

External influences on North American beef production: How will the cattle feeding industry adapt?

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After decades of slow change, the North American cattle and beef industries are undergoing rapid transition. Farming and food production are no longer local industries serving local markets but are part of a global marketplace with scaled opportunities and risks. Individual cattle producers are subject to external influences to a greater degree than ever before and the collective responses to these forces will shape the industry and determine its future.

External influences on cattle feeding can be grouped by starting with a simple question: What does a feedyard need to operate? Answers include:

- Feeder cattle supply
- Market for fed cattle
- Feed
- Water
- Energy
- Labor
- Capital
- Waste disposal
- Knowledge and technology
- Freedom to operate

Feeder cattle supply: US cattle numbers have been declining for 50 years. While we may think of short feeder cattle numbers as a recent trend, the long-term trend is obvious. All US cattle numbers have declined 35 million head in 39 years, an annual rate of 897,000 head. Calf crop and slaughter numbers declined 15 million head in 38 years, or 395,000 head per year. Cow numbers have shrunk in Canada and Mexico, too, so importing more feeder cattle is unlikely.

Pressures that have reduced cattle numbers include alternative uses for land and an extended period of limited profitability for cow-calf producers. Over much of the past few decades, a cow simply could not bid as much for an acre of land as a corn farmer, city developer, white tail deer hunter or reclusive billionaire so land that had cows on it was repurposed and the cows became quarter pounders. That has accelerated with significant drought in major cow states in the past four years.

This trend is likely to continue. While some cattle cycles have produced modest increases in cattle numbers, a typical cattle cycle is flat for a while, then down. The next few years will bring modest expansion in the cow herd (reducing on-feed numbers even more) but significant long term growth is unlikely. The recent USDA projection of 16%

increase in the US cow herd by 2023 seems more like the upper limit of possibility than a realistic forecast.

Feeding capacity has been reduced. Cattle-Fax estimated that 350,000 head of bunk space was idled or repurposed in 2013, continuing a trend, but overcapacity remains and competition for feeder cattle is strong. That is one reason that it has been impossible to buy breakevens during most of the past 48 months. Competition will continue and many feedyards have increased efforts to manage inventory or control cattle further in advance. Use of ranches, wheat pasture and dedicated growing or starting yards are among the strategies. Some feeding companies are affiliated with alliances or calf marketing groups. Few have attempted to manage inventory by buying cows and producing calves themselves (although they might wish they had) because the capital requirements to own or lease enough ground and cows to fill a feedyard are immense. Feedyards will increase efforts to control inventory well in advance of placement. Other yards will become part of the feeder cattle supply chain, rather than feeders.

Despite a shrinking cattle herd, beef production (tons) has increased since 1950 and is similar to 1975 when cattle numbers were at their peak. While cattle numbers dropped, productivity increased dramatically so that we now get more beef (and more milk) from 90 million cattle than we used to get from nearly 140 million cattle. This is a great success story that is only now beginning to be promoted.

What happens when cattle numbers go down? Prices increase and weights go up. Both have happened in record fashion. Increased carcass weights have been driven by at least six factors:

1. Increased use of more aggressive implant programs
2. Increased use of beta-adrenergic agonists
3. Industry transition from selling live weight to carcass weight
4. Economics that favored feeding the one you already have another day instead of selling or replacing it
5. Improved genetic capability of cattle
6. Drought induced culling of poor cattle

Can the increase in carcass weights continue? It is hard to bet against a straight line for 40 years but there are reasons to expect the increase to at least pause for a while after adjustment to current costs and prices. Reason #1 has probably maxed out and we are backing up on #2 with the removal of Zilmax from the market. In the future, growth-stimulating technologies will likely not add any more carcass weight than they added in the first half of 2013, perhaps much less. Improved moisture and grass conditions in much of the country have stopped drought-induced culling except in California.

The shift to selling carcass weight has had a big impact. The economic signals of carcass weight marketing are dramatically different than for selling live weight, especially at the end of the feeding period. We now pay attention to marginal revenue

compared to marginal cost and incremental dressing percentage, terms that were not widely used a decade ago. Carcass weight gain is typically 80%+ of live weight gain at the end of the feeding period. While live weight gain slows, rate of carcass gain remains steady, creating the increase in dressing percentage that occurs as cattle progress through a normal feeding period.

Consider the example of a steer that will close out with average daily gain of 4.0 lb/d. Assume that at the end of that feeding period he is gaining 3.2 lb/d, that the live market is \$135, the carcass market is \$212.50 and his marginal (daily) cost is \$4.50, all in. He is creating \$4.32 of marginal live value per day so every additional day is an \$0.18 loser if he will be sold live. At an incremental dressing percentage of 80%, his carcass gain is 2.56 lb/d, creating \$5.44 of marginal revenue, resulting in marginal profit of \$0.94/d if sold as carcass weight. This simple math explains one of the key reasons that carcass sellers feed cattle to heavier weights. In the case of company-owned cattle, the higher cost of gain (live basis) caused by an extended feeding period can be accepted because profitability is higher whereas custom yards sometimes have a hard time explaining why a higher cost of gain can be related to improved profitability.

Reason #4 is stronger than ever now with fed prices 1.5X cost of gain, so expect that to continue. Whether the fed cattle price over the next decade averages \$135, \$145 or \$155/cwt, feeding cattle to high weights is going to make sense if corn stays around \$5.

If the trend of increasing carcass weights is to continue, genetics will play a key role. Genetic progress is slow and has little influence on the population from one year to the next but over time changes can be dramatic. We are now seeing the results of decades of effective selection for growth. In the 1980's, geneticists developed predictive statistics that were far more effective than those used previously. Expected Progeny Differences (EPD's) for traits like birth weight, weaning weight and yearling weight, published with meaningful accuracy values, allowed purebred producers to make faster progress and commercial producers to make better choices at bull sales but it took a long time for genetic improvement to make a noticeable impact on the population as a whole.

Genetic trends for growth in purebred cattle have continued steadily upward and concentration of these genetics in commercial cattle following years of selection, have created a large population of cattle that can perform exceptionally well when current best management practices are applied. For example, in our Midwest PMS database, the average lot of steers closed in 4Q13 weighed 1427 lb with feed conversion of 6:1 and ADG of just under 4 lb. Nearly one-fourth of the steers (and plenty of heifers) gained over 4 lb/d **and** converted under 6.0 and the average out weight of those steers was 1469 lb. Only 4% of steers (and 27% of heifers) were marketed lighter than 1250 lb. Other databases likely contain similar results.

More recently, genetic progress for growth has continued without concomitant increases in birth weight, allowing more widespread use of high growth bulls. In the past it was possible to find hundreds of such cattle and fill a few pens or a small feedyard with

them, but they are now available by the tens of thousands and a large yard can now be filled year-around with nothing else. The proliferation of big, high performing cattle changes the economics of cattle feeding and creates new opportunities but will require management and marketing adjustments.

One simple way to increase the genetic capability of the population and create more beef and more revenue from the same number of cattle would be to get more out of dairy cattle by using beef breed bulls for some matings. Improved efficacy and reduced cost of sex-specific semen allows dairy breeders to produce dairy-breed heifers from better cows and beef-sired bull calves from heifers or poorer cows. This is happening in scale within a few large operations but for the most part has been ignored by dairy producers. Lim-Flex, a Limousin-Angus composite breed has been used successfully on Jersey cows and heifers to create cattle that perform well and have exception carcasses. With current economics, a purebred Jersey bull calf is essentially worthless at birth while a Lim-Flex sired bull calf from a Jersey cow is worth about \$400 as a day old. Signals like that should change behavior in the dairy industry and partnerships with dairies could help feedyards with their feeder cattle supply problem. An even greater potential opportunity would be direct ovum transfer and using the dairy cows as surrogate mothers for beef breed cattle. Remarkably, cheaper technology and higher value cattle may make that type of technology economically feasible.

The other significant genetic change is in marbling. Premium carcasses, like CAB or Prime, used to be a happy accident that occurred at the outer end of the population distribution, just because there were millions of cattle fed. Packers “creamed the cooler”, sorting outliers to fill orders for the really good stuff and nobody really changed management practices with the intention of producing more of them. Now there are known sets of cattle that can produce 40%+ CAB carcasses with 10%+ Prime in large numbers, with feed conversion at the average of the industry, or better, despite exceptionally high weights. Economic signals are telling us that we need to do more of that because percentage Choice and occurrence of premium grade cattle have both increased while premiums have remained high or increased and the Choice:Select spread has generally been wide over the past few years.

High weights and high prices mean that individual animals are more valuable than ever before. This is a trend that must continue. In any manufacturing system, if the number of units (in this case head of cattle) is reduced, the revenue per unit must increase. The cattle industry must focus on maximizing revenue from each animal produced. While in the past, cost of production was the primary focus, emphasis will shift toward growing revenue. Cost will still be a key consideration but the balance has already shifted.

This will impact beef production practices because we will not manage \$2000 cattle the same way that we used to manage \$900 cattle. Differences in value between animals are greater than ever. Cattle feeders must react to the new economic signals. Targeted outcome groups and a move toward individual endpoint management must be considered. Key steps that must be mastered include:

1. Determination of measurable traits that will affect outcomes
2. Characterization of groups or individual animals
3. Individual identification; creation and management of individual records
4. Sorting into groups to be managed alike
5. Projection of biological and economic performance
6. Application of specific management systems
7. Marketing to capture value

Now our ability to maximize value is limited by lack of knowledge on capabilities of individual animals. Current characterizations are based on identifiable traits such as weight, age, sex, hide color, condition, frame size or density (weight/height), etc. These are pretty blunt instruments. For the most part, use of these measures is based on correlation, rather than causation and they are used because they are relatively cheap and easy to obtain.

With high prices, large differences in growth and carcass value allow for greater investment in characterization, so diagnostic tests of health or genetic capability of individual animals could be considered. Inclusion of known health status could improve performance, reduce the need to handle cattle and save on the cost of prevention or treatment. This is an area of huge investment in product development and research.

Multi-gene panel tests are becoming widely used to describe breeding cattle but are impractical for feeder cattle due to cost. Single nucleotide polymorphism (SNP) tests are recently available for genes like leptin that are known to affect performance and carcass value. The lower cost and rapid turnaround of these SNP tests could make them a routine part of sorting systems. Including genetic information as a component of sorting systems requires sophisticated modeling and prediction methodology but would improve precision of targeted animal production. Economic incentives will be great enough to develop and implement such systems and facilities may need to be re-designed to accommodate them. This creates an additional challenge for custom feeders if cattle must be commingled to use sorting systems without reducing occupancy rate.

Whether health or genetic capability, feeder cattle value will be enhanced by knowledge that creates predictability. Value for “known” feeder cattle will shift from simply reputation and feeding experience to include measurable diagnostics that improve predictability. Measures that made no economic sense when there were 30 million feeder cattle worth \$700 each will be practical for 24 million cattle at \$1300 each.

One challenge of these high genetic capability cattle is that spring calves are poorly matched to the calendar for summer grazing. They are too valuable and too big to grow at low rates prior to grass. Fall calves or those with less genetic capability are a better fit for summer grazing. Plus, economics favor the feeder over a grazer. Some stocker operations could return to cows due to these signals meaning that some cow herd expansion will not require taking out crop ground and putting fences back in.

Market for fed cattle: The decline in cattle numbers has caused the expected impact on packing plants with Tyson closing its Emporia, Kansas plant in 2008, Cargill idling its Plainview plant in 2013 and National's Brawley Beef shutting down in 2014. Collectively, these three decisions reduced US slaughter capacity by approximately 10,000 head per day or about 2.5 million head per year. US slaughter capacity still exceeds expected fed cattle numbers so continued rationalization should be expected. Cow kill plants are almost certain to close in 2014.

With declining cattle numbers, packers will lessen their risk by entering into more captive arrangements to tie up supply. This will be preferable to owning the cattle themselves because of the risk and capital required. In the near term, cattle feeders have the leverage and do not need to change business practices but at some point in the future, plant closings will give surviving packers the upper hand and they will dictate terms. At that point, a cattle feeder will need a chair to sit in when the music stops or will have a huge problem. While feeders are in control, premiums will increase but eventually packers will force larger discounts for cattle or carcasses that do not meet their specifications. The back and forth will result in committed relationships that eventually become exclusive and closed. The cash market will diminish and price discovery may come from elsewhere.

Packers need for cattle has changed the way they discount heavy carcasses. Over the past 30 years, the weight at which heavy carcasses were penalized increased from 850 to 1050. In the past 18 months, penalties at 1000 lb disappeared and many cattle are now sold with no heavy penalty at all, just a promise not to let weights "get out of hand." This has mostly benefitted small and medium-size yards that can make short term or handshake agreements, compared to corporate accounts, which are more likely to have detailed long-term written agreements. Moving heavy limits from 1000 to 1050 increases value by \$30 per head in a set of cattle with 900 lb mean HCW and an HCW standard deviation of 90 lb. Packers made that change without significant pressure from feeders, a telling move. With declining numbers, packers must also take steps to maximize revenue per unit. Renovation of some packing facilities is now underway to allow bigger carcasses without increasing food safety concerns.

A market for the product does not just mean a way to get cattle slaughtered and processed. Someone must buy and consume the beef as well. Here there is excellent news for cattle producers and a very positive long-term outlook. While US per capita consumption has declined with supply, increasing prices are a sign of solid demand and a growing population will continue to consume beef.

Foreign opportunities are greater. Exports contributed \$240 per head in 2013 (USMEF data), up from \$40 in 2003, following the BSE incident. A large part of that is in hide and offal but total exported value is growing \$10-20 per year and the growth is in meat, not by-products.

Growth is likely to accelerate. Global population growth, combined with upward mobility and a growing middle class, is already producing dramatic increases in global meat

production and consumption. Beef has not yet shared equally in that growth but will trend upward. For example, China's middle class will double in the next decade, adding as many **new** middle class consumers as the US has now. While low, beef consumption in China is growing at twice the rate of pork consumption. Most of that beef is imported, but not from the US.

By 2030, Asia Pacific will have 63% of the global middle class while North America and Europe combined will have 18%. Opening and expanding Asian markets is critical to the long term success of the North American beef industry. The next two decades will be tremendous for beef production and consumption but it remains to be seen whether North America will participate in that growth. You could win a few bar bets with the knowledge that India is currently the world's leading exporter of beef. The fact that India's beef comes from water buffalo makes it clear that the good stuff from the US should remain in high demand as global affluence rises.

A key external influence is increasing consumer preference for ground beef. In January, 2014, Rabobank published an interesting edition of its AgFocus called Ground Beef Nation: The Effect of Changing Consumer Tastes and Preferences on the U.S. Cattle Industry. Author Don Close, an astute industry observer, lists increasing beef prices as the primary cause of declining beef consumption. The paper cites the increased proportion of beef consumed as ground product, along with a diminishing price gap between steak and ground beef, and increased grinding of whole muscle cuts as indicators that the US beef production is out of sync with consumers who want more ground beef and less steak. He concludes that the industry emphasis on making all cattle grade Choice is lessening our cost competitiveness compared to other proteins and that the industry must restructure our production systems to avoid continued loss of share to cheaper protein sources like chicken or pork. He recommends that *"the end-use of cattle should be determined as early as possible and the animals managed directly toward the end goal. Between one-third and one-half of the animals should be raised primarily for ground beef."* (emphasis added)

The paper is thoughtful, provocative, convincing and I think, wrong. Everyone should read it and make up their own minds but here is an alternative view. North America should get in, stay in and dominate the premium beef market. Our resources are best utilized creating big, high quality cattle that produce an enjoyable eating experience and maximize revenue per animal. We should actively seek to expand exports so that production can be increased if cow numbers and production practices allow. Rabobank is correct that this type of production system will not create enough 90% lean trim to satisfy our demand for ground beef. Currently lean trimmings originate from cow and bull carcasses, ground steer and heifer whole muscle cuts, and imports, mostly from Australia and New Zealand. With declining cow slaughter for the next few years, 90% lean trim will be in short supply.

Rather than altering US production systems to produce more lean beef, a more practical solution is increased lean beef imports and in fact, Mexico and South America are gearing up to fill that void. There are serious issues with increased imports, both

political and scientific. Currently, FDA is accepting comments on a rule that would open a portion of Brazil to fresh beef export to the US. Nearly all comments thus far are opposed because of the risk of introducing foot and mouth disease (FMD), which could be disastrous for the US cattle industry.

No other country can produce the good stuff in volume like the US and no other country would be willing to pay as much for imported lean beef. While there are issues with relying on exports for revenue and imports for food, as part of a global market we must embrace both. Both have increased substantially in the past several years and that appears likely to continue. We can learn from the example of the Australian industry, which exports ultra-high quality beef to Japan and lean trim to markets that want that. Domestic consumption in Australia is mostly the stuff in the middle. Our system will be different from that but we can learn from the excellent public:private partnership that they have. We must continue to open and grow export markets and identify markets from which we can safely import lean beef. FMD is a serious risk so it may not be Brazil but someone will sell lean beef cheaper than we can produce it, especially with foreign government subsidies for production.

As for devoting one-third to one-half of our cattle population exclusively to ground beef production, that is not going to happen. We have technology to identify cattle that can't produce a satisfactory eating experience and should remove them from the population or use post-mortem means to make the beef palatable. Plus, if a pen of steers was offered for sale at 1250 lb and 10% Choice for grinding purposes, somebody would just buy them, put them back on feed and sell them at 1525 lb, and make money in the process.

Feed: The US will continue to be a major producer and consumer of feed grains and will export grain when stocks:use ratios are high but it is usually more profitable to export grain through meat, rather than directly. Row crop acreage has increased and corn yield trends continue upward. Human consumption of corn for food has plateaued, as has ethanol use for energy. Barring exceptional drought or reduced irrigation, corn will be available and priced in a trading range comparable to current prices.

Corn co-products will continue to be available in amounts similar to current levels. Oil will be spun off and any other components that have greater value for non-feed uses will be extracted. Regional corn basis will move back toward what we all grew up with but not all the way back. Cattle will continue to be fed nearer the feed supply, it is cheaper to transport feeder cattle and even fed cattle than the feed required to feed them an equal number of miles. Wet by-products will continue to enjoy a price:value advantage over dried by-products.

Current levels of water use for irrigation will come under pressure from market and governmental forces. This will affect feed by increasing dry land crops, replacing corn with sorghum in some areas and affecting price basis. The cattle business will be helped immensely if seed companies invest in sorghum, like they currently do with corn,

but that is not likely. More roughage will come from corn fields in the Upper Midwest, in the form of corn silage or earlage, not stalks.

Energy: Increased oil and gas production in North America due to advancements in hydraulic fracturing (fracking) have moved the US close to energy independence. That does not mean that energy will get substantially cheaper because fracking is a relatively expensive way to produce oil but it does suggest that energy in the US will not become substantially more expensive than it is now. The largest potential threat to US energy independence is governmental action designed to discourage oil and gas production by imposing higher taxes, fees or penalties or a system of carbon credits that must be purchased to use oil. Energy will be abundant and affordable and some oil and gas revenues will stimulate rural economies. The negative impact of the energy industry on cattle production will be in water and labor.

Water: First, a few numbers for perspective. The US uses 408 billion gallons of water per day (US Geological Survey estimate). Water use increased steadily from 1950-1980 and has been flat since. Approximately 80% of water use is fresh water, the balance saline. The biggest user of water is thermoelectric power, using 52% of the fresh water and 96% of the saline. Most water used by power plants is returned (slightly warmer) and not consumed.

Agriculture is a water-intensive industry. Irrigation consumes about 1/3 of all fresh water used in the US. While irrigation methods are becoming more efficient, irrigated acreage and water use are growing. Water used for irrigation is not really consumed. Through the hydrologic cycle, irrigation water is returned for reuse but not right away and not always in the same place.

Water will become more expensive. Energy companies will bid against agriculture for water, and this represents a significant threat in some areas.

"Hydraulic fracturing is largely taking place in regions already experiencing high competition for water," according to Ceres, an influential non-profit organisation focused on climate, water and sustainability issues that advises major institutional investors.

Between January 2011 and May 2013, almost 100 billion gallons of water were used to fracture 39,000 oil and gas wells, according to an analysis by Ceres of well records submitted to the industry's FracFocus registry. On average, each well used 2.5 million gallons of fresh water. The total consumption was equivalent to the annual water needs of 55 small cities with an average population of 50,000. The problem with using fresh water for fracking is that it becomes contaminated with oil, salt and chemicals and must then be injected into disposal wells so deep that it never returns to the fresh water supply.

In Colorado's Weld County, for example, the 1.3 billion gallons of water used for fracking in 2012 was equivalent to 15 percent of the amount used in the county for residential consumption.

After power plants, the biggest single use of water is for irrigation, which includes crops as well as golf courses. In 2005, irrigation used 144 billion gallons of fresh water every day, of which 75 billion came from surface sources and 54 billion were pumped from underground aquifers.

In other words, frackers used the same amount of water in two years (2011-2013) that U.S. farmers typically withdraw from underground aquifers every two days. The real competition is not between frackers and households, but between oil and gas producers and farmers. In comparison, the daily consumption of fresh water by industry (17 billion gallons), mining (2.3 billion gallons) and homes and offices (48 billion gallons) is modest.

The number one target has to be cutting wasteful water use by farmers.
"Although the oil and agricultural industries have coexisted for many years in Kern County, elevated water use for hydraulic fracturing in the context of massive drought could alter this course," it warned. "There are growing concerns that the agriculture sector will find it more lucrative to sell their water for oil exploration than growing crops."

If there is good news in the water discussion, it is that combined use by livestock, aquaculture and mining represents only 3% of all water use in the US. Water costs for feedyards and packing plants will increase and additional investments for improved water quality may be required. We will not likely be asked to provide less water for livestock because that would be inhumane and have almost no impact. However, irrigated crop production will almost certainly be affected, resulting in changing feed resources and basis costs. Already, farmers that draw on the Ogallala aquifer have collectively agreed to voluntarily reduce water use, rather than risk legislative action that they would have less control over.

Employees: A common concern among feedyard managers is that quality employees are getting more difficult to find and harder to keep. Working in a feedyard can be physically demanding, sometimes dangerous and every job requires some weekend or evening hours. Other available jobs are simply easier and softer, often better paying as well. A declining rural/ag population means that those who prefer to work in ag are available in ever-decreasing numbers.

The growing energy industry in cattle producing areas has made the labor shortage worse by paying much higher rates for skilled and unskilled employees than feedyards and ranches are used to. It is difficult to bid against Exxon when they want something.

There are two potential solutions to this for cattle feeders and both will have to be employed. First, feeding companies will have to develop their own labor pools, starting

with unqualified workers and providing substantial training before they ever work a minute. The same will be true of management positions. Feedyards will provide management training to current or prospective employees, requiring substantial investment with risk of no payoff for the employer if the employee leaves or does not succeed. A related industry that provides these services to feedyards and dairies for fees or as value-adds is beginning to form.

Second, cattle feeding must continue to evolve to require less labor. Scarcity of labor will increase the price and technology can replace some of it. Some of that has already happened with more technology in feed mills, extended duration implants, more health treatments in feed, remote control gates and chutes and antibiotics that don't require hospital stays. Starter yards and backgrounders are accepting high-risk cattle and turning them into something that can be fed without much labor (most of the time). Design of modern working facilities reduces labor required. These trends will continue and other ways to reduce labor must be incorporated, too. Yards that lag in this transition will become non-competitive. Technology may provide space-age stuff like driverless feed trucks or sensors that identify and report sick animals without the need for a pen rider. Bar codes or RFID technology could negate the need for human recording of every incoming truck weight.

Feeding cattle with fewer people could be contrary to the trend of individualized animal production discussed previously. In the long run, capital allocation to the best use will win. Other manufacturing industries have replaced people with technology to some extent. Cattle feeding will need to do the same.

Waste disposal: The industry view of manure has changed from waste that must be disposed of to a resource that has market value. Demand and increased energy prices have driven up the price of fertilizer, increasing the value of manure with comparable nutrients. Coincident with that, as manure is applied more precisely, nutrients go farther and its water content can make a positive difference in arid climates. Soil scientists have shown that microbes in manure can inoculate soil and improve productivity. In arid areas, moisture can be extended by precisely applying manure with new equipment designs.

Manure value could also influence facility design, especially in Northern climates. Ability to capture and market all nutrients in row crop growing areas must be considered when designing facilities.

Capital: While high fed cattle prices are initially great for feedyards, they almost immediately result in higher feeder cattle prices. In the end, feedyards, as margin operators, bid cattle back to breakeven and high prices simply mean more risk without more potential reward. The amount of capital required to feed cattle has doubled since 2000. Wagering \$2000 hoping to make \$25 is not as good a business as we had in 1980 with \$68 fed cattle. This increased risk without increased return explains a portion of reduced custom feeding over the past decade as investment dollars sought more favorable risk:reward profiles. A real tug-of-war has developed in the feeder cattle

market between entities that do not need the cattle to be profitable (because of other revenue streams) and those trying to feed for profitability. Capital will find its way to the highest returns.

In a high price environment, custom feeding suffers as per head capital requirements become onerous. Financiers will avoid added risk. Either way, somebody is out of position. Credit may be harder to come by as bankers are more conservative due both to restrictive new regulations and having been burned in the past.

Eventually, rising interest rates will rearrange a great deal of production agriculture. Alternative passive investments like, bonds, will become more attractive and land prices will decline (or cease to rise) accordingly. If corn stays around \$4-5 and feeder cattle remain worth \$1000 as calves or \$1300 as 8 weights, a few corn fields might turn back to grass but it seems like fence post removal is usually a terminal process so not much of this will happen. Current economics allow serious consideration of dry-lotting beef cows, which has never been practical in the past.

Freedom to operate: A great risk to production agriculture, especially livestock, is reduced freedom to operate. Freedom can be curtailed through governmental action or the influence of consumers or activists. Governmental restrictions are most likely in the areas of water use and local air or water quality laws. Some states will determine that they do not want a livestock industry and regulate their producers into a competitive disadvantage. Others will gladly accept and support livestock. On a federal level, high estate taxes are a certainty that will disrupt individual family businesses.

The influence of the federal government could be greatest in the area of food safety. Increased pathogen testing by FSIS will add cost to the system without enhancing food safety. As testing technology improves, packers will attempt to transfer pathogen liability to feeders, as the original source of the pathogens. Feeders will invest more in pathogen reduction strategies, increasing use of displacement probiotics and adopting vaccines if they ever become efficacious and cost effective. Other technologies will appear and feeders will redesign facilities to create pre-harvest “safe zones” for the last stage of the feeding period. Feeders will demand compensation for “clean” cattle but probably will not get it, rewarded instead with market access.

Feed will be treated more like food. The FDA has released a major proposed rule to implement the Food Safety Modernization Act (FSMA): Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventative Controls for Food for Animals. This rule requires GMP and HACCP-type plans for feed manufacturers, making the feed business more like the human food business than in the past. It remains to be seen how restrictive these measures will be but they will certainly add to the cost of compliance. Both feed companies and commercial feed mills in yards will be affected to some extent.

Cattle feeders will need effective political advocacy. As much as we all like to be independent and complain about government, they will become an even more critical

partner. With exports comprising an increasing percentage of beef production, the industry will rely on government more than ever to assist with access to critical foreign markets. No individual feeder or company can open a market like Korea. That type of progress requires commodity groups to lobby lawmakers and federal agencies to take action. Increasingly, ag state representatives are focused on social issues more than ag issues. Combined with declining rural population, this lessens ag's clout in Washington and is a substantial threat to production agriculture.

Restrictions from consumers are becoming reality, driven by a small, vocal minority. The International Consumer Attitudes Study (ICAS) categorized 95% of consumers as "Food buyers". They choose foods based on taste, cost and nutrition (in that order) and are not interested in influencing production practices. Another 4% are "Lifestyle buyers". They are interested in luxury/gourmet, organic and local foods and influence production via their choices, but not activism. The remaining 1% are the "Fringe" consumers who are activists, seeking to ban or restrict certain foods or production practices. In countries with relatively cheap food, high disposable incomes and too much spare time (i.e. the US), these fringe consumers make enough noise and political contributions to have influence.

The most likely areas of influence are animal well-being, food safety and a developing area broadly called sustainability. Activist influence is not directly on producers but rather through demands of food companies that have been influenced by activists. For example, McDonalds has specific cage size requirements for laying hens in the US, buys only cage-free eggs in Europe and recently stated that it will buy 12 million cage-free eggs per year in the US, despite a cost that is 2X conventionally produced eggs. Burger King buys only cage-free eggs. McDonalds recently announced that they are moving toward eliminating gestation crates for sows and issued a joint statement with the Humane Society of the United States on the subject. Smithfield, the largest pork producer in the world, and Hormel, have stated their intention to do away with gestation crates in company-owned facilities by 2017.

An interesting partnership has been formed in the area of sustainability. The Global Roundtable for Sustainable Beef (GRSB) includes constituencies that may seem to be opposed to each other. Founding members include NCBA, McDonald's, Cargill, Elanco, JBS, Merck Animal Health, Wal-Mart and the World Wildlife Fund. GRSB takes a "triple bottom line" approach in defining sustainability, meaning a sustainable beef system must be environmentally sound, economically viable and socially responsible.

For the most part, the cattle industry avoided consumer influence on production practices. That changed in 2013 when Zilmax was withdrawn from the market. Although consumer groups were not directly responsible for the decision, there is little doubt that Tyson Fresh Meats and Merck Animal Health had concern about public opinion and it contributed to the decisions that they made.

Private standards from McDonalds or Costco, Tyson's Farm Check program, the feedyard certification in Merck's Five-Step Plan for Responsible Beef and include

requirements feedyards must meet to remain customers or suppliers. Programs of this type could alleviate consumer concern or just place another burden on management. The Beef Marketing Group' Progressive Beef program is a proactive strategy to get in front of the issues and allow feedyards to determine the strategy, rather than having it dictated.

Zilmax may return at some point and reasonable opinions may differ on whether that is a good thing or not. It is clear, however, that voluntary removal of a product that FDA has determined is safe and effective, could be a bad precedent.

Knowledge and technology: Use of technology improves beef's cost competitive position relative to other proteins. Beef marketed as natural remains a relatively small portion of the industry and has not grown as many projected. One reason is the high cost of producing beef with restrictions on technology. While technologies must be applied legally, safely and prudently, an industry based on non-use would be much smaller than our current industry and would turn beef into a luxury item, not a regular center of the plate choice.

A logical extension of the Zilmax situation is the potential for reduction in investment for new technology that serves production livestock. Companies could perceive that such investments are more risky than investing in new drugs or technologies for companion animals or human medicine. If so, the cattle industry will see a reduced flow of new pharmaceutical products and other technologies necessary to improve health or productivity.

Combined with patent expiration and increased generic approvals, the landscape of product use and support will change dramatically. Fewer new molecules and increased patent expiration will change the balance toward generic products. This will result in more choice and increased price competition. It remains to be seen if research, support and value-added services will accompany bioequivalent products. Companies will offer complete product lines, including pioneer and generic approvals, attempting to create "sole supplier" relationships. More restrictive bundling programs will be used to discourage generic use but these will eventually collapse as feeders demand choice.

Public pressure will force the industry to create solutions from non-chemical, non-pharmaceutical means. Biologically active organisms like bacteria or yeast, along with cell wall extracts, MOS compounds, essential oils, enzymes, etc. will become more common and their value recognized. The feeding industry will demand pharmaceutical-quality proof sources for non-pharma products and only those that meet that threshold will be widely used.

Trends in funding of research and subject matter are already apparent and will continue. Pure research will be driven by government dollars focused on food safety and sustainability. Improving production efficiency will not be a priority for government research dollars. Industry dollars will focus on product evaluation and comparison and become more proprietary. The long standing research relationship between the feeding

industry and large pharmaceutical companies will erode as they become fewer and focus less on production agriculture.

Technical expertise will increasingly come from partner companies and less from universities, continuing a long-term trend toward technical services and away from university extension. Half of the Departments of Animal Science will close but those remaining will thrive with high enrollment and adequate resources. In key cattle-producing states, relationships with universities will strengthen and commodity groups will have more influence on research, as long as they provide some of the dollars. In other states cattle-related programs in teaching, research and extension will be discontinued.

Summary and implications:

- Food production is no longer a local industry. Cattle feeders are part of a global economy, subject to external influences with greater opportunity and risk than ever before.
- The single biggest influence is the declining US cow herd. Heavier weights and higher prices are the result. Fewer cattle means the focus must shift to maximizing revenue from each animal.
- Continued genetic progress will be required to continue the trend of increasing carcass weights.
- High value cattle will be managed differently. Systems to improve predictability will be at a premium.
- The most feasible strategy is for the US industry to produce high quality beef for domestic consumption and export and to import lean, low cost beef for grinding.
- Supply and demand will dictate that cattle feeding use less labor and water. Crop production and available feedstuffs will change due reduced water use.
- Capital requirements and risk will continue the decline in custom feeding.
- Pressure from consumer activists will cause food companies to dictate production practices. If that results in reduced use of technology, industry competitiveness will suffer.
- It is not difficult to recognize the external forces. Success will find those who accurately predict the influence of these forces and adapt by creating and implementing the right strategies.

Suggested reading:

Animal Feed vs. Human Food: Challenges and Opportunities in Sustaining Animal Agriculture Toward 2050. Council for Agricultural Science and Technology, CAST Issue Paper Number 53, September, 2013.

Beef Demand: Recent Determinants and Future Drivers, A report to the Cattlemen's Beef Board, Ted Schroeder, Glynn Tonsor and James Mintert, April, 2013.

Food Economics and Consumer Choice. 2009. Jeffrey Simmons, Elanco Animal Health Greenfield, IN.

Fifty years of pharmaceutical technology and its impact on the beef we provide to consumers. T. E. Elam and R.L. Preston. 2004.

Future Patterns of U.S. Grains, Biofuels, and Livestock and Poultry Feeding. Robert Wisner, David Anderson, Ronald Plain, Don Hofstrand, and Daniel O'Brien. American Feed Industry Association and The Council on Food, Agricultural and Resource Economics. June 2012.

Ground Beef Nation: The Effect of Changing Consumer Tastes and Preferences on the U.S. Cattle Industry, Rabobank AgFocus Food and Agribusiness Research Advisory, January, 2014.

The World is Flat. 2005. Thomas L. Friedman.

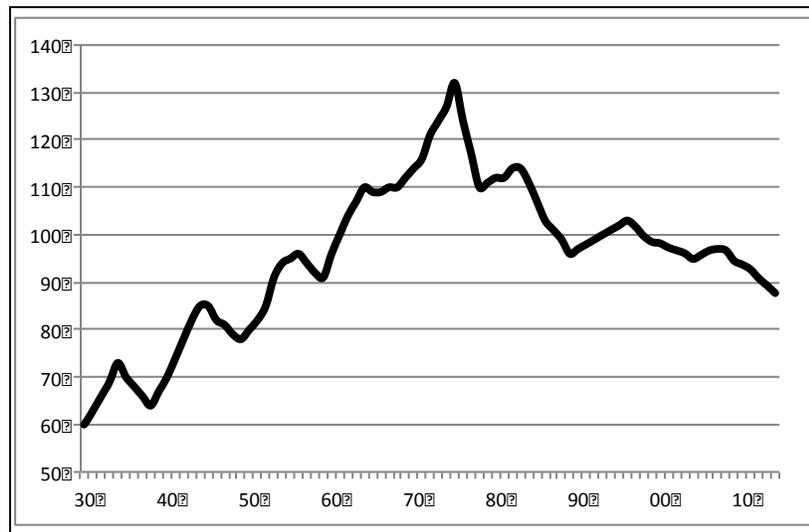


Figure 1: Total US cattle numbers (millions) by year, USDA

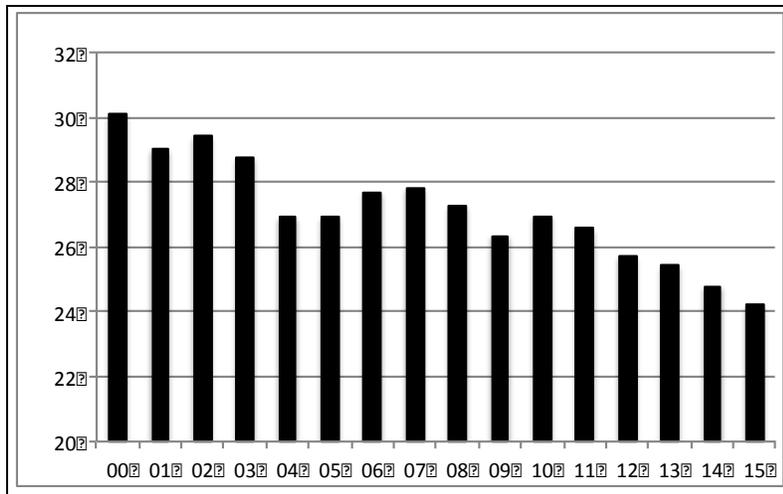


Figure 2: Federally inspected steer and heifer slaughter (millions) by year, USDA

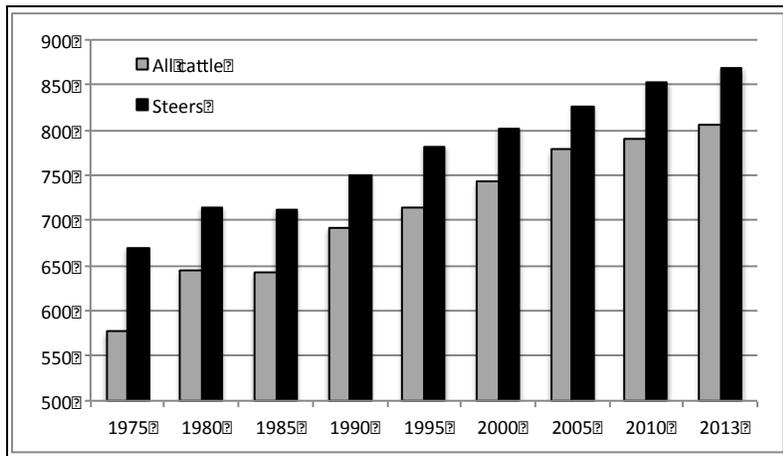


Figure 3: Federally inspected carcass weights by year, USDA

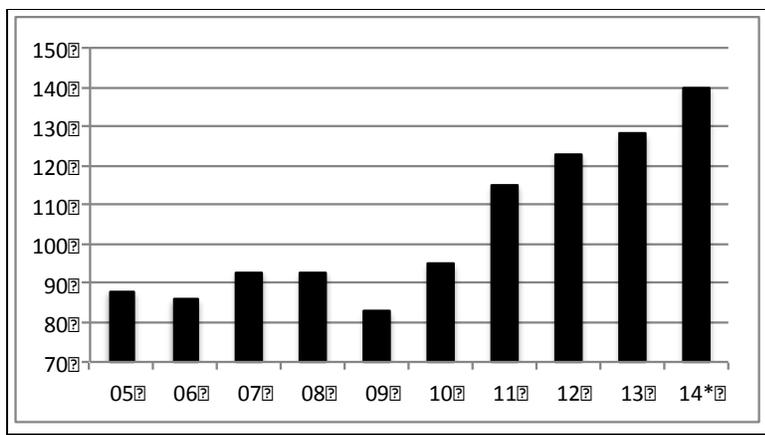


Figure 4: Annual fed steer price by year, adapted from Cattle-Fax

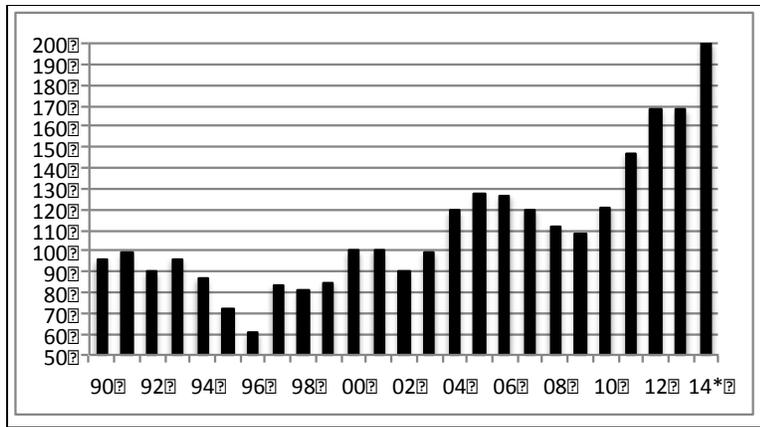


Figure 5: Annual 550 lb steer price by year, adapted from Cattle-Fax

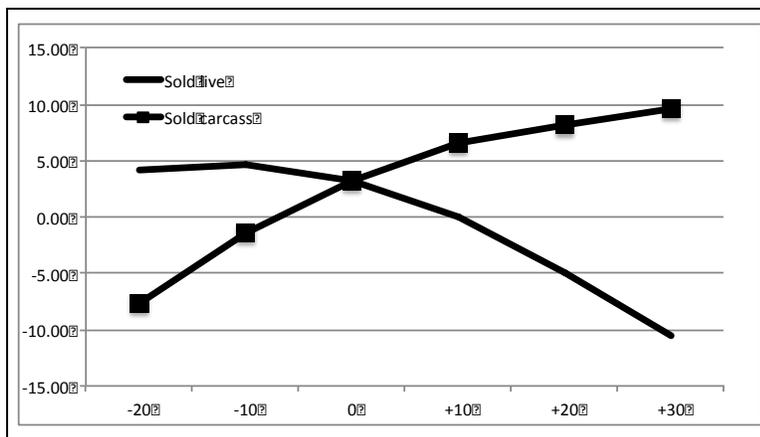


Figure 6: Comparison of profit and loss for cattle sold live or carcass with added days on feed

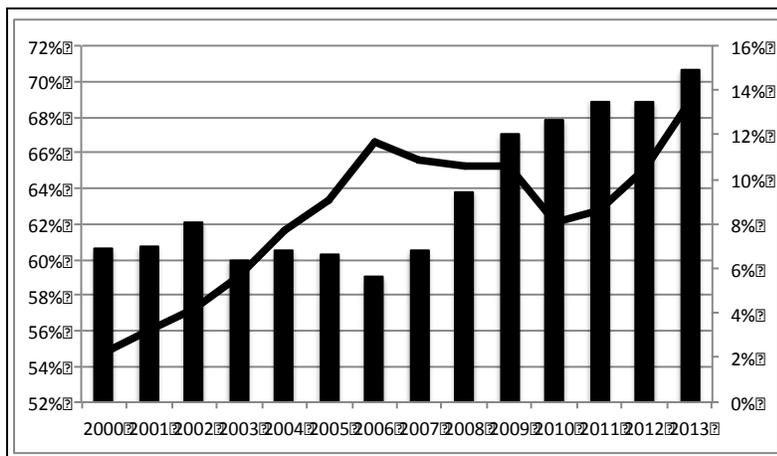


Figure 7: Percentage USDA Choice and Prime (left axis) and USDA Yield Grade 4+5

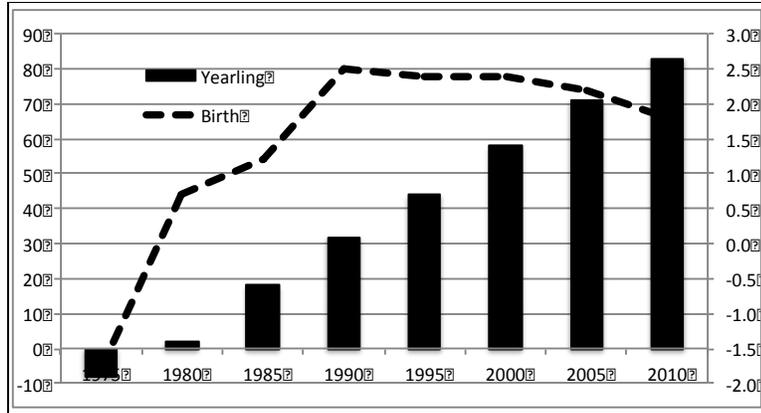


Figure 8. Angus Yearling weight and Birth weight genetic trends

	1980	1990	2000	2010	2014
Feeder, \$/cwt	70.00	82.00	85.00	120.00	175.00
Feeder cost, \$/head	525.00	615.00	637.50	900.00	1312.50
Corn, \$/bu	2.50	2.40	1.90	5.25	4.75
COG, \$/cwt *	63.89	68.30	57.92	86.03	111.67
Sale weight, lb	1115	1181	1263	1343	1425
Fed price, \$/cwt	68.00	77.00	74.00	105.00	145.00
Revenue, \$/head	758.20	909.37	934.62	1410.15	2066.25
Pct vs 1980		20%	23%	86%	173%
30 percent down	157.50	184.50	191.25	270.00	393.75
Total COP, \$/head	233.20	294.37	297.12	510.15	753.75

* Forced breakeven based on feeder cost and fed revenue

Figure 9. Capital required to feed cattle