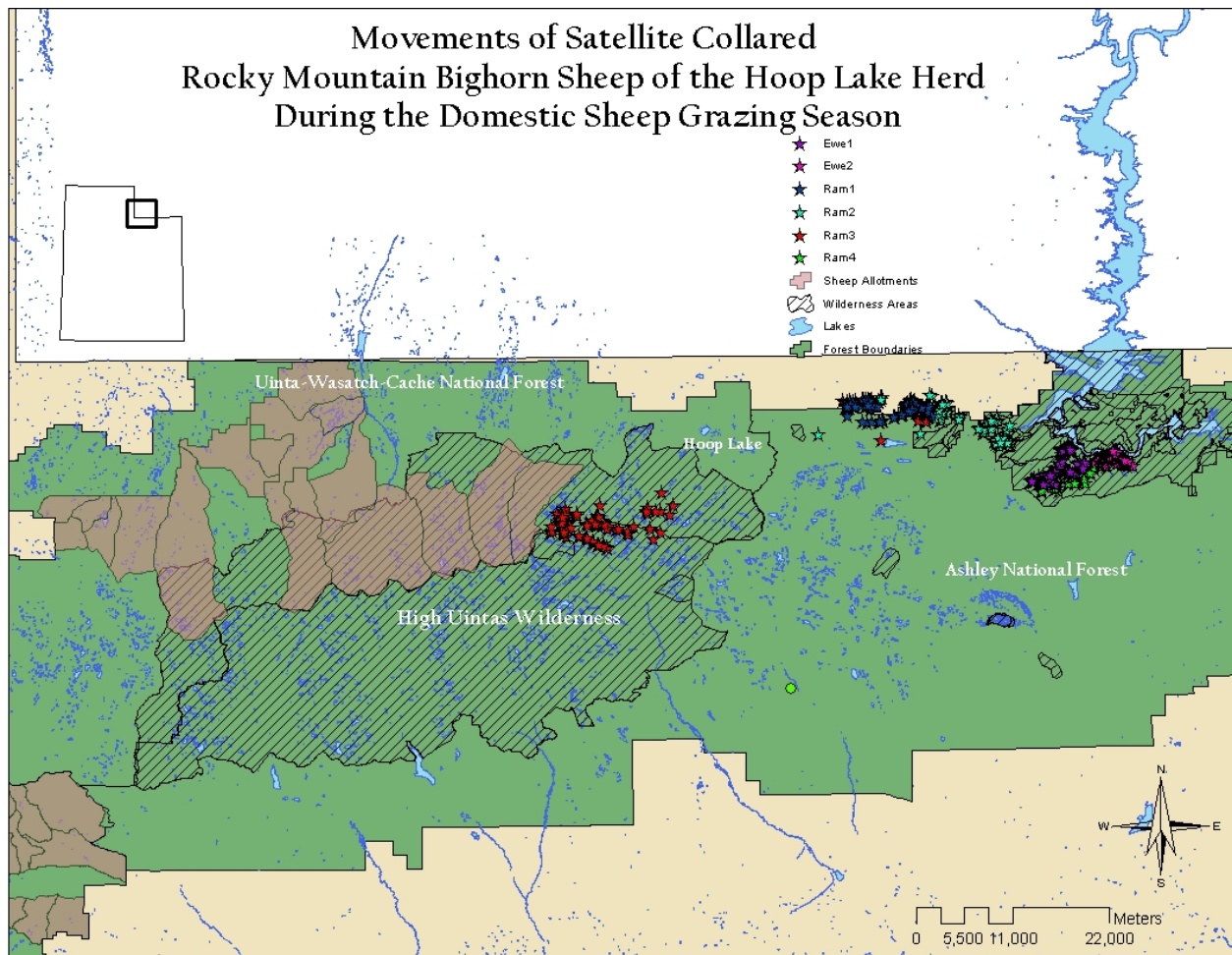
Figures 7-10 separate the satellite points by season as follows:

- Spring - March 1 to July 4
- Grazing (summer) – July 5 to September 30. This is the season in which domestic sheep herds are grazing on the EMVRD allotments.
- Fall - October 1 to November 30
- Winter - December 1 to February 28

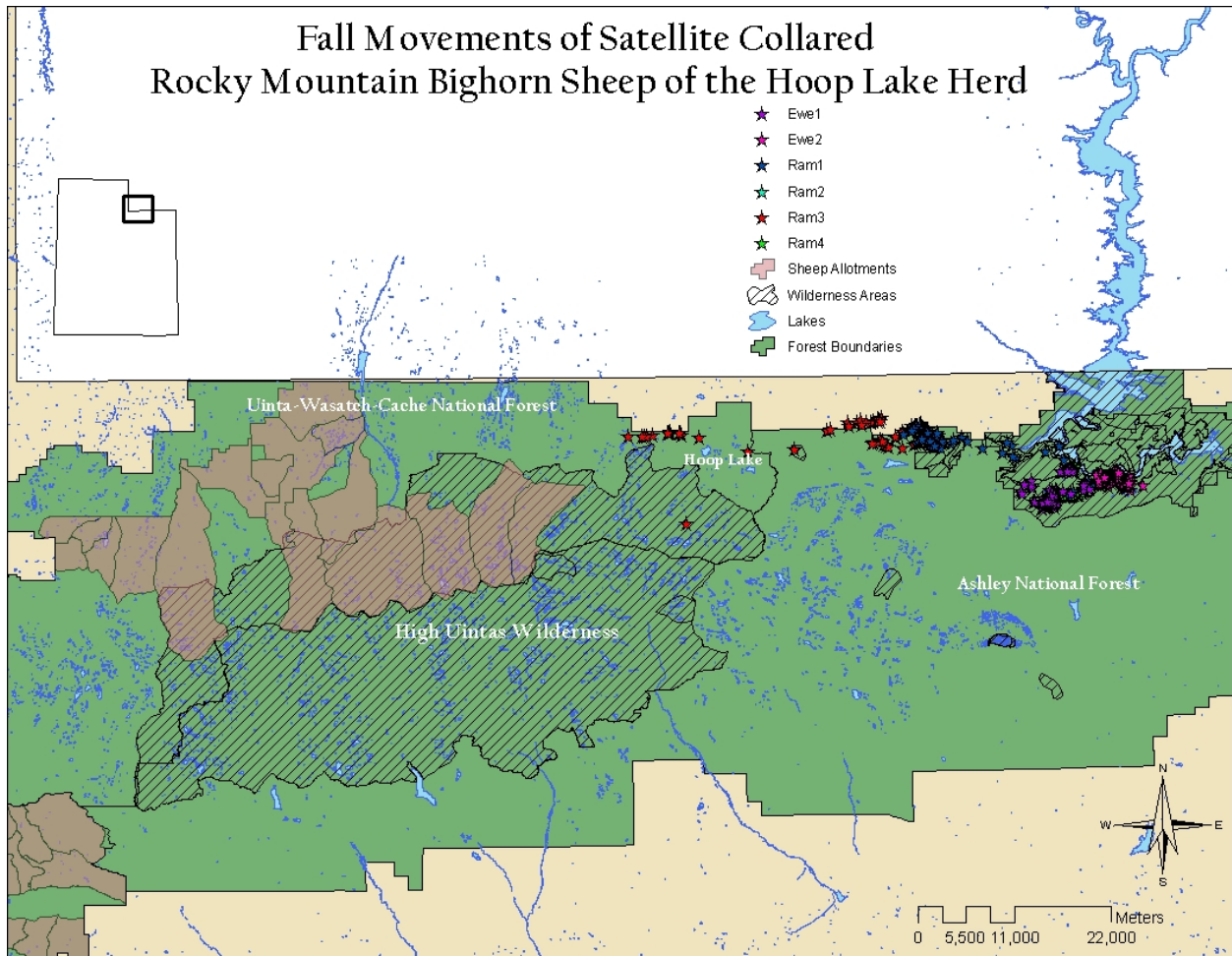




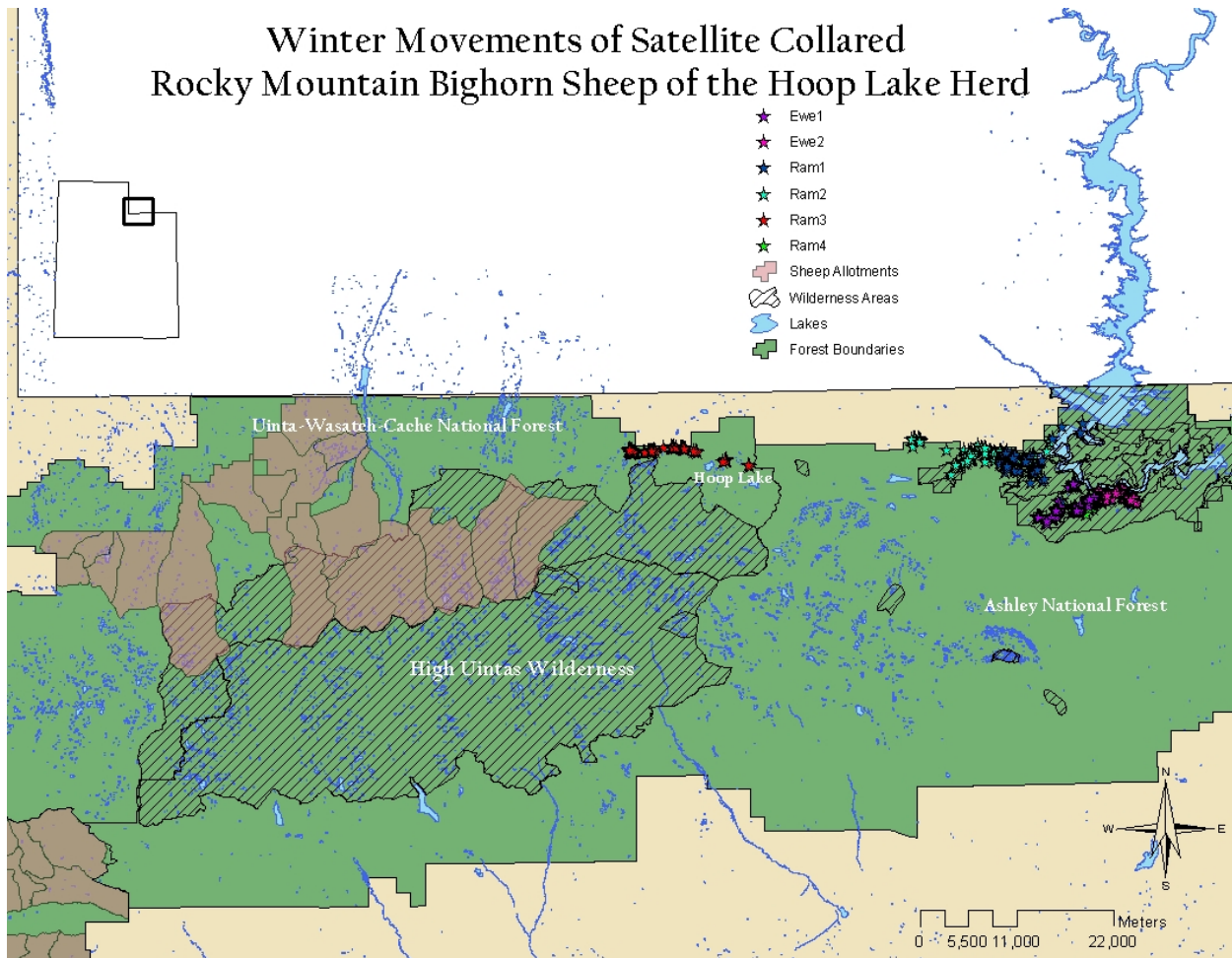
**Figure 7: Spring (March 1 to July 4) movements of the 6 satellite collared bighorn sheep of the Hoop Lake herd on the EMVRD**



**Figure 8: Movements of the 6 satellite collared bighorn sheep of the Hoop Lake herd on the EMVRD during the grazing season (July 5 to September 30)**



**Figure 9: Fall (October 1 to November 30) movements of the 6 satellite collared bighorn sheep of the Hoop Lake herd on the EMVRD**



**Figure 10: Winter movements (December 1 to February 28) of the 6 satellite collared bighorn sheep of the Hoop Lake herd on the EMVRD**

During the process of fitting the bighorn sheep of the Hoop Lake herd with satellite collars, it was determined by the UDWR that bighorn sheep occupy 3 of 14 active domestic sheep allotments on the EMVRD. The proximity of the collared bighorn sheep to active domestic sheep allotments helps to support the finding since bighorn sheep rams are known to travel long distances.

The timing of sheep grazing on these three allotments varies a little from other allotments, and domestic sheep are scheduled to be off the Forest by September 1<sup>st</sup> on the Gilbert Peak allotment (

Table 4), September 10<sup>th</sup> on the Red Castle allotment (

Table 5), and September 7<sup>th</sup> on the Hessie Lake/Henry's Fork allotment (

Table 6) (EMVRD 2011a,b,c).

**Table 4: Rotation schedule for the Gilbert Peak domestic sheep grazing allotment for 2011 (EMVRD 2011a)**

Allotment:	Pasture:	Numbers:	Dates:	Days:
<b>Stock Driveway</b>	Pasture 13	1,500 yearling sheep	07/11	1
<b>Stock Driveway</b>	Pasture 22	1,500 yearling sheep	07/12	1
<b>Red Castle</b>	Bald Mtn. Knob	1,500 yearling sheep	07/13	1
<b>Red Castle</b>	Broadbent Meadow	1,500 yearling sheep	07/14	1
<b>Hessie lake</b>	Flat Top Mtn.	1,500 yearling sheep	07/15	1
<b>Gilbert Peak</b>	Below Elkhorn	1,500 yearling sheep	07/16 - 07/20	5
<b>Gilbert Peak</b>	High Gilbert Peak	1,500 yearling sheep	07/21 - 07/31	11
<b>Gilbert Peak</b>	Basin	1,500 yearling sheep	08/01 - 08/04	4
<b>Gilbert Peak</b>	East Side High Trail	1,500 yearling sheep	08/05 - 08/10	6
<b>Gilbert Peak</b>	Deadhorse Park	1,500 yearling sheep	08/11 - 08/15	5
<b>Gilbert Peak</b>	North of Camp	1,500 yearling sheep	08/16 - 08/20	5
<b>Gilbert Peak</b>	Dollar Lake	1,500 yearling sheep	08/21 - 08/28	8
<b>Hessie Lake</b>	Flat Top Mtn.	1,500 yearling sheep	08/29	1
<b>Red Castle</b>	Bald Mtn.	1,500 yearling sheep	08/30	1
<b>Stock Driveway</b>	Pasture 13	1,500 yearling sheep	08/31	1
<b>Stock Driveway</b>	State line	1,500 yearling sheep	09/01	1



**Table 5: Rotation schedule for the Red Castle domestic sheep grazing allotment for 2011 (EMVRD 2011b)**

Allotment:	Pasture:	Numbers:	Dates:	Days:
<b>Stock Driveway</b>	Pasture 10 South ( <i>overnight</i> )	1,300 ewe/lamb pairs	07/06	1
<b>Stock Driveway</b>	*Pasture 17 North ( <i>overnight</i> )	1,300 ewe/lamb pairs	07/07	1
<b>Red Castle</b>	Bald Mtn. south half (Unit 2)	1,300 ewe/lamb pairs	07/08 - 07/13	6
<b>Red Castle</b>	Salt House (Unit 3)	1,300 ewe/lamb pairs	07/14 - 07/22	9
<b>Red Castle</b>	Upper Salt House (Unit 3)	1,300 ewe/lamb pairs	07/23 - 07/31	9
<b>Red Castle</b>	Red Castle Canyon (Unit 3)	1,300 ewe/lamb pairs	08/01 - 08/09	9
<b>Red Castle</b>	Smith Fork Pass (Unit 4)	1,300 ewe/lamb pairs	08/10 - 08/17	8
<b>Red Castle</b>	Water Fall (Unit 4)	1,300 ewe/lamb pairs	08/18 - 08/26	9
<b>Red Castle</b>	Long Meadow (Unit 4)	1,300 ewe/lamb pairs	08/27 - 09/04	9
<b>Red Castle</b>	Bald Mtn. north half (Unit 1)	1,300 ewe/lamb pairs	09/05 - 09/09	5
<b>Stock Driveway</b>	Pasture 10 south ( <i>overnight</i> )	1,300 ewe/lamb pairs	09/10	1

**Table 6: Rotation schedule for the Hessie Lake/Henry's Fork domestic sheep grazing allotment for 2011 (EMVRD 2011c)**

Allotment:	Pasture:	Numbers:	Dates:	Days:
<b>Stock Driveway</b>	Pasture 11	1,400 ewe/lamb pairs	07/10	1
<b>Stock Driveway</b>	Pasture 21 South	1,400 ewe/lamb pairs	07/11	1
<b>Stock Driveway</b>	Pasture 22 South	1,400 ewe/lamb pairs		
<b>Red Castle</b>	Bald Mtn. Knob	1,400 ewe/lamb pairs	07/12	1
<b>Red Castle</b>	Boradbent Meadow	1,400 ewe/lamb pairs	07/13	1
<b>Hessie/Henry's</b>	Unit 2a (Above Hessie Lake)	1,400 ewe/lamb pairs	07/14 - 07/19	6
<b>Hessie/Henry's</b>	Unit 2b (Flat Top)	1,400 ewe/lamb pairs	07/20 - 07/30	11
<b>Hessie/Henry's</b>	Unit 5 (Upper Henry's Fk)	1,400 ewe/lamb pairs	07/31 - 08/15	16
<b>Hessie/Henry's</b>	Unit 4 (Lower Henry's Fk)	1,400 ewe/lamb pairs	08/16 - 08/23	8
<b>Hessie/Henry's</b>	Unit 1 (Big Meadow)	1,400 ewe/lamb pairs	08/24 - 08/29	6
<b>Hessie/Henry's</b>	Unit 3 (Hessie Lake)	1,400 ewe/lamb pairs	08/30 - 09/04	6
<b>Red Castle</b>	Bald Mtn. Knob	1,400 ewe/lamb pairs	09/05	1
<b>Stock Driveway</b>	Pasture 11	1,400 ewe/lamb pairs	09/06	1
<b>Stock Driveway</b>	State line	1,400 ewe/lamb pairs	09/07	1

### **Findings pertaining to Human Dimensions**

The human-wildlife conflict between humans and wild bighorn sheep is, and has been, prominent in the western U.S. dating back to western colonization. Though the conflict is prominent, during this review, no research was found that examined this conflict in greater detail. There were, however, numerous research articles addressing the spread of pneumonia from domestic sheep to bighorn sheep in areas that are inhabited by both species. In terms of the conflict for this issue, the pro-domestic sheep stakeholders believe there is not enough proof domestic sheep spread pneumonia to bighorn sheep, whereas the bighorn sheep advocates believe the opposite. Through this review, it was discovered that research conducted thus far has shown that when in contact, domestic sheep spread pneumonic bacteria to bighorn sheep

(Wehausen et al. 2011) with one exception when bacteria causing the pneumonia is eliminated from the domestic sheep preceding contact with bighorn sheep (Besser et al 2012).

## **Stakeholders**

The spread of pneumonia from domestic sheep to bighorn sheep has resulted in a wide array of conflict between stakeholders. The USFS must find a way to manage for bighorn population viability while managing forest lands for multiple-use. This can be difficult when stakeholders have polar opposite views. Each of these stakeholder groups have varying interests in regards to the issue between domestic and bighorn sheep. The immediate stakeholders involved in this issue are:

1. USFS
2. Permittees holding sheep grazing permits and other advocates for domestic sheep
3. Wildlife/environmental groups and tourists
4. Hunters and hunter groups
5. Native American tribes

Permittees holding domestic sheep grazing permits and other advocates for domestic sheep: The permittees, many of whom have been grazing sheep on National Forest lands for over 50 years, are concerned that any law or policy passed due to litigation could eliminate domestic sheep grazing on public lands, putting their livelihood in jeopardy. Stakeholders for domestic sheep include: Idaho Wool Growers Association, American Sheep Industry Association, Wyoming Wool Growers Association, Montana Wool Growers Association, Utah Wool Growers Association, and Idaho Farm Bureau. These groups are advocates of continued domestic sheep grazing on National Forest lands regardless of the evidence of transmission of pneumonia from domestic sheep to bighorn sheep.

Wildlife/environmental groups and tourists: Bighorn sheep are important to tourists who utilize forest lands for wildlife viewing. Bighorn sheep are considered one of the most majestic wildlife species in North America, and viewing this animal is an important wildlife viewing opportunity. Some of the wildlife/environmental groups involved in this issue include:

- National Wildlife Federation
- Idaho Wildlife Federation
- Idaho Conservation League
- Hells Canyon Preservation Council
- The Wilderness Society
- Advocates for the West
- Western Watersheds
- Wild Sheep Federation

Hunters and hunter groups: Hunters have an interest in protecting bighorn sheep, because these animals are considered an once-in-a-lifetime trophy species. These groups include:

- Idaho Sportsman's Caucus Advisory Council
- Safari Club International
- Wild Sheep Foundation

By protecting this species, the populations will have fewer limiting factors, and in theory will increase. As the populations increase the number of hunting permits will increase, thus creating more opportunities for hunters to harvest these trophy animals.

Native American Tribes: Bighorn sheep have been utilized by many western mountain Native American tribes, such as the Nez Perce, throughout history. Native Americans would hunt bighorn sheep as a source of food, clothing, and tools. Just like many other traditions, it is very important to these tribes to pass on the skills of hunting these large ungulates to younger generations.

### **Legal Actions**

This issue occurs throughout the western U.S. The first major lawsuit addressing the issue of domestic sheep grazing in bighorn sheep habitat was filed in 2003. In the suit, the Idaho Conservation League et al., the Nez Perce Native American Tribe, and the Hells Canyon Preservation Council appealed the Southwest Idaho Ecogroup Land and Resource Management Plan Final Environmental Impact Statement (FEIS) (USDA Forest Service 2005). The FEIS was completed by the Payette National Forest for the revision of the Payette National Forest Land and Resource Management Plan. The premise of the lawsuit was that the USFS had not sufficiently protected the bighorn sheep populations by preventing potential disease transmission through interactions with domestic sheep herds (USDA Forest Service 2005).

The appeal was forwarded to the Chief of the Forest Service, Dale Bosworth, who concurred with the appellants that the effects analysis and cumulative effects discussion pertaining to bighorn sheep presented in the FEIS were not in compliance with National Forest Management Act (as discussed in the policy/laws section) regulations that concern wildlife viability. Based on his findings, the Chief reversed the Intermountain Regional Forester's 2003 approval of the Payette National Forest FEIS (USDA Forest Service 2010). The Intermountain Regional Forester was instructed by the Chief to analyze the viability of bighorn sheep in the Payette National Forest commensurate with the concerns and questions raised by the appellants in order to amend the FEIS accordingly (USDA Forest Service 2005).

To comply with orders from the Chief, the Payette National Forest revised and added alternatives for examination. Upon review of the Final Supplemental Environmental Impact Statement (FSEIS), the Payette National Forest Supervisor, Suzanne Rainville, made the decision to decrease domestic sheep grazing by 70% by eliminating grazing on 68,718 acres of previously

suitable habitat. The decision to eliminate sheep grazing on several domestic sheep grazing allotments was to be in compliance with all of the orders of the Chief.

The decision made by the Forest Supervisor drew wide support from various environmental and hunting groups, such as the Wild Sheep Federation, Idaho Sportsman's Caucus Advisory Council, and Safari Club International. The Idaho Woolgrowers Association and the Idaho Legislature, however, did not like the decision (Barker 2011). These stakeholders, along with other stakeholders in favor of continued domestic sheep grazing filed appeals against the FSEIS (Myers and Irvine 2010). Many permittees were concerned that similar litigation would spread to other National Forests throughout the west, and their sheep operations would be greatly hindered or even eliminated (personal communication permittees on the EMVRD).

For the past nine years, conflicts have been very heated throughout the west between stakeholder groups. The conflicts intensified recently with the passage of a rider, initiated by Representative Mike Simpson of Idaho, on the Consolidated Appropriations Act of 2012 (CAA). The rider stipulates that use of federal funds will be prohibited for the management of bighorn sheep on National Forest lands if it affects the number of domestic sheep allowed to graze on those lands (see policy/laws section of this report for more detail). In light of the passage of this rider, the Payette National Forest reversed their decision to eliminate domestic sheep grazing on 68,718 acres of previously suitable grazing lands (Ertz 2012a). This decision reversal in turn angered the bighorn advocates who responded with further lawsuits. On April 9, 2012, the Western Watershed Project, Hells Canyon Preservation Council, and The Wilderness Society filed a lawsuit against the USFS. In the lawsuit, the groups are seeking to halt domestic sheep grazing on three allotments on the Payette National Forest (Ertz 2012b) because the decision made by the Payette National Forest was prior to the July 1, 2011 deadline stipulation placed by the rider on the CAA.

### **Findings pertaining to Policy/Laws**

There are several policies and laws that the USFS must comply with in regards to domestic sheep grazing and free-ranging bighorn sheep. The ***Multiple-Use Sustained-Yield Act of 1960*** (MUSYA) authorizes National Forests to manage public land under principles of multiple use and to produce a sustained yield of products and services. Through this Act, the National Forests are to be managed for outdoor recreation, range, timber, watershed, and wildlife and fish purposes (16 U.S.C. 528) (USDA Forest Service 2011a). In regards to the issue addressed in this study, the USFS abides by MUSYA by managing the EMVRD on the UWCNF for grazing of domestic sheep, as well as for wildlife, such as bighorn sheep.

The ***National Forest Management Act of 1976*** (NFMA) is the primary statute governing the administration of national forests. The Act requires the Secretary of Agriculture to assess forest lands, develop a management plan based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System.

There are numerous Congressional findings within NFMA that pertain to the management of National Forests. These findings include (thecre.com):

- 1) It is the public interest for the Forest Service to assess the nation's public interest for the Forest Service to assess the nation's public and private renewable resources and develop a national renewable resource program
- 2) To serve the national interest, the development of the renewable resource program must include a thorough analysis of environmental and economic impacts, coordination of multiple-use and sustained-yield, and public participation
- 3) The Forest Service has the responsibility and opportunity to assure a national natural resource conservation posture that will meet our citizens' needs in perpetuity
- 4) The knowledge derived from coordinated public and private research programs will promote a sound technical and ecological base for the effective management, use and protection of the nation's renewable resources

This Act is relevant to this issue because there are conflicting sides to this issue, and it is difficult for the USFS to identify which is the national interest: protecting bighorn populations and their habitats, or continued domestic sheep grazing.

The *National Environmental Policy Act of 1970* (NEPA) was passed with the intention to declare a national policy that will prevent or eliminate damage to the environment and biosphere, as well as, stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the nation, and to establish a Council on Environmental Quality (FHPL 2003).

The USFS must be in compliance with NEPA before any project is initiated. Prior to the initiation of a proposed project, each natural resource specialist will complete an analysis on their specific resource to determine if there are going to be any adverse or beneficial impacts caused by the proposed action to their specific resource. For the issue regarding contact between bighorn and domestic sheep, these analyses will be completed mainly for the re-certification of range allotments (i.e., permit renewals for grazing of domestic sheep). In reports for these types of NEPA projects, specialists will disclose any possible impacts to bighorn sheep from domestic sheep grazing and determine if those impacts are significant. Upon completion of these reports, the deciding official makes a determination on how to proceed. There is an instance on the EMVRD where three domestic sheep allotments were closed to decrease the potential for interactions between domestic and bighorn sheep prior to the introduction of the Hoop Lake bighorn sheep herd. The decision by the USFS to close domestic sheep allotments by to minimize or eliminate interactions between the two sheep species is no longer an option since the passage of the CAA. In light of the rider placed on the CAA, it does not matter whether these findings determine there are significant impacts or not, because no 2012 appropriations money can be used toward mitigation if it means decreasing domestic sheep grazing in any way, unless the action to close an allotment is voluntary by the permittee.

The ***Taylor Grazing Act of 1934*** (TGA) was signed by President Roosevelt with the intention of stopping injury to public grazing lands, excluding Alaska. The Act prevented overgrazing and soil deterioration by providing for the orderly use, improvement, and development of the grazing lands. In addition the Act was signed to stabilize the livestock industry dependent upon the public range. The TGA was enacted after decades of rangeland deterioration, conflicts between cattle ranchers and migratory sheepherders, jurisdictional disputes, and debates over states' rights. The Act and its amendments ended free access to public ranges. The purpose of the Act was to:

- 1) Stop injury to the public lands;
- 2) Ensure the orderly use, improvement, and development on range lands
- 3) Stabilize the livestock industry reliant on the public range.

The TGA established grazing districts on the vacant, unappropriated and unreserved public lands. The Act also established grazing advisory boards, primarily composed of livestock owners, whose duties were to allocate permits and determine the boundaries, seasons of use, and the carrying capacity of the range. The Act is relevant to this study because it set a precedent for the way that the domestic sheep grazing program is currently operated (BLM 2011).

The ***Public Rangelands Improvement Act of 1978*** (PRIA) established a national policy and commitment to improve the conditions on public rangelands. The Act requires a national inventory and consistent federal management policies, and provides funds for range improvement projects.

In drafting PRIA, Congress found that:

- 1) Vast segments of the public rangelands are producing less than their potential for livestock, wildlife habitat, recreation, forage, and water and soil conservation benefits, and so are in an unsatisfactory condition
- 2) These rangelands will remain in an unsatisfactory condition and some areas may decline further under current levels of management and funding
- 3) Unsatisfactory conditions on public rangelands contribute to soil loss, desertification, siltation and salinity and negatively impact the quality and availability of water, fish and wildlife habitat, and the value of land for recreational and aesthetic purposes; these conditions can be addressed by an intensive public rangelands program involving significant increases in levels of management and funding
- 4) It is in the public interest to charge fees for livestock grazing permits and leases on public lands which reflect annual changes in the costs of production.

Through PRIA, Congress established a national policy and commitment to (Findlaw 2012):

- Inventory and identify current public rangeland conditions and trends
- Manage, maintain and improve the condition of public rangelands

- Charge a fee for public grazing use which is equitable and reflects production cost changes

This Act is relevant to this issue, because PRIA set a premise for the way that the domestic sheep grazing program is currently operated and how grazing fees are calculated and collected by the USFS.

The *Wilderness Act of 1964* was passed with the intention to establish a National Wilderness Preservation System for the permanent good of the whole people, and for other purposes. This Act was declared to be within and supplemental to the purposes for which National Forests are established and administered. This Act also states that nothing within the *Wilderness Act* would interfere with the purpose for which forests were established or with the stipulations of MUSYA (FHS 2012). This Act is relevant to this issue because most of the potential bighorn habitat (Figure 2) as well as the domestic sheep grazing allotments that are in close proximity to the collared satellite bighorn rams (Figure 4) are located in the High Uintas Wilderness. Domestic sheep grazing that is located on allotments established prior to September 3, 1964 is permitted to continue by the *Wilderness Act*, but it is subject to reasonable regulations deemed necessary by the Secretary of Agriculture.

In 2012, a rider was added to the *Consolidated Appropriations Act of 2012* by Representative Mike Simpson of Idaho. The rider states that “*SEC. 442. None of the funds made available by this Act or any other Act through fiscal year 2016 may be used to plan or carry out any action or any subsequent agency regulation for managing bighorn sheep (whether native or nonnative) populations on any parcel of Federal land (as defined in section 3 of the Healthy Forests Restoration Act of 2003 (16 U.S.C. 6502)) if the action may or will result in a reduction in the number of domestic livestock permitted to graze on the parcel or in the distribution of livestock on the parcel.*” There is also language in the Act that is specific to domestic livestock grazing on public lands. This language was added as a result of Rep. Simpson’s rider. The Act states that (Ertz 2012c):

- *Sec. 431. (a) Prohibition Regarding Potential Domestic Sheep and Bighorn Sheep Contact on National Forest System Land- Notwithstanding any other provision of law or regulation (other than the Endangered Species Act of 1973 and regulations issued under such Act), none of the funds made available by this Act or made available by any other Act for fiscal year 2012 only may be used to carry out—*
  - *(1) any new management restrictions on domestic sheep on parcels of National Forest System land (as defined in the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 1609(a))) with potential domestic sheep and bighorn sheep (whether native or nonnative) contact in excess of the management restrictions that existed on July 1, 2011; or*
  - *(2) any other agency regulation for managing bighorn sheep populations on any allotment of such National Forest System land if the management action will*



*result in a reduction in the number of domestic livestock permitted to graze on the allotment or in the distribution of livestock on the allotment.*

- *(b) Exception- Notwithstanding subsection (a), the Secretary of Agriculture may make such management changes as the Secretary determines to be necessary to manage bighorn sheep if the management changes–*
  - *(1) are consistent with the wildlife plans of the relevant State fish and game agency and determined in consultation with that agency; and*
  - *(2) are developed in consultation with the affected permittees.*
- *(d) Voluntary Closure of Allotments- Nothing in this section shall be construed as limiting the voluntary closure of existing domestic sheep allotments when the closure is agreed to in writing between the permittee and the Secretary of the Interior or the Secretary of Agriculture and is carried out for the purpose of reducing conflicts between domestic sheep and bighorn sheep.*
- *(e) Waiver of Grazing Permits and Leases- The Secretary of the Interior and the Secretary of Agriculture may accept the voluntary waiver of any valid existing lease or permit authorizing grazing on National Forest System land described in subsection (a) or public lands described in subsection (c). If the grazing permit or lease for a grazing allotment is only partially within the area of potential domestic sheep and bighorn sheep contact, the affected permittee may elect to waive only the portion of the grazing permit or lease that is within that area. The Secretary concerned shall–*
  - *(1) terminate each permit or lease waived or portion of a permit or lease waived under this subsection;*
  - *(2) ensure a permanent end to domestic sheep grazing on the land covered by the waived permit or lease or waived portion of the permit or lease unless or until there is no conflict with bighorn sheep management; and*
  - *(3) provide for the reimbursement of range improvements in compliance with section 4 of the Act of June 28, 1934 (commonly known as the Taylor Grazing Act; 43 U.S.C. 315c).*

This rider creates a problem for public management agencies that are dealing with conflicts between domestic sheep and bighorn sheep. The hands of federal wildlife managers can be tied by the language in this rider if there is a confirmed pneumonia outbreak in the Hoop Lake herds on the EMVRD, as well as on other public lands.

### **Findings pertaining to Economics**

#### **Development of National Grazing Fees**

Charging ranchers fees for grazing private livestock on public rangelands is legislatively authorized and has been the policy of the USFS since 1906. There has been a long history of proposals for a federal grazing fee dating back to 1924. The legislation on federal grazing fees

changed four more times until PRIA was passed into law. PRIA established a fee formula for USFS (and Bureau of Land Management (BLM)) grazing operations in the 16 western states. The objective of the PRIA formula was to “prevent economic disruption and harm to the livestock industry in the west” (Moskowitz and Romaniello 2002). The formula is to be adjusted annually using various indices aimed to represent the fair market value of grazing (Torell et al. 2001, Vincent 2011). The PRIA grazing fee is as follows:

**Fee = Base value [Forage value index + Beef cattle price index - prices paid index]**

## **100**

Where forage value index (FVI) is the private land grazing lease rates, beef cattle price index (BCPI) is the sales price for beef cattle, and the prices paid index (PPI) is the costs of beef production. The base value for the PRIA fee was set at the 1966 base value of \$1.23 per animal unit months (AUM) or per Head Month (HM). An AUM is the amount of forage required by an animal unit for one month. An animal unit is defined as a mature (1,000 pound) cow or 5 ewes, based on the consumption rate of 26 pounds of dry matter forage per day (Ruyle and Ogden 1993). A HM is defined as a month’s use and occupancy of range by one animal, except for sheep or goats. For grazing fee purposes, 5 sheep or goats are equivalent to one cow, bull, horse, or mule. A full head month’s fee is charged for grazing by adult animals, animals that are weaned or 6 months of age or older when entering public lands, or animals that will become 12 months of age during the permitted use period (USDA/NASS 2004). A HM is the general way in which the Forest Service calculates grazing fees.

As part of PRIA, Congress stipulated that the annual fee adjustment could not exceed 25% of the previous year’s fee. When established, the PRIA formula was considered an experimental formula to be used for seven years. The trial run of the PRIA formula was required to allow the USFS and BLM to study the formula to provide information to Congress, who would then determine a permanent fee or fee formula (Vincent 2011). On February 14, 1986, when the PRIA formula was set to expire, President Reagan issued Executive Order 12548 that indefinitely extended the PRIA fee formula with an imposed minimum grazing fee of \$1.35/AUM or HM (Torell et al. 2001; Vincent 2011).

The grazing receipts collected by the USFS are divided up so that the money is distributed to three entities. Fifty percent of grazing fees, or \$10 million (whichever is greater), is put in the Range Betterment Fund. The money in the Range Betterment Fund is used solely for construction of range developments completed by the agency, such as instillation of pipelines, pumps, troughs, fences, and cattle guards, seeding and reseeded, weed control, water development, and fish and wildlife habitat improvement. Twenty-five percent of the receipts go to states and counties, and the remaining 25% is sent to the U.S. Treasury (Moskowitz and Romaniello 2002; Vincent 2011).

## **Recent Economics**

## Sheep Industry

Domestic sheep are one of the few multi-purpose animals raised in the U.S., mainly being bred for meat and wool production, but some are also bred for milk production. With wool production and demand declining, as a result of increased use of manmade synthetic fibers, some producers have altered their sheep herds to raise hair sheep. Hair sheep still produce high-quality meat and they require little to no shearing (USDA/NASS 2011).

In 2007, retail sales of sheep products (wool, lamb meat, sheep cheese sales etc.) equaled approximately \$768 million. Furthermore in 2007, 2.7 million lambs were processed for meat production, and 4.7 million sheep were shorn, which resulted in approximately 35 million pounds of wool. Currently, the U.S. accounts for less than 1% of the world's wool production (NASS 2008; NRC 2008).

In 2008 and 2011, the American Sheep Industry Association (ASI) published an analysis on the sheep and lamb industry economic impacts. The U.S. sheep industry economically supports itself and backward-linked industries that supply sheep production. From this analysis, it was estimated that \$509 million in lamb, mutton, wool, sheep milk, and breeding stock were produced in 2008. It was also estimated that this \$509 million supported an additional \$1.3 billion in economic activity, which brought the total economic benefit to \$1.8 billion in 2008. In 2011, the analysis estimated that the U.S. sheep industry generated \$486.5 million from the production of sheep products. Sheep products supported an additional \$1.2 billion in economic activity, equaling a total of \$1.7 billion in economic activity in 2011 (Shiflett 2008, 2011).

Based on the analysis, there was a decline in economic activity from 2008 to 2011, despite a decrease in import markets and an increase in demand of lamb meat. In 2011, demand by U.S. consumers was up, imports were down and prices soared (Blaney 2011). The price per pound of lamb was around \$2.20 in 2011, up from \$1.39 per pound in May of 2010. The price of lamb meat in 2011 was the highest ever recorded for a pound of lamb.

The increase in demand for sheep meat in 2011 was a result of a reduction in supply, largely due to decreased sheep production in Australia and New Zealand. Australia's sheep industry decreased from 170 million head 20 years ago to approximately 70 million head in 2011. In New Zealand, the decline was not as large as that seen in Australia, decreasing from 70 million head to 40 million head. As of 2011, roughly about 35% of all lamb and mutton produced was imported to the U.S. (Blaney 2011).

The sheep industry also experiences losses every year. Currently, the largest cause of sheep/lamb loss is predation. Problems with predators are on the rise and coyotes account for 60% of all confirmed predator losses. Other predators include domestic and feral dogs, wolves, cougars, bears, vultures, and hogs (Williams et al. 2008). In 2010, the U.S. sheep industry lost a total of 247,200 head to predators. This represents 39% of total losses, resulting in a \$20.5 million loss to farmers and ranchers (NASS 2010).

## Grazing

Every year, the USFS spends a great deal more money managing the federal livestock grazing program than they collect in grazing fees. The grazing fees collected by the USFS only covers a portion of the cost of running the livestock grazing program. The deficit is covered by appropriations from U.S. Treasury funds. In 2000, the USFS collected \$6.4 million in grazing fees, and received \$54.3 million in appropriations from the U.S. Treasury to cover the deficit. Since 25% of the collected grazing fees are given to the U.S. Treasury, the Treasury only received \$1.6 million from the USFS, resulting in a net loss of \$52.7 million to the U.S. taxpayers (Moskowitz and Romaniello 2002) (Table 7).

**Table 7: FY 2000 Forest Service range program expenditures and receipts (Moskowitz and Romaniello 2002)**

<b>Receipts</b>	<b>\$ Thousands</b>
<b>Total fee receipts</b>	6,403
<b>National Forests</b>	5,786
<b>National Grasslands</b>	617
<b>-Payment to Counties (25%)</b>	1,601
<b>-Payment to Range Betterment Fund (50%)</b>	3,202
<b>Net fee receipts to Treasury</b>	1,601

<b>Expenditures</b>	<b>\$ Thousands</b>
<b>Rangeland Management</b>	26,399
<b>Total Watershed and Vegetative Management</b>	22,942
<b>Vegetative Management</b>	10,242
<b>Weed Control</b>	4,700
<b>NEPA implementation</b>	8,000
<b>Infrastructure allocations</b>	0.250
<b>Administrative overheads</b>	4,985

<b>Total Congressional appropriations</b>	<b>\$54,327</b>
<b>-Net fee receipts to Treasury</b>	<b>\$1,601</b>
<b>Net deficit to the U.S. Treasury of direct costs of range program</b>	<b>\$52,726</b>

In fiscal year (FY) 2004, it was estimated that the USFS spent approximately \$74.2 million on their grazing program nationally while only collecting \$5.7 million. In FY 2009, the USFS estimated that appropriations received for the grazing program was \$72.1 million, with receipts estimated at \$5.2 million (Vincent 2011). From 2007 to 2011, the national grazing fee was set at the minimum level of \$1.35/AUM or HM, which resulted in relatively low receipts for the USFS. If the average private market rate of \$13.10/AUM were applied by Congress to the PRIA formula, agencies in control of managing public land grazing and the U.S. Treasury could collect as much as \$190 million in grazing fee receipts, assuming that the demand for forage remains the same (Moskowitz and Romaniello 2002).

## **Grazing on the Evanston/Mt. View Ranger District**

The EMVRD is located in both Utah and Wyoming on the Uinta-Wasatch-Cache National Forest. As with other ranger districts throughout the USFS, the EMVRD operates a grazing program on various allotments throughout the district. There are 14 allotments designated for sheep grazing on the district.

In 2011, the EMVRD permitted 1,500 yearlings and 15,661 ewe/lamb pairs on the 14 allotments for a total of 17,161 head. In order to calculate HM for the 14 allotments, the number of animals multiplied by the number of grazing days is divided by the average days in a month. The HM is then multiplied by the current grazing rate, which provides the grazing fee.

**HM = [ Number of head x Permitted grazing days ] x current grazing fee rate**

**30.416667**

The grazing fee rate in 2011 was set at \$.27 per sheep per HM. This rate is lower for sheep than for cattle, because five sheep are equivalent to one cow. In total, the EMVRD collected \$9,562.99 in receipts for sheep grazing in 2011 (Table 9).

### **State of Utah Economics**

The state of Utah earns revenue from all of the hunting permits that are sold to either resident or non-resident hunters. Bighorn sheep permits, in Utah, are considered once-in-a-lifetime big game permits. Many people apply for these permits each year, but there are only a hand-full of these permits available. According to Dave Rich, UDWR biologist (personal communication, 2012), a bighorn population should contain at least 200 individuals to be considered a population that is viable enough to sustain hunting pressures. At the current population levels of between 25-30 individuals, the Hoop Lake herd is far away from being viable enough to sustain hunting pressure.

If the Hoop Lake herd were to increase in population size to sustain hunting pressures, the economic benefits to the state would be substantial. As the populations of bighorns increase, the UDWR biologists determine whether or not it is acceptable to increase the number of permits to hunt bighorn sheep. The cost of a bighorn permit has remained the same since at least 2009. For non-residents the cost of a bighorn permit is \$1,513. For residents, the price is considerably less, at \$508. The total revenue for the bighorn permits in the state of Utah can be found in

Table 10. This total does not take into account the amount of money collected by the UDWR through licenses. There are two options for hunters, they can purchase strictly a hunting license, or they can purchase a combination hunting and fishing license. For residents, a hunting license for a person under the age of 14 costs \$11, for persons over 14 the cost is \$26 and the combination license is \$30. For non-residents, the cost for a hunting license is \$65 and the cost of a combination license is \$80 (UDWR 2012).

Another form of revenue for the UDWR from the hunting of Rocky Mountain bighorn sheep is through conservation permits. The UDWR's Conservation Permit Program (CPP) provides a benefit to Utah's wildlife through a source of funding dedicated for special projects. The revenue earned from the CPP funds projects that could not otherwise be funded under normal operating budget for the UDWR. The special projects that are funded through the CPP include:

- Aerial surveys
- Transplants
- Radio telemetry studies
- Special research projects
- Habitat enhancement projects

Every year, the Wildlife Board authorizes the number of conservation permits allocated for a given year based on species population trend, size, and distribution. This information is used, when authorizing permits, to protect the long-term health of populations, the hunting and viewing opportunity for the general public, and the potential revenue that will support protection and enrichment of the species.

There are seven main conservation organizations, Mule Deer Foundation (MDF), Sportsmen for Fish & Wildlife Inc. (SFFW), Rocky Mountain Elk Foundation (RMEF), Foundation for North American Wild Sheep (FNAWS), National Wild Turkey Federation (NWTF), Safari Club International (SCI), and Utah Bowman for Habitat (UBA), that participate in the CPP. These conservation organizations, along with any others that wish to participate, are allowed to keep 10% of the revenue that is raised from the sale of the conservation permits. The 10% is to be used by the conservation organization for administrative costs, such as promotion of conservation permits. In addition to the 10% used for administrative costs, the conservation organization may also retain 60% of the revenue to use for eligible projects. Eligible projects include:

- Habitat improvement
- Habitat acquisition
- Transplants
- Targeted education efforts
- Other projects providing substantial benefit to the species of wildlife for which conservation permits are issued

The remaining 30% of the revenue gained from the conservation permits is collected by the UDWR to use for managing the species of wildlife for which conservation permits are issued (UDWR 2011).

For the 2012 hunting season, FNAWS raised \$348,000 for the 2012 desert and Rocky Mountain bighorn sheep permits. The total for the 2012 Rocky Mountain bighorn sheep permits, raised by FNAWS, was \$107,000 (personal communication Ryan Foutz, Utah FNAWS, 2012).

**Table 8: Revenue from 2012 bighorn sheep permits raised by FNAWS**

<b>Species</b>	<b>Hunt Unit</b>	<b>Total</b>
<b>Desert Bighorn Sheep</b>	Kaiparowitz (1)	\$40,000.00
<b>Desert Bighorn Sheep</b>	Kaiparowitz, Escalante (1)	\$35,000.00
<b>Desert Bighorn Sheep</b>	San Rafael, Dirty Devil (1)	\$47,000.00
<b>Desert Bighorn Sheep</b>	San Rafael, North (1)	\$34,000.00
<b>Desert Bighorn Sheep</b>	San Rafael, South (1)	\$40,000.00
<b>Rocky Mountain Bighorn Sheep</b>	Book Cliffs, South (Rattlesnake) (1)	\$45,000.00
<b>Rocky Mountain Bighorn Sheep</b>	Box Elder, Newfoundland (1)	\$50,000.00
<b>Rocky Mountain Bighorn Sheep</b>	Nine Mile, Range Creek (1)	\$57,000.00

## **Discussion**

This section will summarize the findings of the ecological/biological, human dimensions, policy/laws, and economic sections of this study. This section will also provide possible mitigation measures for the USFS in regards to managing for bighorn sheep population viability while complying with policies and laws in regards to continued domestic sheep grazing on National Forest lands.

### **Ecological/Biological**

Major bighorn sheep die-offs have been known to occur in every western state in the U.S., with the earliest report dating back to the mid-1800s (Martin et al. 1996). The spread of pneumonia causing bacteria from domestic sheep to bighorn sheep has been the focus of numerous studies. The results from this research has indicated that contact between domestic sheep and bighorn sheep can lead to respiratory disease and fatal pneumonia in bighorns, indicating that bighorn sheep are very susceptible to the fatal pneumonic bacteria that domestic sheep carry (Callan et al. 1991; Foreyt 1989, 1992, 1994; Foreyt and Lagerquist 1996; George et al. 2008). The fact that research has proven that domestic sheep carry the pneumonic bacteria responsible for large bighorn sheep die-offs, creates an important issue in multiple-use management (Foreyt et al. 1994; Schommer and Woolever 2001).

Ninety percent of Rocky Mountain bighorn sheep in the U.S. will spend all, or most of their lives on National Forest lands (Schommer and Woolever 2001). There is much concern amongst bighorn sheep advocates regarding the potential contact between domestic sheep and bighorn sheep. Many of the sheep grazing allotments of National Forest lands have been closed, but on some forests, sheep grazing allotments are still numerous. There has been a struggle to manage National Forest lands for bighorn population viability while complying with MUSYA in regards to domestic sheep grazing. However, as data confirm that contact between domestic sheep and bighorn sheep can lead to all-age die-offs of bighorn sheep from fatal pneumonia transmitted from domestic sheep, it is evident that some actions must be taken before a wide-spread, catastrophic die-off occurs.

Figures 4-10, created using data collected by satellite collars, provide a good base of information regarding the movements of the six collared bighorn sheep. In these maps the data were presented as a whole, as well as separated by sex and season. The maps that separated the data by sex showed the ewes remained within the same location year around (Figure 5). This is typical because the ewes will remain in areas that provide good lambing and rearing habitats. The collared ewes were less likely to come into contact with domestic sheep because of this behavior; however, ewes can come into contact with domestic sheep. Kent Hersey (project coordinator for the UDWR), noted that other non-collared ewes of the Hoop Lake herd have been observed within the boundaries of the domestic sheep allotments.

These maps also showed that the 4 collared rams traveled much further distances than the ewes (Figure 6). This was prevalent in the model that was created for the sheep grazing season (Figure 8). The large movement patterns were expected because rams are known to travel 5 to 7 square miles (13 to 18 square km), and sometimes more, in search of potential mates (CONMA 2012). The vast dispersal behavior of bighorn rams is what causes a majority of the contact between bighorn sheep and domestic sheep. In knowing this, the UWCNF wrote operating instructions into the domestic sheep grazing permits for permittees to alter sheep grazing movements to avoid contact with bighorn sheep if any are sighted. Despite these operating instructions, contact continues to occur during the grazing season. In addition to potential contact on the sheep grazing allotments during the grazing season, there is a high probability of interaction between domestic sheep and bighorn sheep after the designated grazing season because domestic sheep are inadvertently left behind, survive predation, and stay in the high country during the rutting season (November to January). To avoid these potential interactions in the off-grazing season, operating instructions included in the grazing permits require that, by the end of the grazing season, permittees are to remove all livestock from the forest (WCNF 2007).

In order to provide separation between bighorn sheep and domestic sheep on the EMVRD, there are several mitigation measures that can be taken (USDA Forest Service 2007):



1. Avoid grazing domestic sheep when ewes are in estrus. When ewes are in estrus, it heightens the possibility of contact between domestic sheep and bighorn rams travelling in search of potential mates.
2. Change the rotation patterns of the domestic sheep on the grazing allotments.
3. Truck domestic sheep into grazing pastures instead of trailing the domestic sheep into the designated areas.
4. Increase efforts to round up stray domestic sheep at the end of the grazing season.
5. Utilize natural barriers where topography permits.
6. Convert domestic sheep allotments to cattle, llamas, or other classes of domestic livestock that do not pose a disease transmission risk to bighorn sheep. These conversions can take place in areas where topography, vegetation, and other abiotic/biotic parameters are suitable.
7. Close domestic sheep grazing allotments where contact between domestic sheep and bighorn sheep does, or is likely to occur.

Many members of the sheep industry for years have said that the “cure” to this issue is to vaccinate all bighorn sheep to stop the spread of pneumonia while allowing continued grazing on public lands. This option, however, is currently not feasible. First of all, it would be difficult and extremely expensive to track down and vaccinate all bighorn sheep that occur in areas where domestic sheep grazing occurs. Second, it is a consensus amongst leading bighorn scientists that a vaccine, if it is ever deemed effective, can take anywhere from 10-15 years to create and be approved (Cole 2011).

Given the restrictions of trying to vaccinate free-ranging bighorn sheep, it would be more cost effective to manufacture a vaccine to eliminate the pneumonia causing bacteria in domestic sheep. Only one research article was found that addressed eliminating these bacteria from domestic sheep. Bessar et al. (2012) wanted to test the hypothesis that *Mycoplasma ovipneumoniae* is an important agent on bighorn pneumonia contracted after comingling with domestic sheep. For this study, four domestic sheep that were tested negative for *M. ovipneumoniae* were comingled with four clinically healthy bighorn sheep. The sheep were monitored for 90 days, during which time only one of the bighorn sheep developed clinical signs of pneumonia and died less than 12 hours after the symptoms were presented (Bessar et al. 2012). The survival rate of bighorn sheep during this study is promising and further research should be conducted to determine if these results can be reproduced, and if a vaccine can be developed to eliminate the pneumonia causing bacteria carried by domestic sheep.

## **Human Dimensions**

For decades there has been conflict between humans and bighorn sheep, and between various interest groups regarding the spread of pneumonia causing bacteria from domestic sheep to bighorn sheep. As recent and past history has shown, this conflict will continue to go in circles as long as the differing sides continue to be polar opposite and resist any form of compromise. In

order to better understand the opposing sides, information was obtained from various news articles and informal conversations with permittees and range specialists on the EMVRD. There was a consensus among permittees and range specialists that many sheep operations would cease to exist if grazing programs were eliminated from USFS operations. Many of the smaller operations would, without a doubt, be eradicated if litigation halted domestic sheep grazing on National Forest lands. Larger operations would have a greater chance of surviving the cut because many of these operations utilize other public lands, particularly BLM lands for grazing during the winter months. One permittee stated that if domestic sheep grazing were to be eliminated from National Forest lands (where the family has held a permit for 40-50 years), their operation would be reduced by as much as 50%, but could still survive. It was expressed, however, that if domestic sheep grazing were to be eliminated on all public lands where bighorn sheep occur or could potentially occur, then their sheep operation would have no chance of surviving.

The likelihood of losing a way of life or a family tradition has many permittees fearful of what could happen. This fear often transforms into anger toward opposing parties, which can also turn into hostility. This fear can also make it difficult for some permittees to be willing to collaborate with opposing parties and discuss mitigation measures that can be taken by all parties involved. This is not to say that this is true for all permittees. One permittee noted that permittees with family members who are losing their sheep operations in other areas due to this same issue are more willing to collaborate. They wish to ensure that everything has been done to try and eliminate the need for litigation to protect bighorn sheep from disease transmission from domestic sheep.

### **Policy/Laws**

There are several issues pertaining to this study subject that can hinder the proper management of bighorn sheep population viability in areas where domestic sheep grazing is prevalent. It is difficult for the USFS to manage for bighorn population viability when mandated to also manage for multiple-use (MUSYA) which includes domestic sheep grazing. The most recent form of litigation that hinders the proper management of bighorn sheep viability is the rider added to the CAA by Representative Mike Simpson of Idaho. This rider prevents the USFS from making and implementing new regulations of land use decisions that would lead to the reduction or alteration of the distribution of current domestic sheep numbers on USFS grazing allotments for the protection of bighorn sheep.

### **Economics**

The receipts that the USFS collect annually in grazing fees are minimal compared to the amount of money that is spent to operate the grazing program. As previously stated, the U.S. Treasury provided the USFS with a total of \$72.1 million in appropriations, for a loss of \$66.9 million. If Congress were to increase the base value from \$1.35 to the current market value (as the private operations do), the USFS and the U.S. Treasury would turn a profit from the federal grazing

programs rather than annually incurring a loss. In an era of economic hardships, it would be beneficial for Congress to reopen the debate on grazing fees to decrease the losses suffered by the U.S. Treasury, and ultimately taxpayers.

**Table 9: Grazing fees for the EMVRD (USDA Forest Service 2011b)**

<b>Allotment</b>	<b>Number Permitted</b>	<b>Days</b>	<b>Grazing Fee</b>
<b>Gilbert Peak</b>	1,500 yearlings	53	\$705.70
<b>Gold Hill/Meadow Creek</b>	1,400 ewe/lamb pairs	69	\$857.49
<b>Hessie Lake/Henry's Fork</b>	1,400 ewe/lamb pairs	60	\$745.64
<b>Humpy Creek</b>	1,177 ewe/lamb pairs	62	\$647.77
<b>Larson</b>	1,248 ewe/lamb pairs	62	\$686.84
<b>Little West Fork/Elizabeth Mountain</b>	1,267 ewe/lamb pairs	54	\$607.33
<b>Lyman Lake</b>	950 ewe/lamb pairs	47	\$396.35
<b>Middle Fork-Blacks Fork</b>	1,200 ewe/lamb pairs	62	\$660.43
<b>Mill Creek/Luke Lym</b>	1,280 ewe/lamb pairs	64	\$727.18
<b>Moffit Creek</b>	1,050 ewe/lamb pairs	81	\$754.96
<b>Red Castle</b>	1,300 ewe/lamb pairs	67	\$773.16
<b>Stillwater</b>	1,200 ewe/lamb pairs	62	\$660.43
<b>West Fork-Bear River</b>	1,114 ewe/lamb pairs	66	\$652.65
<b>West Fork-Blacks Fork</b>	1,200 ewe/lamb pairs	72	\$687.06
<b>TOTAL:</b>			<b>\$9,562.99</b>

For the state of Utah, permits authorized for hunting bighorn sheep can bring in a large sum of money, depending on the number of permits authorized. The number of permits authorized by Wildlife Board is dependent upon the size, distribution and population trend of Rocky Mountain bighorn sheep throughout the state. If the Hoop Lake herd population were to increase to a size that is viable enough to sustain hunting pressures (approximately 200 individuals), then the revenue gained by the state of Utah is likely to increase. If the population reaches this level, the number of once-in-a-lifetime permits, along with the number of conservation permits will increase. It would be easy for the UDWR to estimate the increase in revenue if there were an increase in once-in-a-lifetime permits, but it would be difficult to estimate the increase in revenue from conservation permits because most of these permits are auctioned off by the conservation organizations.

**Table 10: Number of limited entry bighorn sheep permits draw by the UDWR and the associated revenues**

	<b>Number of Permits</b>	<b>Revenue</b>
2009		
Resident	<b>21</b>	<b>\$10,668</b>
Non-resident	<b>1</b>	<b>\$1,513</b>
2010		
Resident	<b>25</b>	<b>\$12,700</b>
Non-resident	<b>2</b>	<b>\$3,026</b>
2011		
Resident	<b>26</b>	<b>\$13,208</b>
Non-resident	<b>2</b>	<b>\$3,026</b>
2012		
Resident	<b>29</b>	<b>\$14,732</b>
Non-resident	<b>2</b>	<b>\$3,026</b>
<b>Total</b>	<b>108</b>	<b>\$61,899</b>

**Table 11: Number of bighorn sheep conservation permits offered to sportsman’s groups by the UDWR (UDWR 2011)**

<b>Year</b>	<b>Number of Permits</b>
2009	<b>3</b>
2010	<b>4</b>
2011	<b>5</b>
2012	<b>5</b>

### **Summary**

After researching numerous peer-reviewed articles and speaking with UDWR biologists, the spread of pneumonic bacteria from domestic sheep to bighorn sheep after contact appears to be inevitable under current management. There are several mitigation measures that can be taken on the ground, but these will likely remain ineffective as long as contact continues to occur. This continuing contact appears to result from a lack of effort of some managers and permittees. Current research indicates that vaccines for bighorn sheep are less promising than a vaccine for domestic sheep (Bessar et al. 2012). The vaccination of domestic sheep would be more cost effective and, if effective, would eliminate the spread of fatal pneumonia causing bacteria to bighorn sheep.

The main barrier to resolving this issue is the largely opposing views of stakeholders. These opposing views also lead to laws, policies, and litigation (e.g., CAA) that can further hinder the ability to develop a solution to this issue. If this continues, based on the scientific research, the only solution that ensures the viability of bighorn populations on public lands, including the Hoop lake population, is the elimination of domestic sheep grazing on public lands occupied by bighorn sheep.

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## **Appendix A**

### **List of Acronyms**

U.S.- United States

USFS- United States Forest Service

EMVRD- Evanston/Mt. View Ranger District

UWCNF- Uinta-Wasatch-Cache National Forest

UDWR- Utah Division of Wildlife Resources

FEIS- Final Environmental Impact Statement

FSEIS- Final Supplemental Environmental Impact Statement

CAA- Consolidated Appropriations Act of 2012

MUSYA- Multiple-Use Sustained-Yield Act of 1960

NFMA- National Forest Management Act of 1976

NEPA- National Environmental Policy Act of 1970

TGA- Taylor Grazing Act of 1934

PRIA- Public Rangelands Improvement Act of 1978

BLM- Bureau of Land Management

AUM- Animal Unit Months

HM- Head Month

FVI- Forage Value Index

BCPI- Beef Cattle Price Index

PPI- Prices Paid Index

ASI- American Sheep Industry Association

FY- Fiscal Year

CPP- Conservation Permit Program

MDF- Mule Deer Foundation

SFFW- Sportsmen for Fish & Wildlife Inc.

RMEF- Rocky Mountain Elk Foundation

FNAWS- Foundation for North American Wild Sheep

NWTF- National Wild Turkey Federation

SCI- Safari Club International

UBA- Utah Bowman for Habitat

**Appendix B**  
**Summary of lawsuits**

<b>Year</b>	<b>Lawsuit</b>	<b>Result</b>
<b>2003</b>	The Idaho Conservation League et al., the Nez Perce Native American Tribe, and the Hells Canyon Preservation Council appealed the Southwest Idaho Ecogroup Land and Resource Management Plan Final Environmental Impact Statement (FEIS) (USDA Forest Service 2005).	the Chief of the Forest Service, Dale Bosworth, who concurred with the appellants that the effects analysis and cumulative effects discussion pertaining to bighorn sheep presented in the FEIS were not in compliance with National Forest Management Act (as discussed in the policy/laws section) regulations that concern wildlife viability. Based on his findings, the Chief reversed the Intermountain Regional Forester's 2003 approval of the Payette National Forest FEIS (USDA Forest Service 2010). The Intermountain Regional Forester was instructed by the Chief to analyze the viability of bighorn sheep in the Payette National Forest commensurate with the concerns and questions raised by the appellants in order to amend the FEIS accordingly (USDA Forest Service 2005).
<b>2010</b>	The Idaho Woolgrowers Association and American Sheep Industry Association et al. appealed the Payette FSEIS (Myers and Irvine 2010).	The rider on the CAA was passed to stop the USFS and BLM from decreasing domestic sheep grazing on public lands in decisions made after July 1, 2011.
<b>2012</b>	The Western Watershed Project, Hells Canyon Preservation Council, and The Wilderness Society filed a lawsuit against the USFS. In the lawsuit, the groups are seeking to halt domestic sheep grazing on 3 allotments on the Payette National Forest (Ertz 2012b) because the decision made by the Payette National Forest was prior to the July 1, 2011 deadline stipulation placed by the rider on the CAA.	