

Valuation of Government Grazing Leases

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Abstract. This paper investigates the value and proposes a public policy regarding government grazing leases. It is found that federal grazing leases have little impact upon the value of ranches. It is speculated that state leases are valued more highly than federal grazing leases because of the higher level of certainty of future availability and reasonable leasing fees. Based on these findings, this paper recommends a change in the classification of multiple use and possible divesting of much of the BLM lands. In addition, it is recommended that the federal government should set grazing rates no higher than their fair market value and attempt to reduce the uncertainty regarding future availability.

Introduction

In many western states, the production acreage of ranches is likely to consist of deeded property along with grazing leases or permits on federal and state land. Even though grazing leases or permits on government land cannot be legally sold, leases may be acquired along with the purchase of the deeded property. Having a grazing lease or permit on government land may have value to a rancher since it has commonly been accepted that these grazing leases or permits rent for a lower price per animal unit than comparable private leases.¹ Private leases and public grazing permits may be comparable in the quantity and quality of forage exchanged, but they are almost never comparable in the terms, conditions and restrictions attached to the exchange agreement. These restrictions may therefore impose additional costs on the permittee, which may explain why the rental rates on public land grazing permits are less and should continue to be less than rates on comparable private parcels.²

Relatively high costs of administering government grazing leases has put pressure on government agencies to increase fees charged to cover more of these costs. In 1983 the average Bureau of Land Management (BLM) administrative cost per animal unit month (AUM) was \$2.44 as opposed to the grazing fee of \$1.40 per AUM (USDA and USDI, 1986).³ At the same time, it could be argued that financial stress imposed on farmers and ranchers due to lower prices of produced goods and higher operating costs has made it economically unpopular to increase fees. With financial pressure on both sides, the need for a broad evaluation of current leasing practices is needed.

In the early 1960s, Roberts (1963) developed a theoretical economic relationship between user fees and the marginal returns to grazing on public lands.⁴ He theorized that part of the difference between the fees charged and the value of the forage at the allowable limit was capitalized into the value of the base property. This premium has

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become known as the "permit value". Whether a positive permit value still exists is one of the questions addressed in this study. Specifically, we will examine the effect of the availability of government grazing leases (i.e., State of Wyoming, BLM leases and Forest Service permits) on the sale price of deeded grazing land.⁵ This paper also examines possible differences between the value of State of Wyoming grazing leases and BLM grazing leases.

The subsequent empirical analysis will utilize reported ranch sale data gathered in Wyoming. These ranch properties may include State of Wyoming grazing leases, BLM leases, Forest Service permits, and/or private grazing leases. The empirical methodology utilizes hedonic models where individual ranch characteristics, including deeded and leased property, play an important role in the valuation of ranches.

This paper is organized into four sections. Section two contains the background on how the government allocates grazing leases. Section three presents empirical analysis conducted on the sample data. The final section presents a summary of the findings, as well as a discussion of changes in public policy that may be warranted from these results.

Background

Grazing fees were first charged by the Forest Service in 1906 for grazing on forest reserves; however, in 1936 fees were first charged on public lands administered by the predecessor to the BLM.⁶ From the start, grazing fees have been controversial. The original grazing fee policy was molded by special interest groups and legislators. Original fees were not meant to be revenue producers, but rather to cover administrative costs (Hooper, 1967). In addition, laws and policies used to govern lands leased by the states, the BLM and the Forest Service were designed to help promote the stability of family ranches, and the economies they help support (USDA and USDI, 1986).⁷ Rental fees charged for BLM and Forest Service properties initially were low and gradually increased. This strategy was followed since it was thought that if the government had immediately required a market rate for grazing permits, many producers might have been forced out of business.

Grazing leases on federal and state land give the holder the right to graze a specified number of animals on the property for a set time period. The grazing quantity is measured and broken down into animal units. An animal unit (AU) is a standardized unit of measurement of forage necessary to provide grazing for a mature cow with calf or the equivalent for one year. An AU is forage based rather than land area based. Rangeland carrying capacity may vary significantly among western ranches, thus their size and value may be based on AU rather than acres. Since government leases may include restrictive time periods (e.g., summer months only), they are often broken down into an animal unit month (AUM), which is equivalent to the amount of forage required to provide for the grazing of a mature cow and calf for one full month. Other animals, such as sheep, goats, horses, and younger stock are viewed as a fraction of an AUM.

State of Wyoming, BLM leases and Forest Service permits must be renewed every ten years by the current holder of the lease. When a lease comes up for renewal, the current holder has a preferred right or privilege of renewal. With this right or

privilege, the current holder of a lease can control the grazing rights on federal and state lands for an indefinite period of time.⁸ The majority of grazing leases are acquired in conjunction with the purchase of deeded property. When deeded property is sold, rights or privileges to leased property are usually transferred with the sale. It is not possible to transfer the rights/privileges to the leased property separately. Transfer of grazing rights must be approved by the government, but is seldom refused.

There are several reasons for the current procedure of leasing public lands. One common argument is that agribusiness must be viewed as a long-term investment. Before a person is willing to invest large sums in capital investment, he or she must have long-term property rights or privileges. Without long-term property rights or privileges, risk of losing the lease may outweigh any possible expected return. Another reason for the preferred right or privilege of renewal is that the government wants to ensure that the land is well cared for by the lease holder. Even though government grazing permits include restrictions on the number of AUMs and the dates when the grazing of livestock is permitted, it is feared that stockmen may overgraze leased land if they have no long-term stake in the property.⁹ By having a long-term stake, the lessee views the property from an ownership perspective and generally will provide better care for the property by not overgrazing and otherwise misusing it. If it is found that leased property is being severely abused, the current lease holder may be refused a renewal or the permitted AUMs may be reduced. However, this rarely happens due to the lack of government policing of the property.

The State of Wyoming, the BLM and the Forest Service determine grazing fees in different ways. Wyoming determines grazing capacity of each individual lease and charges a given price per acre corresponding to a desired price per AUM. Grazing fees for State of Wyoming leases, until only recently, have remained constant at \$1.65 per AUM since 1981. Alternatively, rental rates charged on BLM and Forest Service land may vary from year to year based on a formula defined in the Public Range Improvement Act (PRIA) originally passed by Congress in 1978.¹⁰ During the time period of this study (1986–1989), fees charged by the BLM and Forest Service ranged from \$1.35 to \$1.86 per AUM.¹¹

Fees on BLM and Forest Service land have been the subject of considerable debate both in the livestock industry and in Congress. A federal grazing fee study published in 1986 found that fees set under the PRIA formula were substantially less than private land lease rates negotiated in competitive markets (USDA and USDI, 1986). A 1986 Executive Order mandated that federal land grazing fees continue to be set using the PRIA formula; however, significant pressure and proposals from special interest groups may result in Congress either substantially raising fees or reducing the amount of land available for grazing. This uncertainty, both political and economic, may significantly reduce the permit value of BLM and Forest Service permits.

There is no dispute that the State of Wyoming, the BLM and the Forest Service currently charge considerably lower fees when compared to privately leased property. Over the same time period of this study, leases for private property ranged from approximately \$5.00 to \$7.00 per AUM.¹² However, in most instances, more owner participation accompanies private leases. Owner participation may include paying for any necessary improvements and/or upkeep and may justify higher grazing fees on private land. On the other hand, lower government grazing fees may be justified by the higher operating costs incurred by the leaseholder due to the hands-off treatment by the

state, BLM and Forest Service in their leasing practices. All management of livestock and upkeep of the property is the responsibility of the lessee. Death losses also may be higher on government land. Another factor suggesting lower fees is the lower quality of government leased land. This may result in higher production costs since the acreage required per AUM for government leases on average is much greater, especially for BLM land, than for private land. These differences may partially explain the large gap between the price charged for private leases and public leases.

Another major controversy exists with respect to the preferred right or privilege of renewal granted to current lease holders. Since the property is owned by the state or federal government, it is argued that no one person should have a perpetual grazing right to a property. The current renewal procedure creates a situation where the holder of the government lease may have an unfair competitive advantage, thus the preferred right or privilege of renewal may become a barrier to entry. Thus, it is argued that property due for lease renewal should be bid out to the highest bidder. This process may eliminate the argument that ranchers are being subsidized by the government.

The subsidy argument has a major flaw as pointed out by Hooper (1967) and Roberts (1963). It is true that original ranch owners who were grazing public lands prior to the charging of grazing fees may have received windfall gains when their ranches were sold. However, when the original ranches were sold at an arm's-length price, the new buyers will have paid a competitive risk-adjusted price for the privilege of grazing on public land. Thus, no federal subsidy will have been received by new owners. Given that premiums were paid for acquiring public grazing rights under the assumption of continuing preferential leasing practices, then if the longstanding preferred right of renewal is revoked or rental rates are set at a competitive market rate, the original premium paid for grazing rights may be lost. Even though this would affect only the current lease holders, it could be argued that this alternative is unfair and may make it difficult for some ranchers to remain in business (Lambert, 1987).

Another argument for changing grazing policy is that grazing on federal land may restrict the use of this land for recreational purposes. Here a distinction between BLM and Forest Service land is needed. The BLM is essentially a western United States federal rangeland management agency. In the forty-eight contiguous states it administers 179.5 million acres, almost all in eleven western states.¹³ The Forest Service is slightly smaller in terms of total acres (169 million acres) but is more diffuse and has less of a western rangeland management focus (Obermiller, 1992). Forest Service lands are more predominately forests with scenic and recreational values; whereas, BLM lands tend to have far less scenic or recreational value and their highest and best use is predominately for grazing.¹⁴ Therefore, the concern that grazing leases may impact recreational uses may have some basis when it comes to Forest Service land, but is not valid in terms of BLM land.¹⁵

The results of previous empirical studies have provided mixed results regarding the value of federal grazing permits. Torell and Fowler (1986) estimated that the marginal value of adding an additional leased AU to a New Mexico ranch was \$1,121 (\$93.42 per AUM). The data used for this study covered the January 1979 to July 1985 time period and the results were obtained with ordinary least square analysis (OLS). Martin and Jefferies (1966) also using OLS found that a BLM AUM added \$12.90 to the value of an Arizona ranch, using data from 1957 through 1963.

Collins using OLS and ranch sales in Wyoming from 1980 and 1981 found that state and BLM permits added value to the sale price per deeded acre. Collins (1983) reported that the price per deeded acre was increased by \$55 per AUM from BLM permits and \$88 per AUM leased from state lands. Lambert (1987) using a model to calculate the expected after-tax annual net revenue and net present value of a ranch, estimated the value of a leased AU, when grazing fees were \$1.35 per AUM, to be \$1,611 (\$134.25 per AUM).

Torell and Doll (1991), using New Mexico ranch sales data from January 1979 through December 1988, calculated a total cost advantage that each ranch has for public leases one year before the ranch sale. They found that one dollar in cost advantage of public grazing resulted in a \$2.48 increase in value per AUM. This implied a capitalization rate of 3.35% for perpetuity. Using the capitalization factor (2.48) times the actual cost advantage for federal grazing leases, Torell and Doll found that the marginal permit value for one animal unit year, AU, of perpetual grazing was \$849.59 for 1980 and \$816.20 for 1988. Thus, they estimate that a ranch with one AU of federal government grazing, twelve AUMs, would sell for an additional \$816.20 in 1988.

Winter and Whittaker (1981) studied 1970 to 1978 sales data from two eastern counties in Oregon. They found, using OLS, that AUMs from BLM lands were not significantly different than AUMs from all sources in the determination of ranch sale price.

In a comparison of federal lease and private lease land in Oregon, Obermiller and Lambert (1984) found that the total cost per AUM when operating costs are taken into account resulted in an average per AUM for federal leases of \$13.82 compared to \$14.03 for private lease land. Workman (1988) further showed that when the interest on the investment to acquire BLM land is considered, the cost of BLM AUMs equals the \$14.03 that Obermiller and Lambert found for private leases.

The results of these studies may vary due to differences in land quality, model specification, different levels of BLM and Forest Service fees, and the political climate that existed at the time of these studies. It is important to consider that the underlying premise for a permit value on public grazing leases is the existence of a difference between the fees on public land and private land. Winter and Whittaker (1981) noted that grazing fees have undergone dramatic increases and are expected to continue increasing until the differential is zero. They also noted that it is widely believed that the tenure of future grazing privileges is uncertain. These two points, taken together or separately, indicate that there may not be a *stream of expected returns* in the future. As a result, the differential to be capitalized into the permit value may be rather small. Nevertheless, the value of grazing leases on public land is yet unresolved.¹⁶

The following section estimates the permit value that the market places on government grazing leases, and examines possible differences between the value of Wyoming grazing leases and BLM leases.

Empirical Results

The data consist of 254 ranch sales, of which 151 include deeded property only, 75 sales include State of Wyoming leases, 58 sales include BLM leases, 15 sales include

Exhibit 1
Selected Summary Statistics

Variable	Variable Description	Minimum	Maximum	Mean	Std Dev
PRICE	Sale Price	12800.00	1700000.00	200827.1900	210919.6900
DACRES	Deeded Acres	89.00	45240.00	2483.4300	4401.4400
SACRES	State Acres	0	4952.00	322.2874	769.5986
TACRES	Total Acres	100.00	202374.00	5996.3300	18847.9200
DAUM	Deeded AUMs	60.00	18588.00	1834.9100	1926.6300
BLMAUM	BLM AUMs	0	4164.00	94.3464	364.6124
SAUM	State AUMs	0	1548.00	93.9212	219.8114
FSAUM	Forest Service AUMs	0	1836.00	39.5905	212.3851
PAUM	Private Lease AUMs	0	1392.00	15.4015	108.4748
TAUM	Total AUMs	60.00	21684.00	2078.1700	2240.7500
IRFARM	Irrigated Acres Farm Land	0	687.00	56.2637	111.0756
IRHAY	Irrigated Acres Hay Land	0	3207.00	107.0118	317.9378
DRYCROP	Acres Dry Crop Land	0	2178.00	51.0472	184.9897
SAUM/SACRES	Quality of State Leases	0	.9906	.0900	.1555
REAL	\$ of Real Property	0	110000.00	14315.7500	19687.2400
SCENIC3	Scenrec3 * DACRES	0	45240.00	689.7480	3346.3700
SCENIC4	Scenrec4 * DACRES	0	4066.00	24.1889	270.7744
AUCTION	Auction Sale * DACRES	0	10700.00	78.1456	706.8689
REPO	Repo Sale * DACRES	0	19818.00	452.2007	1904.3500
YEAR	Year of Sale (86=1986)	86.00	89.00	87.4212	.9656
B87	Beginning 1987	0	.9583	.2260	.3091
B88	Beginning 1988	0	.9583	.3256	.3163
B89	Beginning 1989	0	.9583	.2887	.3283
B90	Beginning 1990	0	.7083	.0390	.1217

Care should be taken in interpreting the mean and standard deviation of the variables that have minimum values of 0.0.

Source: Authors' analysis

Forest Service leases and 13 sales include private leases. There were 30 sales that included both State of Wyoming and BLM leases, 5 sales that included both state and Forest Service leases and 5 sales that included BLM, state, and Forest Service leases.¹⁷ Ranch sales which included less than 100 acres were excluded from the analysis. All twenty-three counties in Wyoming are included in the study. These sales occurred from January 1986 to July 1989. Selected summary statistics for each of the variables are included in Exhibit 1.

Since our concern is the effect lease permits have upon the sale price of ranch property, sale price (*PRICE*) is used as the dependent variable. In some observations, sale price includes permanent improvements such as buildings and equipment essential to the operation of the ranch. When improvements were included in the sale, the land appraiser made an estimate of the dollar value of additional real property that was included in the sale price. Rather than deducting real property from the sale price and using this adjusted price as the dependent variable, it was decided to include the value for real property (*REAL*) as an explanatory variable. By doing so, it is possible to statistically test the accuracy of the value placed on improvements by land appraisers and how improvements affect the sale price of a ranch.

Explanatory variables were selected to incorporate and control for the income-producing ability of the ranch, location differences and changes in market conditions. Results from previous studies and the availability of data also influenced the selection of explanatory variables.¹⁸

Hedonic models were selected to estimate the effect that various attributes had on the market price of a particular ranch (Rosen, 1974). Hedonic models may be used to estimate the sale price, while controlling for the quality and quantity of the observations that can obscure the "pure" price movements (Bryan and Colwell, 1982). Initially, a linear functional form model is chosen because it is easier with it to interpret the coefficients for the explanatory variables.

A major factor that influences the sale price of a ranch is its scenic and/or recreational value. A subjective assessment of this factor is done using an ordinal variable of one to four. If a ranch contains very scenic and/or high recreational value it is given a rating of four. Alternatively, if a ranch contains little scenic and/or recreational value it is given a rating of one. Through preliminary analysis it was determined that the value attributed to a ranking of two was statistically insignificant from a ranking of one. As a result, only the rankings of three and four are included in the regression models. To capture the effect that scenic and/or recreational value has upon the value of a deeded acre, these two dummy variables were multiplied by the total deeded acres included in the sale. The coefficient on these variables (*SCENIC3* and *SCENIC4*) will show the premium paid per deeded acre for these two levels of scenic and/or recreational value.

The data consists of 175 arm's-length sales, 16 auction sales, and 63 sales that took place through repossession. The type of sale is controlled using a dummy variable. To capture the effect that auction and repossession sales have upon the sale price of the ranch these dummy variables were multiplied by the total deeded acres included in the sale. As a result, the coefficient on these two variables (*AUCTION* and *REPO*) will show the effect of these types of sales on ranch sale price per deeded acre.

The time (date of sale) variable as it is incorporated in the model controls for the fact that market prices of ranches may not have been stable throughout the time

period of this study.¹⁹ The form used for the date of sale variable was suggested by Bryan and Colwell (1982). Each date of sale is defined as a linear combination of the end points of the year in which the sale occurs. Date of sale variables, $B(y)$, are the proportionate weights. There is a date of sale variable for each year in which sales occurred. For example, suppose a sale occurred in September 1987, then B_{87} is .25, B_{88} is .75 and all other $B(y)$ variables are zero. Since the sale was closer to the beginning of 1988 than to the beginning of 1987, B_{88} is larger and given more weight than B_{87} . This approach allows the rate of change in prices to be different for each year and allows for a price continuum rather than a step function. Since our desire was not to build a price index but rather to control for the market changes, this approach was chosen.²⁰

The availability of water on each ranch is measured in several different ways. In the first approach, an ordinal variable with a rating of one to three is given to each ranch where a rating of one represents ranches with little water and/or surface streams. Alternatively, a value of three is assigned to ranches with substantial water and/or surface water rights. Another set of variables that can also be used to measure the availability of water on a ranch is the number of acres of irrigated crop land and irrigated hay land. Finally, the deeded AUMs will also reflect the existence of, or lack of, water. Since the existence of a relatively large number of acres of irrigated land would result in a large number of AUMs and also result in an ordinal rating of three, these three measures of the availability of water probably should not be used in the same hedonic model.

Empirical Findings

This section includes the results of three models that were developed to estimate the "permit value" of government leases and the contribution that the availability of government leases have on the value of deeded grazing land.

Model I. The first model uses the number of AUMs leased from the BLM (*BLMAUM*), State of Wyoming (*SAUM*), Forest Service (*FSAUM*) and private (*PAUM*) as explanatory variables to capture the effect that leased land has on the sale price of a ranch.²¹ The results of this model are in the first column of Exhibit 2.

The adjusted R^2 is .8123 and the coefficients and t -statistics are shown for each variable.²² Variance inflation factors were used to detect the presence of multicollinearity. These inflation factors, one for each explanatory variable, measure how much the variances of the estimated regression coefficients are inflated as compared to when the explanatory variables are not linearly related. The largest factor among the variables is used as the indicator of the severity of multicollinearity. A variance inflation factor (VIF) exceeding 10 is often considered as an indication that multicollinearity may be influencing the least squares estimates.²³ For Model I, the highest VIF was 4.247, for deeded acres (*DACRES*), and the mean VIF for the model was 1.864. These values of VIF indicate that this model is not significantly affected by multicollinearity.

The *REAL* variable in Model I indicates that appraisers on average undervalue real

Exhibit 2
Regression Results
Dependent Variable = PRICE

Explanatory Variable	Model I	Model II	Model III
<i>REAL</i>	2.4602 (6.857)*	2.5695 (7.293)	2.6822 (8.760)
<i>DACRES</i>	20.9579 (7.790)	24.7570 (9.976)	40.4796 (14.529)
<i>DACRES</i> ²	—	—	- .0008 (- 8.257)
<i>DAUM</i>	26.0366 (5.497)	—	—
<i>BLMAUM</i>	11.8255 (.641)	12.5291 (.683)	- 77.4895 (- 1.971)
<i>BLMAUM</i> ²	—	—	.0268 (2.458)
<i>SAUM</i>	154.1880 (4.729)	73.4644 (1.828)	83.4944 (2.876)
<i>FSAUM</i>	66.2969 (2.168)	45.5605 (1.473)	- 339.0340 (- 3.862)
<i>FSAUM</i> ²	—	—	.2866 (4.701)
<i>PAUM</i>	- 4.3963 (- .081)	- 20.8049 (- .385)	- 67.8956 (- 1.445)
<i>SAUM/SACRES</i>	—	98038. (1.915)	—
<i>SCENIC3</i>	1.7338 (.660)	4.2855 (1.651)	19.5594 (6.668)
<i>SCENIC4</i>	65.3839 (3.007)	53.9245 (2.474)	70.5519 (3.669)
<i>AUCTION</i>	- 15.7902 (- 1.885)	- 18.5664 (- 2.229)	- 17.4212 (- 2.402)
<i>REPO</i>	.0978 (.027)	3.0223 (.840)	6.1304 (1.945)
<i>IRHAY</i>	—	132.3380 (5.876)	121.3470 (6.277)
<i>IRFARM</i>	—	119.4620 (2.079)	118.7830 (2.428)
<i>DRYCROP</i>	—	62.3535 (1.973)	54.9187 (2.005)
<i>B87</i>	- 19190. (- .617)	13185. (.418)	- 5762. (- .212)
<i>B88</i>	- 17736. (- .712)	3592. (.144)	- 12736. (- .592)
<i>B89</i>	- 3354. (- .122)	20352. (.742)	10115. (.429)
<i>B90</i>	- 85226. (- 1.518)	- 66849. (- 1.189)	- 83176. (- 1.723)
INTERCEPT	60452. (2.778)	48511. (2.147)	45250. (2.391)
ADJUSTED R ²	.8123	.8157	.8620

*t-statistics are shown in parentheses.

Source: Authors' analysis

property by approximately 146%. These results are higher than those found in studies by Torell and Fowler (1986) and by Winter and Whittaker (1981) where the authors also found that permanent improvements were valued less than their effect on the sale price of a ranch. Torell and Fowler observed, "Ranches with large investments in buildings are generally those that are well maintained and improved with livestock handling facilities and range improvements." Therefore, the variable *REAL* may be acting not only as a measure of real improvements, but also as a proxy for the level of range improvements. Further, appraisers based their estimate of value on the current market value of similar improvements while the buyer is concerned with the future stream of net benefits resulting from the existing improvement. Ideally these estimates of value should be equal; however in practice they appear not to be.

In Model I, the variables deeded acres (*DACRES*) and deeded AUMs (*DAUM*) were included to determine how these factors affected the value of the ranch. It is not surprising the coefficient on *DAUM* is positive and significant. This indicates that ranchers in Wyoming place value on the productivity of a ranch. What is surprising is that the coefficient on *DACRES* is also positive and significant and that no significant multicollinearity between these two variables was found. This indicates that when other factors are held constant, including *DAUM*, additional acreage adds value to a ranch even though it results in no increase in the productivity of the ranch. This might be viewed as a "bigger is better" attitude among ranchers or may result from the anticipation of increased investment value that additional land *may* yield from later development. A similar result was found by Torell and Fowler (1986).

The coefficients on the variables relating to leased property show mixed results. The coefficients on state AUMs (*SAUM*) and Forest Service AUMs (*FSAUM*) are statistically significant at the .10 level. The other coefficients relating to leased property are statistically insignificant. This indicates that the presence of state leases has a \$154.19 per AUM positive effect and Forest Service permits provide a \$66.30 per AUM positive effect. BLM (*BLMAUM*) and private leases (*PAUM*) have no statistically significant effect on ranch values.²⁴ It is expected that private leases will have no effect on the value of a ranch if they are priced at their fair market value; however, explaining similar results for BLM leases is not so obvious.

Other explanatory variables in Model I are *SCENIC3* and *SCENIC4* and whether the ranch was sold at an auction (*AUCTION*) or as a repossession (*REPO*). *SCENIC4* suggests that ranches with high scenic and/or recreational value will sell for \$65.38 more per acre. Model I also indicates that ranches sold at auction tend to sell for \$15.79 per acre less than for arm's-length sales. Repossessions appear to sell at a similar price to arm's-length transactions, a result that was expected.

Model II. To further identify the factors that are important in determining ranch values, Model II includes three additional explanatory variables and deletes deeded animal unit months (*DAUM*). The number of acres of irrigated hay land (*IRHAY*), irrigated crop land (*IRFARM*) and dry crop land (*DRYCROP*) are added to incorporate the additional productivity due to crop land and irrigation. *DAUM* was deleted since it also is a measure of ranch productivity and the availability of water, thus including the variable tended to cause multicollinearity problems with the other three new variables.²⁵

Model II suggests that irrigated hay land will sell for \$132.34 per acre more than

grazing land, irrigated crop land will sell for \$119.46 per acre more than grazing land, and dry crop land will sell for \$62.35 per acre more than grazing land. Model II, however, still suggests that BLM leases have no value when included as part of a ranch sale. Also, the statistical significance of Forest Service permits becomes questionable.

Model II also includes a quality variable for State of Wyoming leases (*SAUM/SACRES*). Thus, the higher the number of AUMs per acre of state land, the higher the value of the lease.²⁶

Variable inflation factors were run for the explanatory variables in Model II. For Model II, the highest VIF factor was 3.681, for *DACRES*, and the average was 1.773.

Model III. Model III is designed to examine the linearity of the explanatory variables. A number of variables appear to exhibit a quadratic relationship. Deeded acres (*DACRES*) appears to follow a concave, quadratic function. This suggests that larger ranches with more deeded acres will tend to sell at lower prices per acre. This economy of scale found in larger ranches is directly observable in ranch sales data.

Both BLM leases (*BLMAUM*) and Forest Service permits (*FAUM*) seem to exhibit a quadratic, convex relationship where each of these types of leases increase in value when more AUMs are available in the ranch sale. Even though Model III is plagued with multicollinearity, because *DACRES* and *DACRES*², *BLMAUM* and *BLMAUM*², and *FSAUM* and *FSAUM*² are all placed in the same model, this model suggests that sale price is a quadratic function of *DACRES*, *BLMAUM* and *FSAUM*.

If we plot the quadratic function for the value of BLM leases, the value is negative until the quantity of BLM grazing is 2886 AUM. Thus, for the average size BLM lease (413 AUM), the sale price of a ranch is negatively affected. Only when the quantity of BLM leases is in excess of 2886 AUM does it have a positive effect on ranch sale price. Since the ranch sale with the largest BLM allotment was 4164 AUM, Model III again suggests that BLM grazing leases have little positive impact on ranch sale prices.

Plotting the quadratic function for Forest Service permits results in a similar pattern to that of BLM leases. The value is negative until the amount of Forest Service permits exceeds 1183 AUM. For the average size Forest Service permit (670 AUM), the sale price of a ranch is negatively affected. Since the largest allotment of Forest Service permits is 1836 AUM, Model III suggests that Forest Service grazing leases have little positive impact on ranch sale prices.

A possible explanation for the convex function observed for both BLM leases and Forest Service permits is that ranches with small amounts of either type of grazing permits may view these permits as more of a bother than they are worth. Alternatively, ranches with large tracts of leased land may view the leased portion of the ranch to be critical to the viability of the ranch and its economy of scale.

Estimate of Fee for Zero Permit Value

It is observed from the previous empirical analysis that State of Wyoming grazing leases possess permit values when sold in conjunction with deeded acres. It also is

observed that BLM and Forest Service grazing leases have low permit or possibly zero permit values. This observation occurs even when, historically, Wyoming State grazing leases have been priced higher per AUM than BLM or Forest Service grazing leases. One possible explanation for this observation is the current uncertainty with regard to future lease rates on federal land and the possibility that grazing will be discontinued on some federal land.

When comparing Wyoming State leases with BLM leases and Forest Service permits, we find that historically state leases have had a stable, although somewhat higher, cost per AUM than BLM leases or Forest Service permits that have used the PRIA formula. On the other hand, ranchers in Wyoming perceive themselves as having a considerable degree of political control over state grazing fees and policy. Thus, the added certainty of future grazing fees and policy perhaps is the primary reason that state grazing permits have value and currently BLM and Forest Service grazing permits have little value.

A natural extension of this analysis is to estimate the state grazing fee that would create a zero permit value. During the time period of this study, Wyoming charged \$1.65 per AUM.²⁷ This rate remained at this level from 1981–1989. From the previous empirical results, the capitalized value of an additional state AUM is estimated to be \$83.49 (Model III). Assuming a capitalization rate of 3.35/2.50%, the implicit annual benefit, permit value, assumed for one additional state AUM is \$2.80/\$2.09. Adding the implicit annual benefit to the lease rate of \$1.65 results in a rate of \$4.45/\$3.74 per AUM that would result in a zero permit value.²⁸

This study has had the unique advantage of estimating the permit values for two distinct types of government grazing leases that historically have followed substantially different policies with considerably different political control being exerted by ranchers. Ranchers holding BLM grazing leases and Forest Service grazing permits are completely at the mercy of the federal government with regard to future rate levels and availability. On the other hand, ranchers holding State of Wyoming leases observed stable lease rates from 1981–1989 and continue to exert considerable political pressure to maintain favorable future lease rates. Thus, the effect of uncertainty on state permit values may be considered to be minimal; whereas the effect of uncertainty on the permit value for BLM and Forest Service leases may have reduced it to a much lower value. Assuming that state, BLM and Forest Service leases would have the similar permit values given the same fee policy and level of uncertainty, the rate, estimated above, that would reduce the permit value for state leases to zero, likewise may reduce BLM and Forest Service permit values to zero given the same certainty level, would be from \$4.45 to \$3.74 per AUM. However, because federal leases may have lower quality land when compared to state leases, the lower of these two values is our best estimate of the lease rate that will result in zero permit value for federal permits.

The government grazing lease policy suggested is for the State of Wyoming to begin setting grazing rates no higher than \$4.45 per AUM adjusted for future inflation levels. The federal government should set both BLM and Forest Service rates no higher than \$3.75 per AUM and attempt to alleviate the current uncertainty regarding the future availability of these leases. These rates will reduce permit values to approximately zero and will fulfill the fiduciary responsibility of these agencies to their respective constituencies.

Findings and Policy Issues

Using the data from 254 sales of ranches in Wyoming from 1986 through 1989, the above models present an interesting scenario concerning the value of grazing leases. State of Wyoming leases are valued more highly than BLM leases or Forest Service permits. The difference in value between state and federal leases may be due to the higher risk and uncertainty of federal leases. A major factor with regard to the risk of federal leases may be the continued availability of leases and future level of grazing rates.²⁹

The rates on State of Wyoming leases are relatively stable, whereas BLM leases may change yearly due to the PRIA formula. Lease fees for State of Wyoming land are controlled by people who are more receptive to the desires and requirements of the ranching industry. In fact, ranchers in Wyoming exert considerable political control at the state level. BLM and Forest Service rates are controlled by the federal government where the desires of ranchers are far less important. This in itself adds more political uncertainty. The uncertainty demonstrated in the value of federal leases from 1986–1989 was well justified. In 1991 there was a serious attempt to raise BLM rates from the current \$1.97 per AUM to \$8.70, or more, per AUM by 1995. The defeat of this bill was engineered *only* through an agreement with conservative western lawmakers to help defeat an amendment sponsored by Sen. Jesse Helms that would have prohibited the National Endowment for the Arts from funding projects that depicted “in a patently offensive way, sexual or excretory activities or organs.” This deal has since been dubbed “Corn for Porn.” Similar attempts to raise grazing fees again failed in 1992 and 1993. Even though these recent attempts failed, the Clinton Administration, facing the current federal deficit and public concern over livestock grazing on federal lands, has proposed to raise federal grazing rates from the current \$1.86 per AUM to \$4.28 per AUM; however, at this time it appears that this increase has been delayed until summer 1994.

A change in public policy may be warranted because of these results. From a portfolio diversification viewpoint, the federal government is in a much better position to withstand risk and uncertainty than the individual rancher; therefore, a suggestion would be that federal leases be set with less uncertainty from the rancher’s standpoint. This may be accomplished by the federal government setting rates no higher than \$3.75 per AUM adjusted for inflation and abandoning the current PRIA formula. The PRIA formula is based on the previous year’s beef prices and production costs which may be out of phase with actual values. Thus, the formula may provide little diversification for the rancher. Further, if this policy was enacted for a period of at least ten years the existing political uncertainty would be removed.

A further policy issue needs to be considered. What will happen if the fees on BLM and Forest Service land increase to the extent that a negative permit value is reached? One argument is that if fees get sufficiently high, ranchers will simply abandon their lease permits. However, Johnson and Watts (1989) feel the more likely scenario will be that ranchers will either apply for nonuse status or lower their stocking levels. Where private leases typically have a set rent level whether cattle are grazed or not, lease fees on federal land are per AUM. Even though a maximum stocking limit is set for federal land, the rancher is only charged for actual stocking. Adjusting stocking levels can lower the rancher’s rental cost or eliminate them in the event of nonuse.³⁰ The

irony related to an unreasonable increase in federal grazing fees is that raising fees may likely fail to increase federal revenues due to ranchers either abandoning lease permits or by reducing stocking. If, however, the motive is that of environmental groups who want the elimination of grazing leases or at least lower stocking, a substantial increase in grazing fees may be an effective solution.

One problem that should be addressed by the BLM, Forest Service and the State of Wyoming, that has not been fully addressed in this study, is the variability of the value of government grazing leases. The values of \$4.45 per AUM for state leases and \$3.75 per AUM for BLM and Forest Service leases are mean or average values. Factors such as the location of the lease, availability of water, productivity, etc. will greatly affect the actual value. Certain grazing leases may have values considerably higher than the mean, whereas other leases may have values that are considerably less than the mean. A justification for setting lease rates at levels significantly below the mean is that a much lower percentage of ranchers will find it unprofitable to continue to utilize government leases. If rates are set at the mean rate and assuming that actual forage values are symmetrically distributed, approximately half of all government leases will be unprofitable. Thus, any future studies that attempt to evaluate the effect of increasing government grazing fees on local, state or western economics is incomplete without considering the variability in forage values of government leases.

The current controversy regarding the use of federal public lands has involved individuals and special interest groups from across the county; whereas 99.1% of the total federally owned BLM land in the forty-eight contiguous states is found in eleven western states. Further, as indicated in Note 7, in these eleven states the percent of federally owned land ranges from 29% to 86% (in Wyoming 64% of the state consists of public land). Thus, any changes in policy with regard to the use of these lands will significantly impact these eleven states to the exclusion of most other states. This lack of equality regarding the impact of policy toward public lands may be equalized in different ways. One method would be to give states more control over the grazing policy and rates charged on the public lands in their respective states. Alternatively, public lands could be reclassified with regard to their highest and best use. Public lands with high scenic or recreational value should have their highest and best use classified as such where grazing may be substantially reduced or eliminated on these lands. Alternatively, those lands with little scenic or recreational value should have their highest and best use classified as grazing. The current controversy regarding "multiple use" confuses the entire issue of the use of federal lands and assumes that federal lands are relatively homogeneous. Federal lands, however, are very heterogeneous, ranging from very scenic to completely flat grasslands. By classifying the highest and best use as either scenic and recreation or grazing, much of the multiple use controversy may be alleviated. Such a policy would result in some reduction in government grazing; however ranchers would be effectively compensated by having less uncertainty regarding the future availability of government grazing leases and more stability in grazing rates.

Perhaps a more controversial solution to this problem is for the federal government to either sell off or give to the individual states the land that has limited scenic and/or recreational value. With average BLM administrative costs per AUM typically higher than the revenues received per AUM, this land is currently a liability to the federal government, not an asset. It is logical for the federal government to divest itself of the

land business and shed this liability by putting the control back into the hands of the individual states or individuals.

Notes

¹In the report of the USDA and USDI (1986) they found public grazing leases rented for 15% less than private grazing leases. Also the correct terminology is BLM grazing leases and Forest Service permits; however, in our paper these terms may be used interchangeably.

²For further insight on this issue, see Obermiller (1990).

³An AUM (animal unit month) is the forage needed to provide for the grazing of a 1,000 lb. cow with calf for one full month.

⁴This was later expanded upon by Hooper (1967).

⁵Forest Service permits were included in the study; however, the main focus of our paper is on State of Wyoming and Bureau of Land Management grazing leases.

⁶A discussion of the history of Forest Service fees and BLM fees can be found in Hooper (1967).

⁷The importance of federal land to western states should be recognized. Eleven western states contain 87.9% of the federal lands outside of Alaska (Obermiller, 1992). In these states the percent of federally owned land ranges from 29% to 86% (Wyckoff, 1977). In Wyoming 64% of the state consists of public grazing land (USDA and USDI, 1986). With agriculture being the second largest industry in Wyoming, federal and state land and its management has a large influence on the economy of the state.

⁸Forest Service grazing permits are treated similarly to BLM grazing leases with respect to renewal; however Forest Service permits allow no subleasing and require that the permit holder own livestock and base property. Also, according to Wally Chesbro of the U.S. Forest Service, Forest Service permits generally have better forage and require fewer acres per AUM than BLM leases.

⁹In an article by John Workman (1988), it is shown that this is not the case. He argues that a grazing lease specifies the number of AUs allowed and the time span for that usage, thus addressing overgrazing whether it is a long-term lease or not. Further, Johnson and Watts (1989) stated, "Despite the allegations that the federal range is overgrazed, the evidence available indicates it is less intensively utilized than other public and private lands. In making a comparison, Peter Emerson of the Wilderness Society found that 68% of the federal range was in condition classes good or fair. Only 35% of the nonfederal range were classified as being in those two top categories."

¹⁰The PRIA formula resulted from a one-year study conducted in 1977 and was subsequently reviewed in a 1986 study (USDA and USDI, 1986). The recommendations of the 1977 study was to adopt the PRIA formula on a seven-year trial. The formula was reviewed in 1986 and its continuation was a result of an executive order. The PRIA formula takes into account several different agricultural indexes in arriving at a rental fee per AUM. The PRIA formula is $CF = \$1.23 * (FVI + BCPI - PPI) / 100$ where CF = Calculated Fee to be charged, $\$1.23$ = base value established in 1966, FVI = Forage Value Index, $BCPI$ = Beef Cattle Price Index, and PPI = PRIA Prices Paid Index.

¹¹BLM rates were obtained from Jerry Fetter of the BLM office in Cheyenne, Wyoming. State rates were obtained from Lee Ann Hopson of the State Land Office in Cheyenne, Wyoming. Forest Service information was obtained from Wally Chesbro of the Forest Service Office in Laramie, Wyoming.

¹²Estimates of rental fees charged per AUM for private leases were obtained from Joe Ross, a Land Appraiser with the State of Wyoming.

¹³The eleven western states (Washington, Oregon, California, Arizona, New Mexico, Nevada, Utah, Colorado, Wyoming, Idaho, Montana) contain 177.9 million acres of the total of 179.5 million acres of BLM land, 127.0 million acres of the total of 169.0 million acres of Forest Service land, and 58.8 million acres of the total of 65.2 million acres of other federal lands. The eleven western states, therefore, contain 87.9% of *all* federally owned land in the lower forty-eight states (Obermiller, 1992).

¹⁴If highest and best use is determined by the market value of the resource used, the highest and best use for some of the BLM land may be for mineral extraction. However, mineral extraction currently occupies very little of the BLM surface area. Also, when mineral extraction is completed, the mining company is responsible for reclamation of the surface area which in most cases returns the highest and best use of the land back to grazing.

¹⁵BLM land in Wyoming, as well as in most other western states, consists predominately of land that was never claimed or purchased from the federal government. It is land that nobody wanted, thus both its productivity and scenic and/or recreational value are usually limited. However, a permit holder must allow public access to BLM land. Given that much of Wyoming BLM land requires forty acres or more to support an AU, the recreational user is usually in little danger of being injured in a stampede.

¹⁶The authors have discussed the value of BLM and Forest Service grazing leases with loan officers at Farm Credit Services offices in Casper and Worland, Wyoming. They indicate that it is their practice to value an AUM of federal government grazing lease at approximately twenty dollars.

¹⁷The observations for this study were gathered from the Commissioner of Public Lands for the State of Wyoming and were compiled by the land appraisers of that office.

¹⁸For example, see Collins (1983), Winter and Whittaker (1981) and Martin and Jefferies (1966).

¹⁹Thompson (1988) and Torell and Fowler (1986) found prices of ranches were increasing. Vanvig and Gleason (1988) found that this also applies to Wyoming.

²⁰Alternative approaches were considered for controlling for the date of sale. One approach is to perform a separate regression for each of the years during which ranch sales took place. A combined model is then estimated using implied prices for each of the ranch characteristics across the four different regressions. This approach will provide demand curves for BLM grazing in four different markets. This approach requires that a sufficient quantity of data exists for each year of the study to allow reasonable degrees of freedom for each of the four regressions. Given the size of the sample and the fact that none of the existing time variables used in the study are significant, the authors determined that additional methods of controlling for the date of sale are unwarranted.

²¹This model is similar to work done by Martin and Jefferies (1966).

²²An earlier version of this model included location variables to account for any regional differences in value. However, based on an incremental *F*-test, these location variables were not significant as a group and therefore were left out of the final model.

²³For a discussion of variance inflation factors, see Neter et al. (1983).

²⁴A log-linear form of this model was tested; however it does not appear to fit the data as well as the linear form.

²⁵The authors also attempted to use dummy variables controlling for the presence of water and found that these variables did not explain productivity as well as either *DAUM* or the variables *IRFARM*, *IRHAY*, and *DRYCROP*.

²⁶A quality variable for BLM and Forest Service leases is more difficult to estimate since, in many cases, these leases are granted on the basis of AUM and no acreage figure is given. Also, in some cases a rancher may lease an AUM allotment on the same land as other ranchers.

²⁷The current grazing fee on State of Wyoming land is \$2.50 per AUM.

²⁸Capitalization rates of 2.50% to 3.35% are consistent with studies by Workman (1988),

Gardner (1963) and Torell and Doll (1991). This is a real rate where inflation would effect both the nominal lease fee and the expected benefit equally.

²⁹These findings are in part supported by Torell and Fowler (1986). They found that ranch land in New Mexico that had government leases, dropped in value faster from 1982 through 1986 than did ranches that did not have government leases. They attributed this greater decline to proposals for increasing grazing fees on federal land and the increased grazing fees on New Mexico lands.

³⁰In many cases, federal grazing land is interspersed with deed land. This is especially the case with BLM land. Thus, if a rancher decides to no longer lease BLM land, the land must be fenced if the rancher's livestock are to be kept off. Wyoming is a "fence out state" therefore, the obligation of fencing the BLM land would fall on the federal government.

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