

DEMOGRAPHICS AND LONG-TERM OUTLOOK FOR WESTERN US BEEF, SHEEP, AND HORSE INDUSTRIES AND THEIR IMPORTANCE FOR THE FORAGE INDUSTRY

Tim DelCurto, Tom Murphy, and Shannon Moreaux¹

ABSTRACT

The Western US livestock industry is intimately linked to the Western US Forages industry. While we often consider these two important agricultural commodities as separate segments of the agricultural industry, they are dependent on each other and often prosper/struggle together depending on market demands and relative supply. Understanding the current standing and long term outlook of the western US animal industries is important to assess regional demand for forages and potential for future markets and opportunities.

Over the past 10 years, the Western US livestock industry has experienced considerable challenges with highly volatile commodity markets (hay and grains), significant regional droughts, and changing domestic and export markets for meat animals. Currently, the US Beef is experiencing stable markets for meat products with a decade of all-time highs in beef production despite a reduction in cow inventory. In contrast, the US Sheep Industry has experienced dramatic declines in sheep inventories over the past 20 years however seems to be leveling off with some promise of improvement. In addition, the increasing popularity for wool products has benefited the western Sheep industry with increased market value for fine wool which has stimulated interest in the range Sheep industry. Likewise, the Western Horse industry has dealt with significant problems that include the ban on horse slaughter facilities, and the economic depression in 2008 and 2009.

The goal of this paper is to discuss the current demographics and long-term outlook for the Beef, Sheep and Horse industries in the western US. Where possible, we will also discuss how changes in these industries may impact demand and use on western forage resources.

WHAT MAKES THE WESTERN US LIVESTOCK INDUSTRIES UNIQUE

Simply put, the western US livestock industry is dominant in areas of the west that is not suited for farming. A significant portion of the Western US is characterized by high elevation rangelands that exceed 1000 m in elevation (Figure 1). The Rocky Mountains are a key feature of many of the western States and the associated mountain plateaus are key features of the range sheep and beef cattle industries. The geological features of the region are often characterized by

¹T. Delcurto (timothy.delcurto@montana.edu) Professor and Nancy Cameron Chair, Range Beef Cattle Nutrition and Management, Dept. of Animal & Range Sciences, Montana State University, Bozeman, MT; T. Murphy, Assistant Professor of Sheep Production, Dept. of Animal & Range Sciences, Montana State University, Bozeman, MT; S. Moreaux, Associate Professor of Equine Sciences, Dept. of Animal & Range Sciences, Montana State University, Bozeman, MT.

In: Proceedings, 2017 Western Alfalfa and Forage Symposium, Reno, NV, Nov 28-30. UC Cooperative Extension, Plant Sciences Department, University of California, Davis, CA 95616. (See <http://alfalfa.ucdavis.edu> for this and other alfalfa conference Proceedings.)

shallow/rocky soils, rugged terrain, and steep slopes. Because of the dominance of high elevation regions throughout the western US, many areas have limited or short growing seasons

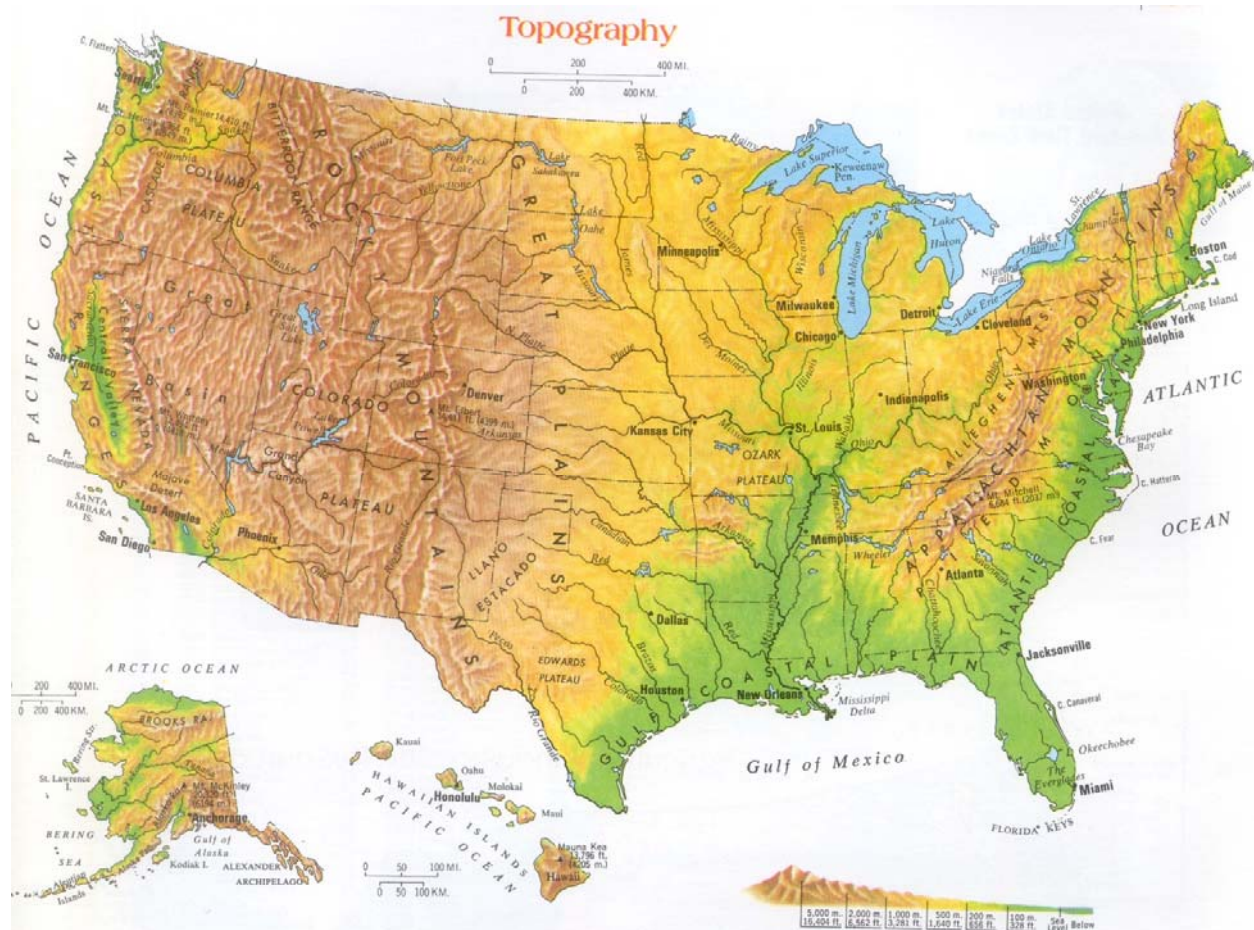


Figure 1. Topography of the United States. Color bands denote the regional elevation ranges. The Western US is dominated by areas that exceed 1000 meters in elevation.

with the relative length of growing periods being dependent on adjacent topography, climatic patterns, as well as the actual elevation.

In addition, most of the western US is characterized by arid and semi-arid environments with precipitation zones of less than 50 cm (20 inches; Figure 2). Therefore, western livestock producers typically operate in areas with growing seasons of less than 120 days, and precipitation amounts and patterns that often limit production of native and introduced forages. In addition, the limited precipitation and unpredictable as well as highly variable pattern of rain/snow events lead to seasonal shortages of forage and hay for livestock production.

Short growing seasons and variable precipitation patterns lead to forage resources that are often limited in nutrition quality and quantity. Therefore, many livestock producers need to consider supplemental inputs to meet their animal's nutritional needs although the need for supplemental

inputs vary from year to year. Thus, the western beef industry is very extensive in its land use, with optimal production being a function of the resources on each ranching unit, and the success the manager in matching the type of cow and/or production expectations to the available resources (Putman and DelCurto, 2007). Successful beef producers are not necessarily the ones who wean the heaviest calves, or who obtain 95 percent conception or provide the most optimal winter nutrition. Instead, successful producers are those who demonstrate economic viability despite the multiple economic, environmental, and social pressures on the industry.

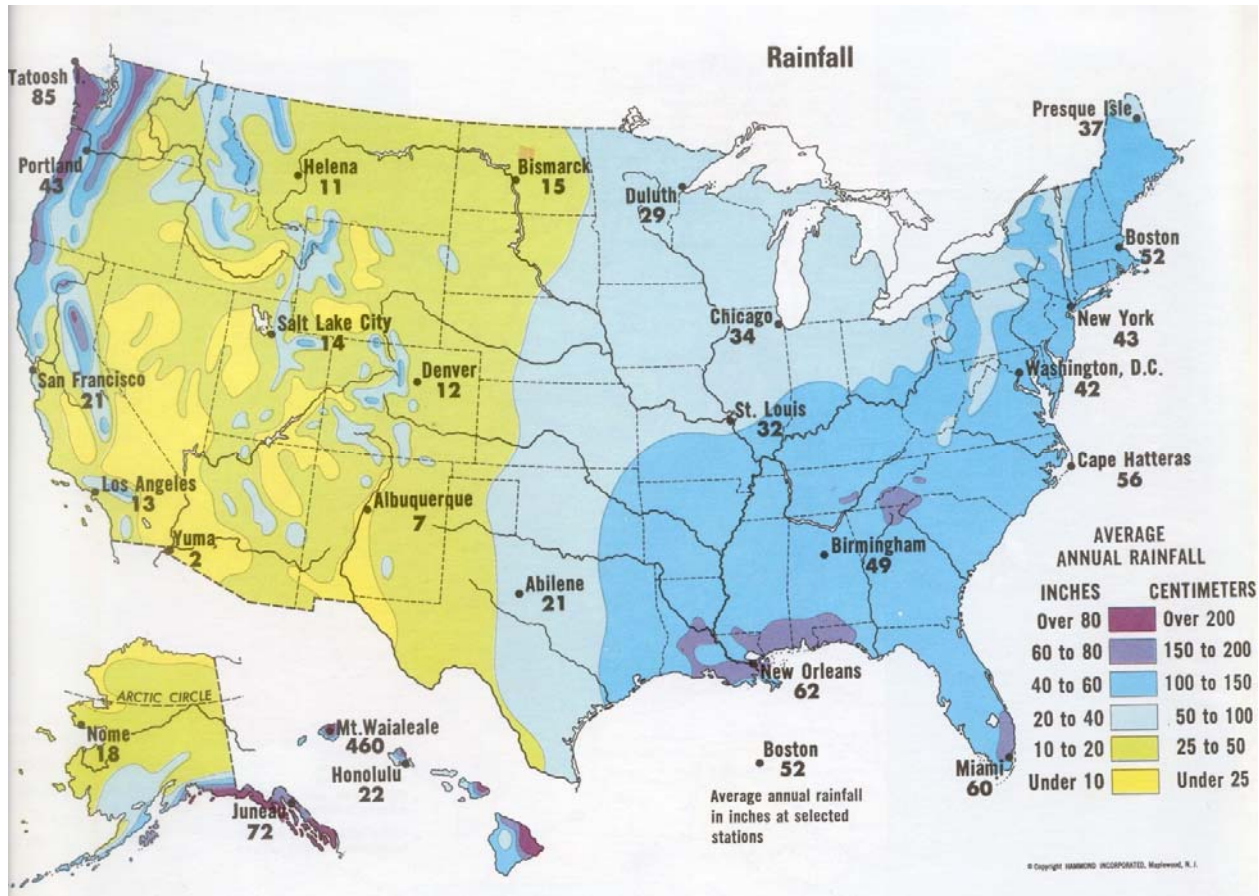


Figure 2. *Precipitation Map of the United States. Color bands reflect precipitation zones with the majority of the Western US represented by areas of less than 50 cm of precipitation.*

THE U.S. BEEF INDUSTRY

The United States is the world's largest beef cattle producer (pounds of beef per year) as well as the most efficient. Over the past decade, the United States has consistently produced between 24 and 27 billion pounds of beef per year. This is remarkable considering the severe droughts that have plagued the southwest and western regions of the country during this time frame. The closest world competitor is Brazil but the quality and type of cattle differ dramatically in respect to age and carcass quality. Simply put, the United States doesn't have significant competition from other countries of the world with respect to beef production capabilities or product quality.

It is often stated in popular press that the United States beef herd has declined over the past 40 years (Figure 3). While that statement is true, it is often taken out of context to suggest that the industry is declining in importance. As stated above, this industry has set beef production highs for the past 10 years. Generally, the ability to produce greater quantities of beef with less cattle is attributed to increasing beef cattle size, increasing reproductive efficiency, and the contribution of the dairy industry to beef production. In 2016, the dairy industry provided approximately 22.7% of US Beef contributing 5.7 billion of the 25.2 billion pound yearly total. Potential future advances in biotechnology (ie. “sexed semen”) may further the importance of the dairy industry in contributing to the US Beef Industry.

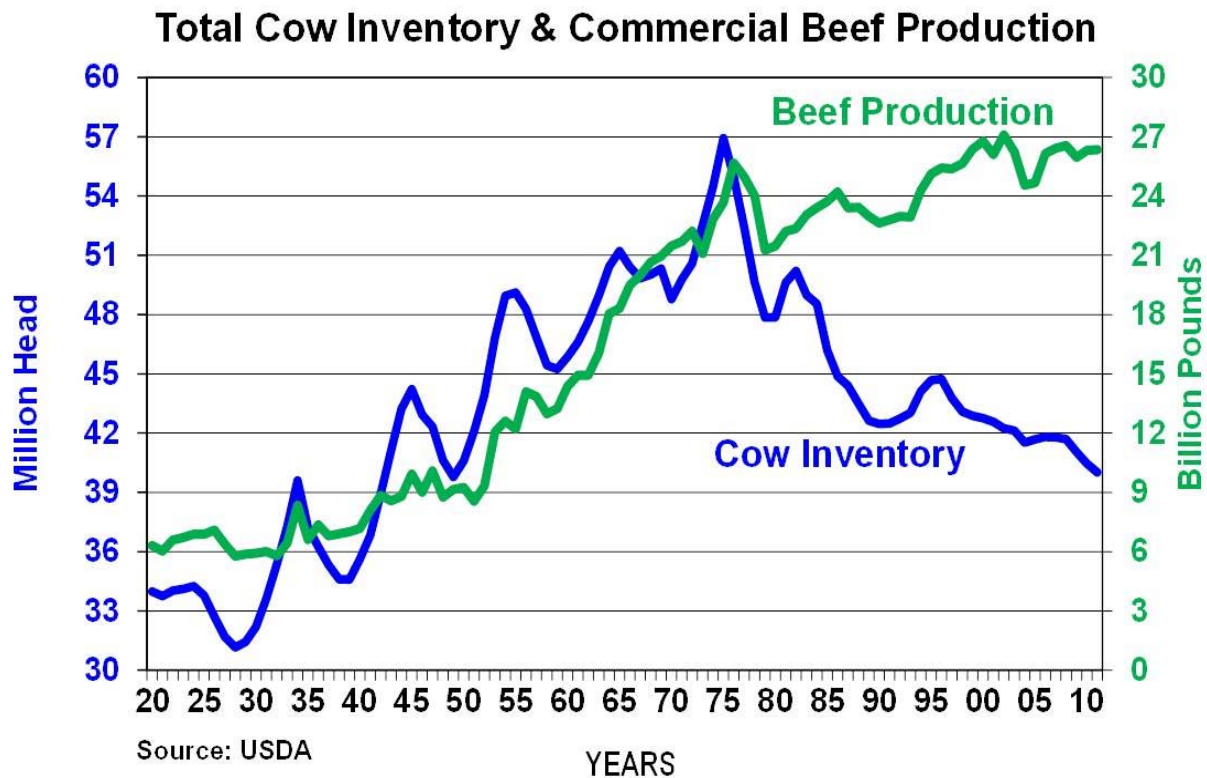


Figure 3. Comparison of the United States Beef Cow Inventory to the annual Beef Production estimates in billions of pounds. Over the past 10 years, the US has reached all-time highs in beef production (lbs per year) despite the continuing decline in cow numbers. This has been attributed to increasing cow size, improved reproductive efficiency and greater contributions from the dairy industry.

The Western Beef Industry. The 11 western states represents approximately 20% of the US Beef Cow herd inventory with approximately 6.4 million beef cows. Montana is currently the 6th largest beef cow/calf state with 1.5 million mother cows. Perhaps compared to the mid-west, western beef production does not seem that important. However, when rural regions of the

western US are evaluation, beef cattle production as well as, hay production are corner stones of their economies.

Beef cattle producers in the western region are faced with many challenges. First, their ranch resources are often limited in quality forage and quantity of forage is dynamic and dependent on arid and semi-arid climates. Thus, western ranch managers often select cattle based on their ability to fit the limited nutrition environments. Often, western beef producers select cattle with smaller frames, low to moderate milk production, and the ability to be reproductively efficient in a limited nutritional environment. These producers also tend to select calving dates that optimize beef cattle production with the forage resources that are available. As a result, greater than 80% of western beef producers calve in the spring. Ranches that market calves at weaning tend to calve a month or two before the onset of green forage. In contrast, with producers who retain ownership or keep calves as yearlings, a growing number of producers are moving calving dates to more closely match the onset of green forage. By calving in April/May, producers are trying to match the cow's nutritional requirements as closely to the forage resources as possible and minimize supplemental inputs.

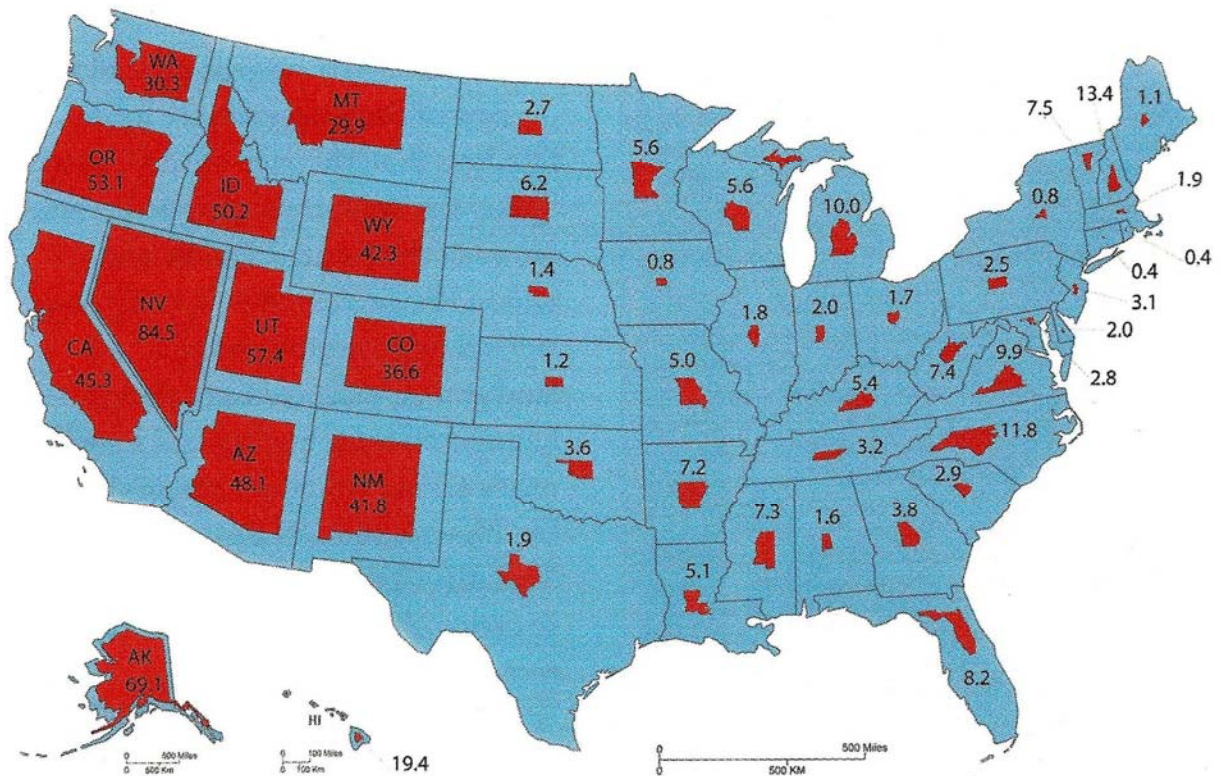
Supplemental and Harvested Forage Needs. Despite the efforts to match the cow type and production to the rangeland environments, most western livestock producers are dependent on supplemental and harvested forage during the year. High elevation rangelands/ranches often have extended periods of snow cover. During these periods, harvested forages are necessary. Ranches that provide feed during the winter period (December through March) often require a minimum of 2 tons of harvested forage per cow. While a great deal of effort is made to reduce the reliance on harvest forage, most of the alternatives (stockpiled forage, straws and other crop residues) are also limited by nutritional quality and need substantial nutritional inputs to meet the nutritional demands of the cow/calf. Strategic supplementation is important for these producers and often critical to their success (DelCurto et al., 2000; Kunkle et al., 2000). In respect to supplemental inputs, most beef cattle producers focus on finding sources of supplemental protein. Numerous forms of supplemental protein are available and include distiller's grains, oilseed meals (canola, soybean, and cottonseed) and non-protein nitrogen sources (urea). For most producers, however, the preferred source of supplemental protein is feeder quality alfalfa. When compared to other sources on an equal protein basis, alfalfa is often the cheapest form of supplemental protein.

Public Land Ownership in the Western US. Finally, the western livestock industries are also dependent on the continued use of public lands for livestock grazing (Figure 4). Approximately 20% of the animal unit months (AUMs) for western livestock production are derived from public lands. While that doesn't seem like a large amount, when one considers that 60% of the beef production is derived from ranches of 100 head of producing cows or more, you can estimate that approximately 1/3 of the forages for the larger ranches come from public lands (four months of grazing). The greatest challenge for western US livestock producers relates to the need to manage these lands for multiple values and/or uses. In addition to grazing livestock, timber, and mining; other values include recreation (hunting, camping, hiking, and fishing), conservation for wildlife, and, in some cases, the desire to preserve lands for future generation.

Because of the arid to semi-arid nature of most of the lands of the western US and a changing and unpredictable environment, these lands are often more sensitive to disturbance or overuse, and can be damaged by improper livestock use. Currently, livestock producers have to be vigilant in respect to being good stewards of the land and respectful of other values or uses of the public lands (DeLCurto et al., 2005; DeLCurto and Olson, 2010). Current concerns often relate to threatened and endangered species, riparian area structure and function, as well as general clashes with the public in respect to other values or uses. Grazing management strategies that utilize the land for livestock production while maintaining biological processes that promote vegetation and wildlife diversity are ongoing goals for producers in this region.

WHO OWNS THE WEST?

Federal Land as a Percentage of Total State Land Area



Data source: U.S. General Services Administration, *Federal Real Property Profile 2004*, excludes trust properties.

Figure 4. Public Land Ownership as expressed as a percentage of the total state land area. The Western US has a number of challenges relative to other regions because of the ownership demographics.

Currently, research is underway evaluating livestock grazing as a tool to improve public land vegetation diversity and structure. Specifically, studies with various species of livestock have

suggested that targeted grazing could be a tool to reduce noxious weeds and, in turn, encourage more desirable vegetation. Likewise, livestock grazing is being used to control fuels on public lands with the goal of reducing the occurrence and severity of wildfires.

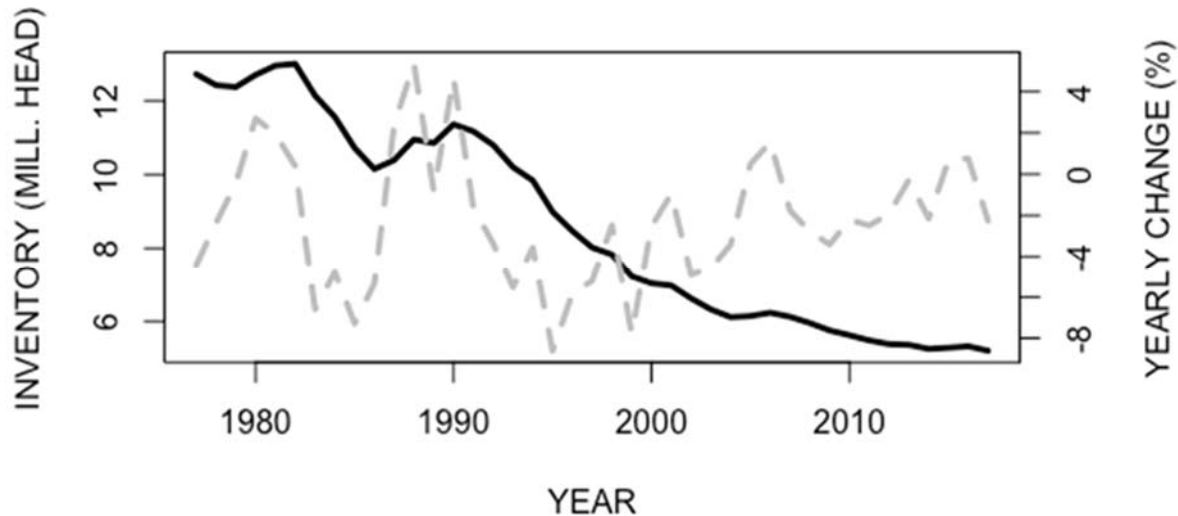


Figure 5. Estimated total sheep inventory (solid black line) and percentage change from previous year (dashed gray line) in the US from 1977 to 2017.

THE U.S. SHEEP INDUSTRY

History and Current Trends. The first permanent US sheep flock was established in Virginia in the early 1600s (Bell, 1970). From there, the American sheep industry continued to grow and eventually peaked at an estimated 56 million head in 1945 (USDA, 2004). Figure 5 displays the estimated total sheep inventory and the percentage change from the previous year from 1977 to 2017. Over the last several decades, the US sheep industry has contracted drastically in size and in 2017 it was reported that there were approximately 5.2 million total sheep (USDA, 2017a). However, there appears to be a diminished rate of decline in recent years, suggesting that the observed exponential decay of the US sheep inventory may be close to its lower asymptote.

Most recently, the US was ranked 50th in the world in total sheep inventory, substantially smaller than China (1st; 202 million head), Australia (2nd; 72.6 million head), and India (3rd; 63 million head), to name a few of the world leaders (FAO, 2017). Not surprisingly, the current number of sheep in the US is small in comparison to swine (71.7 million head; USDA, 2017b) and beef and dairy cattle (103 million head; USDA, 2017c). However, the number of sheep operations across the nation (88,338) ranks only behind beef cattle (727,906), as more Americans raise sheep than dairy cattle (64,098) and hogs (63,246; USDA, 2012).

Traditionally, the bulk of the US sheep population has been located in the 24 states west of the Mississippi River. This is still generally true today as an estimated 81% of the country's sheep

are found in the West, with Texas (1st; 700 thousand head), California (2nd; 585 thousand head) and Colorado (3rd; 395 thousand head) being among the leaders (USDA, 2017a). Furthermore, the majority of the total US sheep inventory (44%) is found on large operations (> 1,000 head; USDA, 2012) which are more typical of the Western sheep industry.

Many eastern states (MI, NY, OH, PA, VA, WI, and “Other States”) actually exhibited a positive growth in their sheep inventory from 2001 to 2007, whereas the inventory in all but two western states (OK and MO) continued to decline during this period (NRC, 2008). Despite eastern states being home to only 19% of the total US inventory in 2012, they contained 39% of the nation’s sheep producers (USDA, 2012). Therefore, recent trends suggest that the makeup of the US sheep industry is shifting toward smaller flocks. For example, the proportion of operations with < 100 head, 100 to 999 head, and > 1,000 head in 1974 was 77%, 20%, and 3%, respectively (NRC, 2008), contrasted with 92%, 7%, and 1%, respectively, in 2012 (USDA, 2012).

Production characteristics. Sheep have been bred to produce one or more of three products: wool, meat, and milk. The majority of the world’s dairy sheep are located in the Mediterranean countries of southern Europe and northern Africa (FAO, 2017). Sheep milk is typically processed into high quality cheeses and Roquefort, Pecorino Romano, and Manchego styles can often be found in US urban and suburban supermarkets. While the US dairy sheep industry has been growing over the last several decades, it is still quite small (Thomas et al., 2014). Therefore, the two major US sheep commodities are wool and lamb.

Advances in textile technologies allow today’s wool products to range in application from next-to-skin to protective outerwear suitable in all temperatures. Wool’s durability and odor resilience are ideal for both the working class and outdoor enthusiasts. Additionally, its fire retardant properties are capable of protecting US military men and women where synthetic fibers (e.g. nylon, polyester, etc.) fail. Throughout the country and world, the western states are known for producing a high quality wool clip. California marketed the most wool in 2016 (1.22 million kg; 2.7 million lbs), followed by Wyoming (1.09 million kg; 2.4 million lbs) and Utah (1.04 million kg; 2.3 million lbs). The heaviest average individual fleece weights came from sheep in Utah (4.3 kg; 9.4 lbs), Montana (4.1kg; 9.0 lbs), and Nevada (4.0 kg; 8.8 lbs; USDA NASS, 2017a).

Sheep are shorn once per year, generally in winter or spring before pregnant ewes give birth. The highest average returns from wool on a unit basis in 2016 were garnered in Washington (\$4.62 kg-1; \$2.10 lb-1), Nevada (\$4.40 kg-1; \$2.00 lb-1), and Montana and Wyoming (\$4.18 kg-1; \$1.90 lb-1; USDA NASS, 2017a). Therefore, the average revenue from a Nevada and Montana fleece was over \$17 per head in 2016. However, receipts from the sale of wool represented just 5 to 13% of the total revenue for the average US sheep producer from 2010 to 2015 (LMIC, 2016). Though the sale of wool is a timely income source for the extensively managed operations prevalent in the western states, the success of most sheep operations in the US hinges on the value of their lamb crop.

An estimated 50% of lambs are born in April and May on operations with 500 or more breeding ewes (USDA APHIS, 2014). Sheep producers are benefitted by the ewe’s ability to give birth to and raise multiple lambs at a time. The states with the highest lambing percentage in 2016 were:

Minnesota (129%), Iowa (125%), and Missouri (123%; USDA NASS, 2017a). As with most commodities in agriculture, if the sheep producer wants more output (i.e., a greater lambing percentage), they need to supply more input (i.e., better genetics and increased nutrition). Therefore, the highest lambing percentages in the US tend to come from Midwestern states where harvested feeds are generally more abundant and less expensive.

The average age and weight of lambs at weaning was 4.5 months and 33.8 kg (74.5 lbs), respectively, on western and central US sheep operations in 2010. Additionally, these operations marketed their non-replacement lambs shortly after weaning at an average age and weight of 5.7 months and 42.8 kg (94.3 lbs), respectively (USDA APHIS, 2012). From there, most lambs are placed in drylot and fed a high concentrate diet until they are finished, which was at an average live weight of 61.2 kg (135 lbs) in recent years (NRC, 2008). California and Colorado have traditionally been the largest lamb feeding states, with an estimated 260,000 and 195,000 lambs on feed, respectively, in 2016 (USDA NASS, 2017a). Like the US sheep inventory, the average per capita consumption of lamb in the US has continued to decline and was below 1 pound per person in 2015. This is especially concerning considering Americans had an average of 34.1 kg (75.1 lbs) of poultry, 23.3 kg (51.4 lbs) of beef, and 21 kg (46.3 lbs) of pork available per person in 2015 (USDA ERS, 2017). Efforts to promote American lamb, especially within the younger, more diverse US population, have increased in recent years.

There are many reasons, both anecdotal and substantiated, for the contraction of the US sheep industry. Throughout most of the history of domestic and international sheep production, wool was the major product and sheep meat was, more or less, a byproduct (USDA ERS, 2004). With technological advances in the 1960s, less expensive manmade fibers began to outcompete wool in the textiles market. Since then, sheep producing nations have mostly switched their emphasis to improving lamb production while trying to maintain a quality wool clip. Although the US is the largest meat and poultry consuming nation in the world, attempts to promote lamb and increase its consumption have largely been unsuccessful. Despite these unfortunate realities, sheep production in the US can still be quite profitable. For example, it was estimated that the typical Wyoming region sheep operation had an average profitability of \$28.11 per ewe per year from 2010 to 2015 (LMIC, 2016), the equivalent of a per cow profitability of \$140.56 per year. Though the American sheep industry has its share of challenges, it will continue to benefit the economy and ecology of the Western US.

THE US HORSE INDUSTRY

The United States has the world's largest horse population and recent estimates indicate a growth from 9.2 million horses in 2005 to 10.1 million in 2011 (AHC, 2005, FAO, 2011). The US horse industry is economically significant and extremely diverse, involving agriculture, entertainment, recreation, business, sport and gaming. Unfortunately, US equine industry statistics are meager and infrequent. The United States Department of Agriculture National Animal Statistical Services (USDA NASS) only publishes on farm inventory and defines a farm as an operation with at least \$1,000 in agricultural sales annually or has at least five equids. By comparison to other published reports this represents less than half of the total US horse population. Additionally, the USDA publishes a periodic study of equine demographics and health (USDA APHIS NAMS 2015)

The majority of available US equine population and industry statistics can be gleaned from three sources in addition to the USDA, the American Horse Council (AHC), American Horse Publications (AHP) and the Food and Agriculture Organization (FAO) of the United Nations. The FAO estimates and reports population statistics, The AHC is a non-profit corporation that represents all segments of the equine industry in Washington before Congress and the federal regulatory agencies. AHP is a professional association for equine media and periodically surveys the industry and releases economically important trends. In 2005 the AHC published the most significant equine industry economic impact study to date. The 2005 AHC National Economic Impact Study reported 9.2 million horses, a \$39 billion direct economic effect on the US economy, involved 4.2 million Americans and supported 1.4 million full-time jobs (AHC 2005). The AHC recently began collecting data for the second National Economic Impact Study to be published in 2018. To date AHP has published three Equine Industry Surveys, the first in 2010, again in 2012, and the most recent in 2015. The most recent survey comparing 2009 results indicates stability in the equine industry and shows promises of growth. Importantly, the survey indicates an increase in equine event participation and in young adult participation. Additionally, respondents reported a willingness to decrease spending in other areas to maintain or increase spending on health and nutrition for their horses (AHP 2015).

The American Quarter Horse (AQH) represents approximately one third of the total US horse population and 55% of the horse population in the 11 western states (USDA NAMS 2016, AQHA, 2016). For the past 8 years Montana ranks second in annual AQH production in the western states and fifth nationally. The vast majority of horses in the west are used for pleasure or farm and ranch work, 47% and 25% respectively. Given these data, it is reasonable to assume that growth and stability in the equine industry, especially in the American west, is promising.

LITERATURE CITED

American Horse Council, 2005

https://static1.squarespace.com/static/554bdb41e4b09cd39c9fb002/t/55ad24f1e4b026cf2523d602/1437410545032/National+Economic+Impact+of+the+U.S.+Horse+Industry+_+American+Horse+Council.pdf

American Horse Publications, 2015

<https://www.americanhorsepubs.org/equine-survey/2015-equine-survey/>

American Quarter Horse Association 2016 Annual Report, 2016

<https://www.aqha.com/media/17914/2016-annual-report.pdf>

Bell, D. S. 1970. Trends in the sheep industry of the United States: Effects of breed type and economic circumstances. Res. Cir. 179.

DelCurto, T. and K. C. Olson. 2010. Issues in Grazing Livestock Nutrition. In: Proc. 4th Grazing Livestock Nutrition Conference. B. W. Hess, T. DelCurto, J.G.P. Bowman, and R. C. Waterman (Eds). West. Sect. Am. Soc. Anim. Sci., Champaign, Il pp 1-10.

- DelCurto, T., K. C. Olson, B. Hess and E. Huston. 2000. Optimal supplementation strategies for beef cattle consuming low-quality forages in the Western United States. *J. Anim. Sci. Symposium Proc.*
- DelCurto, T., M. Porath, C. T. Parsons, and J. A. Morrison. 2005. Management strategies for sustainable beef cattle grazing on forested rangelands in the Pacific Northwest. Invited synthesis paper. *J. Range Ecol. Manage.* 58:119-127.
- FAO. 2007. <http://www.fao.org/faostat/en/#data/QA> (accessed October, 2017).
- FAO. 2011. http://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Country_info_2010/Reports/Reports_5/USA_ENG_REP_2012.pdf
- Kunkle, W. E., J. T. Johns, M. H. Poore, and D. B. Herd. 2000. Designing supplementation programs for beef cattle fed forage-based diets. *J. Animal Sci. Symposium Proc.*
- LMIC, 2016. U.S. baseline lamb cost of production model. http://lmic.info/sites/default/files/general_files/Project%20_Summary.pdf (accessed October, 2017)
- NRC. 2008. Changes in the sheep industry in the United States: Making the transition from tradition. Nat. Acad. Press Washington, D.C.
- Putman, D. H. and T. DelCurto. 2007. Forage systems for Arid Zones. In: R. F. Barnes, C. J. Nelson, K. J. Moore, and M. Collins (Eds) *Forages, Volume II. The Science of Grassland Agriculture* (6th edition). Iowa State Press, Chapt. 22 pp 323-339.
- Thomas, D. L., Y. M. Berger, B. C. McKusick, and C. M. Mikolayunas. 2014. Dairy sheep production research at the University of Wisconsin-Madison, USA – A review. *J. Anim. Sci. Biotechnol.* 5:22-23.
- USDA, Animal and Plant Inspection Service. 2012. Sheep 2011 Part I: References of sheep management practices in the United States, 2011.
- USDA, Animal and Plant Inspection Service. 2014. Lambing management practices on U.S. sheep operations, 2011.
- USDA, Animal and Plant Inspection Service. 2016. Equine 2015, Baseline Reference of Equine Health and Management in the United States, 2015.
- USDA, Economic Research Service. 2004. Trends in U.S. sheep industry. AIB-787.
- USDA, Economic Research Service. 2017. <https://www.ers.usda.gov/data-products/food-availability-per-capita-data-system/> (accessed October 2017).

USDA, National Agricultural Statistics Service. 2012. Census of Agriculture. AC-12-A-51.

USDA, National Agricultural Statistics Service. 2017a. Sheep and Goats (January 2017). ISSN: 1949-1611.

USDA, National Agricultural Statistics Service. 2017b. Quarterly Hogs and Pigs (September 2017). ISSN: 1949-1921.

USDA, National Agricultural Statistics Service. 2017c. Cattle (July 2017). ISSN: 1948-9099.