

Differentiated Cost of Production in the Northwest:

An Analysis of Six Food Categories

BEEF / June 2016



This research was commissioned by the Cascadia Foodshed Financing Project, a project of Philanthropy Northwest, and made possible by generous grants from JPMorgan Chase Foundation, the Greater Tacoma Community Foundation and the Thread Fund. Ecotrust appreciates the thoughtful support and partnership of these organizations to pursue reliable prosperity for all Oregonians and Washingtonians.

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Project Background

Consumers have demonstrated a willingness to pay a premium for food attributes such as "freerange," "antibiotic-free," "organic," and "local." However, when production systems designed to yield those attributes are authentically implemented on the ground, such methods also tend to bear higher production and processing costs in comparison to conventional production methods. As a result, higher retail prices do not always ensure a sufficient income to the producer, nor constitute a viable supply chain.

Further, institutions such as schools, hospitals, colleges, and jails are noticeably slower as a buyer segment (versus restaurants, retailers, and manufacturers) to respond to customer interest in differentiated products for a variety of reasons, including high price sensitivity. Such buyers are vital players in the quest to get fresh, nutrient-dense food to vulnerable populations, however, so creating frameworks that allow them to access minimally processed, regionally produced food at reasonable prices would serve farmer and eater alike.

Understanding the costs of differentiated production systems in comparison to conventional approaches is vital to identifying opportunities where efficiencies may be gleaned or market value harvested to support a viable regional food ecosystem.

Ecotrust is conducting cost of production analysis in six distinct food product categories, including this one on beef. In each category we define an "ag of the middle" scale and a "differentiated production system" for analysis purposes, meaning: a specific alternative production system (one that spawns product attributes about which consumers care, such as organic, pastured, or grassfed) will be defined at a particular scale of operation (big enough to participate meaningfully in an institutional supply chain), and be assessed relative to the conventional/commodity/industrial model of production for that category.

While there are certainly many variations of both production systems and scales of operation possible in a thriving regional food system, singling out a specific system allows us to create an economic model that facilitates sensitivity analyses and high level conclusions regarding which regional food sectors could make efficient and effective use of investment.

Note, this project builds on the foundation laid by the Oregon Food Infrastructure Gap Analysis report, released in May 2015. The full report and executive summary can be accessed here: http://www.ecotrust.org/ publication/regional-food-infrastructure/, or a quick digital summary of highlights is available at http://food-hub.org/intrepid. The beef chapter from that report is included with this model/report as an addendum.

Introduction and Summary of Findings

Grass-finished beef is an important and growing production system that offers an alternative to conventionally raised, grain-finished feedlot beef. Grass finishing promises superior animal welfare, as well as a range of environmental benefits if approached using rotational grazing or a related practice such as holistic management.¹ Grass-finished beef may also carry health benefits in comparison to conventional beef, such as low fat content, and presence of high levels of omega-3 fatty acids, antioxidants, and vitamins; however, results of studies measuring these benefits are not definitive.

There exists a small (though growing) niche market for grass-finished beef in the Pacific Northwest, with a small-scale supply chain that is locally and regionally focused, and based on strong supply chain relationships between ranchers, processors, retailers, and consumers. However, scaling up grass-finished beef to become a major player in the Pacific Northwest beef industry faces significant challenges.

The three most important challenges identified by our producer contacts and the published literature are:

- 1. Higher average production costs related to slower cattle weight gain and longer time spent on pasture;
- 2. Locally specific scarcities of available, nearby irrigated pasture for finishing cattle on grass; and
- 3. Supply chains that are not oriented towards grass-finished producers, including:
 - a. Lack of year-round supply due to seasonal production constraints and regionally fragmented markets;
 - b. Relatively few strong relationships between producers and slaughter facilities; and
 - c. Lack of expertise in processing and preparation for the retail or restaurant markets.

In general, according to existing enterprise budget data, grass-finished beef can be economically viable in comparison with feedlot beef, provided that three important conditions are present: producers receive premium prices (our data suggests at least 20%), corn prices are not too low, and average daily weight gain (ADG) for grass-finished cattle are not too low (our data suggests minimum 1.75 lbs. / head / day). In general, grass-finished beef is generally not price competitive with feedlot beef unless corn prices are very high (our data suggest at least \$5.00/bushel).

¹ Rotational grazing is an approach to grass-finishing beef that minimizes environmental harms by keeping cattle on pasture for short enough periods to avoid habitat damage and soil erosion; and keeping cattle away from direct contact with water sources and riparian areas, which can harm water quality and riparianspecies.

It is possible that locally and regionally focused, grass-finished beef production in the Pacific Northwest can be scaled up beyond its current production level. However, to do so would require significant supply chain strengthening across the region to ensure year-round (or at least three-season) supply at a reasonable finishing and processing cost. A relatively favorable economic environment, such as high corn prices, would also contribute to the competitiveness of grass-finished beef production.

Overview: Grass-Finished Beef

The USDA defines grass-finished beef as beef raised with continuous access to pasture over its lifecycle. Grass-finished beef may be fed "hay, haylage, baleage, silage, crop residue without grain, and other roughage sources" (Gillespie and Nehring 2012). While grass-finished beef allows a smaller range of feeds than organic beef, it is generally known as a less stringent standard than organic, because the pasture on which the cattle are raised need not be certified organic.

Publicly available data on the market share of grass-finished beef is scarce. The 2012 Mintel Red Meat Report (not public; available for purchase) found that in the major metropolitan areas of the United States, grass-finished beef accounts for between 3% – 6% of all U.S. beef sales; the proportion of retail consumers that reported purchasing some quantity of either "grass-finished" or "locally raised" beef during that year was 43% (Williams and Ofte 2014). As of 2013, the estimated value of grass-finished beef production in the United States was \$450 million, spanning over 3,000 producers and growing at a 25-30% annual rate. An additional \$1.5 billion worth of grass-finished beef was imported from major beef-producing countries such as Argentina (Williams and Ofte 2014).



Beef cattle move between paddocks at Lazy R Ranch in Cheney, WA (Yorgey and Kruger 2016) Photo by Matt Ziegler

Data Scan: Organic Beef Production

Though data on grass-finished beef production is scarce, there does exist consistent and reliable public data at the state, regional, and national level on organic beef production. While many organic cattle are finished on (certified organic) corn, such cattle must also be raised in the first part of their lifecycle on certified organic pasture, and raised without antibiotics or growth hormones. These data can give us a general sense of the trajectory of alternative beef production, though they do not shed light on grass-finished beef specifically. This section summarizes the data on organic beef production collected by USDA and uses the data to draw general conclusions about alternative beef market trends.

Figure 1 through Figure 4 below present data on sales (in dollar value and head, respectively) of organic cattle, excluding cows, in both organic and conventional markets in Oregon from 2011-2014. ² The figures show an increase in the sales of organic cattle by both dollar value and head, as well as an increase in the proportion of organic cattle that are sold in organic markets. The results suggest a small but growing market for organic cattle.



Figure 1. Organic and Conventional Market Sales (\$) of Organic Certified Cattle (Excluding Cows), Oregon, 2011-2014

² In its data on cattle, USDA distinguishes between sales of cows only, and all other cattle sales excluding cows, including bulls, steers, heifers, and calves.



Figure 2. Organic and Conventional Market Sales (\$) of Organic Certified Cattle (Excluding Cows), Washington, 2011-2014



Figure 3. Organic and Conventional Market Sales (Head) of Organic Certified Cattle (Excluding Cows), Oregon, 2011-2014



 Organic Market Sales of Organic Cattle (Excl Cows) (Head)

Conventional Market Sales of Organic Cattle (Excl Cows) (Head)

Figure 4. Organic and Conventional Market Sales (Head) of Organic Certified Cattle (Excluding Cows), Washington, 2011-2014

Figure 5 and Figure 6 below show total sales (in dollar value and head) of organic beef cattle in Oregon and Washington between 2008 and 2014, separated into cattle excluding cows (Figure 3) and cows only (Figure 4). Linear time trends are displayed alongside each data series. The left-hand vertical axis displays the dollar value of the cattle sold, while the right-hand vertical axis displays the number of head of cattle sold. The results show an overall increasing trend in the number and value of organic cattle (excluding cows) sold in the region. The value of organic cows has increased, while the number of head sold has decreased, suggesting an increase in the price of organic cows.





Figure 6. Total Sales (\$ and Head) of Organic Beef (Cows Only), Oregon and Washington, 2008-2014

Figure 7 and Figure 8 below provide the corresponding data series for the United States as a whole, demonstrating that overall, the number and value of organic cattle have increased over the period 2008-2014.





In conclusion, we find that the most reliable available dataset on alternative beef production, the USDA organic data, demonstrate an overall trend increase in both volume and value over the past decade. This trend gives us reason to be optimistic about alternative beef production in general, including grass-finished.

Figure 7. Total Sales (\$ and Head) of Organic Beef Cattle (Excluding Cows), United States (Total), 2008–2014

Figure 8. Total Sales (\$ and Head) of Organic Beef Cattle (Cows Only), United States (Total), 2008-2014

Production Systems: Rotational Grazing

Rotational grazing is an important production system for grass-finished beef and dairy cattle, due to its significant environmental benefits that include protection of water quality, protection of riparian (streambank) ecosystems, and maintenance of soils and native pasture habitat. Most cattle in the United States are raised under continuous grazing systems on pasture during the first phase of their lifecycle. Continuous grazing leads to rapid depletion of the pasture, since forage is not given time to recuperate between grazing periods. Further, many continuous grazing systems do not include adequate fencing, leading cattle to degrade riparian areas (stream banks) and contaminate local water sources. Rotational grazing systems, by contrast, maintain the health of native pasture, reduce soil erosion, minimize the need for chemical applications of fertilizers or pesticides, and decrease nutrient runoff into waterways. From being virtually unknown in the United States until the 1990s, rotational grazing systems have become an increasingly popular alternative for cattle raising operations: for example, adoption among Wisconsin dairy farmers reached 22% by 2002 from virtually zero in 1990 (Undersander, et al. 2002).

In a rotational cattle grazing system, producers divide pasture into sections called paddocks. Depending on the number of cattle and the size of the land base, the number of paddocks could be as few as two, and as many as 40. Producers rotate cattle through the paddocks over periods ranging from one to ten days on average, depending on the season and species of grass in the pasture. Timing of rotations is adjusted to maximize pasture forage growth; using a rigid schedule reduces the benefit of the system (Undersander, et al. 2002). Rotational grazing can be conducted at varying levels of management intensity. Management-intensive rotational grazing includes a larger number of paddocks, more frequent rotation, and longer pasture rest periods. In general, more intensive management leads to higher productivity of the system (more cattle per acre), yields higher quality pasture, reduces problems of weeds and erosion, and is more robust to drought.

Holistic management (HM) is an approach to rotational grazing that emphasizes the importance of understanding the ranch as an ecosystem (Yorgey and Kruger 2016). Founded by ecologist and farmer Allan Savory in the 1960s in Zimbabwe, HM has become a global phenomenon with training centers on every continent. Holistic management focuses on long-range planning, systems thinking, and quality of life that includes humans as part of ecosystems. Holistic management has become a well-regarded method of livestock management in the Pacific Northwest, and an increasing number of ranchers are studying and adopting it.



A series of small paddocks share access to shade and water at Lazy R Ranch in Cheney, WA. This hub and spoke set up is part of the holistic management approach to rotational grazing (Yorgey and Kruger 2016).

Photo by Georgine Yorgey

There is no representative data on the adoption of rotational grazing or HM practices in the Pacific Northwest, but research indicates that it is a growing practice in the region. Beth Robinette, co-manager of holistically managed Lazy R Ranch near Spokane, WA, teaches courses in HM on the ranch along with her father, co-manager Maurice Robinette, and identifies a high level of interest in HM among the cattle raising community. However, she notes that ranchers face challenges in adopting the approach, since it is very planning-intensive. Beth remarks, "It takes two hours of planning for every hour of physical labor. It's a big turn-off to (many) producers. If you've never done biological monitoring, grazing planning, or financial planning, all of it seems really intimidating" (Robinette 2016). The nonprofit Roots of Resilience teaches and promotes HM in the Pacific Northwest (Roots of Resilience 2013).

Alternative Beef Production in the Pacific Northwest: Trends and Emerging Issues

Though USDA data indicate that alternative beef production in the Pacific Northwest is growing, it is important to note that the Pacific Northwest beef industry as a whole faces difficulties in supply chain integration that make the scaling-up of a locally and regionally focused beef sector difficult. This section provides a brief snapshot of the Pacific Northwest beef industry, an overview of the national beef value chain, and a synopsis of the challenges facing beef producers in the Pacific Northwest today.

1. Snapshot of the Pacific Northwest Beef Industry

Livestock production is a central piece of the Pacific Northwest agricultural economy, and has been present in this region as far back as the early 1800s. The abundance of grass and water resources provided early settlers with an ideal environment for raising livestock (Galbraith and Anderson 1991). Today, while Oregon and Washington are not the highest cattle-producing states in the U.S., livestock contributes a sizable amount to both state economies. In 2012, animals and animal products accounted for about \$1.6 billion of Oregon's \$4.9 billion farm economy; in Washington, animals and animal products accounted for \$2.6 billion of the \$9.1 billion farm economy (NASS 2016).

Most beef producers in the Pacific Northwest are cow-calf operators, which are typically small-scale operations that raise 50 head of cattle or less (Ecotrust 2015). According to Washington State University's School of Economics, of the 9,139 Washington cow-calf operations in 2012, 65% had an inventory of less than 10 beef cows, and only 2.8% had an inventory of more than 100 beef cows (Washington State Beef Commission 2014). Similarly, according to the Oregon Food Infrastructure Gap Analysis report, "Oregon is primarily a state of cow-calf operators, rather than feedlot, finishing, and cut meat production" (Ecotrust 2015). Oregon's livestock inventory in 2014 totaled 1.28 million head of cattle and calves, with 516,000 of those recognized as beef cows (Beef2Live 2016); in that year, Oregon's calf crop was 630,000 head. In the same year, Washington's cattle inventory was 1.1 million head of cattle and calves, of which only 209,000 were beef cattle (Beef2Live 2016); its calf crop was 405,000. By comparison, Texas – ranked highest in the nation in number of total cattle and beef cows – produced 10.9 million cattle in 2014, with 3.9 million beef cows (Beef2Live 2016).

2. An Overview of the Beef Value Chain

Cow-calf operations represent the first phase of the "cattle cycle" or beef value chain. In a typical cow-calf operation, new calves are born in the spring and remain with their mothers on range or pasture until weaned at 6-8 months. At this point, cow-calf operators typically sell weaned calves to "stocking" or "backgrounding" operations where they gain additional weight. In this second phase, cattle still forage on grass or pasture, but "often receive supplemental feeds over winter as forage quality declines" (Ecotrust 2015).

In the third phase, cattle weighing 600-900 pounds are sold to feedlots as feeder cattle, where they will remain for 90-120 days. The feeder cattle are fed a grain-based diet and often receive hormone and antibiotic treatments to manage the transition from grass to grain (Ecotrust 2015). Beef cows weigh between 1,100-1,300 pounds at slaughter, they are sent to slaughter at a packing operation, "some of which also produce processed beef products" (Lowe and Gereffi 2009). Once beef is cut, packed, and/or processed, distribution occurs through "wholesalers or direct sales to retailers, although the wholesale role is increasingly being performed by the large packers and processors themselves" (Lowe and Gereffi 2009). For more information on the role of large packing operations, please refer to Section III.B of this document, which deals with infrastructure.

Understanding the beef value chain, including the role of cow-calf operators within the U.S. beef industry, allows us to identify the challenges faced by Pacific Northwest beef producers. As a result of consolidation among meatpackers and the disappearance of smallscale processing facilities, the current economic environment favors industrial-scale meat production and presents numerous obstacles for independent, local producers. These obstacles are discussed in the next section.

The supply chain for grass-finished beef in the Pacific Northwest tends to differ from that of grain-finished beef, in that most grass-finished producers hold the cattle over their entire lifecycle, instead of selling the weaned calves at auction. Typically, a Northwest cow-calf operator seeking to expand into grass-finished beef will hold over a number of their cattle at weaning, to be finished on pasture (Kruger 2016). Most such producers only hold over a small proportion of their herd; 5-6 head is typical. For this reason, it is unlikely that a separate, finishingonly pasture operation for grass-finished beef in the Pacific Northwest would attain enough throughput to be profitable at the current scale of production (Kruger 2016). The key to expanding grass-finished production, then, is to convince a number of cow-calf operators that it is profitable to hold over a larger proportion of their weaned calves to be finished on pasture. But such a move would require a change in the rancher's business plan, as holding weaned calves would negatively impact producers' short-run revenue and increase total operating costs from holding cattle, including pasture leasing, supplemental feed, trucking, and other inputs (Kruger 2016).

The remainder of the grass-finished supply chain tends to take one of two forms: direct sales to consumers, or wholesaling. Grassfinished producers who sell directly to consumers often contract for slaughtering, cut and wrap services. For instance, Lazy R Ranch in Cheney, WA, sells the majority of its annual 50 butchered cattle direct to consumers via custom slaughter. Consumers pay for whole or half carcasses by the pound, as well as per-pound cut and wrap fees (Robinette 2016). By contrast, grass-finished producers and aggregators who sell wholesale beef to retailers, such as Season's Peak, tend to contract for slaughtering and primary processing only, while the retailer takes care of cut and wrap (Panner 2016). 3. Challenges in Organic / Grass-finished Beef Production

Considering that over 90% of U.S. beef is produced conventionally, it is no surprise that transitioning from conventional to alternative beef production (such as organic or grass-finished) presents a number of challenges, particularly for the cow-calf operator.

a. Processing

One of the biggest obstacles for small producers seeking to scale up grass-finished beef production for the local and regional market relates to the lack of close-by, economically competitive processing facilities that can handle small batches. Since 1980, significant consolidation within the meatpacking industry has led to a dwindling of USDA-inspected slaughtering plants, particularly those operating at a smaller scale. Since 1998, the number of meat processing facilities has dropped by 18% nationwide (Ecotrust 2015). In the Pacific Northwest (Oregon and Washington), over that time period the number of facilities has fallen 34% (99 to 65); and the number of small facilities employing fewer than five people has fallen 48% (62 to 32). Data on the number of these facilities that were USDA-inspected is not available.

With fewer facilities available, ranchers in the Pacific Northwest who want to process their own meat are faced with either transporting their cattle long distances to be slaughtered – usually out-of-state – or paying additional fees to access services at large processing facilities. In many cases, large plants simply refuse to slaughter "small batches" of cattle because it reduces their profits and efficiency, especially when those animals lack the uniformity of conventional, grain-fed cattle (Ecotrust 2015). To remain competitive, processors will often have minimum head requirements or work on a contract basis only, which further excludes small-scale producers (Summary of Meat Processing Issues in Washington State 2009). Without an accessible (or affordable) way to process their cattle, independent producers face a weaker incentive to transition to an organic or grass-finished system: the cost is too high.

Successful local and regional grass-finished beef processing and marketing in the Pacific Northwest has tended to occur in proximity to a small- to mid-scale slaughtering and primary processing plant that works in close partnership with ranchers. For example, Season's Peak, a regional rancher-owned grass-finished beef company that supplies regional retailers, processes all of its cattle at Mohawk Valley Meats, a certified organic, USDA inspected slaughter facility based in Springfield, OR. The Mohawk Valley plant is independently owned and prides itself on speed and efficiency of processing. According to a Season's Peak producer we interviewed, the unit cost is higher than conventional slaughtering and packing plants, but is not excessively high (Panner 2016); Season's Peak is able to make use of the facility profitably despite the higher cost. The strong partnership between Season's Peak and Mohawk is a factor in ensuring a reliable supply of grass-finished beef to regional buyers. By contrast, the small-scale slaughtering facility in Odessa (WA), cooperatively owned by Cattle Producers of Washington (CPOW), has struggled financially due to lack of reliable supply from producers.

b. Maintaining Ownership

In addition to a lack of processing facilities, many small ranches are unable to bear the high cost of maintaining ownership of their beef through all phases of production. Not only is more land required to raise cattle, but "for one company to undertake the entire cattle life cycle including stocking and backgrounding through feedlot, slaughter and processing requires extremely large amounts of capital" (Lowe and Gereffi 2009). Two strategies – the use of mobile slaughtering units (MSUs) and the emergence of beef cooperatives and aggregation firms have enabled ranchers to capitalize on rising demand for grass-finished beef products while maintaining ownership of livestock. For instance, the rancher-owners of Season's Peak retain ownership of their cattle until it "hits the rail," meaning slaughtered and primary processed (Mays 2016). The rancher-owners of Country Natural Beef, similarly, retain ownership of beef through the slaughtering and primary processing stage (Stevenson and Lev 2013). Please refer to Section III.B, devoted to infrastructure, for more information on MSUs, and Section III.C, devoted to aggregation, for more information on beef cooperatives and related firms such as Country Natural Beef and Season's Peak.

c. Availability of Rangeland and Pasture

For many aspiring grass-finished beef producers, availability of suitable rangeland and pasture is a key constraint on their ability to adopt grass-finishing methods, or increase the scale of existing grassfinishing operations. As stated above in Section II.C.2, most grassfinished beef producers in the Northwest are cow-calf operators who hold a portion of their weaned calves for finishing. However, whereas cow-calf operators can raise calves on a wide range of pasture types and quality levels, successful grass-finished beef producers require irrigated, well-managed, well-fenced pasture on which to finish their cattle. In many regions of the Pacific Northwest, such pasture is scarce (Kruger 2016, Mays 2016).

The issue of available pasture extends to broader questions of ownership and control over land. In the Pacific Northwest, like most of the western U.S., cattle producers tend to rely on public lands to provide the amount of space and forage necessary to raise their animals. While grazing leases on these lands tend to be granted at relatively low cost, the use of public land for grazing is subject to fairly strong limitations. For instance, the number of cattle that producers can stock on these lands is very restricted. Combined with generally inadequate fencing and scarce irrigation, the result is that ranchers that rely on public lands are virtually unable to conduct rotational grazing, holistic management, or any related production system that results in efficiently and economically produced, high-quality grass-finished beef. The vast majority of ranchers who use public lands are cow-calf, and sell weaned calves into the commodity beef market at auction (Kruger 2016).

Organic certification is also very difficult to achieve for cattle raised on public lands. As with many food categories, achieving organic certification in the beef industry is a closely regulated and expensive process that can deter small producers. In general, "it is not typically practical for cattle raised in the West on rangeland to be certified organic" (Ecotrust 2015). The problem is that "in a public lands situation ranchers do not have the ability to guarantee that chemicals were not used for weed or fire suppression" (Ecotrust 2015), and therefore cannot ensure that cattle grazed exclusively on organic forage.

d. Cash Flow Challenges

In the case of grass-finished operations, ranchers can encounter cashflow challenges in holding animals an additional year until they reach target weights (Ecotrust 2015). Kathy Panner of Season's Peak remarks that the slower growing time for grass-finished cattle is one of the factors that ensure higher production costs (Panner 2016). Slow animal growth entails not only that the rancher wait a longer time before reaping the returns from investment, but also incur a higher daily operating cost if supplemental feeds such as hay or silage are necessary to maintain the animal's weight through the winter months (Kruger 2016).

In general, maintaining cash flow is one of the challenges of grassfinished beef production. Grass-finished beef producers seeking to scale up too rapidly to meet consumer demand run the risk of selling animals before they reach optimal weight. This practice reduces future cash flow and undermines future growth; grass-finished beef producers have gone bankrupt from selling cattle too soon. Debt financing based on excessively rapid growth projections can trap grass-finished beef producers into this vicious cycle. Kathy Panner, manager of Season's Peak, has observed that the grass-finished beef market suffers from high producer turnover, due in large part to poor cash flow planning and indebtedness stemming from excessively rapid growth (Panner 2016). The final difficulty grass-finished beef producers face in ensuring cash flow is price. In general, grass-finished cattle produce leaner cuts of beef than conventionally-raised cattle. If consumers are unwilling to buy such cuts, grass-finished cattle can be redirected to commodity markets, in which leaner beef cuts tend to grade poorly (Ecotrust 2015), since the USDA grading system values "marbling" or high fat content, which is produced through finishing cattle on grain. The commodity beef grading system thus reduces grass-finished ranchers' revenue, since a lower grade typically results in a lower price point for their product. Restaurants, an important market channel for small producers, tend to favor grain-finished, marbled beef to please consumers. Grassfinished beef producer Beth Robinette of Lazy R Ranch finds that in general, ground beef is the easiest cut to sell, because it is the easiest cut for the producer to supply large volumes at consistent quality; by contrast, other cuts such as flank steak are often difficult to supply in volume. Further, many chefs are not familiar with cooking grassfinished beef, which requires different treatment from its grain-finished counterpart to ensure that consumers will appreciate it (Robinette 2016).

e. Seasonality

In general, grass-finished beef in the Pacific Northwest is a seasonal product, which presents unique marketing challenges since it does not appear in stores all 12 months per year. Grass-finished cattle are typically harvested in the fall at the end of the grazing season, meaning that grass-finished beef products are sold frozen for most of the year, which impedes consumer acceptance of the product (Ecotrust 2015). Raising cattle on low-quality pasture, or harvesting cattle during the wrong season, can also reduce the quality of the meat.

Though no single ranch in the Pacific Northwest can supply grassfinished beef year-round for the retail market, sourcing from a variety of ranches in different sub-regions of the Northwest can extend the range of seasons when fresh grass-finished beef is available. This strategy has been adopted by Season's Peak, the grass-finished beef marketing firm that supplies the regional retail market from 18 ranches around the Northwest, from central Washington (Ellensburg) to southwestern Oregon (Riddle). Season's Peak manager Kathy Panner notes that while Wallowa County cattle (northeastern Oregon) are at their peak in October, those in Douglas County (southwestern Oregon) reach their peak in July. These differences stem from the geography of the two subregions; Wallowa County's best grass emerges in July, while Douglas County's emerges in April (Panner 2016). It is worth noting that the peak seasons for finishing grass-finished beef reflect local geography, and do not necessarily match the optimal time to bring the product to market.

Year-round grass-finished beef is challenging in the Northwest, but not impossible. Lazy R, a custom slaughter-oriented ranch in Cheney, WA, are able to supply direct-to-consumer grass-finished beef year round, through careful pasture management and the use of supplemental feeds December through April, predominantly alfalfa, canary grass, and barley straw (Robinette 2016). Farther south in warmer states such as Colorado, Missouri, and Texas, warmer weather makes year-round grazing more feasible (Kruger 2016).

Some U.S.-based firms marketing grass-finished beef are able to supply year-round by sourcing from multiple regions. For instance, longtime beef producer BN Ranch, formerly known as Niman Ranch, has embraced the seasonality inherent in the grass-finished beef industry by sourcing from multiple locations around the globe. Highlighting "locale" over "local," BN Ranch operates cattle ranches in California, Canada, and New Zealand and "harvests its genuine grass-grown, grass-finished beef when forages are at their finest" (BN Ranch: Grassfed Beef 2015). By raising cattle in three locations, BN Ranch is able to provide "best in season beef" year-round by connecting different grazing seasons.

4. Price Premiums for Grass-finished (Grass-Finished) Beef

Grass-finished beef typically sells at a significant premium above conventional beef for the same cuts. Table 1 below presents average retail price data for conventional beef alongside average direct-toconsumer price data for grass-finished beef from February 2016, for four of the most popular cuts of beef (USDA 2016). Grass-finished premiums range from a low of 56% (Top Round) to a high of 147% (sirloin steak).

	Ground Beef	Chuck Roast	Top Round	Sirloin Steak
Conventional (Retail)	\$3.96	\$5.35	\$6.00	\$8.28
Grass-finished (Direct)	\$9.11	\$8.66	\$9.34	\$20.47
Grass-finished Premium (%)	130%	62%	56%	147%

All conventional prices are given for USDA Choice cuts (high estimate)

Table 1. Retail Price Estimates (\$/lb)for Conventional vs. Grass-finished Beef(Feb 2016), USDA Averages

Figure 9 below presents a timeline of conventional retail beef prices (by cut) from March 2015-January 2016. All price estimates are in \$/lb. The data show an overall upward trend in the per-pound price of most cuts of conventional beef. Beef cuts listed are based on the top choices made by consumers. Based on this graph, USDA Choice Sirloin Steak remains the highest-priced cut, with ground beef consistently priced lowest. Round Steak cuts, whether USDA Choice or not, have highly correlated pricing.



Figure 9. Average Conventional Retail Beef Prices by Cut, US Average, March 2014–January 2016

5. Estimates of Market Size

This section estimates the total retail market size for beef as a whole, and grass-finished beef as a subset of that total, in the Pacific Northwest. In 2015, national annual average per capita beef consumption was 53.9 lbs. / person / year retail weight (Bentley and Buzby 2015). A recent value chain analysis of the U.S. beef industry conducted by the Environmental Defense Fund (EDF) (Lowe and Gereffi 2009) calculated the breakdown of beef consumption by six top-level categories: ground, stew, steak, processed, beef dishes, and "other cuts" including hot dogs. The authors break out annual consumption data into at-home and away-from-home consumption; at-home consumption comprises the majority (about 65%) of beef consumed in the United States. Assuming that regional (Pacific Northwest) beef consumption in pounds is equal to the national average, and adapting the prices given above in Table 1 to fit the category breakdown given by the EDF study (Lowe and Gereffi 2009), we estimate the total size of the consumer market for beef in the Pacific Northwest. We assume population size of 4.01 million for Oregon, and 7.06 million for Washington, following the most recent population size estimates for those states.

For all of our conventional prices, we use the price series from February 2016 from the USDA Economic Research Service (USDA 2016). For the average steak price, we assume the mean of all of the steak prices quoted in the series (\$6.65 / lb). For the "All Other Beef" category, we use the average price for the catch-all category "All uncooked other beef, not veal" (\$4.54 / lb.) (USDA 2016).

Given those assumptions, we estimate that the size of the annual total retail consumer market for beef in the Pacific Northwest (Oregon and Washington) is approximately \$2.92 billion. For the top three categories of ground beef, stew beef, and steak, the retail consumer market is approximately \$1.72 billion.

	Annual Total Consumption (2015) (lb./person/yr)	Average Commodity Retail Price (\$/ <u>lb</u>)	Retail Market Size, Oregon and Washington (\$ million)
Ground (not Lean)	13.8	\$3.96	\$605.0
Stew	6.6	\$5.02	\$404.8
Steak	9.7	\$6.65	\$714.1
Top 3 Categories	30.1	-	\$1,723.8
All Other Beef	23.8	\$4.66	\$1,196.1
TOTAL	53.8	-	\$2,919.9

 Table 2. Estimated Retail Consumer

 Market Size, All Beef, Oregon and

 Washington (2015)

To estimate the size of the grass-finished niche of the beef market, we use the annual consumption data cited by the EDF study (Lowe and Gereffi 2009), and assume conservatively a grass-finished beef market penetration of 3%. For price estimates, we use the average grass-finished beef prices quoted above in Table 1. Grass-finished beef typically sells at a significant premium above conventional beef for the same cuts.

Table 3 below presents the estimated market size for the top three categories by amount consumed, along with a catch-all category of "All Other Beef". For grass-finished stew meat, we use February 2016 grass-finished prices of \$9.61 (USDA 2016). For steak prices, we apply the grass-finished steak premium of 147% to the mean conventional steak price quoted above (\$16.43/lb). For the prices of "All Other Beef," we use the average 2015 price data for the BLS category "All uncooked other beef, not veal", and assume a grass-finished price premium of

102%, which is equal to the median of the price premiums quoted in Table 1 above. We use recent population estimates for the U.S. Pacific Northwest (Oregon and Washington) of 11.07 million to derive the retail market size estimates in Table 3 below.

The estimates given in Table 3 below indicate that the total retail market size for grass-finished beef, conservatively estimated, for Oregon and Washington, is about \$188.2 million. For the top three categories of grass-finished beef, it is about \$115.7 million. Of this total, \$52.9 million consists of consumption of steak, which has the second-highest consumption in pounds per capita, but the highest price point and thus the largest potential market by value. \$41.7 million consists of ground beef, which has the highest consumption per capita, but a lower price point. Stew meat consists of the smallest of the three categories by value, \$21.1 million.

	Annual Total Consumption (lb./person/yr)	Annual Grass- finished Consumption (lb./person/yr)	Sample Grass- finished (Direct-to- Consumer) Price (\$/ <u>lb</u>)	Retail Market Size, Oregon and Washington (\$ million)
Ground	13.8	0.4	\$9.11	\$41.7
Stew	6.6	0.2	\$9.61	\$21.1
Steak	9.7	0.3	\$16.43	\$52.9
Top 3 Categories	30.1	0.9	-	\$115.7
All Other Beef	23.8	0.7	\$9.17	\$72.5
TOTAL	53.8	1.6	-	\$188.2

 Table 3. Estimated Retail Market

 Size, Grass-finished Beef, Top Three

 Categories, Oregon and Washington.

The next section estimates the share of this market that can be expected to accrue to the grass-finished beef rancher, assuming that the rancher raises the cattle over their entire lifecycle rather than selling to a specialized grass-finishing operation (which are rare). Most successful grass-finished beef producers who sell through retail channels, rather than direct, own the product until it is purchased by the retailer, and contract for slaughter, cut and wrap. The grass-finished producer's place in the supply chain is thus akin to the wholesaler, not the feedlot.

Since we lack a robust dataset of grass-finished beef retail prices, the market size estimates given below rest on the assumption that the retail price of grass-finished beef is equal to the direct-to-consumer price. This assumption will give us a conservative estimate of market size, since retail prices are likely to be somewhat higher than direct-to-consumer prices due to the longer value chain for retail in comparison to direct sales.

We assume that retail shares are the 2015 annual average given by USDA Economic Research Service (42.4%) (USDA 2016). We assume the slaughtered cattle weigh an average of 600 lbs. "on the rail". We assume slaughter fees are \$50 / animal (thus \$0.08 / lb.), and cut and wrap fees are \$0.75 / lb. (Coyote Creek Farm 2016).³ Given these assumptions, the prices received, and share of the final retail price, received by the rancher are given in Table 4 below.

Cut	Reta	il Price	Rano	her's Price	Rancher's Share
Ground	\$	9. 11	\$	4.41	48%
Stew	\$	9.6 1	\$	4.70	49%
Steak	\$	16.43	\$	8.63	53%
All Other	\$	9.17	\$	4.45	49%

Table 5 below takes the rancher's share of the final price given above and applies it to the retail market size estimates derived above in Table 3. Based on the assumptions outlined in this section, we estimate conservatively that the total (potential) market size at the farmgate (rancher) level for grass-finished beef in the Pacific Northwest in 2015 was approximately \$93.5 million. Note that since a large proportion of grass-finished beef consumed in the U.S. is imported (e.g. from Argentina), this estimate reflects the potential market size, not the value of product actually sold by grass-finished ranchers.

Cut	Retail Market Size	Rancher's Share	Rancher's Market Size
Ground	\$41.7	48%	\$20.2
Stew	\$21.1	49%	\$10.3
Steak	\$52.9	53%	\$27.8
All Other	\$72.5	49%	\$35.2
TOTAL	\$188.2	-	\$93.5

³ Cut and wrap fees differ across processing plants, as well as across jobs within the same processing

Table 4. Estimated Farmgate Pricesand Share of Retail Price Received byGrass-Finished Rancher (2015).

 Table 5. Estimated Market Size, Retail

 and Rancher, Grass-Finished Beef, Pacific

 Northwest (2015)

plant. The assumption given above is meant to be an example that does not reflect all market conditions.

6. Defining Agriculture of the Middle in Grass-Finished Beef

This section defines briefly the scale of production necessary that is definable as Agriculture of the Middle for grass-finished beef. We use the rule of thumb of \$250,000 - \$500,000 in gross sales as a proxy for Agriculture of the Middle (McAdams 2015). The relevant scale of production, measured in head of cattle, depends on the sale price of the finished and slaughtered cattle.

The USDA Agricultural Marketing Services publishes a monthly Grass Fed Beef report (USDA 2016) that quotes the range of prices being offered per hundredweight of dressed (slaughtered and primary processed) grass-finished beef carcass from the wholesaler. The most recent report cited a price per hundredweight of \$270-\$350. A typical dressing percentage, or conversion from live to dressed carcass, is 60%. We assume an average live cattle weight of 1,000 lbs., and thus an average dressed weight of 600 lbs. We assume that the grass-finished cattle rancher receives the dressed carcass price, minus a slaughter fee of \$50 per animal.

Given these price and weight estimates, we can derive some basic estimates of the number of head of cattle required for a grass-finished beef producer to be considered "Agriculture of the Middle." These estimates are given in Table 6 below. For instance, if the price per dressed hundredweight is \$270, the producer must raise 159 head of cattle to reach \$250,000 in gross revenue, and 318 cattle to reach \$500,000 in gross revenue.

	Producer Revenue	Dressed Cattle Price (\$ / cwt)			
			\$270	\$350	
Table 6 Entimeted Hard Circ For		\$250,000	159	122	
Agriculture of the Middle Grass-Finished Beef Production		\$500,000	318	244	

Drivers of Supply of Organic and Grass-Finished Beef

Production Costs

The cost of producing beef finished on grass in pasture, relative to beef finished on grain in feedlots, is a major driver of supply. In general, grass-finished beef costs more to produce than grain-finished beef. The key cost factors that determine this difference are the slower weight gain of feeder cattle on grass in comparison to grain; the difficulties in finding close-by irrigated pasture suitable for the finishing stage; and the relatively low price of feed grains that feedlot cattle consume, such as corn.

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While some budgets indicate that production costs for grass-finished beef are competitive with those of grain-finished, these results can be misleading. For instance, a recent budget from Washington State University (Neibergs and Nelson 2008) assumed that finishing cattle on pasture grass entailed about 2.4 lbs. / day of average daily gain (ADG). As a result, the total number of days needed to finish these animals (from 879 lbs. feeder weight to 1,252 lbs. market weight) was 153 days, and the pasture cost of feeding these cattle was assumed to be \$216/head in 2012 USD. However, ADG varies by local environmental conditions (Forero, et al. 2012), and there is evidence that the assumption of 2.4 lbs. ADG is overly optimistic. A review of recent studies revealed an ADG for grass-finished beef of about 1.5 lbs. (Comerford 2016), entailing a 249-day finishing period and a pasture cost of \$352/head, assuming the same unit cost of land as given in the original budget.⁴ A recent study at UC Davis (Forero, et al. 2012) indicated that ADG may vary from 1.0 to 2.75 lbs. / head / day, based on environmental conditions such as: summer heat, pasture plant species, soil fertility, irrigation, cattle genetics, health, mineral nutrition, and other factors. Grass-finished cattle rancher (and manager of Season's Peak) Kathy Panner estimates that her cattle gain approximately 2 lbs. / head / day (Panner 2016). The quality of available pasture forage, and thus the ability of grass-finished cattle to gain weight sufficiently rapidly to offer a competitive product, varies substantially across geographical space and time.

Table 7 below presents sample cost data for a grass-finished and feedlot (grain-finished) beef operations. Grass-finished beef data are adapted from a recent study at Washington State University (Neibergs and Nelson 2008), and feedlot beef data are adapted from a recent study at University of Wisconsin (Wisconsin Beef Information Center 2012). For simplicity, we assume that both production systems raise and finish steers only. For the grass-finished system, we assume that finished steers weigh 1,252 lbs. and sell for \$120/cwt live. For the feedlot system, we assume finished steers weight 1,300 lbs and sell for \$100/cwt live. We assume that in both cases, identical feeder steers are purchased from stocking operations at a weight of 875 lbs., for a price of \$95/cwt.

The grass-finished system assumes an ADG of 1.5 lbs. / day on irrigated pasture, which is rented for \$36 / AUM (Animal Unit Month). These assumptions entail that the total pasture cost for grass-finished beef is \$352 / head. For the grain-finished system, we assume corn is \$3/bushel, entailing a feed cost per head of \$218, which also includes significant provision of vitamin and mineral supplements and corn silage. Low (or subsidized) corn prices are the key to the price competitiveness of grain-finished beef. Importantly, we are

⁴ A 249-day finishing period is about 8 months, which is close to the limit of how long cattle in the Pacific Northwest can graze without needing supplemental hay or silage.

also assuming that the grass-finished cattle do not need to be fed supplemental hay or silage. This assumption is optimistic for the Pacific Northwest, in which the growing season on grass is relatively short, leading most grass-finishing operations to either purchase or grow supplemental (non-grain) feed for cattle, usually in the form of hay. These supplemental feeds can be a major cost center, especially in regions with relatively short grazing seasons or relatively low-quality pasture (Kruger 2016).

Following the budget from WSU (Neibergs and Nelson 2008), we assume trucking costs for grass-finished cattle are much higher for grass-finished systems, due to the increased mileage such cattle must travel between leased pasture plots. Our budget comparison assumes trucking costs are \$35.65 / head, versus only \$5.00 for the grainfinished system. Lack of conveniently located, contiguous plots of irrigated pasture is a problem for many regional grass-finished beef producers (Kruger 2016, Mays 2016). On the east side of the Cascades, for example, row crops, fruit trees, vineyards, and hay / silage crops tend to yield higher profit per acre than irrigated pasture, giving landowners little incentive to install pasture (Mays 2016).

We assume veterinary and vaccine costs are higher for the grainfinished system due to the increased health hazards present in feedlots in comparison to pasture; these costs are \$17 / head for grain-finished and \$6.05 / head for grass-finished. We assume marketing costs are equal across systems at \$12.00 / head; hired labor costs are equal at \$15.00 / head; miscellaneous costs are equal at \$10.00 / head; and interest costs are 7.5% of operating capital excluding feed costs for both systems. We assume overhead costs are similar across the two systems: these include machinery and equipment depreciation; insurance; fuel/oil, repairs, utilities, and opportunity costs of management.

Under these assumptions, grass-finished beef requires a premium of 17% or more to be competitive with feedlot beef. The 20% live weight price premium we assumed in Table 7 below provides the grass-finishing operation with a higher return per head than the feedlot. These results are sensitive to small changes in assumptions: lower corn prices, lower ADG, or higher pasture or trucking costs would all increase the premium necessary for the grass-finishing operation to be competitive with the feedlot. However, the general rule of thumb of 20% higher production costs has been confirmed with us by one of our producer contacts (Panner 2016).

Production system	Grass-Finished	Feedlot (Grain-Finished)
Location	WA	WI
Budget year	2008	2012
Donai year	2012 030	
	\$/head	\$/head
Average weight (lbs.)	1,252	1,300
Average price (\$/cwt live)	\$120	\$100
(finished steers)	\$1,502.40	\$1,300.00
Feeder steer costs	\$831.25	\$831.25
Feed Costs		
Irrigated Finish Pasture	\$352.00	
Minerals and Supplements	\$4.15	• • • • • •
Corn Feed Cost		\$121.41 \$76.68
Corn Silage Feed Cost		\$20.24
Subtotal Feed Cost	\$356.15	\$218.33
Additional Costs		
Health / Veterinary	\$6.05	\$17.00
Trucking	\$35.65	\$5.00
Marketing	\$12.00	\$12.00
Hired Labor Miscellaneous Costs	\$15.00	\$15.00
Interest on Operating Capital	\$5.90	\$4.43
Subtotal Additional Costs	\$84.60	\$63.43
Overhead costs		
Insurance (Vechicles, liability, etc.)	\$2.10	See "yardage costs" below
Machinery and Equipment	\$3.68	
Opportunity Cost of Management	\$25.02	
Fuel/oil, Machinery repair, Utilities	\$33.62	
Subtotal Overhead Costs	\$64.42	\$65.33
Total Costs	\$505.18	\$347.09
Net Return	\$165.97	\$121.67

Table 7. Sample Cost Comparison:Grass-Finished vs. Feedlot Beef

In summary, we find that grass-finished beef can be economically viable in comparison with feedlot beef, provided that premium prices are paid, corn prices are not too low, and average daily weight gain for grass-finished cattle are not too low. Without premium prices of about 20% or more, however, grass-finished beef is generally not competitive with feedlot beef unless either corn prices are very high, or the average daily weight gain of the grass-finished cattle is significantly above the average.

Infrastructure

Infrastructure is one of the central challenges in developing a regionally focused supply chain for Pacific Northwest beef. This section summarizes the issues facing Pacific Northwest beef infrastructure and identifies emerging alternatives.

1. Summary of Existing Infrastructure

Regionally, the Pacific Northwest is known for having many small producers, but very few processing facilities. In a 2012 study, the USDA Economic Research Service found that western states, including Oregon and Washington, had a scarcity of small slaughter facilities compared to large numbers of small farms (Johnson, Marti and Gwin 2012). With so few places to process their meat under USDA-inspection, small producers end up with "little negotiating power and must take the prices offered to them" (Gardner 2009). In this way, lack of processing infrastructure becomes a "major impediment to the vitality and profitability" of small, locally-focused meat operations (Johnson, Marti and Gwin 2012), as well as a barrier to conventional farms interested in transitioning to alternative production systems like grass-finished beef. While problematic, this gap makes sense considering that most northwest beef producers sell their cattle as calves, as opposed to maintaining ownership throughout the production cycle. Additionally, it is important to note that the "presence of small livestock operations does not necessarily indicate demand for inspected processing" (Johnson, Marti and Gwin 2012).



Carman Ranch cattle in Wallowa, Oregon Photo by Nolan Calisch

Within the Pacific Northwest, Oregon's meat processing capacity is relatively low. According to a list collected by Oregon State University in 2015, there are 14 USDA-inspected slaughter establishments in the state of Oregon, with two of those performing in-house work only (Gwin 2015). With just 14 facilities, it is not surprising that over 95% of cattle produced in Oregon are slaughtered out-of-state (Gardner 2009). Again, this statistic makes sense considering that Oregon is a "primarily a state of cow-calf operators, rather than feedlot, finishing, and cut meat production" (Ecotrust 2015). In addition to a reduced number of processing plants, Oregon also lacks adequate rendering capacity. Since the closure of two rendering facilities in 2006, plants are now required to transport animal byproducts to California or Washington, which has led to higher in-state processing costs (Gardner 2009). Finally, while not a processing plant, it is important to note that Oregon is home to Beef Northwest Feeders, "one of the nation's largest cattle feeding and backgrounding operations" (Beef Northwest Feeders 2016). Beef Northwest manages four feedlots in eastern Oregon and Washington with a "collective one-time capacity of 95,000 head," as well as grazing operations for cows, calves, and feeder cattle throughout the northwest (Beef Northwest Feeders 2016). However, while large backgrounding operations like Beef Northwest are located in-state, Oregon does not have the infrastructure or demand necessary to process large amounts of cattle from feeder stage to slaughter, cut and wrap.

Compared to Oregon, Washington's meatpacking industry has become dominated by large firms. As of 2008, Washington had 11 packers that primarily slaughtered beef, pork, and lamb (Review of the Food Processing Industry in Washington 2008), with six of these facilities located in Western Washington, and five on the Eastside. In general, Washington's Eastside is characterized by "two very dominant packers," and "accounts for about 80% of the processing volume" (Review of the Food Processing Industry in Washington 2008). One of these large processing plants is likely AgriBeef (AB Foods), the primary processor for the Country Natural Beef cooperative. Finally, "many fed cattle are shipped into Washington from Idaho, Alberta, and other locations outside the state" (Review of the Food Processing Industry in Washington 2008), further indicating Washington's large processing capacity. Economies of scale in meatpacking have made it difficult for smaller-scale facilities, such as central Washington's rancher-owned Cattle Producers of Washington (CPOW) facility, to compete.

In addition to having few slaughtering facilities, Oregon has a lack of independent meat distributors (Ecotrust 2015). Willamette Valley, for example, has "only 0.34 meat distributors per one hundred thousand people" (Ecotrust 2015). Because most Oregon cattle are slaughtered out-of-state, it makes sense that there would be less demand for local distribution. In general, the fact that most northwest beef producers run cow-calf operations, as opposed to marketing their own meat, suggests that there has historically been less of a need for distribution infrastructure.

2. Out-of-State Processing

While many factors contribute to Oregon's lack of processing capacity, it is ultimately a result of widespread consolidation within the meatpacking industry. The "Big Four" meatpacking corporations -Tyson Foods, Cargill, JBS USA, and National Beef Packing Company - have come to control over 80% of all beef slaughtered in the U.S. (Ostind 2011). The Big Four have thus acquired significant power over the processing and distribution of U.S. beef, including cattle raised in the Pacific Northwest. Consolidation has caused slaughter facilities "to become larger and operate at greater speed" (Ecotrust 2015), ultimately outcompeting small and midsize plants. Once these smaller processors close, their relatively high operating costs make it difficult for them to reopen, and also discourages new plants from starting up. In this type of concentrated environment, "large meat processors exert considerable economic control over producers in the form of production contracts and animal ownership" (Summary of Meat Processing Issues in Washington State 2009), ultimately creating a market situation that favors industrial-scale beef production and promotes vertical integration within the supply chain.

In her 2011 article for High Country News, author Stephanie Paige Ogburn describes the struggle between cattlemen and large processing corporations: "The meatpackers' power derives from the industry's structure, which resembles a pyramid. At the bottom are the cowcalf operators – mostly hundreds of thousands of mom-and-pop operations... There's just a brief window of time when cattle can be sold at their prime, which gives the meatpackers leverage" (Ogburn 2011). Such leverage often comes in the form of "packer-offered advance marketing agreements," which take advantage of the small number of buyers in today's beef industry. In many cases, feedlot owners feel pressured to accept these agreements, whether or not the price is fair, because it may be the only way to sell their cattle. In this way, meatpackers have an incentive to manipulate the beef market: as more cattle become "locked up" in advance agreements, the cash market shrinks and "packers benefit twice" (Ogburn 2011). Known as the "captive supply," contracted cattle are priced based on their value in the cash market. So, as fewer cattle are sold through auction, packers can offer a lower price for them, pushing overall cattle prices down (Ogburn 2011). If feedlots speak out against price manipulation, meatpackers have even boycotted cattle suppliers by refusing to do business with them (Ogburn 2011).

With few plants that support small-scale producers, the Pacific Northwest is particularly vulnerable to meatpacking interests, especially without strong, local supply chains for beef. And as the industry continues to streamline, vertical integration threatens to make traditional cow-calf operators obsolete. Investing in local infrastructure, such as assisting processors in "obtaining USDA certification" (Gardner 2009), may help prevent such a shift. The next section addresses the question of local beef infrastructure in the Pacific Northwest.

3. Alternative Beef Infrastructure in the Northwest: Is It Growing?

Locally-oriented, alternative beef processing infrastructure in the Pacific Northwest has primarily taken the form of mobile slaughtering units (MSU), also known as Mobile Meat Processing Units (MMPU). These small-scale slaughtering and processing facilities represent one strategy used to increase processing capacity while avoiding the high cost of building and operating a fixed facility. MSUs have lower operating costs than fixed facilities, and their mobility allows them to respond to a wider area. In addition, MSUs directly respond to the lack of small-scale USDA-inspected processing facilities in the northwest: they can only process a small number of animals, so are better suited for many independent producers.

In 2003, the Oregon Department of Agriculture (ODA) conducted a feasibility study for establishing a USDA-inspected MSU in eastern Oregon. Today, Eastern Oregon Mobile Slaughter Services is fully operational, and provides services to farms within a 100-mile radius of Hermiston, OR; an area where many Oregon cattle ranches are located. In Washington, several MSUs exist, including the Community Agriculture Development Center (Colville, WA), the Island Grown Farmers' Cooperative (Bow, WA), and the Puget Sound Meat Producers Cooperative (Tacoma, WA).

However, MSUs' viability hinges on their flexibility, which demands that they serve any cattle producer: organic MSUs have struggled in this regard. As of March 31st, 2016, the Puget Sound Meat Producers Cooperative – the only MSU in the Pacific Northwest to be certified organic – ceased operations, with president Fred Colvin citing "challenges operating the trailer as a stand-alone business" and admitting that "perhaps, the usefulness of the cooperative overseen by volunteers has [passed]" (Colvin 2016). The president also noted that "operation of the trailer has enabled many farmers to realize higher returns for their business, which is a significant success." Currently, it appears that the MMPU will be taken over by a new operator, Puget Sound Processing, LLC. However, it remains unclear whether the trailer will remain certified organic or not. The annual membership meeting in April 2016 will determine their future focus, which could include "helping to develop markets for local USDA meat products," but could also lead to the "dissolution of the cooperative."

While MSUs respond to a clear need for more small-scale processing facilities, these systems face challenges, including: low potential for scaling-up (given a processing maximum of 10 animals per day), rising fuel costs, a shrinking employee pool, and the fact that MSUs must often operate in tandem with a fixed "cut and wrap" facility (Ecotrust 2015). On the other hand, MSUs provide the following benefits: reduced transportation costs for small-scale producers; greater flexibility in small-scale slaughtering than large processing plants (Ecotrust 2015). Overall, the success of any MSU depends on secure funding, a business plan that identifies "minimum numbers of livestock necessary for profitability," and a skilled work force to operate the facility (Ecotrust 2015). As far as future growth, the fact that MSU programs are "relatively low-revenue, low margin businesses" (Ecotrust 2015) can make them challenging to get off the ground. However, if the business is able to survive, MSUs can provide a "missing link between livestock farmers and consumers and... thus help keep farming viable" (Summary of Meat Processing Issues in Washington State 2009).

Aggregation

An important emerging factor in regional beef markets – grass-finished or otherwise – is the development of aggregation firms that improve the returns to the individual producer and offer the possibility of differentiated, locally focused production. This section summarizes the state of these emerging systems.

1. Country Natural Beef

Country Natural Beef (CNB), formerly known as Oregon Country Beef, is perhaps the most successful alternative beef supply chain that focuses heavily on the Pacific Northwest. It is a beef cooperative founded in Oregon and made up of nearly 100 ranches throughout the western U.S., including Hawaii. Founded in the 1980s, the idea for CNB arose during a tough economic climate for beef ranchers. Co-founder Connie Hatfield, based in Oregon, saw an opportunity to market a differentiated, higher-value product, as well as a way to escape the often volatile commodity beef market. In 1987, CNB began with just 14 ranching families and 200 head of cattle; today, the cooperative raises more than 100,000 brood cows, and sustainably manages more than 6 million acres of land (Ecotrust 2015). The CNB model places a high value on rancher independence, as well as keeping administrative costs "to a bare minimum" (Stevenson and Lev 2013). In addition, the coop requires all members to actively participate in the decision-making process, and approaches partnerships using the Japanese values-based business model known as "Shin Rai," meaning "mutual support and mutual reward" (Stevenson and Lev 2013).

CNB's internal structure is organized around the concept of being consumer driven, and producer controlled (Stevenson and Lev 2013). In line with their commitment to ranchers, CNB "sets stable prices that are based on production costs, return on investment and [bringing in] a reasonable profit" (Stevenson and Lev 2013). Additionally, CNB pays for its operating costs using a percentage of producer revenue, rather than borrowing funds. Members do not assume equity positions or financial ownership of the co-op, and because CNB does not have any brick-and-mortar locations, trucks, or debt, it also has no capital assets or financial liabilities. Instead, CNB relies on a number of strategic partnerships to process, store, and distribute their products, and therefore "replace the need for internally or externally generated capital... and much post-production expertise" (Stevenson and Lev 2013).

CNB uses one feedlot managed by Beef Northwest Feeders, and processes all meat exclusively through AB Foods (with some additional hamburger processing done at Fulton Meats in Portland). By partnering with Beef Northwest, which is also a co-op member ranch, CNB can maintain control of their meat and ensure that animal care and nohormone or antibiotic policies are followed. On the processing side, partnering with AB Foods allows CNB to monitor the production phase, as all beef is slaughtered, packaged, and distributed from one location. In this way, the CNB model has found a way to avoid costly processing and distribution issues encountered by many small cattle operations. By creating strong partnerships across each stage in the "cattle cycle," CNB has essentially created a vertically-integrated system, but in a way that is mutually beneficial for both producer and processor. In their 2013 value-chain study of CNB, Oregon State University and the Center for Integrated Agricultural Systems at UW-Madison describe the CNB model as "function[ing] like an 'otherthan-for-profit' organization with dual responsibilities to provide both affiliated ranchers with sustainable prices and affiliated store and company customers with quality meat and high order fill rates" (Stevenson and Lev 2013). Put another way, the CNB model helps to "protect the values chain commons" (Stevenson and Lev 2013).

Following a rapid growth period from 2000-2005, CNB's sales have remained more or less stable since 2007. While the co-op "lost member ranches and total beef production declined" in 2008 during the recession (Stevenson and Lev 2013), both membership and production have recovered in recent years (2009-2012). Overall, CNB's greatest challenges to growth are 1) protecting major retail accounts like Whole Foods (which represents over 50% of CNB sales), and 2) retaining co-op membership despite spikes in commodity prices (Stevenson and Lev 2013). In addition to being drawn away by the commodity market, the co-op has experienced membership loss following its adoption of additional animal welfare requirements (Stevenson and Lev 2013). CNB continues to work on both short- and long-term ways to address this "supply problem" (Stevenson and Lev 2013).

With regard to future growth, CNB has established several new partnerships: Shepherd's Grain supplies CNB with barley to replace corn in cattle feed rations, and CNB provides beef for Truitt Brothers Chili. At the same time, continued growth could threaten CNB's already limited supply. Stacey Davies, CNB Marketing Director, notes that "while growth would be the optimal strategy for maintaining health of the cooperative, because of supply constraints we are not looking for new partners" (Stevenson and Lev 2013). One example of this occurred in a trial partnership with Chipotle: "due to inadequate supply, CNB abandoned the relationship" (Stevenson and Lev 2013). As far as investment opportunities, the CNB model is not set up to accept financial support; what matters most for the continued success of the co-op is retaining a strong membership base to protect its beef supply.

2. Season's Peak

Season's Peak is a group of 18 grass-finishing cattle raising operations distributed throughout the Pacific Northwest (Oregon, Washington, and northern California), which markets a total of about ~1,000 head of cattle per year through regional grocery retailers. The company is structured as an LLC that is owned by its rancher members and behaves similarly to a co-op. It makes use of the multiple locations of its rancher members to offer grass-finished beef throughout the year, though they have found the goal of high-quality, year-round grass-finished beef supply a difficult one to attain (Panner 2016). The company has recently produced sufficient quantity to meet retailers' demand with additional beef left over. Entirely self-financed, Season's Peak is committed to stable supply to maximize cash flow and reduce supply risk. Growth is not part of its mission statement; it does not accept outside capital investment. Nearly all of the Season's Peak ranchers are also members of Country Natural Beef and market grain-finished beef through the latter company. All of the Season's Peak ranchers practice some form of rotational grazing or holistic management. All of Season's Peak's cattle are slaughtered and primary processed at the Mohawk Valley Meats packing plant in Springfield, OR (Panner 2016).

3. Additional Cases: Potential for Scaling and Replication

In the Country Natural Beef case study, the authors (Stevenson and Lev 2013) refer to potential CNB expansion in the form of a creating a "sister cooperative" located east of the Rockies. So far, it appears that no such "sister cooperative" currently exists, but plans may still be evolving. According to the case study, the ideal model would include "regionally specified rancher cooperatives that could associate with Country Natural Beef through the use of existing logistical infrastructure" (Stevenson and Lev 2013). Outside of CNB, similar beef cooperative models exist in other parts of the country, including the Wisconsin Grass-finished Beef Cooperative and the Shenandoah Valley Beef Co-op.

Carman Ranch, located in northeastern Oregon's Wallowa Valley, offers one example of informal aggregation, where a larger, more well-known brand (Carman Ranch) is helping smaller producers find a market for their products. Through the Carman Ranch buying club, owner Cory Carman provides Carman Ranch beef, as well as "a selection of other pasture-raised foods from Wallowa County producers" (Carman Ranch Direct 2016).



Cory Carman of Carman Ranch in Wallowa, Oregon Photo by Nolan Calisch

Drivers of Demand for Alternative Beef

Environmental Values

Existing experimental evidence shows that consumers on average are willing to pay positive premiums for grass-finished/finished beef. A 2013 study at the University of Maryland examined consumers' willingness to pay for locally raised, grass-finished ground beef using two methods: a choice experiment (conjoint analysis)⁵ and a measurement of consumers' actual in-store behavior at a local

5 A choice experiment is a survey in which respondents are presented with several sets of hypothetical products defined by different combinations of attributes at different prices. For each set, the respondent is asked to choose their most preferred product-price combination from the list. Choice experiments yield estimates of consumers' willingness to pay (WTP) for specific product attributes.

conventional retailer (Adalja, et al. 2013). The choice experiment study used two samples: a random sample of consumers as a whole in the state of Maryland, and a sample of members of a Maryland-based local food buying club. While consumers as a whole stated additional willingness to pay (WTP) of \$2.71 per pound for lean ground beef raised within 100 miles of the location of purchased; the buying club members stated WTP of \$1.21. For the grass-finished attribute, the buying club members stated WTP of additional \$2.65 / lb. for beef raised on pasture for six months or more, while the consumers as a whole stated only \$1.63 / lb. The in-store experiment revealed lower, but still positive, WTP for grass-finished (\$0.82 / lb.) and locally raised (\$1.47/ lb.) beef. While these results cannot be generalized beyond the individual study, they do indicate that consumers – including those who shop at conventional grocery retailers – are willing to pay price premiums for locally raised and grass-finished/finished beef.

Further evidence from food buyer surveys indicates that environmental, animal welfare, and local values are important motivations for purchasing beef. For instance, a 2008 survey of forty-two meat buyers representing distributors, retailers, and foodservice in California revealed that humane raising practices, environmental stewardship, and local origin were three of the ten most important attributes that they looked for when considering purchasing beef to meet niche market demand (Ecotrust 2015).

Health: Grass-finished vs. Grain-fed Beef

1. Scientific Documentation

When consumers look for information on the health benefits of grassfinished beef, they typically run across information that highlights its lean quality, low fat content, and presence of high levels of omega-3 fatty acids which are considered to be "good fats" healthful for the human body. In addition, grass-finished beef has been shown to contain higher levels of cancer-fighting antioxidants and vitamins (like A and E) than in meat raised on grain. The abundance of omega-3s in grass-finished beef can be traced to their diet, since "sixty percent of the fatty acids in grass are omega-3s" (Robinson 2015). However, once cattle are moved to a feedlot and finished "omega-3 poor" grain, they begin "losing their store of this beneficial fat" (Robinson 2015).

As far as scientific documentation of these health benefits, results are not definitive. On the one hand, a 2010 study published in the Nutrition Journal notes that "research spanning three decades supports the argument that grass-finished beef has a more desirable saturated fatty acid lipid profile as compared to grain-fed beef" (C. A. Daley, et al. 2010). The same study also claims that "grass-finished beef is... higher in precursors for Vitamin A and E and cancer fighting antioxidants such a glutathione and superoxide dismutase activity as compared to grain-fed contemporaries" (C. A. Daley, et al. 2010). On the other hand, other journal articles find the jury is still out on whether grass-finished beef contains more beneficial nutrients for humans. For instance, in article published by the Washington Post in 2015, Alice H. Lichtenstein, professor at Tufts University's Friedman School of Nutrition Science and Policy, agrees that grass-finished beef contains omega-3s, but not many when compared to other sources (Haspel 2015). Based on data from the USDA, "a 100-gram serving (a little under four ounces) of grass-finished top sirloin contains 65 milligrams of omega-3 fats" (Haspel 2015). Unfortunately, that 65-milligram amount "is only about 22 milligrams more than that for regular beef and still far below levels in low-fat fishes such as tilapia (134 milligrams), haddock (136)... [or the] omega-3 powerhouse king salmon [which has] 1,270 milligrams" (Haspel 2015). In the end, it appears that omega-3 levels do not provide much of an advantage (Haspel 2015).

2. Public Perceptions

Consumers generally associate grass-finished beef with being a leaner, more animal-friendly product. While some question the tenderness of grass-finished beef, or perceive it as "dry, or gamey," overall demand for this product is on the rise. A number of surveys show that consumers have "expressed a willingness to pay premiums for humanely raised meat" (Ecotrust 2015), though it remains questionable how many consumers follow through when purchasing.

Marketing / Branding

The marketing of grass-finished beef is one of the most important drivers of demand. Grass-finished beef companies, whether individual ranches, co-ops, or other aggregation firms, have been able to market their product successful based on trust, storytelling, and direct consumer outreach including in-store demos (Shire 2012). When these forms of marketing are not present, however, there has been inconsistency in the ways that grass-finished beef is marketed at retail meat counters and restaurants. For instance, the regional beef coop Country Natural Beef has expressed frustration about inconsistent labelling and packaging of their product at Whole Foods (Stevenson and Lev 2013). In smaller supermarkets such as New Seasons Market in Portland and Puget Consumer Co-ops in Seattle, Country Natural Beef products are identified directly on their packaging. In fast food restaurants such as Burgerville in Portland, the products are identified on a large menu board. In general, marketing is identified as a key challenge for grass-finished beef producers seeking to expand operations. Kathy Panner notes that the Season's Peak brand has so far had a low profile at its retail outlets; the product does not yet have name recognition (Panner 2016).

Conclusions and Recommendations

Grass-finished beef has gained a toehold on the market in the Pacific Northwest, but it has a long way to go. Grass-finishing systems tend to have higher production costs than feedlots, and are often difficult to scale due to a number of factors including: the unavailability of nearby irrigated pasture; lack of economically competitive slaughtering and processing facilities targeting small producers; and relative lack of skill among consumers and chefs in handling and preparation. Further, the beef industry in the Pacific Northwest suffers from a lack of supply chain integration in general: there are relatively few finishing, slaughtering, and processing operations. Scaling up the grass-finished beef sector in the Northwest thus involves solving two sets of problems: those related to beef supply chains in general, and those related to the scaling of grass-finishing operations more specifically.

That said, there is reason for optimism about the trajectory of grassfinished beef in the Pacific Northwest. The overall market trend for all forms of alternative beef is upwards. Consumers have revealed willingness to pay price premiums for grass-finished and locally raised beef. And there are key success stories in the development of niche markets and supply chains for Pacific Northwest grass-finished beef (e.g. Cory Carman), as well as aggregation mechanisms that are capable of developing locally and regionally focused brands for alternative beef (e.g. Country Natural Beef), even though the majority of such beef is not strictly speaking grass-finished.

Our investor recommendations are the following:

1. If the investor is seeking to support an individual grass-finishing operation, look for one that can claim a reliably high average daily weight gain (ADG) on pasture for their cattle, and has reliable, objective data to prove it. A minimum of 1.75 lbs. ADG is a good rule of thumb. Long grazing seasons, low grazing lease rates, locally available irrigated pasture and forage, and low trucking costs due to efficient transport or contiguous leased or owned parcels are also desirable characteristics for a grass-finishing operation to have.

2. Seek opportunities to establish or strengthen existing alternative supply chain structures, including aggregation firms that can connect regional producers and consumers with a year-round supply of beef. These firms may include co-ops, rancher-owned brands, or partnerships between ranchers working at different scales. An effective aggregation firm will have strong partnerships with slaughter facilities and reliable distribution channels.

3. Seek opportunities to foster partnerships between crop farmers and cattle ranchers. As crop farmers seek to expand their methods of building healthy soils, and cattle producers seek to maximize grazing opportunities, there may be potential for synergies in rotating cattle grazing and crop production, where cattle are able to graze on cover crops (such as clover) that rotate with annual row crops to fix nitrogen in the soil. Lack of contiguous or nearby pasture plots often constrains grass-finished beef producers seeking to scale up; connecting these producers with crop farmers could expand the range of available lands for grazing.

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