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Examining the capacity of Nebraska rangelands for cattle production

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Introduction

According to the 2017 United States Department of Agriculture National Agriculture Statistics Service report (USDA-NASS 2017), Nebraska is ranked number one in the United States for both cattle on feed and for beef slaughtering capacity. Nebraska ranks number two in all cattle and calves while ranking number four in cow/calf production. Beef production contributes $12.1 billion annually to the Nebraska economy (Nebraska Beef Council 2018). The value of beef and veal exports for Nebraska in 2017 was about $1.26 billion (Nebraska Agriculture Fact Card 2017). By way of comparison, the value of field and miscellaneous crops for Nebraska was forecasted to be $9.52 billion in 2017 (USDA-NASS 2018). The value of corn and soybean exports for Nebraska in 2017 was about $2.82 billion (Nebraska Agriculture Fact Card 2017). In 2012, there were 23,280 ranches with cattle in Nebraska and 22,977 farms with corn (USDA-NASS 2014).

With over 2.5 million head of cattle on feed and an annual calf crop of approximately 1.65 million head, we used an annual feedlot inventory turnover rate of 1.93 (Jensen and Mark 2010) to estimate that approximately 66% of the feeder cattle that enter into Nebraska feedlots each year are imported into the state. However, this is not the case nationally as the United States beef cow/calf herd population is estimated to be almost 5 times larger than the population of cattle on feed (Hayek and Garrett 2018). No doubt some of this is due to cattle being raised extensively on grass. However, in a recent study on sustainable beef production, Eshel et al. (2018) estimated that current U.S. grazing land can only support 35% of our present daily beef output indicating the need to better understand the productive capacity of various segments of our beef production systems.

Given the above information, our research question is to determine what the capacity is to increase cow/calf production in Nebraska given current production

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practices and the current capacity of our perennial grazing land systems. The motivation for this research is that necessary research has not been conducted in order to perform a gap analysis of the forage supply and demand from perennial grazing lands on a statewide basis.

Previous research focuses primarily on the individual farm or ranch level. Bastian et al. (2009), Ritten et al. (2010a) and Ritten et al. (2010b) explore different range livestock management strategies given extended drought conditions and different price cycles for profitability and risk management purposes. Adams et al. (1994) analyze extended winter grazing systems for improving economic returns from Nebraska Sandhills cow/calf operations. Others have used forage sampling techniques to estimate carrying capacity in order to compare the impact of different grazing strategies (Grobler 2016) or stocking rates (Holechek and Piper 1992) on grazing land study sites.

No previous research exists which brings together the forage production potential, and the cow-calf demand on a state-wide level in the manner presented here. Epstein et al. (2002) used geographic information system (GIS) mapping of forage potential similar to our methodology to evaluate organic matter decomposition rates in colder versus warmer climates across 10 U.S. Great Plains states. Other studies have expanded the scope beyond the farm level but still are focused on specific aspects related to stocking rates or forage productivity. Zhang et al. (2007) use remote sensing to compare different methods to evaluate grassland productivity. Mu et al. (2013) use econometric methods to estimate potential changes in stocking rates due to climate change. Mysterud et al. (2014) use mapping districts for landscape-level evaluation of current forage production on alpine ranges of Scandinavia.

The objectives of this research are (1) to quantify the potential carrying capacity in Nebraska on a regional basis given current perennial grazing land acres and average production conditions and (2) to estimate the current use of this carrying capacity given cattle inventories and standard production practices in each region of the state. Achieving these objectives will provide a baseline for future research in Nebraska to expand cow/calf production in a sustainable way to help meet the supply needs for the Nebraska cattle feeding and processing sectors.

Methods

We begin with two simplifying assumptions. The first assumption is that cattle production is the sole user of the perennial grazing resources. The 2012 Census of Agriculture (USDA-NASS 2014) shows 23,152 head of bison in the state of Nebraska primarily in Cherry and Hamilton counties. Also, the census shows 71,771 sheep and 25,840 goats in the state. However, our analysis focuses on the capacity of the current grazing resources to produce calves. Our results can be adjusted accordingly under a different assumption that a percentage of those resources are set aside for alternative use. The second simplifying assumption is current cattle production practices continue in regard to demand for perennial grazing resources. The inclusion of changing production practices such as increased utilization of crop land for grazing or increased dry lot feeding of cows are beyond the scope of this analysis and only addressed in the conclusions by way of discussion about future research needs.

Potential supply of perennial forage for grazing

Working with the USDA Natural Resource Conservation Service (NRCS), a GIS mapping system is used to estimate the potential perennial forage production in each county based on the most productive plant community best adapted to each ecological site. First, using ArcMap software, all grassland/pasture lands in Nebraska are extracted from the NASS 2012 Cropland Data Layer (CDL). The 2012 CDL is used to match the most recent NASS Census cattle data used in this research to estimate demand for these perennial forage resources. Next, the National Soil Information System (NASIS) is queried to extract the weighted average production potential (in average years) for each soil map unit in Nebraska. This process is similar to Epstein et al. (2002), but uses the weighted average production potential from NASIS for each map unit, which takes into account the production capacities of all the major and minor components within it. Each component, via this method, is assigned a weight, based on its percent makeup of the whole map unit. These tabular data are joined via ArcMap to a geospatial layer of soil map units using a common identifier – the map unit key (MUKEY). Then, using USDA's Soil Data Viewer, an ecological site is generated for each soil map unit. Lastly, these two data layers (soil map units and grassland/pasture) are analyzed against each other via an ArcMap process called zonal statistics. This process calculates the total acres of grassland/pasture available within each individual soil map unit and ecological site. The net result is county-level data depicting soil map units, soil map unit acres, potential grazing acres within each map unit, and their weighted average production capacity in pounds per acre during an average precipitation year. Conservation Reserve Program (CRP) land is not included in the grassland/ pasture data layer, so it is not included in the estimate of forage available. Grazing land acres and estimated animal unit months (AUMs) of forage supply in each county in Nebraska are shown in the appendix.

We consider 3 different perennial forage harvest efficiencies: 25%, 30% and 40%. Harvest efficiency refers to the percentage of total forage production that is consumed by the grazing animal; harvest efficiency is affected by the grazing practices the producer is using. A 25% harvest efficiency is typical on grazing lands that are continuously stocked throughout a grazing season. Grazing pressure influences harvest efficiency. A comparison of stocking rates across 6 North American Great Plains states result in average harvest efficiencies of 38%, 24%, and 14% and average grazing efficiencies of 61%, 49%, and 39% for heavy, moderate, and light stocking rates, respectively (Smart et al. 2010). We use a moderate stocking rate harvest efficiency of

25% as our baseline assumption. The "take half, leave half" rule of thumb is the same as 50% utilization with a 25% harvest efficiency. When using take half, leave half, 50% of the forage is left, 25% is consumed, and 25% is trampled, laid on, and consumed by insects or other animals (Redfearn and Bidwell 2017). We also look at 30% and 40% harvest efficiencies that could result from improved grazing distribution by such practices as fencing and livestock water development and from increased grazing pressure by such practices as implementation of rotational grazing systems. The improved grazing distribution and increased grazing distribution is commonly associated with rotational grazing systems such as a 4-pasture deferred rotation (30%) and short duration grazing (35 to 40%). This study assumes an AUM is 780 pounds of air-dry weight forage. Figure 1 shows the AUMs supplied annually by perennial forage acres in each region under the assumption of 25% harvest efficiency and average growing conditions. Average growing conditions are defined as a year with an average amount of precipitation.

Some assumptions are made for this research which significantly impact these results. In estimating the pounds of forage available in each region, the most productive plant community was used for each ecological site description. The most productive plant community is used because data of the actual plant community is currently unavailable for public use. Of course, using the most productive plant community would cause the actual forage production to be lower than what we estimate for this analysis. This may impact the results significantly; for example, in Eastern Nebraska, where a majority of pasture acres are predominantly smooth brome grass and Kentucky bluegrass, the actual plant production is less than the most productive plant community for most Eastern Nebraska soil map units. Also, NASS CDL data identifies potential perennial grassland/pasture grazing acres in each county, not the acres actually grazed in each county. Some of the acres could be protected sites (e.g., state wildlife management areas) or privately controlled non-grazed acres. Therefore, we have characterized the perennial forage supply for grazing as a *potential* supply under average growing conditions. Pope and Shumway (1984) found that analyzing forage-beef production under average yield grossly overestimates expected returns.

Cattle inventory demand for perennial forage grazing

We use the 2012 Census of Agriculture (USDA-NASS 2014) to obtain the number of cattle in each county in Nebraska. These numbers include the breakdown for the number of cattle and calves, beef cows, milk cows, cattle on feed, and other cattle. Numbers for all the classes of cattle needed to complete our analysis were not provided, so we make some assumptions. The first assumption is that replacement heifers are equal to 20% of the beef cow numbers with an equal number of replacement heifer calves and replacement heifer yearlings. Only 80% of the yearling heifers are expected to get bred, and then moved into the cow herd, but all 20% graze. This equates to the assumption of a 16% replacement rate. The second assumption is that the number of bulls are equal to 4% of the beef cow numbers representing a 1 to 25 bull to cow ratio. The number of backgrounding calves (stockers) utilizing grazing resources can then be calculated with the following formula.

(1) Stockers = Other Cattle – Bulls – Cattle on Feed – Replacement Heifer Calves – Replacement Heifer Yearlings

To analyze supply and demand, we separate Nebraska into 8 regions to account for different grazing practices throughout the state (Figure 1). Nebraska Extension Educators were interviewed to determine the most common practices in each region in regard to the months each year that cattle are on perennial grass pasture. In consultation with the Extension Educators, an assumption is made for the whole state in regards to the average size of the different types of cattle during the different times they are grazing. The weight for the stockers and replacement heifers is the weight they would be mid-way through the grazing season. Replacement heifers are not separated out into fall and spring herds because replacements for the fall herd commonly come from the spring herd. This information is all summarized in Table 1.

As indicated in Equation 1, data for cattle on feed is necessary to estimate the number of stockers in each county. In some counties, the cattle on feed total is not reported for privacy reasons based on the number of entities reporting. To fill in the missing data, we follow a multi-step process. The first step is to use the midpoint of each farm inventory category less than 500 head for the inventory of the farms in those categories not reporting the number of head (Table 2). For farms in the greater than 500 head category, we attempt to find the size of the feedlot by using various sources including Extension Educators, the Nebraska Cattle Feeders Directory, articles from area newspapers, and local producers. After these 2 steps, 18 feedlots remained with greater than 500 head inventories across Nebraska that were of unknown size. We determine that there are 180,516 cattle located in these 18 feedlots, or an average of 10,029 per feedlot, by taking the total cattle on feed in Nebraska as reported by NASS and subtracting the total cattle on feed we already account for in the data. In a few counties, applying this average to the feedlots of undetermined size results in a negative stocker number. In those counties, the cattle on feed number is reduced to make the stocker number equal to zero with the cattle on feed residual distributed to the other feedlots of unknown size remaining in the statewide pool. This leads to a 'complete' dataset for cattle on feed in each county and, thus, completed estimates for stockers on grass in each county in 2012.

The USDA NASS Census provides the total number of cows and heifers calved in each county as well as a breakdown of that total into beef cows and milk (dairy) cows. Similar to cattle on feed, some milk cow and beef cow totals were not provided for privacy reasons. To fill in the missing data and calculate an accurate estimate of the number of beef cows in each county utilizing the grazing resources, another multi-step process is used similar to the process used for cattle on feed. The first step is to use the midpoint of each farm inventory category less than 500 head (Table 2) to fill in missing inventory values for beef cows and milk cows. Next, for the counties missing data for operations of 500 head or more, the total number of head from farm sizes less than 500 is subtracted from the county total of cows and heifers calved to determine the missing number of cows in the county. Then, the missing number of cows in the county is divided by the number of operations with 500 or more that are not provided to find the average size of the 500 head or more operations in that county. That number is used to fill in the missing data for the number of beef cows and milk cows in those counties. After estimating the beef cow and milk cow numbers for each county, a check sum is performed to compare these numbers to the state totals and the result is an overestimation of 1,218 milk cows using county numbers. A uniform percentage adjustment is applied to the counties that have estimated beef or milk cow data to shift this quantity of the milk cow inventory over to the beef cow inventory and reconcile all of the numbers. Estimated beef cow numbers for each county are shown in the appendix.

Using these practices and the cattle inventory numbers, demand for grazing perennial grass resources is calculated for each county in AUMs and then consolidated into demand totals for each of the 8 regions as shown in Figure 1. A linear adjustment is used when calculating AUMs. When the cattle are not grazing, they are assumed to be fed an alternate feed or grazing cornstalks. Some regions have a significant number of cows that are fall calving. Fall calving cows spend less time grazing perennial forages due to when they calve. Fall cows typically calve between August and October.

Results

Assuming 25% harvest efficiency and average growing conditions, we calculate a total of 21,762,913 AUMs supplied using 2012 grassland/pasture acres in Nebraska. Using the 2012 Nebraska cattle inventory data and the number of months on pasture (Table 1), we calculate a total of 21,780,502 AUMs demanded from perennial grassland/pasture acres. These results indicate that, as a whole, the state of Nebraska was operating at 100% of carrying capacity. The Central, East, Southwest, Northeast, and South Central regions were above their carrying capacity while the Panhandle, Sandhills, and North Central regions were below their carrying capacity (Table 3). Some of these regional differences can be explained by animal movements during the production year. For example, cattle from the Southwest, Central, and Northeast regions commonly are transported into the Panhandle, Sandhills, and North Central regions to graze during the summer but are returned to their home region in the fall/early winter. Although the cattle spend much of the year outside their home region, they are counted as being in their home region for the entire year. These grazing season movements are even more apparent when data analysis occurred at the county level and helped prompt the shift to a regional analysis for the state that coincided with identifying differences in the most common grazing practices. Of course, the latter half of 2012 was also plagued by drought conditions which prompted early movement of the cattle off rangelands into feeding pens or crop residue grazing environments which would have further reduced cattle numbers in counties dominated by perennial grazing lands. Another important consideration of this research is potential forage availability is used instead of actual. Actual forage production would be less than potential, so harvest efficiency for the state would be higher than we found in this research. The 2012 drought impacted where the cattle were and the cattle numbers but did not impact the forage supply because it was estimated using average precipitation.

Harvest efficiency could be sustained at levels higher than 25% if producers adopted management strategies that improve grazing distribution and/or grazing pressure; thereby, increasing carrying capacity. We analyze carrying capacity using 30% harvest efficiency and 40% harvest efficiency as reported in Table 3. We find only the Central, East, and Northeast regions to be over capacity under a 30% harvest efficiency assumption. At 40% harvest efficiency, all regions are operating under capacity. In the far right column of Table 3, we calculate the harvest efficiency for each region and the state under the assumption of 100% capacity. These numbers range from 20% in the North Central region to 37% in the east with a statewide harvest efficiency of 25%. These numbers support a conclusion that the perennial grassland/pasture acres in Nebraska are fully stocked at a harvest efficiency of 25% but not over stocked. This is consistent with the economic theory that resources are put to their best and full economic use under natural market conditions.

Our results indicate Nebraska is operating at full capacity for cow/calf production utilizing perennial grazing land resources if all grazing land were managed extensively (i.e., continuously stocked). Our estimate of the total AUMs demanded by the 2012 Nebraska cattle inventory matches the AUMs supplied under the assumption of 25% harvest efficiency. The Nebraska Farm Real Estate Market Highlights 2017-2018 (Jansen and Stokes 2018) provides average monthly cow/calf pasture rental rates by region. Adjusting these cow/calf pasture rental rates to an AUM rate and matching regions with our analysis, we estimate the AUMs demanded by the 2012 Nebraska cattle inventory to have an economic value of $875 million dollars in 2017. Perennial grazing lands and the cow/calf industry obviously play an important economic role in Nebraska's economy. Any future adjustments to grazing management practices which increase harvest efficiency could have a significant impact on the industry. Nebraska grazing land managers appear to have the potential to increase carrying capacity of perennial forage resources if more management intensive practices (e.g., rotational grazing) that increase harvest efficiency are more commonly implemented across the state.

Summary and conclusions

This research provides the first statewide carrying capacity gap analysis for Nebraska that appears in the literature. The research lays a foundation for many research projects currently in progress (Cox-O'Neill et al., 2017; Drewnoski et al., 2018; Gardine et al., 2018; Warner et al., 2015) or under consideration that are studying the future potential for cattle production in Nebraska. For example, our results indicate that Nebraska cow/calf production is operating at full capacity based on extensive production practices (25% harvest efficiency) including the number of months the animals are grazing perennial pastures and the classification of cattle doing the grazing. Current University of Nebraska studies (Gardine et al., 2018; Warner et al., 2015) are analyzing production systems where cows may spend more time grazing crop residue or more cows are fed in a dry lot setting instead of grazing. These systems could reduce the demand for perennial grazing resources while maintaining an equivalent cow/calf production capacity or, more likely, increase the demand on perennial grazing resources as the cow herd increases in size because of the increasing use of crop residue and annual forages.

The increased interest in the utilization of crop land for growing annual forages as a grazing crop for livestock is driven by a number of factors including the high cost of grazing land, the interest in increasing returns on cropland, and the general view that current perennial forage resources are being fully utilized. Our results suggest, on a statewide basis, perennial forage resources are fully utilized unless harvest efficiency is increased by more widespread use of grazing management strategies that increase harvest efficiency. A move from 25% harvest efficiency to 30% harvest efficiency on a statewide basis represents a potential 20% increase in carrying capacity. Matched with an equivalent increase in cattle demand for that capacity, this could mean a $175 million direct impact on the state in annual use of perennial grasslands.

Much more can be learned from these results. The next stages of this research will include focus group meetings in each region to examine the potential to increase cow/calf production and profit potential. Assessments will be made of grazing strategies as means to increase harvest efficiency on perennial grassland pastures and of changes to current production practices to better utilize cropland acres in conjunction with perennial grassland acres to increase overall carrying capacity. The production potential and production practices vary across the state and imply different feed availability and production risks by region. Future research will examine the susceptibility of each of the 8 regions to drought, the different mitigation strategies that could be employed given available resources, and the impact marketing plans could have on the effectiveness of various strategies. Cow/calf production and perennial grassland pastures play a major role in Nebraska's economy. The potential to increase this role is dependent upon efficient and effective use of available resources. The results in the present paper provide an important foundation for this future analysis.

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Appendix

Estimated Nebraska County-Level Data for Cattle and Perennial Grazing Land (2012)

	Estimated Grazing Demand (AUM's)	Estimated Grazing Supply (AUM's)	Harvest Efficiency (%)	Acres of Grass (Acres)	Estimated Beef Cows That Have Calved (Head)
Central Nebraska					
BOONE	121,771	474,218	25.68%	119,736	16,367
GREELEY	205,398	795,445	25.82%	217,245	22,721
HAMILTON	44,580	135,032	33.01%	30,535	5,992
HOWARD	196,656	679,860	28.93%	170,773	21,754
MERRICK	89,473	359,503	24.89%	73,883	12,026
NANCE	87,157	425,492	20.48%	103,265	11,715
PLATTE	114,788	279,706	41.04%	58,767	15,428
POLK	88,266	192,012	45.97%	39,753	11,864
SHERMAN	209,511	854,145	24.53%	215,371	23,176
VALLEY	225,476	834,073	27.03%	215,051	24,942
YORK	31,999	116,338	27.51%	26,469	4,301
Panhandle					
BANNER	151,808	704,756	21.54%	392,093	13,060
BOX BUTTE	245,784	891,786	27.56%	368,818	18,750
CHEYENNE	145,848	627,858	23.23%	321,904	11,390
DAWES	391,842	1,527,637	25.65%	672,572	27,893
DEUEL	60,732	224,713	27.03%	92,218	4,138
GARDEN	337,715	2,249,790	15.01%	835,979	28,178
KIMBALL	127,021	961,116	13.22%	433,241	9,745
MORRILL	447,091	1,518,154	29.45%	692,041	32,866
SCOTTS BLUFF	177,436	445,329	39.84%	239,939	11,565
SHERIDAN	640,280	3,518,296	18.20%	1,257,572	46,329
SIOUX	440,898	2,438,371	18.08%	1,202,658	31,644
East					
BUTLER	197,341	347,697	56.76%	72,606	12,476
CASS	67,680	205,222	32.98%	46,558	4,096
DOUGLAS	21,587	156,196	13.82%	33,030	1,046
GAGE	227,113	683,267	33.24%	151,166	11,139

JEFFERSON	181,301	524,414	34.57%	120,381	10,762
JOHNSON	118,754	470,155	25.26%	98,871	7,976
LANCASTER	165,060	769,370	21.45%	162,608	10,130
NEMAHA	77,333	175,271	44.12%	37,704	4,618
OTOE	116,988	358,748	32.61%	73,094	8,022
PAWNEE	222,593	598,439	37.20%	125,009	10,546
RICHARDSON	220,570	306,874	71.88%	62,590	9,106
SALINE	164,737	314,357	52.40%	71,203	10,147
SARPY	18,594	123,230	15.09%	25,781	1,145
SAUNDERS	189,184	433,892	43.60%	87,018	9,909
SEWARD	190,446	346,455	54.97%	75,590	9,910
Sandhills					
ARTHUR	271,741	1,384,330	19.63%	87,569	16,446
BLAINE	349,545	1,379,250	25.34%	428,191	20,010
CHERRY	2,397,733	10,766,962	22.27%	3,523,843	135,852
GRANT	284,937	1,381,960	20.62%	459,559	16,239
HOOKER	207,218	1,324,195	15.65%	454,089	12,009
KEITH	311,632	1,215,406	25.64%	431,408	17,382
LINCOLN	1,218,851	3,708,278	32.87%	1,183,410	69,252
LOGAN	250,789	958,126	26.17%	313,516	15,367
MCPHERSON	323,911	1,582,925	20.46%	531,793	18,389
THOMAS	236,567	1,270,651	18.62%	440,703	13,298
Southwest					
CHASE	228,361	724,923	31.50%	278,367	15,565
DUNDY	250,978	976,960	25.69%	369,900	16,106
GOSPER	138,985	488,562	28.45%	134,326	11,150
HARLAN	139,397	567,075	24.58%	134,185	12,063
HAYES	164,903	724,348	22.77%	284,262	15,872
HITCHCOCK	170,199	582,394	29.22%	229,949	13,818
FRONTIER	333,763	1,433,985	23.28%	378,709	25,433
FURNAS	161,759	789,489	20.49%	192,711	14,082
PERKINS	162,569	348,965	46.59%	129,776	11,847
PHELPS	152,178	183,563	82.90%	48,202	8,543
RED WILLOW	221,672	754,012	29.40%	206,098	15,288
South Central					
ADAMS	63,447	206,324	30.75%	49,454	6,901
BUFFALO	372,326	928,106	40.12%	239,252	38,780
CLAY	123,488	272,318	45.35%	63,016	13,630
CUSTER	853,785	4,421,913	19.31%	1,177,691	86,057

DAWSON	373,973	1,063,344	35.17%	282,530	33,959
FILLMORE	45,290	134,159	33.76%	31,244	3,962
FRANKLIN	143,831	713,251	20.17%	178,904	15,794
HALL	102,718	282,652	36.34%	65,171	9,024
KEARNEY	110,555	164,970	67.01%	43,497	7,718
NUCKOLLS	158,016	514,626	30.70%	123,122	15,131
THAYER	89,337	325,803	27.42%	80,904	9,858
WEBSTER	160,632	696,221	23.07%	164,551	16,391
Northeast					
ANTELOPE	209,178	532,344	39.29%	134,652	23,242
BURT	44,622	173,556	25.71%	37,934	4,958
CEDAR	197,037	423,110	46.57%	103,815	21,893
COLFAX	96,939	194,168	49.93%	39,364	10,771
CUMING	109,377	200,658	54.51%	40,331	12,153
DAKOTA	27,949	108,026	25.87%	24,204	3,105
DIXON	92,736	285,094	32.53%	65,229	10,304
DODGE	47,655	145,234	32.81%	29,755	5,295
KNOX	400,527	1,356,853	29.52%	345,584	44,503
MADISON	124,875	304,476	41.01%	63,021	13,875
PIERCE	150,228	369,973	40.61%	78,537	16,692
STANTON	96,795	320,896	30.16%	74,967	10,755
THURSTON	40,072	148,235	27.03%	32,813	4,452
WASHINGTON	48,528	202,221	24.00%	42,805	5,392
WAYNE	64,908	154,408	42.04%	32,687	7,212
North Central					
BOYD	221,087	782,478	28.25%	228,291	21,042
BROWN	283,176	2,122,674	13.34%	646,057	31,464
GARFIELD	191,487	1,143,679	16.74%	315,259	17,337
HOLT	1,006,969	4,177,322	24.11%	1,021,639	87,142
KEYA PAHA	238,725	1,333,036	17.91%	384,061	26,525
LOUP	131,678	1,134,749	11.60%	329,650	13,374
ROCK	353,232	2,146,688	16.45%	540,312	39,248
WHEELER	266,824	954,512	27.95%	259,551	21,289

Table 1: Grazing Practice Assumptions for Each Nebraska Region: Months on Perennial Pasture

Type of Cattle	Average Weight for the period	Animal Units (AU)	Central Nebraska	East		Southwest		Panhandle	Northeast		South Central	North Central		Sandhills
Calving Season			Spring	Spring (75%)	Fall (25%)	Spring (85%)	Fall (15%)	Spring	Spring (80%)	Fall (20%)	Spring	Spring (90%)	Fall (10%)	Spring
Cow Calf Pairs	**1300 lb cow and 300 lb calf**	1.6	4	7	3	5.5	3.25	5.5	5	0	5	5.5	2	5
Non-Lactating Cows	**1300 lb cow**	1.3	0	2	3	0	2.5	1	0	5	0	0	3.5	4.5
Replacement Heifer Yearlings	**900 lb Heifer**	0.9	4	9		5.75		5.5	5		5	5.5		9.5
Bulls	**2000 lb Bull**	2.0	4	5		5		6.5	5		2	3		9.5
Stocker	**700 lb Calf**	0.7	0	8		5		4	0		2	3		4

Table 2: Farm Inventory Midpoints

2012 Farm Inventory	*Midpoint Used*
1 to 9	5*
10 to 19	15*
1 to 19	10**
20 to 49	35
50 to 99	75
100 to 199	150
200 to 499	350

** applies to beef cows and milk cows*

*** applies to cattle on feed*

Table 3: Results Comparing Nebraska Grazing Demand to Supply

Region	***25% Harvest Efficiency***	***30% Harvest Efficiency***	***40% Harvest Efficiency***	***Harvest Efficiency assuming 100% Capacity***
Central	110%	92%	69%	28%
East	150%	125%	93%	37%
Southwest	112%	93%	70%	28%
Panhandle	84%	70%	52%	21%
Northeast	142%	119%	89%	36%
South Central	107%	89%	67%	27%
North Central	78%	65%	49%	20%
Sandhills	94%	78%	59%	23%
Nebraska	100%	83%	63%	25%

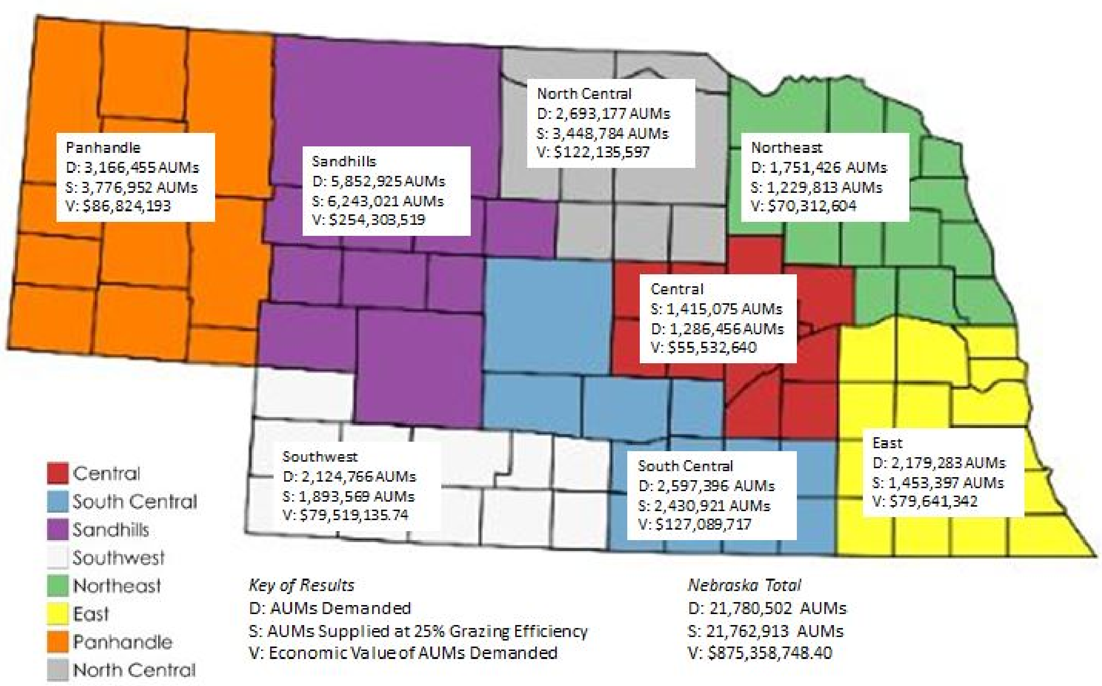

Figure 1: Regions with AUMs of Forage Supplies and Demanded and Economic Value