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ABSTRACT

Throughout the western United States, many sheep producers utilize public range lands as a source of grazing for their herds. Thus, the public grazing fee associated with grazing on these lands is a cost in the production of many sheep operations in the western states and is expected to be influential in determining the level of profitability within the industry. Policy makers continue to debate the appropriate level of the public grazing fee. This article is about the impacts of various public grazing fee policies on the probability of profitability for sheep producers within Utah. These results can be applied to many western states that utilize public lands for grazing.

Grazing Fee Policy Changes Impact Sheep Producer's Profitability

By Ryan Larsen & Ryan Feuz

Introduction

The US sheep and wool industry has experienced many changes over the past century. Dramatic changes in US inventory, world production changes, changing demand, and policy changes have contributed to additional risk for sheep producers. Input and output price volatility have led to fluctuations in profitability. Western producers rely heavily on public grazing to maintain a positive profit margin. Understanding the implications of changing the permit fee aids both producers and policy makers. This research provides an analysis of those permit fee changes to profitability and an overview of the US sheep industry.

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Since the mid-1940s the industry has witnessed dramatic annual declines in sheep inventories. From its climax in 1942 when total sheep inventory in the country was over 56 million head, it has now fallen to under 9.25 percent of that value with only 5.20 million head in 2017 (US Sheep Inventory, 2017). Figure 1 depicts the dramatic decline within the US sheep industry between 1942 and the present by graphing the total US sheep inventory over that time period.

Many factors have contributed, including declining consumption of lamb and mutton, the growth in manmade fiber use, scarcity of labor, and predator losses. Beginning in the mid-1940s, the industry first started to experience a decline as WWII came to an end, resulting in a large decrease in demand for wool used for the military (Jones, 2004). Throughout the 1960s and into the 1970s many synthetic fibers were developed and grew in prominence and a wide spread consumer preference change occurred as more consumers demanded synthetic fiber blends over wool as they preferred the appearance as well as the favorable price (Jones, 2004). While the industry may have weathered the storm from the decrease in wool demand, compounding those effects was the simultaneous decline in lamb and sheep meat consumption. Ever since sheep were domesticated nearly 10,000 years ago in central Asia, the industry has revolved around the joint products of wool and meat. As the wool industry contracted in the US, a shift to a greater focus toward meat production would have been expected. However, just as wool and fiber preferences changed so too did the meat consumption preferences of consumers. Annual per capita retail consumption of sheep fell from 4.2 lbs. in 1961 to 1 lb. in 2016. During the same time period, per capita consumption of chicken rose from 27.8 lbs. to just over 90 lbs. (Supply

& Utilization, 2017). Additionally, the scarcity of labor available to tend sheep as well as predator losses have been suggested as contributors to the decline (Jones, 2004). All of these factors have combined to create the perfect storm of conditions to render the US sheep market nearly insignificant within the world economy.

The United States has a very small presence in the overall global sheep market. The US sheep inventory accounts for less than 0.5 percent of the total global sheep inventory. Within the United States, sheep production takes place in all 50 states, however, the vast majority of production is concentrated in Texas and the mountain west states. In table 1, the top ten sheep inventory states can be seen, making it very evident that the distribution of sheep production within the country is uneven with the vast majority of production taking place in the western states.

The United States has vast quantities of public land, especially within these same western states, that is utilized for grazing of livestock every year. Public-land grazing is an important element within the sheep industry with many sheep producers utilizing the resources available through public-land grazing. Within grazing, the standard unit used to measure grazing allotments is the animal unit month (AUM). By definition, the AUM is the amount of forage needed by an “animal unit” (AU) grazing for one month. The quantity of forage needed is based on a cow’s metabolic weight, and the animal unit is defined as one mature 1,000 pound cow and her suckling calf. In 2004, ten federal agencies collectively managed more than 22.6 million AUMs on about 235 million acres of federal lands for private grazing and land management. Of this total, the Bureau of Land Management (BLM) and United States Forest Service (USFS) managed 21.9

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million AUMs on almost 231 million acres or more than 98 percent of the federal lands used for grazing (United States Government Accountability Office, 2005). Both the BLM and USFS charge a grazing fee to producers on a per AUM basis established annually through the use of a government formula known as the Public Rangelands Improvement Act (PRIA) grazing fee formula. As this public grazing fee represents a cost in the production of sheep, it is expected to be influential in determining the level of profitability within the industry. The level of the public grazing fee is currently widely debated, with some making the case that the fee should be raised substantially to coincide with private grazing fees determined by the market, such as Halladay (2015). Others, such as Rimbey and Torell (2011), show support for the fee being lowered to help stabilize livestock industries as well as provide access to public lands for more producers. As policy decisions concerning the public grazing fee are made moving forward, it will be imperative to have a better understanding of what impacts potential policies may have on the profitability of sheep producers utilizing public grazing lands. If raising the level of the fee is shown to substantially decrease the probability of profitability or inversely if a lowered fee is shown to help substantially increase the probability of profitability, then this evidence could be instrumental in providing support for the direction which policy makers should pursue in setting the public grazing fee. Research of this kind is larger than simply informing policy makers as it may have a direct effect on the livelihood of sheep producers as well as other livestock producers throughout the country.

As mentioned, the PRIA grazing fee is an ongoing source of debate with opposing sides taking various stances on public grazing fee policy. There are some policy makers who believe the current PRIA grazing fee formula does

not do an adequate job of establishing a fee with some in support of raising the fee to be more in line with private grazing rates. In fact, for Fiscal Year 2014 the Obama administration originally purposed a budget, that later would be revised, which would have added \$2.50/AUM administrative fee to the current public grazing rate (Halladay, 2015). The main argument cited in support of this view is that current expenses for both the BLM and USFS far exceed receipts from grazing permits. For Fiscal Year 2014 the total inflation-adjusted appropriations for BLM and USFS were \$143.6 million while grazing receipts amounted to only \$18.5 million, or 13 percent of the appropriations (Glaser, Romaniello, and Moskowitz, 2015). A similar relationship can be seen throughout all receipt years. Figure 2 summarizes total inflation adjusted grazing appropriations for both BLM and USFS as compared to total inflation adjusted grazing receipts. These appropriations and receipts are only those connected with grazing activity and do not represent total appropriations and receipts for other activities within the BLM and USFS.

Understanding the importance of grazing appropriations is vital when analyzing sheep profitability in the western United States. A cost of production study done by the American Sheep Industry found that sheep producers lost money 50 percent of the time in the western study region. This highlights the profitability risk faced by sheep producers in the west. This same study found that feed related costs accounted for close to 25 percent of total operating costs. Any changes to feed costs could have measurable impacts on profitability. The majority of western states have published production budgets for sheep production. These provide a framework to begin analyzing potential scenarios faced by a sheep producer. This research fills in the gap by analyzing the impact of

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grazing fee changes on sheep profitability. This research uses a Utah-based production budget but the results can be applied to any state that utilizes public grazing. This research does not attempt to provide support for any one stance within the range of views concerning the current PRIA grazing rate system, but rather to demonstrate the effects on expected profitability within the Utah sheep industry after increasing or decreasing the public grazing fee. The results will help policy makers that rely on public grazing to weigh all arguments within the context of the public grazing fee debate and make appropriate policy decisions in the future. No attempt is made to formulate the details of possible new public grazing fee policy but instead the effects on the probability of profitability are evaluated.

Methodology

To evaluate the effects of public grazing fee policy change on the profitability of the Utah sheep industry, a Utah range sheep enterprise budget was developed and used. The Utah budget was created by adapting a Wyoming region enterprise budget developed by a Livestock Marketing Information Center work group in conjunction with a cost of production model developed for the American Sheep Industry Association (ASI) (U.S. Baseline Lamb Cost of Production Model, 2016). Among other things, the goal of the work group was to develop four regional sheep enterprise budgets and then combine the regional budgets to create a national lamb cost of production model that could be updated annually. This national budget then provides ASI with baseline estimates regarding the on-farm/ranch costs of producing lambs. The Wyoming regional budget encompassed the traditionally known western states of Colorado, Wyoming, Montana, Idaho, Utah, Arizona, Nevada, Oregon, Washington, and California. In order

to create a budget that represents solely the Utah costs of production, the Wyoming regional budget was used as a template with key parameters updated with Utah figures (see Table 2 for detailed Utah budget). The adjusted parameters included lamb price, cull ewe price, wool-ewe price, alfalfa hay price, feed price, lambing percentage, and mature ewe death loss rate. Data for these parameters was collected from the United States Department of Agriculture's National Agricultural Statistics Service, the Livestock Marketing Information Center, and the Chicago Mercantile Exchange. These parameters are considered to have some of the largest effects on estimated returns. To incorporate risk within the Utah budget, the data for these parameters is fitted to distributions using Palisade's @Risk and then the parameters within the budget are replaced with stochastic values. (Palisades Decision Tool Suite, Version 7.5) and then the parameters within the budget are replaced with stochastic values. @Risk is a stochastic simulation software. It provides a method to incorporate risk into a production budget. The key inputs into the stochastic simulation are the defined stochastic variables. The stochastic variables for this analysis are lamb price, cull ewe-price, wool-ewe price, alfalfa hay price, feed price, lambing percentage, and mature ewe death loss rate. Historical data for the individual variables were used to define the stochastic parameters of the variables. A simulation of returns per ewe to land, risk, and management is then run within @Risk with 10,000 iterations taken. The 10,000 iterations can be viewed as 10,000 different scenarios with the associated profitability under each scenario. The result is a baseline budget calculation which can provide probabilities of profitability. In order to evaluate the effects of grazing fee policy change to the probabilities of profitability within the Utah sheep industry the public grazing fee is then increased and decreased to represent three various

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grazing fee policy scenarios. Under each scenario only the grazing fee amount is allowed to vary while all other variables are held constant. This means that while the grazing cost may increase or decrease under the various scenarios, the number of AUMs is treated as constant. The public grazing fee is an input cost in the production system. If the fee is increased it is reasonable to assume that unless a cheaper alternative exists then producers would hold constant their consumption (number of AUMs).

Scenario 1 represents an abolishment of the public grazing fee or in essence a \$0/AUM fee. Scenario 2 represents an increase of \$2.50 to the current 2016 grazing fee of \$2.11/AUM for a total fee of \$4.61/AUM. This scenario is selected as it represents a likely hypothetical policy which was proposed as recently as 2014 when the Obama administration proposed that a flat tax of \$2.50/AUM be added to the annually calculated PRIA grazing fee. Though this policy was not implemented, it nevertheless represents a likely policy alternative which could be proposed again. For the third scenario the public grazing fee is raised dramatically to coincide with the current Utah average private grazing rate of \$15/AUM. This, of course, represents an unlikely policy alternative; however, important implications can still be drawn from the results of the simulated returns under such a policy. The Stoplight chart in figure 4 compares the resulting probabilities of returns to land, risk, and management per ewe of the three simulated scenarios along with the baseline. A stoplight chart is a variation of a stacked bar chart and provides a means of showing status of risks using color displays. Typically, red, green, and yellow (stoplight) colors are used to indicate mitigation action status or risk impacts, depending on items defined by the project. Figure 4 displays the probabilities of

profitability per ewe of Utah sheep producers for each scenario previously described. The probabilities are displayed by scenario of Utah sheep producers showing negative returns per ewe in red, the probability of returns between \$0 and \$10 per ewe in yellow, and the probability of returns over \$10 per ewe in green. Figure 5 shows the distribution of profitability levels for each of the three scenarios. The different distributions highlight the decreased probability of profits because of the increasing grazing fees. For example, the average profitability for scenario 2 (\$4.61 grazing fee) is \$5,978 while for scenario 3 (\$15 grazing fee) it is -\$9,606.

Results and Implications

The baseline results help tell the story of the current conditions of the Utah sheep industry. Figure 4 shows that Utah sheep producers could expect to achieve positive returns to land, risk, and management 60 percent of the time leaving negative returns to be expected 40 percent of the time. This depicts an industry that has a significant amount of risk in which many producers would struggle to achieve positive returns. These results are in line with what would be expected as Utah sheep inventories have been declining historically, similar to the rest of the nation, indicating that it has been a difficult industry for producers to survive and remain profitable. By comparing the results of each scenario to the baseline the effects of each scenario's respective public grazing fee policy can be evaluated. Under the scenario 1 policy of removing the public grazing fee, the probability of returns per ewe being less than \$0 decreases by 5.1 percent from the baseline of 40.0 percent to only 34.9 percent. Naturally, from a producer's perspective this would appear as a highly attractive scenario. Downside risk decreases while upside risk increases indicating that range sheep producers could expect to be profitable

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approximately 65.1 percent of the time under a \$0/AUM public grazing environment as compared to the current baseline scenario of only 60 percent expected positive returns. However, this type of scenario may not be very practical, especially considering the historic nature of the fee. The PRIA grazing fee system has been in place since 1966 and even before its implementation, various levels of fees were still charged to graze public lands; the values were simply less consistent throughout the different agencies managing the lands. Even if fees were removed, there would need to be some system put in place to manage the public grazing resources and allocate the use of the public lands fairly and in a way that they could be used sustainably for years to come. Nearly every system imaginable would likely incur some cost to producers utilizing the grazing resources and this would surely offset the removal of the PRIA grazing fee at least to some degree. Additionally, with the removal of the PRIA grazing fee it is important to recognize that while producers may benefit as indicated by a greater probability for profitability, the revenue of the agencies managing the public grazing lands would decrease. The disparity between grazing fee receipts and the agencies' expenses would widen and thus this cost would eventually be passed onto tax payers as these agencies would require additional funds to continue to manage the public lands appropriately.

Under scenario 2 when \$2.50/AUM is added to the calculated PRIA grazing fee, the results of the simulated budget indicate that the Utah sheep industry could expect increased probability of negative returns per ewe compared to the baseline. Total downside risk increases by 3.7 percent leaving 56.3 percent probability of positive returns. However, this increase in downside risk to producers must be weighed against the simultaneous

increase in expected revenue generated by the BLM and USFS due to the increased grazing permit fee. Under this scenario the 2015 PRIA grazing fee of \$1.65/AUM would have been increased to \$4.15/AUM. According to the BLM, for Fiscal Year 2015 they were allocated \$79 million for the rangeland management program. Of that figure, \$36.2 million was spent on livestock grazing administration while only \$14.5 million was collected from grazing fee revenue (Gorey, 2016). The increased fee under scenario 2 would have increased the revenue generated from grazing permits in 2015 by the BLM from \$14.5 million to approximately \$36.4 million or just over the \$36.2 million spent on livestock grazing administration for the year. A similar increase in revenue also would be expected within the USFS.

Under the third scenario, the public grazing fee would be increased to coincide with average private grazing rates in Utah. The resulting probabilities of returns per ewe indicate that downside risk, or risk of negative returns per ewe, would be greatly increased compared to the baseline. The probability of negative returns per ewe under scenario 3 would be 63.4 percent representing an increase of 23.4 percent from the baseline. With a probability of negative returns of this level the Utah sheep industry would certainly struggle. With no other changes made to help ensure greater probabilities of positive returns a policy of this nature would likely fatally cripple the industry in the region.

Although, the sheep and wool industry is by no means a large or vital part of the US economy, it has a unique and important history and is vital to those within the industry. As is demonstrated by the Utah sheep enterprise budget analysis, policy increasing or decreasing the public grazing fee would undoubtedly have an impact on the

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bottom line or profitability of the sheep producers within the region. Although this study focuses on Utah, the results can be applied to many western states that utilize public lands for grazing. Great care and consideration must be taken as policy makers attempt to address the public grazing fee concerns. As is the case with all policy changes, there are winners and losers. It is important to recognize not only the impacts to the sheep industry but also the simultaneous impacts to the agencies managing the public rangelands.

While grazing fee policy is sure to affect many livestock industries throughout the country, due to the current drastically weakened state of the sheep and wool industry perhaps greater consideration is needed in evaluating effects of new public grazing fee policy on this industry.

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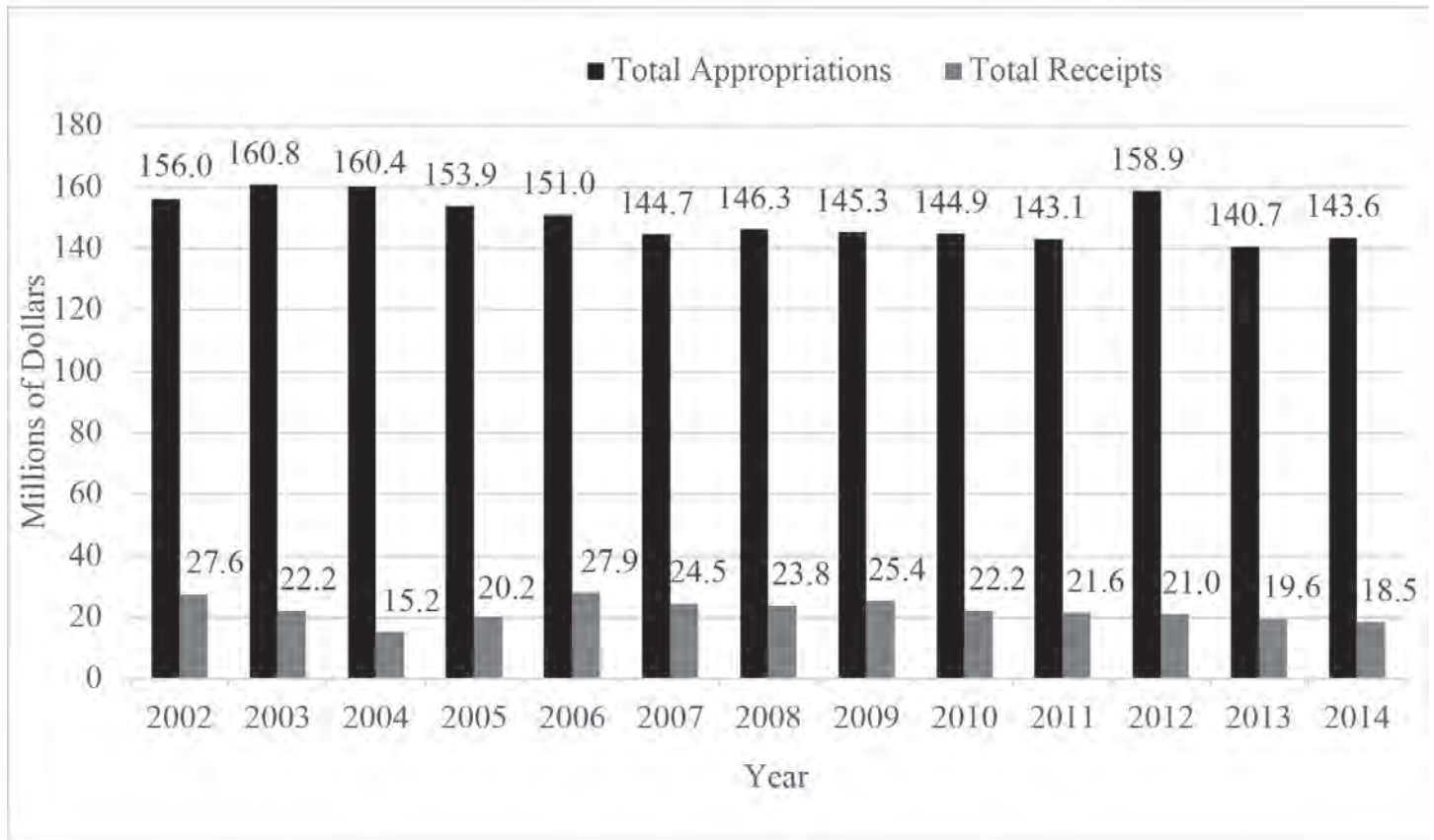
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Figure 1: Total US sheep inventory



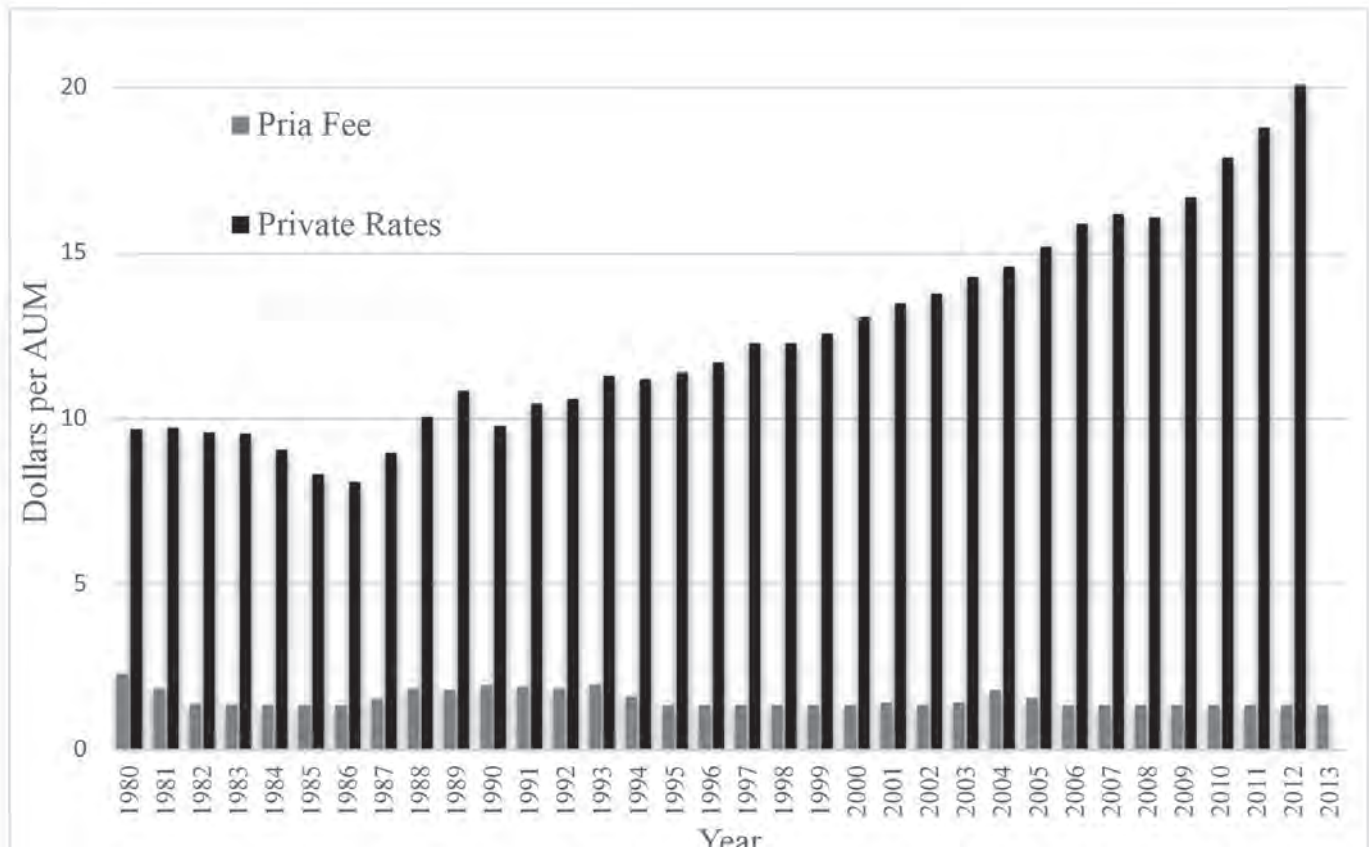
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Figure 2. Total BLM and USFS direct grazing appropriations vs. receipts, 2002-2014. Source: Glaser, Romaniello, and Moskowitz, 2015.



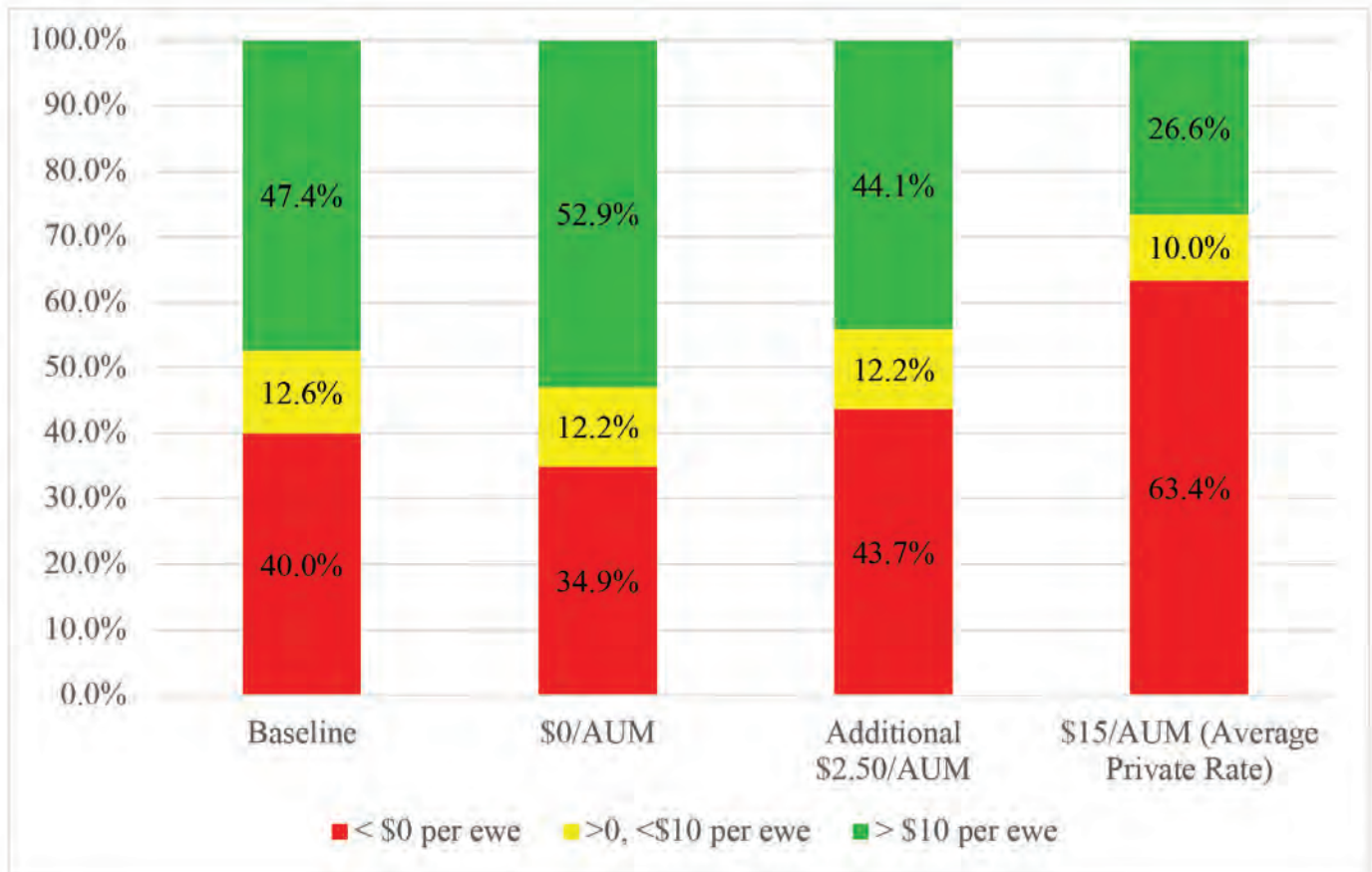
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Figure 3. Public PRIA grazing fee compared to private grazing rates. Source: Glaser, Romaniello, and Moskowitz, 2015.



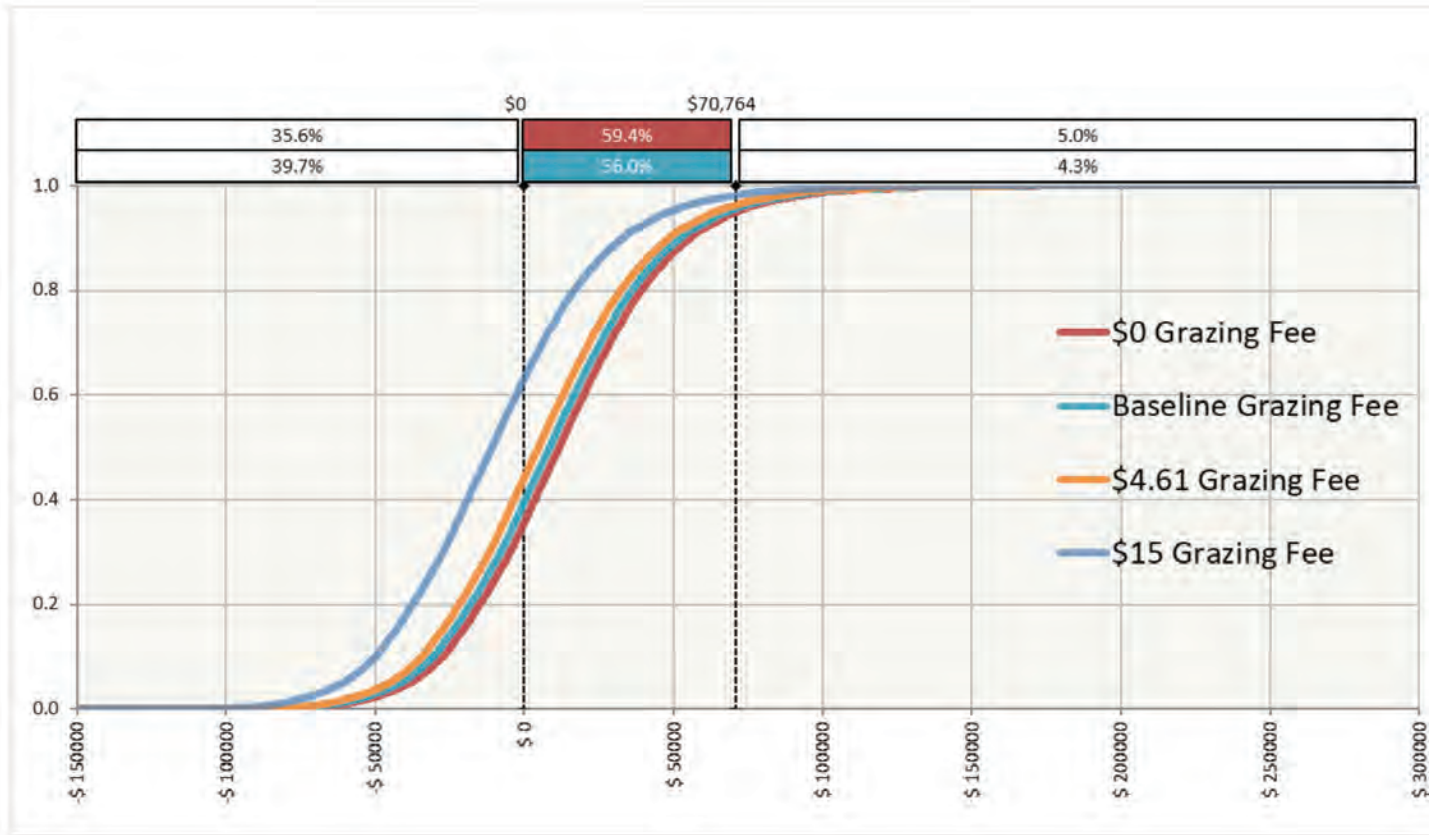
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Figure 4. Stoplight chart of probabilities of returns per ewe of less than \$0.00 and greater than \$10.00 under four scenarios



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Figure 5. Profitability distribution of sheep production under 4 different grazing fee scenarios



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Table 1. 2016 US sheep and lamb inventory: Top ten states

State	Number of head
Texas	735,000
California	575,000
Colorado	435,000
Wyoming	355,000
Utah	285,000
Idaho	255,000
South Dakota	255,000
Montana	230,000
Oregon	190,000
Iowa	175,000
Total	5,320,000

Source: USDA NASS Sheep and Goat Report, January 29, 2016.

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Table 2. Utah representative sheep production budget

	Weight Per Head	Unit	Number of Head Units	Price Cost Unit	Total Value	Per Ewe Value or Cost
Gross Receipts						
Lambs	90	lb	867	1.48	115,415.28	115.42
Cull Ewes	150	lb	150	0.26	5,755.00	5.76
Cull Rams	225	lb	5	0.30	337.50	0.34
Wool - Ram, fine wool	12	lb	15	2.25	405.00	0.41
Wool - Ram, meat breed	8	lb	15	0.65	78.00	0.08
Wool - ewe	10	lb	1000	1.35	13,500.00	13.50
Total Receipts					\$ 135,490.79	\$ 135.49
Operating Costs						
Alfalfa Hay		ton	38	147.50	5,605.00	5.60
Feed Grain		cwt	215	9.32	2,003.88	2.00
Salt/Mineral		lb	4000	0.15	600.00	0.60
Federal Range		AUM	1500	0.00	-	-
Pasture		AUM	900	15.00	13,500.00	13.50
Hauling		head	1000	2.70	2,700.00	2.70
Marketing		head	1000	1.50	1,500.00	1.50
Predator Assessment		head	1000	1.00	1,000.00	1.00
Shearing - ewe		head	1000	3.80	3,800.00	3.80
Shearing - ram		head	30	7.75	232.50	0.23
Camp Supplies		head	1000	5.00	5,000.00	5.00
Dog Food		head	1000	2.00	2,000.00	2.00
ASI lamb checkoff		head	1100	0.50	550.00	0.55
Veterinary Medicine		\$	625	1.00	625.00	0.63
Machinery (fuel, lubrication, Repair)		\$	1200	1.00	1,200.00	1.20
Vehicle (Fuel, Repair)		\$	8600	1.00	8,600.00	8.60
Equipment (repair)		\$	520	1.00	520.00	0.52
Housing and Improvements (repair)		\$	720	1.00	720.00	0.72
Hired Labor		Herder	15000	2.00	30,000.00	30.00
Owner Labor		hour	675	20.00	13,500.00	13.50
Interest on Operating Capital		\$	21000	0.05	1,050.00	1.05
Total Operating Costs					\$ 94,706.38	\$ 94.71
Income Above Operating Costs					\$ 40,784.41	\$ 40.78
Ownership Costs						
Capital Recovery						
Purchased Livestock		\$	5500	1	5,500.00	5.50
Housing and Improvement		\$	1000	1	1,000.00	1.00
Machinery		\$	500	1	500.00	0.50
Equipment		\$	2500	1	2,500.00	2.50
Vehicles		\$	2800	1	2,800.00	2.80
Interest on Retained Livestock		\$	125000	0.05	6,250.00	6.25
Taxes and Insurance		\$	800	1	800.00	0.80
Overhead		\$	8200	1	8,200.00	8.20
Total Ownership Costs					\$ 27,550.00	\$ 27.55
Total Costs					\$ 122,256.38	\$ 122.26
Returns to Land, Risk and Management					\$ 13,234.41	\$ 13.23