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TO: Idaho State Board of Land Commissioners
Grazing Rate Review Subcommittee

CC: Tom Schultz, Idaho Department of Lands
Diane French, Idaho Department of Lands

FROM: Dennis Becker, Policy Analysis Group, University of Idaho

RE: Grazing Rate Review Analysis

DATE: January 20, 2017

I. INTRODUCTION

The Policy Analysis Group (PAG) at the University of Idaho submits these comments in response to the Idaho State Board of Land Commissioners (Land Board) review of the rate charged for livestock grazing on nearly 1.8 million acres of state endowment rangelands and timberlands. The Grazing Rate Review Subcommittee (Subcommittee), appointed by the Land Board, requested on May 25, 2016 that the PAG evaluate five grazing rate alternatives across five evaluation criteria described below. Peer review of this analysis was provided by Dr Neil Rimbey, Extension Range Economist at the University of Idaho, and Dr John Tanaka, Associate Director of the Agriculture Experimental Station at the University of Wyoming. Additional review and comments were received from members of the Subcommittee.

II. EVALUATION CRITERIA

Criteria A: Formula is consistent with fiduciary responsibility under Article 9, Section 8 of the Constitution of the State of Idaho. This criterion addresses the mandate to maximize long term financial return to trust beneficiaries through revenues generated from state endowment trust lands as specified in the state constitution. Exert of Article 9, Section 8 is included below with emphasis added for the fiduciary responsibility.

SECTION 8. LOCATION AND DISPOSITION OF PUBLIC LANDS. It shall be the duty of the state board of land commissioners to provide for the location, protection, sale or rental of all the lands heretofore, or which may hereafter be granted to or acquired by the state by or from the general government, under such regulations as may be prescribed by law, and in such

manner as will secure the maximum long term financial return to the institution to which granted or to the state if not specifically granted; provided, that no state lands shall be sold for less than the appraised price. [Constitution of the State of Idaho, July 3, 1890]

Criteria B: Formula is defensible process driven by market data. This criterion reflects on the process used to determine a defensible grazing rate and is focused on the degree to which each alternative uses published and established market data for prices, costs, and revenues associated with livestock grazing in Idaho.

Criteria C: Formula optimizes management of resources that supports long-term sustainability. This criterion addresses the degree to which a grazing rate could affect how lessees utilize the resource base, how investments are made to ensure long term sustainability of the resource including capital improvements, and helps to incentivize protection of the resource base for future generations to ensure long term financial returns to state endowment trust beneficiaries.

Criteria D: Transparent formula that is practical and efficient to administer. This criterion is concerned with the transparency of formulas and data used to calculate grazing rates, how those data are derived and collected over time, the degree to which administrators and lessees understand how the formula functions, and the practicality and efficiency of administrators employing the formula over time.

Criteria E: Formula is fair, predictable and certain for both parties. This criterion is concerned with the predictability of the grazing rate over time in order to reduce the risk of investment by the lessee and by the Land Board. This criterion also focuses on the degree to which an alternative is a fair rendering of grazing rates relative to market rates and return on investment to state endowment trust beneficiaries.

III. GRAZING RATE ALTERNATIVES FOR IDAHO ENDOWMENT LANDS

The alternatives proposed by the Subcommittee are briefly described below. Where appropriate, specific language is taken from supporting documents provided by the Subcommittee and Idaho Department of Lands (IDL). These documents provide the basis for comparison of alternatives.

Alternative #1: Status Quo – The current formula for determining grazing rates on endowment lands was enacted by the Land Board in 1993. The formula uses a contributory value approach that focuses on the lands’ value in the production of livestock, which is based on indices to approximate the value of forage applied on an Animal Unit Month (AUM) basis. Indices include

(a) private lease rates or forage value appraised at the state level and across the 11 western states, (b) price received for beef cattle, and (c) price of inputs to produce beef cattle. It builds upon data developed and used in the Public Rangeland Improvement Act (PRIA) federal grazing fee formula, which uses annual PRIA indices published by the USDA-National Agricultural Statistics Service (NASS), and an index of Idaho private grazing lease rates to predict the lease rate index two years into the future. Predicting two years is necessary because the NASS data are not available until late January, and IDL requires a minimum of six month notification to lessees of changes in rates. The equation currently used by IDL to set grazing rates is as follows:

$$\text{IDFVI}_{t+2} = -26.44 + (0.54678 \text{ FVI}_t) + (0.34163 \text{ BCPI}_t) - (0.25416 \text{ PPI}_t) + (0.73536 \text{ IDFVI}_t) \quad (\text{Equation 1})$$

Where:

- IDFVI_{t+2} = Idaho Private Lease Index at time t + 2 (or, 2 years in the future)
- FVI_t = 11 Western State Private Lease Rate Index at time t (or, present)
- BCPI_t = US Cattle Price Index at time t
- PPI_t = Prices Paid Index (cattle inputs) at time t
- IDFVI_t = Idaho Private Lease Index at time t

Alternative #2: Wyoming Model – This alternative adopts a modified grazing fee formula developed and currently used in Wyoming for state grazing rates. The “Wyoming Model” has three components: (a) five-year average of private lease rates, (b) multiplied by the five-year weighted average parity ratio for beef cattle per hundredweight (CWT), (c) multiplied by an adjustment factor to reflect costs of harvesting forage from isolated state parcels.

The private grazing rate is annually estimated and published by NASS for each state, and is used to establish an average rate per AUM. The Beef Cattle Parity Ratio (BCPR) measures the purchasing power of products sold in terms of production inputs used, compared with purchasing power in the base period. The adjustment factor reflects additional contributions made by the lessee for costs associated with management of scattered sections, which has ranged from 80% to 100% in Wyoming. The Subcommittee recommended the following equation with a 100% adjustment factor:

$$\$/\text{AUM} = (5\text{-yr average private grazing fee}) \times (5\text{-yr average BCPR}) \times (100\% \text{ adjustment factor}) \quad (\text{Equation 2})$$

Alternative #3: Calf Crop Share – This alternative uses a calculation based on dollars produced per cow as the basis for establishing a corresponding grazing rate. The \$/AUM rate is derived using the USDA’s published weekly nationwide average price per head of a 550 lb steer calf as the primary variable, then factors in adjustments for other variables occurring in the beef production system, such as death loss and heifer devaluation. The formula is anchored by a Calf Crop Index value, which is derived from an average of five calf crop cost models, or budgets, developed by the University of Idaho. The formula adopts the provision authorized by the Land Board in 1993 to reduce the AUM rate for sheep by 25% if the previous annual average lamb price is less than or equal to 70% of the price for calves under 500 lbs during the same period. The following equation is recommended:

$$\$/\text{AUM} = \frac{(((A \times B) + (A \times B \times C)D) / 2) \times E}{12} \quad (\text{Equation 3})$$

Where:

A = USDA 550 lb Annual Steer Average (\$/head)	\$1,200.00 (example)
B = UI Weaning Percentage Average	87.00%
C = UI Heifer Weight Average Percentage	90.45%
D = Average Heifer Discount	92.50%
E = Calf Crop Index (based on UI Average Pasture Costs)	

$$\text{Calf Crop Index} = \frac{(\$1,200 \times 0.87) + [(\$1,200 \times 0.87 \times 0.9045) \times 0.925]}{2} = \$978.74$$

$$\text{Calf Crop Share} = 13\%$$

$$\$/\text{AUM} = \frac{\$978.74 \times 0.13}{12 \text{ months}} = \$10.43 \text{ (example)}$$

The USDA 550 lb Annual Steer Average is updated annually. All other variables remain static unless during review the determination is made that the formula inputs no longer reflect market conditions. The proposed review process is that IDL would undertake an annual look-back using rolling five-year averages of: (a) AUM rate—for initial review, the rolling average is retroactively calculated as though the formula was in effect; (b) 550 lb annual steer average—rolling average of the USDA 550 lb Annual Steer Average; and (c) IDL grazing program costs—rolling average of the costs allocated to the IDL grazing program. If the calculated difference between the rolling five-year averages of the AUM Rate and the 550 lb Annual Steer Average is greater than or less than 10% of the prior year’s calculated difference, the Land Board would authorize an independent review of the rate methodology.

Alternative #4: Market Rate – This alternative seeks to emulate a market-based approach where grazing rates are negotiated between the state and lessee. IDL would engage in negotiations with the existing lessee, and anyone else expressing interest, through the public auction process required by the Idaho Constitution. The bid rate for a given allotment would constitute the market value of the property, with no base grazing fee. Interested parties would bid the amount they were willing to pay per AUM. Due to dynamic market conditions, the assumption is that leases would be short-term, no more than five years. While there would be no minimum bid requirement, IDL could establish internally a target grazing rate, after taking into account land expectation value, a target return on asset, and administrative costs. If no bid meets or exceeds the target rate, IDL could determine whether the interests of the endowment are better fulfilled by not offering the lease, or accepting a bid below a target rate of return on the principle that “something is better than nothing.” In making such determinations, IDL would take into account costs incurred in not offering a lease, including potential cost of fencing the property to exclude neighboring livestock.

Because past and future market rates for public leases are unknown, no attempt was made to estimate a market rate. However, the Land Board is subject to the Prudent Investor Rule (Idaho Code § 68-501), which stipulates that the trustee “shall invest and manage trust assets as a prudent investor would, by considering the purposes, terms, distribution requirements and other circumstances of the trust.” Under this standard, the Land Board must select an option that is likely to “secure the maximum long term financial return” to endowment beneficiaries. The market rate alternative includes a provision whereby IDL may consider land expectation value and a target return on assets in deciding whether or not to accept a bid. Therefore, a target return on asset is used in this analysis as one possible benchmark from which to compare grazing rate options. The calculated rate necessary to meet this benchmark is not a proxy for a market rate, but merely a point of comparison. In reality, multiple benchmarks could be used based on regional differences in forage quality, access to parcels, and other attributes.

$$\$/\text{AUM} = \text{future market rate} \qquad \qquad \qquad (\text{Equation 4})$$

Alternative #5: Revised Status Quo – This alternative revises the current Status Quo formula to correct statistical concerns. The first is that key indices (PPI and FVI) are highly correlated and may artificially inflate statistical predictability. The recommendation is to remove PPI (Prices Paid Index). A related concern is that the 11 western state private lease rate index (FVI) and Idaho-specific lease rate (IDFVI) are highly correlated, also potentially inflating predictive ability. The recommendation is to remove the west-wide FVI and index Idaho forage values solely on previous years (IDFVI). The following equation is recommended:

$$\text{IDFVI}_{t+2} = 13.85 + (0.9967 \text{ IDFVI}_t) \quad (\text{Equation 5})$$

Where:

IDFVI_{t+2} = Idaho Private Lease Index at time $t + 2$ (or, 2 years in the future)

IDFVI_t = Idaho Private Lease Index at time t

IV. FINDINGS

The following analysis evaluates each alternative across the five criteria defined by the Subcommittee. The findings are organized by criterion to facilitate side-by-side comparison.

Criteria A: Formula is consistent with fiduciary responsibility under Article 9, Section 8 of the Constitution of the State of Idaho

Grazing rates were estimated for each alternative using the formulas provided by the Subcommittee. Where possible, historic rates were calculated for 2011-2016 (Table 1) reflecting years IDL had complete data. Historic market rates for public leases are unknown. Rate calculations are provided in Appendix A for each alternative.

Table 1. Historic grazing rates as calculated by alternative (2011-2016).

	Alternative #1 Status quo	Alternative #2 WY model	Alternative #3 Calf crop share	Alternative #4 Market rate	Alternative #5 Revised status quo
2011	\$5.13	\$5.44	\$6.97	NA	\$5.35
2012	\$5.25	\$5.68	\$7.97	NA	\$5.47
2013	\$6.36	\$6.01	\$8.00	NA	\$6.57
2014	\$6.89	\$7.24	\$11.62	NA	\$7.10
2015	\$6.77	\$7.36	\$12.02	NA	\$6.98
2016	\$8.09	\$7.27 ¹	\$9.19	NA	\$8.30

¹ Based on forecasted private lease rate, and beef cattle parity ratio for 2016.

An income capitalization approach, land expectation value (LEV), was used to compare financial performance across each alternative (Table 2). LEV is the attainable net income, based on fair market value, divided by the discount rate (Becker and Cook 2016). Return on Assets (ROA), which is net program income divided by LEV, was compared for each alternative against a benchmark rate of return recommended in the Land Board asset allocation plan (“Callan Report”)(Becker-Wold et al. 2014, p.22). The 10-year bond equivalent yield for funding costs provided by the Farm Credit System Bank was used in Callan Report to estimate a nominal discount rate of 3.5% (1.25% real discount rate). This yields a target grazing rate of \$12.15/AUM with an LEV of \$53.4 million, or \$30/acre (\$53.4 million value/~1.8 million grazing acres)

(Equation 6). This target rate is the assumed minimum grazing fee averaged across all leases that would be necessary to meet performance metrics recommended in the Callan Report. In reality, financial performance will vary greatly by region and quality of lease. The Land Board could adopt a different benchmark return on assets, but is used here to compare alternatives.

$$\$/\text{AUM} = \text{Administrative costs } (\$/\text{AUM}) + ((\text{LEV}@3.5\% / \text{Authorized AUMs}) \times \text{Target ROA}@3.5\%) \quad (\text{Equation 6})$$

The sensitivity analysis in Table 2 illustrates financial performance for each alternative (Table 1), for two time periods (FY 2016, FY 2011-2016), and five discount rates (2%-6%). Management costs were based on those incurred by IDL for endowment lands in 2016 and held constant, which results in no change in LEV attributable to changes in program costs. Thus, the ROA reflects net income from grazing leases only (forage value) independent of land appreciation (bare land value), because forage is what ranchers lease from the state. Higher grazing fees produce higher LEVs and ROAs, and higher discount rates produce lower LEVs and higher ROAs.

The highest ROA was derived using the Calf Crop Share approach (Alternative #3), which is a function of dollars produced per cow. Assuming \$9.19/AUM (2016 grazing rate), the ROA fails to meet the benchmark rate of 3.5% for all but the highest discount rate analyzed. However, the ROA exceeds the benchmark for 2014 and 2015 grazing rates of \$11.62 and \$12.02, respectively, for the higher discount rates analyzed. High livestock prices in those years contributed to higher grazing fees.

The Revised Status Quo (Alternative #5) yielded the next highest grazing rate, and tracked similarly to the Status Quo (Alternative #1) and Wyoming Model (Alternative #2). In most years analyzed, the Revised Status Quo and Wyoming Model rates were higher than the Status Quo rate. But none of these three met the benchmark rate of return for any of the years analyzed.

No grazing rate was calculated for Alternative 4 because past and future market rates for public leases are unknown. If a market based approach were adopted revenue would likely decrease on many leases because of the absence of competition, but increase for others in high demand. Administrative costs would likely increase from the need to examine each parcel to determine a minimum acceptable bid, which would decrease program revenue. The Prudent Investor Rule (Idaho Code § 68-502) discussed earlier would require the Land Board to consider uncertain ROA for the market rate alternative against known ROAs for the other alternatives.

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Table 2. Sensitivity analysis of different grazing rates, return on grazing fee only (nominal)

	Benchmark ROA (3.5%) ¹	Alternative #1 Status quo	Alternative #2 WY model	Alternative #3 Calf crop share	Alternative #4 Market rate ²	Alternative #5 Rev status quo
Net Income Calculation: 2016 Actual Values (\$/AUM)						
(a) Grazing rate	\$12.15	\$8.09	\$7.27	\$9.19	NA	\$8.30
(b) IDL cash expenditures (\$/AUM)	\$4.59	\$4.59	\$4.59	\$4.59	NA	\$4.59
(c) Net income from grazing (\$/AUM)	\$7.56	\$3.50	\$2.69	\$4.61	NA	\$3.71
Net Income Calculation: 2011-2016 Actual Values (\$/AUM)						
(d) Grazing fee	\$12.15	\$6.42	\$6.50	\$9.30	NA	\$6.63
(e) IDL cash expenditures (\$/AUM)	\$4.92	\$4.92	\$4.92	\$4.92	NA	\$4.92
(f) Net income from grazing (\$/AUM)	\$7.23	\$1.50	\$1.58	\$4.38	NA	\$1.71
Land Expectation Value (LEV) Calculation: 2011-2016 Net Income Average Values (\$/Acre; 1.8 million acres)						
(g) LEV @ 2% discount interest rate	\$52.76	\$10.92	\$11.55	\$31.94	NA	\$12.49
(h) LEV @ 3% discount interest rate	\$35.17	\$7.28	\$7.70	\$21.29	NA	\$8.32
(i) LEV @ 4% discount interest rate	\$26.38	\$5.46	\$5.77	\$15.97	NA	\$6.24
(j) LEV @ 5% discount interest rate	\$21.10	\$4.37	\$4.62	\$12.77	NA	\$4.99
(k) LEV @ 6% discount interest rate	\$17.59	\$3.64	\$3.85	\$10.65	NA	\$4.16
Return on Assets (ROA) Calculation: 2016 Grazing Net Income / Fair Market Value (LEV)						
(l) ROA with LEV @ 2% interest rate	2.0%	0.9%	0.7%	1.2%	NA	1.0%
(m) ROA with LEV @ 3% interest rate	3.0%	1.4%	1.1%	1.8%	NA	1.5%
(n) ROA with LEV @ 4% interest rate	4.0%	1.9%	1.4%	2.4%	NA	2.0%
(o) ROA with LEV @ 5% interest rate	5.0%	2.3%	1.8%	3.1%	NA	2.5%
(p) ROA with LEV @ 6% interest rate	6.0%	2.8%	2.1%	3.7%	NA	3.0%

¹ Assumed minimum grazing rate required to meet the recommended 3.5% nominal ROA (Becker-Wold et al. 2014).

² Past and future market rates are unknown, as are likely increases in administrative costs.

Criteria B: Formula is defensible process driven by market data

Alternative #1: Status Quo and Alternative #5: Revised Status Quo

The Status Quo employs a range of indices based on cattle prices and private grazing lease rates. Users have become familiar with its functionality and degree of responsiveness to market conditions. A key attribute is the use of a base adjustment factor of \$1.70/AUM, which works out to about \$5.00/AUM for the price of forage in 1993. The \$1.70 adjustment has been included in the rate formula every year since adoption, and is retained in the Revised Status Quo Alternative #5. Reanalysis of this adjustment factor is warranted given the more than 20 years that have passed since adoption. This would include revisiting the manner in which the factor was established since the original rate was based on one Land Board member's bottom line price they were willing to pay for forage at that time (Rimbey 2015).

Another concern with the Status Quo formula is the high degree of multicollinearity that exists among indices. Multicollinearity is when two or more variables used to predict a dependent variable, in this case the grazing rate, are highly correlated. This results in artificially inflated statistical predictability. Rimbey (2015) recommended removal of highly correlated indices (PPI, FVI), which was done in the Revised Status Quo formula. For that reason, the Revised Status Quo is more defensible than the Status Quo alternative. Both alternatives are driven by market data but are less responsive to changes in livestock prices than other alternatives.

Alternative #2: Wyoming Model

Similar to the Status Quo and Revised Status Quo formulas, the Wyoming Model incorporates private grazing lease rates in the calculation. The Wyoming Model also incorporates an index of expected dollars produced per cow (Beef Cattle Parity Ratio). The BCPR is a measure of total inputs compared against total revenue to determine breakeven projections. The BCPR is readily available from the NASS on a monthly basis by state. The Wyoming model (with 100% base adjustment) tracks closely with the Status Quo and Revised Status Quo formulas, but is based more closely on market rates for livestock without the need for a base adjustment factor.

Alternative #3: Calf Crop Share

The Calf Crop Share alternative is indexed closely to the dollar produced per cow. The average price of a 550 lb steer calf, which is readily available from the NASS database by region on a weekly basis, is the only input that changes from year to year. Other inputs like weaning percentage, heifer weights, pasture cost, and crop share change only if thresholds are triggered during an annual review. Pasture cost and crop share index may change frequently with changes in livestock markets, which may require more frequent analysis of inputs. Those inputs, which are derived from the University of Idaho, are not readily available on an annual basis.

Alternative #4: Market Rate

Because leases are likely to be shorter duration, less than five years, they should reflect lessees' perception of short term livestock futures. They should also reflect differences in forage quality and lease attributes. However, a concern is that grazers could work together to submit below market bids even if the quality of forage, access to water, and other attributes are similar for adjacent lands for which higher lease rates are paid. A similar concern exists for landlocked parcels surrounded by a single private landowner.

To control for low bids, the Subcommittee recommends consideration of a hurdle rate in deciding whether or not to accept bids. The rate could take into account (a) LEV, (b) regional target ROA, and (c) IDL grazing program administrative costs. These controls seem appropriate so long as the process used to establish target ROAs is fair for both parties. The Callan Report recommends a benchmark rate equal to the nominal discount rate of 3.5%. This may be unrealistic in regions with low quality forage or poor access; whereas, areas with high quality forage could realize higher ROAs. Selection of regional discount rates is somewhat subjective and prone to manipulation.

Another concern is that IDL may be compelled to accept a low bid if it is determined that the cost of not offering a lease is greater than accepting the bid. Additional consideration should be given to situations where bidders may have a clear advantage in the negotiation process as a result of actions IDL could be compelled to implement.

Criteria C: Formula optimizes management of resource that supports long-term sustainability

Alternative #1: Status Quo; Alternative #5: Revised Status Quo; Alternative 3: Wyoming Model

Motivations for resource utilization and sustainability are likely similar for the Status Quo, Revised Status Quo, and Wyoming model because grazing rates track similarly and are less likely to generate wide price swings that affect lessees' management practices. Too high grazing rates could create perverse incentives to over-utilize the resource base, and too low rates, especially if coupled with short-term leases, could lead to an under-investment in range improvements.

Alternative #3: Calf-Crop Share

Compared against the estimated 2016 private lease rate of \$17.34/AUM, the 2016 Calf-Crop Share rate of \$9.19 is 47% lower, which is below the 30% adjustment factor estimated in previous studies where the value of services, access to water, and related features are lower than for private lands (Bartlett et al., 2002; Gustanski et al., 2012). There is of course great

variability in features that affects estimation of an adjustment factor. The concern, however, is these estimates are dated, and it is unknown whether or not the 30% factor remains an appropriate benchmark, nor is it known at what rate increased resource damage could result.

Alternative #4: Market Rate

Implementing short term leases for the Market Rate alternative increases the ability to make changes more frequently compared to the current practice of 20 year leases. Problem lessees could be removed from a parcel earlier to address resource damage concerns, or lessees could choose not to re-bid a parcel damaged by wildfire. However, lessees with short-term contracts may also have less incentive to engage in sustainable grazing practices or range improvements than those under long-term leases who are trying to maximize return over that period of time. Another consideration with short-term leases is that it could erode ranch asset value appraisals, which may include permit or lease hold values associated with public grazing. It should be noted that current program practices allow for lease terms of up to 20 years; 20 years has become the standard because it reduces administrative burden and allows the practice of premium bonus bids, which has generated additional income for trust beneficiaries.

Criteria D: Transparent formula that is practical and efficient to administer

Alternative #1: Status Quo and Alternative #5: Revised Status Quo

There is a high degree of familiarity among IDL staff about how the current formula operates, and it would also be true of the revised formula. The revised formula is a simplified version of the Status Quo formula that removes statistically unnecessary indices for cattle prices, prices paid, and west-wide private grazing lease rates. Both formulas are easy to update from year to year. Subcommittee members expressed concern that dramatic changes could be disruptive leading to unforeseen expenses associated with revising untested models. But as discussed, the \$1.70/AUM base adjustment factor is in need of revision if either alternative is chosen.

Alternative #2: Wyoming Model

The Subcommittee acknowledges that parity prices may not provide an accurate basis for agricultural price and income controls because of the variability of net farm income with changing commodity prices and quantities produced compared to the base periods. However, parity prices attempt to address concerns about the level of services offered on public leases, which some producers assume to be about 30% of the private grazing fee. Because the 30% discount basis may be unrealistic the parity ratio provides a way to factor in differences in services. Thus, the parity ratio may generate a more realistic rate than trying to estimate the variability associated with private rates.

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The use of an adjustment factor allows administrators to adjust the grazing rate over time according to external factors. As indicated by the Subcommittee, an 80% adjustment factor could be used on an upward adjusted basis to account for blocked parcels, Tier 1 quality parcels, and regional market lease rate variances. The indices used in the Wyoming Model, with a base of 100% adjustment factor, mirrors closely the historical grazing rates generated by the Status Quo formula, but uses a simpler method. Whether the Status Quo rate is an appropriate benchmark is another matter.

Alternative #3: Calf-Crop Share

Fewer people are likely acquainted with the calf crop index developed by the University of Idaho, or with inputs used in the Calf Crop Share formula. If this formula is adopted, greater understanding of how the indices are generated, and annual reporting of changes would be necessary to improve transparency. The Subcommittee states that transparency would be enhanced by making publicly available an overview of the actions taken by the Land Board over time, all AUM rate and review calculations annually, and links to the underlying data sources used to calculate the AUM Rate and review triggers. This is good practice regardless of the alternative selected. The review process proposed in conjunction with this alternative includes:

- IDL will annually undertake a backward- looking review of key grazing program metrics for the prior year, and report to the Land Board. In the event that the policy review triggers are not engaged over the course of five consecutive years, IDL will nevertheless undertake a review of the rate methodology to ensure it remains consistent with market conditions and the Land Board's fiduciary obligation. As part of this review the department will calculate three rolling five-year averages: (a) AUM rate, (b) 550 lb Annual Steer Average, and (c) IDL grazing program costs.
- If the calculated difference between the rolling five-year average of the AUM Rate and the rolling five-year average of the 550 lb Annual Steer Average is greater than or less than 10% of the prior year's calculated difference, the Land Board will authorize an independent review of the grazing rate methodology to ensure its application remains consistent with the board's fiduciary obligation.
- If the calculated difference between the rolling five-year average of the AUM Rate and the rolling five-year average of the costs allocated to IDL's grazing program is greater than or less than 10% of the prior year's calculated difference, the Land Board will commission an independent expert review of the costs allocated to IDL's grazing program to ensure such costs are accurately allocated.

Alternative #4: Market Rate

The Market Rate alternative is transparent in so far as competitive bids are received for expiring leases. Short term contracts may ultimately increase the number of grazers willing to bid on certain parcels, while it may reduce the number of bidders on others. Continuing the public auction process as a proxy for negotiated price setting is warranted; the process is transparent and has been used for a number of years. To address concerns about unacceptably low bids, the Subcommittee recommends setting an internal target rate of return in deciding whether or not to accept bids. This seems appropriate and would increase transparency in so far as the process used to establish targets is transparent and reflects regional differences in forage quality. A diverse committee, such as this Subcommittee, would be necessary to ensure discount rates are fair and equitable.

In terms of efficiency, short term leases will likely increase administrative costs. The frequency of auctions, the process of evaluating bids against regional ROA targets, and corresponding administrative costs are likely to vary by region. Subcommittee members have expressed concern that IDL might have to reprioritize staff to accommodate increase workloads, which could jeopardize other program functions. How much this increases costs or affects staff priorities is unknown.

Criteria E: Formula is fair, predictable and certain for both parties

Alternative #1: Status Quo and Alternative #5: Revised Status Quo

The Status Quo alternative adopts a base AUM rate with the opportunity if a market exists for a conflict auction to capture any value not reflected in the base AUM rate (premium bid). This approach ensure a minimum return on all rangeland leases, but allows for a public auction to capture any upside value through a premium bid. The Revised Status Quo is similar.

In terms of price volatility, past performance suggest the Status Quo and Revised Status Quo rates will experience greater stability than the other alternatives (Table 2). But the gap between the Status Quo rate and the private lease rate is widening over time (Rimbey 2015). This is likely also true of the Revised Status Quo. Based on the rates presented in Table 2, the Status Quo and Revised Status Quo rates are expected to be substantially lower than for other alternatives when livestock prices are high (e.g., 2014-2015), and closer when livestock prices are low (e.g., 2016). However, only six years of data were analyzed, and future trends may experience greater variability than observed here.

Alternative #2: Wyoming Model

The Wyoming Model is also likely to be relatively stable based on the data analyzed for Table 2, and tracks closely with the Status Quo and Revised Status Quo. How this performs over time relative to private lease rates is unknown, but the public land adjustment factor would allow for the tweaking of rates to correct for observed discrepancies.

Alternative #3: Calf-Crop Share

The Calf-Crop Share formula provides a fair approach to setting grazing rates, as it removes potentially arbitrary adjustment factors used in other formulas. An external check on the accuracy of this approach was provided by the Subcommittee whereby the value derived tracks closely with the University of Idaho Calf Crop Index. However, price swings are likely greater for this alternative because rates are more closely indexed to the price paid for livestock, which was observed in 2014-2015 when livestock prices peaked (Table 2).

Alternative #4: Market Rate

The Market Rate is a fair approach to setting grazing rates in so far as competitive bids are secured, administrative costs are understood, and target ROAs are established in a transparent manner. However, the lack of a base rate creates a high degree of uncertainty for both parties, as well as the opportunity for price manipulation. Market volatility is greater for this alternative and likely lead to greater price swings when bid prices reflect the real price paid for livestock. However, when averaged across all leases, financial performance should be somewhat predictable if a benchmark ROA is used as the standard to evaluate whether or not to accept bid rates.

V. CONCLUSION

A summary of key findings for each alternative across the five evaluation criteria is provided in Table 3. These findings reflect observations made based on data analyzed for 2011-2016. Future rates and trends may vary depending on how underlying indices and livestock rates change relative to each other.

Grazing Rate Review Analysis

Table 3. Summary of key findings by proposed alternative

	Consistent with fiduciary responsibility	Defensible process driven by market data	Supports long term sustainability	Transparent and practical to administer	Fair and predictable for both parties
Alternative #1: Status Quo	- Failed to meet benchmark rate of return for years analyzed	+ Recognized process for deriving grazing rates - Base adjustment factor is dated - Multicollinearity - 2-year rate lag is slow to respond to markets	+ Less likely to generate wide price swings that affect lessees' management practices	+ Widely understood and accepted process + Market data are readily available - Base adjustment factor lacks transparency	+ Predictable process with slow rate of change - 2-year lag rate does not reflect real time markets - Difference from private lease rate is widening over time
Alternative #2: Wyoming Model	- Failed to meet benchmark rate of return for years analyzed	+ Formula is driven by market data + Rate tracks closely with the Status Quo	+ Less likely to generate wide price swings that affect lessees' management practices	+ Market data are readily available + Effective implementation in neighboring state + Straightforward formula	+ Predictable process with slow rate of change + Does not require base adjustment factors
Alternative #3: Calf-Crop Share	+ Meets benchmark rate of return for some years and discount rates - Rate corresponds to livestock prices, which fluctuate greatly	+ Highly responsive to market data + Inputs track closely with livestock markets	- Wide price swings could alter lessees' management practices	+ Livestock market data are readily available - Underlying indices lack transparency, and may require more frequent measurement than currently available	+ Rate corresponds closely to livestock price + Does not require base adjustment factors - Potential for wide price swings
Alternative #4: Market Rate	+ Accepted bids required to meet benchmark rate - Unknown administrative costs - Difficult to set regional LEV/ROA benchmarks	+ Highly responsive to market data - Lessees could work together to set prices - Difficult to set regional LEV/ROA benchmarks	+ Greater ability to remove problem lessees - Wide price swings could alter lessees' practices - Could erode ranch asset value appraisals	+ Reflects perception of short term livestock futures - Short term leases likely to increase administrative costs	+ Rate corresponds closely to livestock price + Somewhat predictable financial performance if using LEV/ROA targets - Potential for wide price swings locally
Alternative #5: Revise Status Quo	- Failed to meet benchmark rate of return for years analyzed	+ Corrects statistical issue with the Status Quo - Base adjustment factor is dated - 2-year rate lag is slow to respond to markets	+ Less likely to generate wide price swings that affect lessees' management practices	+ Inputs and calculations are similar to Status Quo + Market data are readily available - Base adjustment factor lacks transparency	+ Predictable process with slow rate of change - 2-year lag rate does not reflect real time markets - Difference from private lease rate is widening

VI. LITERATURE CITED

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APPENDIX A. Grazing Rate Calculations by Alternative

Grazing Rate Review Analysis

Alternative #1: Status Quo Rate

$$\text{IDFVI}_{t+2} = -26.44 + (0.54678 \text{ FVI}_t) + (0.34163 \text{ BCPI}_t) - (0.25416 \text{ PPI}_t) + (0.73536 \text{ IDFVI}_t) \quad (\text{Equation 1})$$

Where:

IDFVI_{t+2} = Idaho Private Lease Index at time t + 2 (or, 2 years in the future)

FVI_t = 11 Western State Private Lease Rate Index at time t (or, present)

BCPI_t = US Cattle Price Index at time t

PPI_t = Prices Paid Index (cattle inputs) at time t

IDFVI_t = Idaho Private Lease Index at time t

Year	FVI	BCPI	PPI	IDFVI	\$/AUM
2009	433	355	806	413	\$5.99
2010	441	398	866	413	\$5.12
2011	460	509	946	442	\$5.13
2012	490	556	980	457	\$5.25
2013	507	548	994	457	\$6.36
2014	540	646	1015	487	\$6.89
2015	507	548	994	457	\$6.77
2016	540	646	1015	487	\$8.09

Source: Rimbey 2015

Grazing Rate Review Analysis

Alternative #2: Wyoming Model

$$\$/\text{AUM} = (\text{5-yr average private grazing fee}) \times (\text{5-yr average BCPR}) \times (\text{adjustment factor}) \quad (\text{Equation 2})$$

Year	Idaho private grazing rate ¹	Beef Cattle Parity Ratio (BCPR) ¹	\$/AUM (100% based)
2007	\$13.80	--	--
2008	\$12.60	--	--
2009	\$12.60	--	--
2010	\$12.00	--	--
2011	\$14.50	41.50%	\$5.44
2012	\$15.30	42.42%	\$5.68
2013	\$15.50	43.00%	\$6.01
2014	\$16.50	49.08%	\$7.24
2015	\$17.00	46.67%	\$7.36
2016	\$17.34	44.53%	\$7.27

¹Source: USDA-NASS Quick Stats

Grazing Rate Review Analysis

Alternative #3: Calf-Crop Share

$$\$/\text{AUM} = \frac{(((A \times B) + (A \times B \times C)D) / 2) \times E}{12} \quad (\text{Equation 3})$$

Where:

A = USDA 550 lb Annual Steer Average (\$/head)	variable
B = UI Weaning Percentage Average	87.00%
C = UI Heifer Weight Average Percentage	90.45%
D = Average Heifer Discount	92.50%
E = Calf Crop Index (based on UI Average Pasture Costs)	13.0%

Year	550lb steer (\$/cwt)	550lb steer (\$/head)	Weaning percentage	Heifer wt. discount	Calf Crop Index	\$/AUM
2011	\$146.46	\$805.62	\$700.89	\$586.41	\$643.65	\$6.97
2012	\$167.41	\$920.73	\$801.04	\$670.20	\$735.62	\$7.97
2013	\$168.12	\$924.68	\$804.47	\$673.07	\$738.77	\$8.00
2014	\$244.06	\$1,342.32	\$1,167.82	\$977.07	\$1,072.44	\$11.62
2015	\$252.42	\$1,388.31	\$1,207.83	\$1,010.55	\$1,109.19	\$12.02
2016	\$193.13	\$1,062.21	\$924.12	\$773.18	\$848.65	\$9.19

Source: Painter and Rimbey 2015

Grazing Rate Review Analysis

Alternative #4: Market Rate

$\$/\text{AUM}$ = future market rate

(Equation 4)

Alternative #5: Revised Status Quo

$$\text{IDFVI}_{t+2} = 13.85 + (0.9967 \text{ IDFVI}_t) \quad (\text{Equation 5})$$

Where:

IDFVI_{t+2} = Idaho Private Lease Index at time t + 2 (or, 2 years in the future)

IDFVI_t = Idaho Private Lease Index at time t

Year	IDFVI	\$/AUM
2011	301.890	\$5.35
2012	308.970	\$5.47
2013	373.860	\$6.57
2014	405.210	\$7.10
2015	398.290	\$6.98
2016	475.970	\$8.30

Source: Rimbey 2015

Grazing Rate Review Analysis

Benchmark ROA

$$\$/AUM = \text{Administrative costs } (\$/AUM) + ((\text{LEV@3.5\%} / \text{Authorized AUMs}) \times \text{Target ROA@3.5\%}) \quad (\text{Equation 6})$$

$$= \$4.59 + ((\$53,422,907 / 257,950) \times 3.5\%)$$

$$= \$12.15$$