


**MEMORANDUM**

**TO:** Bonnie Hamilton  
Montana Department of Revenue

**FROM:** Jeff Mosley  
Professor of Range Science & Extension Range Management Specialist



**DATE:** May 16, 2022

**SUBJECT:** Agricultural Property Tax Classification

**Department  
of  
Animal  
and  
Range  
Sciences**

Per your request, I estimated the number of Animal Unit Months (AUMs) necessary to generate \$1500 in annual gross income. My calculations used the spreadsheet originally developed by Dr. Myles Watts from the Department of Agricultural Economics and Economics at Montana State University. Dr. Watts prepared the original spreadsheet for the Montana Department of Revenue in July 2009. At your request in 2014, I reviewed the spreadsheet for accuracy, updated it with recent cattle prices, and then used the spreadsheet to estimate the number of AUMs needed to meet the \$1500 revenue threshold. I used the same spreadsheet again in 2020 after updating it with cattle prices from 2013–2019, and I used the same spreadsheet again this year after updating it with cattle prices from 2015–2021.

I obtained cattle price data from the USDA Agricultural Marketing Service. From 2015–2021 in Montana, the Olympic average for calves was \$161.37 per hundred weight and the Olympic average for slaughter cows was \$63.68 per hundred weight (Table 1).

Table 1.

Year	Calf Price (cwt)	Cow Price (cwt)
2021	\$162.82	\$60.01
2020	\$153.08	\$55.73
2019	\$167.27	\$61.95
2018	\$162.46	\$61.97
2017	\$161.23	\$65.32
2016	\$146.33	\$69.15
2015	\$207.90	\$96.71
Olympic Average	\$161.37	\$63.68

**Extension Range Management**  
213 Animal Bioscience Bldg  
PO Box 172900  
Bozeman, MT 59717-2900

Tel (406) 994-5601  
Fax (406) 994-5589  
Email jmosley@montana.edu

The Montana State University Extension Service is an ADA/EO/AA/Veteran's preference employer and educational outreach provider.

Spreadsheet results are shown in Table 2 for 6 alternative management scenarios with 1200-lb cows:

- Alternative 1: raise own replacements and account for calf forage consumption
- Alternative 2: raise own replacements but do not account for calf forage consumption
- Alternative 3: purchase replacements and account for calf forage consumption
- Alternative 4: purchase replacements but do not account for calf forage consumption
- Alternative 5: purchase bred cows (no bulls or replacements) and account for calf forage consumption
- Alternative 6: purchase bred cows (no bulls or replacements) but do not account for calf forage consumption

The Olympic average from the 6 alternatives in Table 2 is 25.43 AUMs. Alternatives 3 and 4 are most typical of small beef cattle operations, and the average for Alternatives 3 and 4 is 25.12 AUMs.

Recommendation: In the 2023 reappraisal cycle, the Montana Department of Revenue (MDR) should consider using 25 AUMs as the minimum number of AUMs necessary to generate \$1500 of annual gross income.

### **Livestock Grazing Capacity Calculations**

When estimating a parcel of land's livestock grazing capacity, MDR uses data and procedures consistent with the USDA Natural Resources Conservation Service (USDA-NRCS) and Montana State University Extension Range Management. A formula compares livestock forage supply with livestock forage demand:

$$\text{Number of AUMs/acre} = x \div ab$$

Where,

$x$  = amount of palatable forage produced per acre annually (lbs/acre);

$a$  = factor to adjust for the proportion of forage allocated to livestock

$b$  = amount of forage needed per month per Animal Unit (lbs/AUM)

### Amount of Palatable Forage

MDR uses USDA-NRCS soil survey data to estimate the amount of palatable forage produced per acre. However, soil surveys do not directly provide such an estimate. Instead, soil surveys provide the amount of total annual production of aboveground plant biomass, regardless of its palatability. Because some of the biomass is unpalatable, using total plant production values from soil surveys would cause MDR to overestimate livestock grazing capacity. Another complexity is that the total plant productivity values provided in soil surveys are for parcels in climax ecological condition (i.e., pristine or near-pristine condition). Privately owned Montana rangelands, however, are rarely in climax condition, and plant production on Montana privately owned rangelands is usually less than climax. One reason is that the ecological condition which is most economically and ecologically sustainable for ranching is 40-60% similar to climax, not 100% similar to climax.<sup>1</sup> Therefore, using plant productivity values from climax would cause MDR to calculate grazing capacities that are above a ranch's long-term economic optimum and possibly encourage landowners to stock their land above its ecological grazing capacity. MDR assessments of livestock grazing capacity appropriately account for these complexities by using soil survey total plant productivity values from Unfavorable Years.

### Proportion of Forage Allocated to Livestock

Montana state laws and regulations require Montana landowners to provide forage for wildlife. Thus, Montana landowners cannot stock their land with the maximum number of livestock that the land could support without wildlife. MDR assessments of livestock grazing capacity appropriately account for this fact by using the number '4' for the forage utilization factor, which allocates 25% of the available forage to livestock, 25% to wildlife, and 50% to sustaining rangeland health.

### Amount of Forage per Animal Unit Month (AUM)

An Animal Unit Month (AUM) is a unit of measure used to quantify forage allowance for grazing animals. In the same way that one ton is a unit of measure comprised of 2,000 pounds, the range management profession (including the Society for Range Management, USDA-NRCS, and MSU Extension Range Management) defines one AUM to be a unit of measure comprised of 790 pounds of oven-dried forage. This amount equals the weight of forage consumed (consumed = ingested + trampled) monthly by a grazing ruminant (e.g., cow) that weighs 1,000 pounds.<sup>2, 3</sup>

One complexity when using soil survey data to estimate livestock grazing capacity is that soil surveys provide plant productivity values based on air-dried weights rather than oven-dried weights. MDR assessments appropriately account for this difference by using 915 pounds of air-dried forage per AUM, rather than 790 pounds of oven-dried forage per AUM.

Another complexity was introduced beginning in the 2015 reappraisal cycle when Montana statute directed MDR to include an additional adjustment for average cow size. Montana statute currently requires MDR assessments to be calculated using 1,200 pounds for average cow size rather than 1,000 pounds. Consequently, MDR assessments of livestock grazing capacity derived from soil survey data are based on 1,098 pounds of air-dried forage per AUM (i.e.,  $1.2 \times 915 \text{ pounds} = 1,098 \text{ pounds}$ ).

### **References**

1. Dunn, B.H., A.J. Smart, R.N. Gates, P.S. Johnson, M.K. Beutler, M.A. Diersen, and L.L. Janssen. 2010. Long-term production and profitability from grazing cattle in the northern mixed grass prairie. *Rangeland Ecology and Management* 63:233-242.
2. Fuller, K.B., M. DelCurto, and J. Mosley. 2021. *Animal Unit Month (AUM) Lease Rates*. Montana State University Extension MontGuide MT202103AG.
3. Society for Range Management. 1998. *A Glossary of Terms Used in Range Management, 4<sup>th</sup> Edition*. Denver, CO, USA: Society for Range Management.

Table 2.

**Calculate Minimum AUMS to Meet Revenue Threshold**

	<b>Alt 1</b>	<b>Alt 2</b>	<b>Alt 3</b>	<b>Alt 4</b>	<b>Alt 5</b>	<b>Alt 6</b>
<b>Herd Composition, Weight, and Prices</b>						
Cows	1	1	1	1	1	1
Bulls (1 bull per 25 cows)	0.04	0.04	0.04	0.04	0	0
Replacement Heifers (18% replacement rate)	0.18	0.18	0.18	0.18	0	0
Calves Weaned (91% weaning percentage)	0.91	0.91	0.91	0.91	0.91	0.91
Cow Weight (1200 lbs)	1200	1200	1200	1200	1200	1200
Calf Weight (45% of cow weight)	540	540	540	540	540	540
Olympic Average Cow Price cwt (2015-2021)	63.68	63.68	63.68	63.68	63.68	63.68
Olympic Average Calf Price cwt (2015-2021)	161.37	161.37	161.37	161.37	161.37	161.37
Calves Sold (calves weaned - replacements)	0.73	0.73	0.91	0.91	0.91	0.91
Cow Death Loss (1%)	0.01	0.01	0.01	0.01	0.01	0.01
Cows Sold (replacements - cows died)	0.17	0.17	0.17	0.17	0.17	0.17
<b>Animal Unit Months (AUMs)</b>						
Animal Unit Equivalent - Cows	1.2	1.2	1.2	1.2	1.2	1.2
Animal Unit Equivalent - Bulls	1.5	1.5	1.5	1.5	0	0
Animal Unit Equivalent - Replacement Heifers	0.85	0.85	0.85	0.85	0	0
Animal Unit Equivalent - Calves	0.3	0	0.3	0	0.3	0
Cow AUM (cow AUE x 1.0)	1.2	1.2	1.2	1.2	1.2	1.2
Bull AUM (bull AUE x 0.04)	0.06	0.06	0.06	0.06	0	0
Replacement Heifer AUM (replacement heifer AUE x 0.18)	0.15	0.15	0.15	0.15	0	0
Calf AUM (calf AUE x 0.91)	0.27	0	0.27	0	0.27	0
Grazing Months	10	10	10	10	10	10
Total AUMs (sum of cow, bull, heifers, and calf AUMs)	16.8	14.1	16.8	14.1	14.7	12
<b>Revenue</b>						
Calf Revenue (calf weight x calf price x calves sold/100)	636.12	636.12	792.97	792.97	792.97	792.97
Cow Revenue (cow weight x cow price x cows sold/100)	129.91	129.91	129.91	129.91	129.91	129.91
Total Revenue per Cow (calf revenue + cow revenue)	766.03	766.03	922.88	922.88	922.88	922.88
Revenue per AUM (total revenue per cow / total AUMs)	45.60	54.33	54.93	65.45	62.78	76.91
Minimum Revenue Threshold	1500	1500	1500	1500	1500	1500
AUMS Needed (minimum revenue/revenue per AUM)	32.90	27.61	27.31	22.92	23.89	19.50

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