Additional Evidence on the Homogeneity of the Value of Government Grazing Leases and Changing Attributes for Ranch Values[†]

Ronald W. Spahr*
Mark A. Sunderman*

Abstract. Using Wyoming ranch sales from 1979–1983 and 1989–1993, this study investigates how ranch value determining attributes may have changed over this period. The 1979–1983 period is one of political stability and rising prices. In contrast, the 1989–1993 period is one of political uncertainty but stable prices. It is found, during 1989–1993, ranch prices were based more on productivity; whereas, during the earlier period, prices were based more on speculative potential. Also, it is found that government grazing leases were valued differently between time periods, ecological regions and types of leases. This suggests that the current single-price grazing fee commonly used misprices many leases. Because of the heterogeneity in the value of grazing leases, we recommend a variable-fee form of pricing be adopted.

Introduction

From the beginning, grazing on public lands has been controversial. However, recently there has been considerable public debate regarding grazing leases and the fees charged on these leases. The original grazing policy was modeled by special interest groups and legislators. Recent suggested changes to grazing policy are no different. Unfortunately, arguments behind these proposed changes may not be based on solid evidence, but rather on emotion and special interest. Consequently, the purpose of this study is to further explore the intrinsic value of grazing leases and the effect on lease values caused by the current political climate. Using hedonic modeling, we will test the hypothesis that attributes contributing to ranch values have changed over time due to changing market conditions and the changing political climate.

Recently, the Clinton Administration and the U.S. Department of Interior have proposed new land use reforms that also propose higher grazing lease rates. Proponents for increased grazing fees and more restrictive grazing permits argue that public lands should have increased availability for multiple use. They also argue that permits that authorize the use of federal or state land for grazing do not compensate taxpayers for their reduced access to these lands nor do current grazing fees compensate taxpayers for the full market value of the forage produced on public lands.

Opponents to proposed land use reform and higher grazing lease rates argue that any increase in grazing fees will severely affect the ranching industry by reducing operating incomes, forcing ranchers and their families out of business and decreasing ranch values.

These arguments and others that are currently being heard in Washington and across the West may already have had a detrimental effect on ranch values. To estimate the effect of the current political climate on ranch values and on the attributes contributing to ranch values, this study uses ranch sales data in Wyoming from 1979 through 1983, and 1989 through 1993.

During the period from 1979 through 1983, ranch values generally were increasing and the political climate regarding rangeland reform and grazing leases was rather stable. The Federal Land Policy and Management Act of 1976 called for grazing leases to be set at market value after a phase-in period; however, the Federal Land Policy and Management Act and Grazing Fee Moratorium of 1977 amended the 1976 act to prevent implementation of the recommended procedures for the 1978 grazing year on the basis that Congress would not otherwise have a reasonable opportunity to examine the recommendation of the 1976 act. As a result, the Public Range Improvement Act (PRIA) of 1978 was enacted. This act provided a formula for setting annually a single grazing fee for BLM and Forest Service leases. The PRIA formula derives a grazing fee per animal unit month (AUM) of public forage through the use of three indices and a base fee.[1] The indices vary from year to year and reflect values of private forage land lease rates (Forage Value Index), beef cattle prices (Beef Cattle Price Index) and costs of beef production (PRIA Prices Paid Index). The base fee of $1.23 was established by the 1966 Western Livestock Grazing Survey which used the total cost approach to fee evaluation (USDA/USDI, 1993). With the use of this formula the grazing fee could be changed annually. Originally the PRIA formula was adopted for a seven-year trial period. 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/USDI, 1986). Nevertheless, a 1986 Executive Order mandated that federal land grazing fees continue to be set using the PRIA formula. Even though there has been almost yearly debate in Washington regarding grazing fees, the PRIA formula is still in effect.

During the 1989–1993 period, in contrast to the earlier 1979–1983 period, there was much controversy over federal grazing fees. For example, in 1991 there was a serious attempt to raise BLM (Bureau of Land Management) rates from the then-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 (Sunderman and Spahr, 1994).

During the early years of this study (1979–1983), ranch values increased substantially (see Rowan and Workman, 1992). However, after 1983, there was a dramatic decrease in ranch values. Inflation during the late 1970s and early 1980s alone cannot explain the dramatic increase in land values but does partially explain investment strategies during this period. Expectations of continued land appreciation provided incentives for land investment and speculation. These expectations were fulfilled for a short period until the beginning of the decline in ranch values in 1983. On the other hand, ranch prices seem to be much more stable during the later years of this study (1989–1993).

This study has a number of objectives. We will investigate the value of each attribute

contributing to ranch values for the subperiod 1979 through 1983, during which ranch values increased, and during the more recent time period, subperiod 1989 through 1993, when ranch values were more stable but during which political uncertainty was present due to the threat of rangeland reform and substantially higher lease fees. One of the attributes evaluated is the effect that the availability of grazing leases has on ranch values. Specifically, the effect of the availability of BLM, Forest Service, State of Wyoming and private leases on ranch sales prices will be evaluated for both the earlier years and for the later years. It is hypothesized that by observing the earlier years, with relative political certainty but rapidly increasing ranch values, and later years, with more stable ranch values but more political uncertainty, the intrinsic value of public grazing leases may be more accurately assessed. Also, by observing these two subperiods, we may determine the change in the value of ranch attributes that may have resulted from the changing market. We also will investigate the homogeneity of public lands with respect to quality and productivity and assess the propriety of the current federal practice of setting a single grazing fee.

Description and Previous Work

In Wyoming, as well as many western states, ranches are likely to consist of deeded property and accompanying grazing leases or permits on federal or state land. When ranches are sold, it is common practice for public grazing leases to be transferred along with the deeded property. A public grazing lease or permit may have value since it is commonly accepted that grazing leases or permits rent for a lower price than comparable private leases or rent for less than their face market value. It has been theorized that part of the difference between the fees charged and the value of the forage at the allowable limit is capitalized into the value of the base property (Hooper, 1967). This premium has become known as the "permit value".

Fees for grazing livestock on public lands were first assessed in 1906 by the United States Forest Service. The BLM assessed its first fees for forage use in 1936. Grazing fees were implemented to provide these agencies with an income base to cover the administrative cost of public land management (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/USDI, 1986).

Permits that authorize the use of federal or state lands for ranching were first issued free-of-charge for the purposes of developing and settling the vast areas of the western states' public lands, since at that time there were no competing uses for these lands (Nielsen, 1972). Each permit specifies an appropriate number of livestock allowed to graze on the public land as measured in Animal Units (AUs). Animal Units may be further broken down into Animal Unit Months (AUMs), which define the amount of forage needed to sustain a one-thousand-pound cow with calf, a horse, or five sheep for one month's time (U.S. GOA, 1992).

The current public debate regarding land use reforms and higher grazing lease rates may be categorized into a few different points of view. Proponents for increased grazing fees and restrictive grazing permits argue that federal and state agencies are not collecting full market values for public forage land, and public lands should have increased availability for multiple use. The debate regarding the level of fees that should be charged

by federal and state agencies for livestock grazing on public lands and how they should be implemented is largely fueled by three conflicting viewpoints.

One view holds that federal and state agencies are not collecting full market value for livestock grazing on public lands as directed by the Federal Land and Policy Management Act of 1976 (Martin and Jefferies, 1966; Torell and Fowler, 1986; Collins and Constantino, 1990; Sunderman and Spahr, 1994). These studies conclude that a premium for control of the grazing permit, permit value, is capitalized into the sale price of ranches. This permit value on public lands administered by federal and state agencies is a direct result of grazing lease rates on public lands being set below rates found in the private marketplace, or less than their fair market value. Nielsen (1972) concludes, "As long as ranchers are willing to pay each other for grazing permits, the government is not getting full market value in fees." Those holding this first viewpoint urge that the Federal Land and Policy Management Act of 1976 be strenuously implemented so the government will receive the full market value of its grazing land leases.

A second view holds that federal and state agencies should not recognize capitalized permit values since ranch sales accompanied by grazing permits are private transactions in their entirety. Currently, these agencies do not place a stated value on these capitalized permit values. Torell and Doll (1991) estimate that 85% to 90% of ranches with grazing rights to public lands have transferred ownership since the original permits were issued. Those holding this view urge federal and state agencies to refuse to recognize that permittees who have purchased ranches with grazing permits have paid a capitalized premium for those forage rights, thereby effectively ignoring the existence of permit values.

A third view assumes that public grazing lands are a public resource and should be managed from a societal perspective. Its proponents hold that an appropriate resolution for the grazing fee issue is to implement a competitive bidding system. Nielsen (1972) claims that the competitive bidding process elevates public bids to the marginal value product of the forage used in livestock production. The competitive bidding processes would most efficiently achieve the goal of collecting full market value for the government.

Opponents argue that any increase in grazing fees will severely affect the ranching industry by reducing the level of operating income, forcing ranchers and their families out of business and decreasing the value of ranch lands. Lambert (1987) in an analysis of northeastern Nevada ranches concludes that a public lands grazing fee increase from the 1985 Bureau of Land Management federal lease rate of $1.35 per AUM to the average 1985 private land lease rate of $8.40 per AUM would reduce mean net ranch revenues from $7.72 per AUM to $3.99 per AUM. Additionally, he estimates that ranch values would fall from $134.25 per AUM to $92.08 per AUM. Torell, Garrett and Ching (1981) also found similar results.

A similar argument for not raising lease rates is that ranch owners pay capitalized premiums on these leasehold interests in the form of property and inheritance taxes assessed on the capital values of the base property (Hooper, 1967). Thus, ranchers who currently control public grazing permits will be paying for these leasehold interests twice if grazing fees are increased.

Another argument often raised for eliminating the current grazing practices has been that the current system results in ranchers being subsidized by the government. This 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).

It has been established that the rates of private forage leases are greater than the rates of public forage leases (USDA/USDI, 1993; Obermiller and Lambert, 1984). This observed discrepancy in lease rates may be attributed to factors such as the lessees' higher costs of upkeep of public rangelands, the differences in quality of the rangelands, the cost of lost or killed livestock on public rangelands, and the uncertainty of the outcome of the grazing fees debate.

Grazing fees may take two different forms, a single-fee form in which one fee is assessed for all lands administered by a federal or state agency regardless of land quality or productivity or a variable-fee form where assessed fees vary for each permit or geographical region. The BLM and the Forest Service currently use the single-fee form of assessment based on the fee calculation formula outlined by the Public Range Improvement Act (PRIA) of 1978 (Sunderman and Spahr, 1994). The State of Wyoming also relies on a single-fee form of assessment.
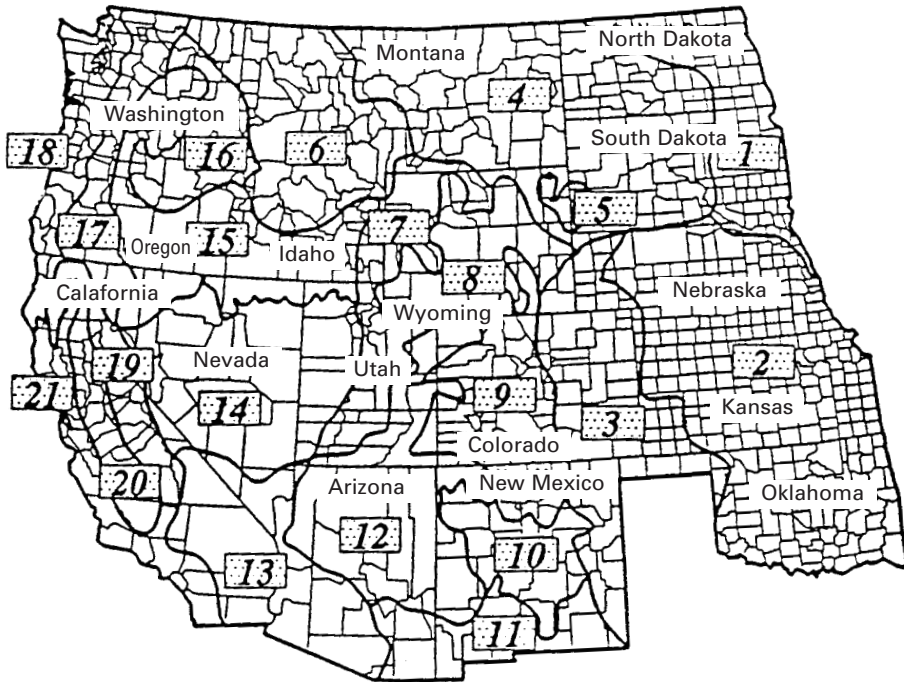
The single-fee form grazing fee has been widely criticized by those who believe that it is an inequitable way to assess grazing fees. The opponents of the single-fee form argue that not all land is equal in productivity or regional value and should not be assessed as though it were equal (McCarl and Brokken, 1985). By using the single-fee form grazing fee assessment, the resulting forage value estimates will be broad averages that may impute excessive amounts of variation into the estimated value of the grazing permit (Nielsen, 1972).

Regardless of the criticism of a single-fee form of grazing fee, it remains the method used by the federal government and most states. However, the quality and productivity of public lands administered by federal and state agencies are not uniform throughout the country, nor are these public lands completely uniform in any one western state. The State of Wyoming is a prime example of this nonuniformity due to its many ecological regions. Conversely, assessing a single uniform rate for use of these public lands for grazing may result either in overcharging or in undercharging of the users.

In offering an amicable solution to the grazing fees debate, Nielsen (1972) suggests that permittees be stratified into grazing fee market areas having more homogeneous total operating costs. What Nielsen suggests can also be applied to grazing fee market areas having more homogeneous quality and productivity characteristics. Previous studies by Nielsen (1972), Collins (1983), McCarl and Brokken (1985), Sunderman and Spahr (1994), Spahr, Sunderman and Jones (1994), and others have observed the existence of heterogeneity in grazing leases and have stressed the inapplicability of using the single-fee form of grazing fees. However, a USDA/USDI (1993) study, which includes the State of Wyoming as one of its three test states, recommended that fees for forage on

Exhibit 1
Map of Ecoregions

Source: USDA/USDI, 1993

Bureau of Land Management lands be applied west-wide as derived by the single-fee form grazing fee assessment. The USDA/USDI study stated:

> Differences among ranching areas, as shown by the data, were not large enough in relation to the wide variation that existed within areas to provide a basis for recommending differential base fees among ranching areas.[2]

According to this USDA/USDI study, the forage within the State of Wyoming is regionalized into clustered intrastate allotments based on seven ecoregions representing a composite set of ecological boundaries identified by differences in soil, vegetation, landform, climate, and use.[3] Wyoming also covers three pricing areas established on the basis of political boundaries, economic regions, ecological regions, or some combination thereof with the state.[4]

Data and Hedonic Models

Permits for livestock grazing on federal and state lands, with few exceptions, may only be transferred through the sale of land, water or livestock. As a result, a permit value

Exhibit 2
Map of Pricing Areas
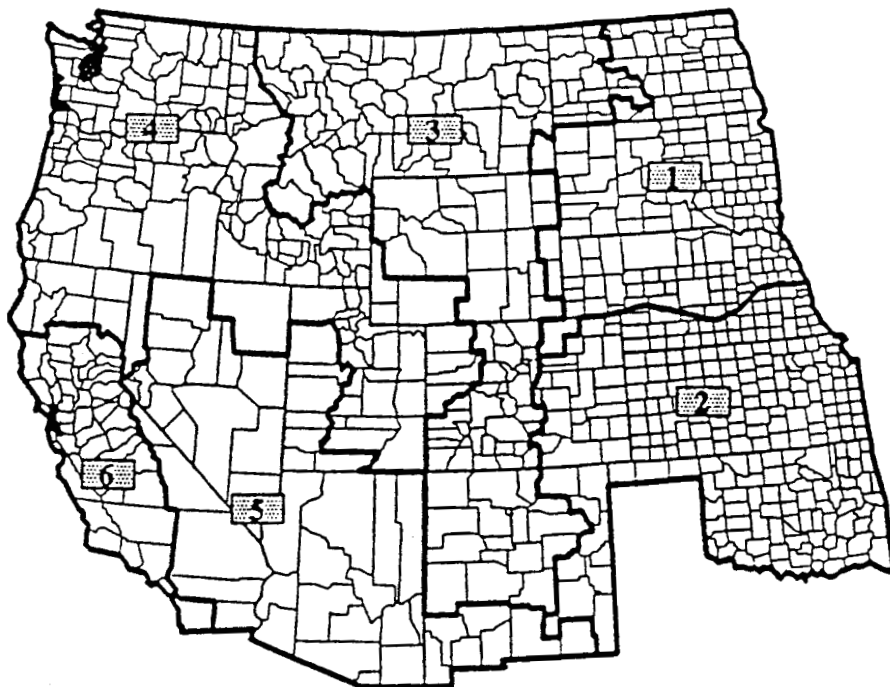
Source: USDA/USDI, 1993

reflecting the cost advantage of leasing lands for grazing from federal and state agencies is imputed into the sale prices of the ranch when sold. Consequently, the sale price is specified as the dependent variable in all models.

The data consists of two sets. One set contains 128 ranch sales from five counties in the State of Wyoming for January 1979 to December 1983. The second set consists of 130 ranch sales from the same five counties in Wyoming between January 1989 and June 1993.[5] Further, the data used in this study come from either Ecoregion 8 or 9. Even though the State of Wyoming covers three pricing areas, the data from this study all fall in pricing area 3.[6]

For the purposes of this study, ranches with less than 100 deeded acres are omitted from the data set, because in all practical circumstances ranches with less than 100 deeded acres are not purchased for livestock production, but as hobby ranches. Also, ranches with grazing permits for forage lands in other states are eliminated from the data set. Non-arm's-length sales, as well as any sales that are viewed as stress, were also deleted. Other deletions are made because of incomplete data for individual ranch sales.

The forage (in AUMs) to be valued within the State of Wyoming is divided into two groups, deeded forage and leased forage. The broad category of deeded forage comprises lands that are strictly purchased and owned by the rancher.

Exhlblt 3
Description of Variables

Variable	Description
PRICE	Sale Price
DAUM	Deeded AUMs
BLM3AM	Section 3 BLM Grazing Lease AUMs
BLM15AM	Section 15 BLM Grazing Lease AUMs
STATEAM	State Lease AUMs
USFSAM	Forest Service Grazing Permit AUMs
PRRAM	Private Lease AUMs
REAL	$ of Real Property Included in Sale
UG	Dummy Variable for Ranches with Little or No Scenic and/or Recreational Value
OK	Dummy Variable for Ranches with Average Scenic and/or Recreational Value
GOOD	Dummy Variable for Ranches with High Scenic and/or Recreational Value
DUG	UG * Deeded Acres
DOK	OK * Deeded Acres
DGOOD	GOOD * Deeded Acres
IRRAM	AUMs on Irrigated Land
B79, B80, B81, B82, B83, and B84	Weighted time variable for the beginning of the year listed. These variables are for the data from 1979–1983. B79 is excluded from the regressions as the base period.
B89, B90, B91, B92, B93, and B94	Weighted time variable for the beginning of the year listed. These variables are for the data from 1989–1993. B89 is excluded from the regressions as the base period.

In many 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. To examine whether these real property improvements are valued by potential buyers differently between ecoregions, two additional variables are created. These variables *REAL*8 and *REAL*9 are created by multiplying *REAL* by either a zero or one dummy variable for each ecoregion. As a result, *REAL*8 represents real property on ranches in Ecoregion 8 and *REAL*9 represents real property on ranches in Ecoregion 9.

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.[7]

Hedonic models were selected to estimate the effect that various attributes had on the market price of a particular ranch. A linear functional form model is chosen because it is easier to interpret the coefficients for the explanatory variables.

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.[8] 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 1990, then $B90$ is 0.25, $B91$ is 0.75 and all other $B(y)$ variables are zero. Since the sale was closer to the beginning of 1991 than to the beginning of 1990, $B91$ is larger and given more weight than $B90$. 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.[9]

Public grazing leases consist of Section 3 (Taylor Grazing Act) BLM land ($BLM3AM$), Section 15 (Taylor Grazing Act) BLM land ($BLM15AM$), State of Wyoming leases ($STATEAM$), U.S. Forest Service leases ($USFSAM$), and private leases ($PRRAM$). Each of these variables reflect the number of animal unit months of grazing allowed or available. Section 3 BLM leases generally consist of larger acreages or tracts of land that may represent an interest in a grazing association or at least represent a larger scale. Section 15 BLM leases generally consist of those tracts that are interspersed among a ranch's deeded acres. Many times these Section 15 tracts were lands that were not homesteaded or purchased from the federal government. These tracts usually have the least desirable terrain and usually contain little water. Thus, it is hypothesized that these two types of BLM leases will represent leases with different levels of intrinsic desirability.

To test the relative homogeneity or heterogeneity of government grazing leases between Ecoregion 8 and Ecoregion 9, each of the above government leasing variables ($BLM3AM$, $BLM15AM$, $STATEAM$, and $USFSAM$) are multiplied by either a zero or one dummy variable for each ecoregion. These variables are $BLM3AM8$, $BLM15AM8$, $STATEAM8$, and $USFSAM8$ for ranches located in Ecoregion 8 and $BLM3AM9$, $BLM15AM9$, $STATEAM9$, and $USFSAM9$ for ranches located in Ecoregion 9. Thus, the coefficient for each of these variables in the hedonic model will represent the value of these respective government grazing leases per AUM for their respective ecoregions.

In addition to variables that reflect the productive value of ranches sold, three dummy variables were used to address the difference in scenic or recreation value for all ranches in the data set. These scenic dummy variables were subsequently multiplied by the number of deeded acres for each ranch sold. Variables DUG, DOK and $DGOOD$ represent ranches with very little, average and substantial scenic and/or recreational value, respectively. These variables were assigned with the aid of professional appraisers who work for Farm Credit Services. The purpose of these variables is to determine the value placed on ranches with high levels of scenic and/or recreational value as compared to ranches with little, if any, such value. It should be noted that ranches in Ecoregion 9 tend to have higher scenic and/or recreational value because, as defined, these ranches are located in the mountains of southern Wyoming.

The final variable in both Models 1 and 2 represents the AUM of production for ranches in Ecoregion 8 or 9 associated with irrigated hay or pasture. These variables $IRRAM8$ and $IRRAM9$ represent the adjustment to the value for $DAUM8$ and $DAUM9$, respectively, that irrigated hay or grazing has on the base value per $DAUM$.

Empirical Results

Referring to Exhibit 4, it is apparent that both Models 1 and 2 applied to both the 1979–83 and the 1989–93 data represent good fits with adjusted R^2 values in the high .9s. Model 1 and 2 are both linear models where it is assumed that each ranch attribute (see Exhibit 3) contributes in a linear manner to the ranch sales price. The difference between Model 1 and 2 is the treatment of deeded animal unit months (*DAUM*). Model 1 uses *DAUM* across the entire sample, thus representing the average value for all ranches sold in each of the two time periods. Alternatively, Model 2 multiplies a zero-one dummy variable for each of the two ecoregions by *DAUM* to create *DAUM*8 and *DAUM*9. These variables estimate the contribution that a *DAUM* has to ranch values in each of the two ecoregions. Further, to allow for the comparison of the coefficients between models, the models have been estimated where the intercept is forced through the origin. This makes it possible to observe the actual change in value of these different ranch attributes across these two time periods.

Model 1 suggests that the average contribution to the value of a ranch for *DAUM* during the 1979–83 time period was $112.19 and $260.85 during 1989–93. Using Model 2 it is observed that the value of a *DAUM*8 was $232.27 during the 1979–83 time period and $242.61 during the 1989–93 period. Perhaps not a surprise is the value for *DAUM*9 during 1979–83. The value was not statistically significant or approximately zero. Conversely, in 1989–93 the value of *DAUM*9 was estimated at $186.86.

This may be explained by the nature of the market for ranch land during the 1979–83 time period. As previously explained above, Rowan and Workman (1992), as well as anyone associated with ranch and farm land prices, realized that during the 1979–83 time period expectation of continued land appreciation provided incentives for land investment and speculation. Apparently, for ranches in the mountains of southern Wyoming the speculation on ranches in this region was at a level that ranches sold mainly on the basis of their scenic and/or recreation value and not on the basis of their productivity.

Exhibit 4
Dependent Variable = *PRICE*

Variable	Model 1 1979–1983	Model 1 1989–1993	Model 2 1979–1983	Model 2 1989–1993
DAUM	112.194	260.846	—	—
	(3.022)	(8.189)	—	—
*DAUM*8	—	—	232.271	242.608
	—	—	(6.137)	(7.348)
*DAUM*9	—	—	−27.005	186.856
	—	—	(−.682)	(3.668)
*BLM*3*AM*8	27.979	58.860	64.202	59.672
	(1.769)	(1.732)	(4.290)	(1.775)
*BLM*3*AM*9	214.246	−65.404	220.360	22.510
	(2.706)	(−.431)	(3.212)	(.143)
*BLM*15*AM*8	−15.853	15.017	−10.135	3.000
	(−.453)	(.808)	(−.334)	(.154)

BLM15AM9	−92.938	−40.359	42.928	107.841
	(−.479)	(.642)	(.253)	(1.063)
STATEAM8	74.098	35.945	−70.562	30.175
	(1.238)	(.862)	(−1.234)	(.730)
STATEAM9	−248.393	59.005	−12.779	163.235
	(−1.727)	(.547)	(−0.098)	(1.353)
USFSAM	—	181.160	—	169.425
		(2.003)		(1.890)
USFSAM8	148.057	—	135.071	—
	(2.941)		(3.093)	
USFSAM9	311.440	—	239.445	—
	(2.040)		(1.803)	
PRRAM	−88.087	175.484	−93.034	291.401
	(−1.661)	(.362)	(−2.025)	(.603)
REAL8	3.054	2.965	2.736	2.923
	(5.272)	(5.951)	(5.423)	(5.924)
REAL9	4.469	4.248	5.340	4.130
	(8.571)	(3.830)	(11.253)	(3.759)
DUG	42.408	−32.414	10.895	−25.889
	(3.279)	(−3.554)	(.881)	(−2.673)
DOK	76.792	−13.052	84.165	.443
	(3.869)	(−1.197)	(4.882)	(.034)
DGOOD	91.732	12.611	69.099	18.305
	(3.549)	(1.276)	(3.043)	(1.787)
IRRAM8	−26.167	−232.047	−164.311	−213.479
	(−.523)	(−5.259)	(−3.348)	(−4.767)
IRRAM49	−21.328	−178.176	113.068	−94.320
	(−.562)	(−5.525)	(2.846)	(−1.701)
B80	81576	—	98452	—
	(1.105)		(1.537)	
B81	75478	—	81044	—
	(1.064)		(1.318)	
B82	98486	—	154110	—
	(1.412)		(2.521)	
B83	35871	—	25646	—
	(.490)		(.404)	
B84	30238	—	−16821	—
	(.273)		(−.175)	
B90	—	−7197.427	—	−17973
		(−.130)		(−.326)
B91	—	60648	—	65234
		(1.594)		(1.730)
B92	—	131928	—	125764
		(3.080)		(2.960)
B93	—	171964	—	168757
		(3.248)		(3.221)
B94	—	55301	—	34030
		(.222)		(.138)
Adjusted R^2	.9753	.9693	.9815	.9700
No. of observations	128	130	128	130

A second attribute of sale price is the value of real improvements on the ranch. Farm Credit Services appraisers have estimated the contribution that real improvements have on the value of each ranch; thus our measure of the effect that these real improvements have on ranch prices is relative. A coefficient of one for real improvements, *REAL*, suggests that the appraiser is correct in his estimate of value added. For the 1979–83 time period, looking at Model 1 and 2 in Exhibit 4, the relative value of *REAL*8 was approximately 2.90 for Ecoregion 8, which contains less scenic ranches, whereas for Ecoregion 9, which contains more scenic ranches, the relative value of real improvements was approximately 4.90.[10] This suggests that real improvements during the 1979–83 time period on ranches with little or no scenic value represented approximately one-half the relative contribution toward sale price as compared to Ecoregion 9 or the more scenic ranches. During the 1989–93 time period, the relative value of *REAL*8 was approximately 2.94 whereas the relative value of real property in Ecoregion 9 was approximately 4.19. Again, for 1989–93, the relative value placed on the value of real property was substantially higher for ranches in Ecoregion 9 than for those in Ecoregion 8.

Another attribute that displays an interesting contribution to ranch values is the value of AUMs contributed by irrigated hay or grazing, *IRRAM*. This variable also represents the relative availability of water on the ranch. *IRRAM*8 and *IRRAM*9 represent irrigated AUMs in Ecoregions 8 and 9, respectively.

During both the 1979–83 and 1989–93 time periods, ranches in Ecoregion 8 demonstrated that sale price is reduced by the availability of irrigation. This appears to be contradictory as there is a saying in Wyoming that "water is everything." However, as explained by a Farm Credit Services appraiser, this is an obvious result because putting up hay and irrigating is "damned hard work and expensive." It is much less work and less expensive to generate AUMs on a ranch by having more acres of grazing land than to generate these same AUMs by irrigation. On the other hand, it appears that ranches in Ecoregion 9 placed a positive value on irrigated AUMs during the 1979–83 period, but during 1989–93, the value added to *DAUM* because of irrigation was negative. This suggests that during the 1979–83 time period, ranch purchasers paid a premium for irrigated AUMs; whereas, by 1989–93, they valued irrigated AUMs more similarly with ranches in Ecoregion 8. This, again, suggests that ranches sold during the 1989–93 period placed more value on productivity than during the previous subperiod.

The primary objective of this study is to investigate the value of grazing leases that accompany the sale of a ranch and determine their relative homogeneity or heterogeneity. As expected, the value of private leases, *PRRAM*, that accompanied the sale of a ranch have negative, if any, effect on ranch sale prices. In both models in Exhibit 4, the coefficient for *PRRAM* is not statistically significant or is statistically significant and negative. During the 1979–83 time period, the availability of private leases reduced the value of a ranch significantly; whereas during the 1989–93 time period the effect on ranch values was statistically insignificant from zero. This observation is to be expected if we assume that most private leases are priced at or near their intrinsic value. Also, many private leases result from a third party owning a ranch or parcel in the same vicinity of the selling ranch. This person usually does not actively engage in ranching, thus desires to gain some return through leasing. The existence of these parcels, if grazing is priced at market, will, at best, add no value to the selling ranch or, more likely, will reduce the sale price of the selling ranch due to the inconvenience of the private lease.

BLM Section 3 (*BLM*3*AM*) and BLM Section 15 (*BLM*15*AM*) leases appear to affect

ranch sales prices differently. During the 1979–83 period, Section 3 grazing leases for Ecoregion 8 ($BLM3AM8$), using Model 2, were worth approximately $64 per AUM; whereas, Section 3 grazing leases for Ecoregion 9 ($BLM15AM9$), again using Model 2, were valued at approximately $220. During the 1989–93 period the value of these leases for Ecoregion 8 was approximately $59 per AUM; whereas, the value of Section 3 leases in Ecoregion 9 was not statistically significant from zero. The permit value for Section 15 BLM leases was not statistically significant from zero for both subperiods and for both ecoregions.

Using a real discount rate of 3.32%,[11] would suggest that the annual permit value of Section 3 leases for the 1979–83 period in Ecoregion 8 was $2.12 and for Ecoregion 9 was $7.30; whereas, the most recent time period reflected a permit value for Ecoregion 8 of $1.96 and zero for Ecoregion 9.[12] As is obvious, Section 15 leases had a zero permit value for both subperiods.

U.S. Forest Service leases ($USFSAM$) appear to add significantly more to the sale price of a ranch than other federal leases. During the 1979–83 time period, Ecoregion 8 ranches accompanied by U.S. Forest Service leases increased in price by approximately $142 per AUM. Alternatively, ranches in Ecoregion 9 increased in sale price by approximately $275 per AUM of Forest Service lease.

Because of a lack of data, $USFSAM$ were not broken down by ecoregion for the 1989–93 period. However, the value of these leases for both ecoregions was approximately $180 per AUM which represents an annual permit value of approximately $5.98.

The fourth type of public lease is State of Wyoming land. To a considerable extent, land owned by the State of Wyoming in the five counties included in this study represent the two school sections in each township deeded to the state to support public education. For both the 1979–83 and 1989–93 time periods, the contribution to sale price of State AUMs is statistically insignificant for both models in Ecoregion 8; however, for Model 1 and Ecoregion 9, the value was negative and statistically significant for the 1979–83 time period. This result is not found in Model 2 for Ecoregion 9. Thus, the availability of State of Wyoming grazing leases with the sale of deeded ranches at best has no impact on the sale price and at worst, has a negative effect on the price. Thus, current lease rates on State lands are either at the appropriate level or slightly high.

The existence of very high adjusted R^2 terms in all the hedonic models reported has caused concern for the authors. High adjusted R^2 may result from high levels of multicollinearity or from the fact that data is accurately reported and the market for ranch prices is quite efficient. To test which alternative is correct, we have included a variance inflation factor test, VIF, for each attribute in each model. A variance inflation factor (VIF) exceeding 10 is often considered as an indication that multicollinearity may be influencing the least squares estimates.[13] For both models, VIF values in excess of 10 were found for only $DAUM8$, $DAUM9$, $IRRAM8$, $IRRAM9$ and DUG. All other VIF values were less than 10. Also, if $IRRAM$ variables were deleted from the model, VIF values were less than 10 for all attributes. Thus, it is our conclusion that multicollinearity is not the cause of high adjusted R^2 values.

Conclusions

This study has analyzed ranch sales data from five counties in Wyoming for two separate subperiods, 1979–83 and 1989–93. These two subperiods were chosen because the market

for ranches and the political climate for federal grazing leases was different during each subperiod. The 1979–83 subperiod was rather calm politically with regard to grazing leases; however, ranch prices were increasing and high during this time. Alternatively, during the 1989–93 subperiod, ranch values were more stable; however, there existed a great amount of uncertainty regarding the future cost and availability of federal grazing leases.

The general trend from the earlier subperiod to the latter subperiod is that deeded animal unit months (the measure of a ranch's productivity) had more effect on the sale price of ranches in latter years. Thus, subsequent to the market correction in the mid-1980s, it is observed that ranches in the 1990s sell for prices effectively based on productivity. Adding to this perception are ranches containing recreation and/or scenic value. Based on Model 2, these ranches during the 1989–93 time period sold for approximately $44 per acre more than nonscenic ranches, whereas during the 1979–83 time period the difference in price per acre was $58. This may have resulted from investors from outside Wyoming buying Wyoming scenic ranches with little consideration for productivity during the 1979–83 period. This practice continues; however, indications are that scenic ranches do not command the premium today as they did during the 1979–83 period.

Using both the 128 ranch sales for the 1979–83 period and the 130 ranch sales for the 1989–93 period, it is observed that the value of public grazing leases varied across type of leases and across ecological regions and type of terrain. BLM Section 3 leases consistently had higher annual permit values ($1.96) than Section 15 BLM leases which appeared to have little, if any, permit value. Forest Service leases, however, appear to have higher annualized permit values of $5.98 per AUM. Further, both BLM and Forest Service permit values fell from the 1979–83 period to the later 1989–93 period. State of Wyoming grazing leases had no estimated annual permit value.[14] All lease permit values varied considerably across the two ecological regions as well as for different ranch terrain as measured by recreational and/or scenic qualities. Thus, this study, as was the case for Sunderman and Spahr (1994), recommends that public grazing fees vary according to the type of lease, the ecological region and terrain. The current single fee charged by the BLM, Forest Service and State of Wyoming per AUM appears to be very unfair to BLM Section 15 leaseholders and perhaps a bargain for current Section 3 BLM and Forest Service leaseholders. Thus, the results of this study suggest that the previous USDA/USDI (1993) study recommending a single grazing fee is in error. We recommend that public policymakers adopt a variable-fee policy.

The current controversy regarding the use of federal public lands has involved individuals and special interest groups from across the country; whereas, 99.1% of the total federally owned BLM land in the forty-eight contiguous states is found in eleven western states. Further, in these eleven states the percent of federally owned land ranges from 29% to 86% (in Wyoming more than 60% 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. The federal government may reduce the political impact of its landownership in western states by turning over the administration or outright deed federal properties to the states in which the lands are located. Thus, by deeding federal lands with little scenic or recreational value, where the highest and best use is likely limited to grazing, to the states in which the land is located or, at a minimum, allowing the individual states to administer these lands, will cause little loss of potential use of these lands and simultaneously place economic control of these lands back into the hands of the individual states.

If BLM lands that were determined to have little scenic and/or recreational value were either sold or deeded to the states and those lands that did possess recreation and/or scenic values were turned over to the Forest Service, the BLM could be eliminated.

Notes

[1]The PRIA fee formula is: $FEE = \$1.23[(FVI + BCPI - PPI)/100]$.

[2]USDA/USDI 1993: 85.

[3]See Exhibit 1.

[4]See Exhibit 2.

[5]Ranch sales are from Albany, Carbon, Converse, Johnson, and Natrona Counties in Wyoming.

[6]A description of the variables used in this paper is provided in Exhibit 3.

[7]For example see Sunderman and Spahr (1994), Collins (1983), Winter and Whittaker (1981), and Martin and Jefferies (1966).

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

[9]Alternative 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, the authors determined that additional methods of controlling for the date of sale are unwarranted.

[10]These values are the average of the coefficients for both Model 1 and 2.

[11]This capitalization rate is 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.

[12]To determine the forage value of a lease, add the permit value to the expected lease rate.

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

[14]Annualized permit values were determined by using a real discount rate of 3.22% to capitalize these values paid for BLM, Forest Service and State of Wyoming grazing leases.

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