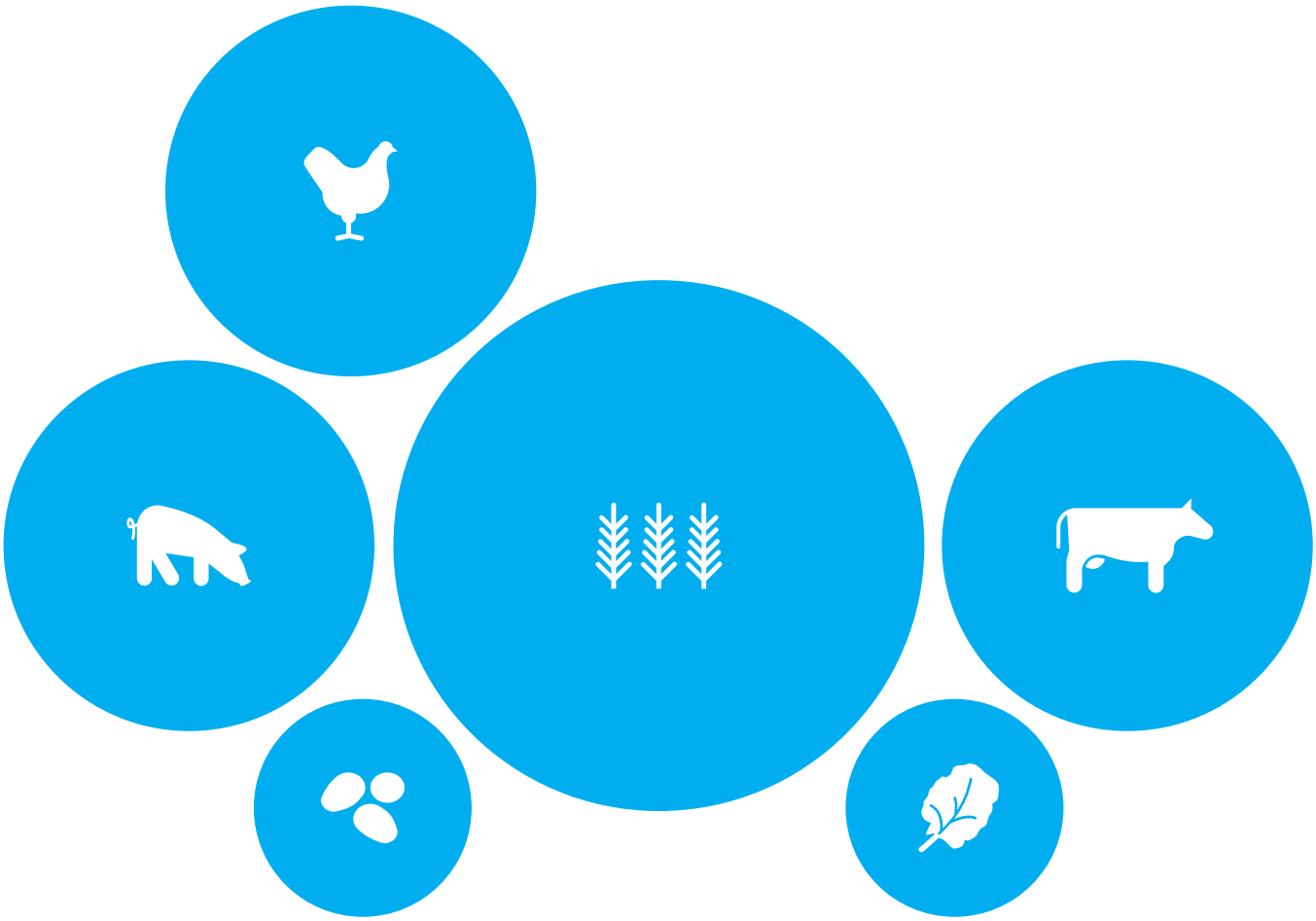

Cascadia Foodshed Financing Project

MARKET RESEARCH SYNTHESIS / June 2016

ecotrust

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 and the Greater Tacoma Community Foundation, and the Thread Fund. We are grateful to Chad Kruger, Director of Washington State University's Center for Sustaining Agriculture and Natural Resources, for his role as an advisor to this project. Ecotrust appreciates the thoughtful support and partnership of these organizations to pursue reliable prosperity for all Oregonians and Washingtonians.

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For more than twenty years, Ecotrust has converted $80 million in grants into more than $800 million in assets for local people, businesses, and organizations from Alaska to California. Ecotrust's many innovations include cofounding an environmental bank, starting the world's first ecosystem investment fund, creating programs in fisheries, forestry, food, farms, and social finance, and developing new tools to improve social, economic, and environmental decision-making. Ecotrust honors and supports the wisdom of Native and First Nation leadership in its work. Learn more at www.ecotrust.org

If our shared goal is to catalyze a strong, thriving regional food economy in the Pacific Northwest, what should we invest in?

This is the question that spurred the Cascadia Foodshed Financing Project and Ecotrust to research the opportunity for regional market viability in six food product categories, and to explore the potential for successful collective investment.

This research follows from Ecotrust's 2015 report, Oregon Food Infrastructure Gap Analysis (www.ecotrust.org/publication/regional-food-infrastructure), a 15-month study funded by Meyer Memorial Trust. That research explored the barriers and gaps preventing regional food economies from flourishing beyond direct market channels, like farmers' markets and farm subscription programs, to wholesale channels, such as retail grocery, regional restaurant, value-added manufacturing, and institutional foodservice.

The study identified a significant gap in the size and vitality of the region's "agriculture of the middle." Ag of the Middle (AOTM) is a conceptual framework that refers to mid-sized, locally-owned farms and ranches–those that are too big for farmers' markets, but too small for global commodity markets.

	Small	AOTM	Commodity
How big are they?	$	$$	$$$$$
Who are their customers?	Eaters	Restaurants Retailers Institutions Distributors	Processors Brokers Distributors
What's their region?	Local	Regional	Global
How diversified are they?	Very	Somewhat	Minimally
Where's the boss?	In the field	On-site	At HQ
Who owns the business?	Family	Family Co-op Partnership	Corporation
Who sets the price?	Producer	Negotiation (farmer/buyer together)	Market
Does the producer have an off-farm job?	Yes	No	No

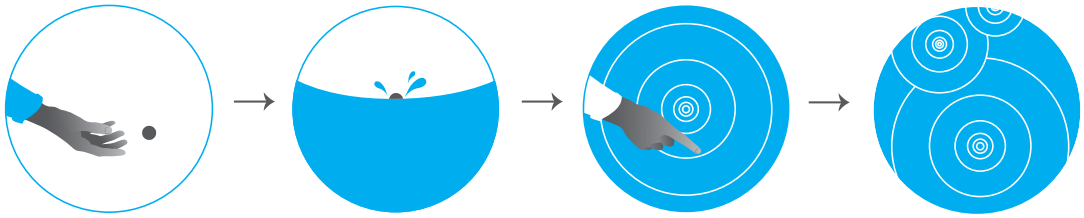
Ag of the Middle Framework (AOTM)

"Ag of the Middle" is a conceptual framework, not a set of hard and fast rules. Learn more at www.agofthemiddle.org.

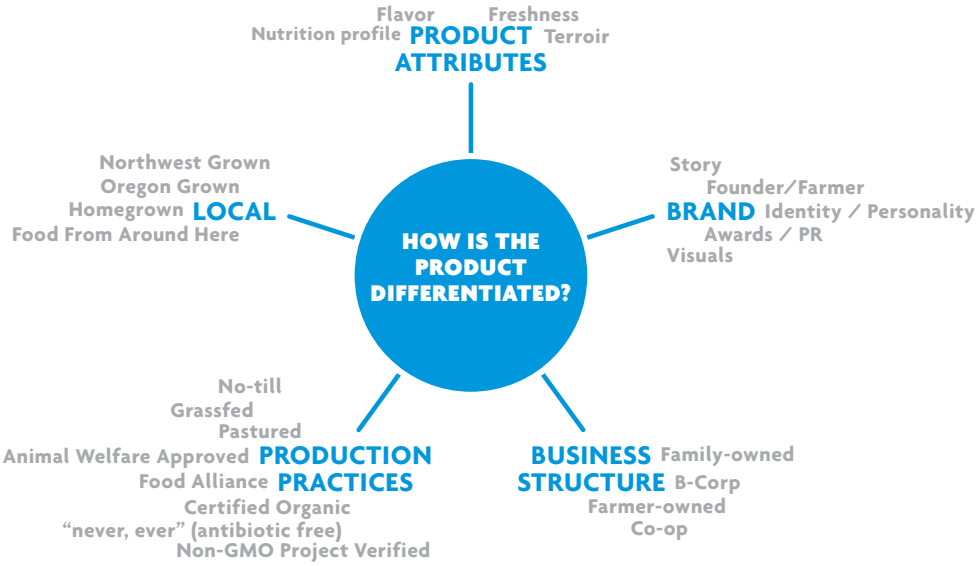
Ecotrust's research indicated that AOTM operations would be the ideal scale to support regional food economies because they have the capacity to provide a meaningful volume of product (whether independently or by aggregating with other small and midsized farms), offer more consistent product quality, availability and reliability, and meet the insurance and food safety regulatory requirements of larger supply chains. Plus, they tend to source local inputs and labor (thereby creating a meaningful economic multiplier effect), engage in restorative production practices, and actively participate in their communities. In other words, they tend to retain "local values" while offering wholesale volume.

Economic Multiplier Ripple Effect

According to research conducted by Ecotrust in the report *The Impact of Seven Cents*, updated in 2015, for each $1.00 spent on local food purchases a total of $2.00 of economic activity is generated in the local economy.



The research further showed that to be competitive, AOTM producers must differentiate. Simply marketing products as "local" is usually not enough to warrant a price premium sufficient to create financial viability. Differentiation may be achieved on multiple dimensions–product attributes (nutrition profile, flavor, terroir), ownership structure (co-op, family owned), production practices (certified organic, grass-finished, non-GMO), brand or story, and yes, "local."



However, having determined that investment is needed to develop a regional AOTM cohort offering differentiated products in order to spur strong regional food economies, the Gap Analysis study left many open questions. One significant to the issue of collective food system investment is: **"Which products or categories, if pursued at the regional level, offer potential market upside?"**

It is important to clarify that what we often refer to as "the food system" is actually a collection of relatively discrete industry sectors —produce, meat, poultry, dairy, grains, seafood, and so on—each with their own infrastructure and markets. Differentiated production often comes with higher costs and unique infrastructure needs, so assessment of financial market opportunity requires digging in at the sector level to determine where costs might be recouped and durable regional markets cultivated.

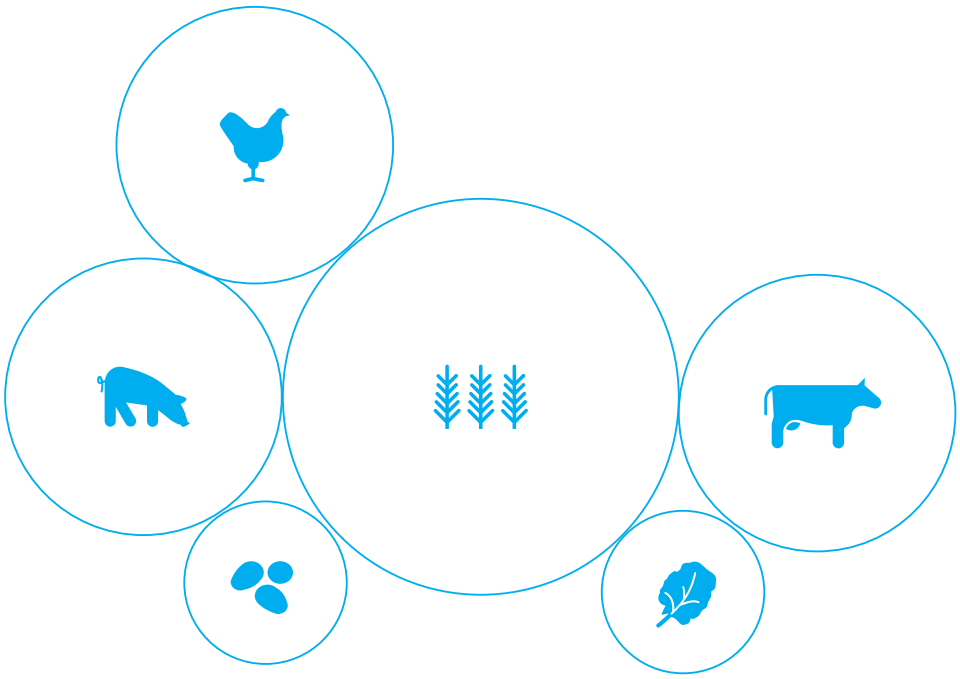
For example, would collective investment in the Pacific Northwest be best focused on expanding production of differentiated leafy greens and/or storage crops, in anticipation that climate change will ultimately shift California production north? Should we put wind behind the sails of the Western Washington innovators exploring wet-side wheat and grains? What is to be made of animal agriculture, such as poultry, pork, or beef, for which there continues to be significant demand and well established commodity markets, but very little local, differentiated supply (not to mention environmental and social concerns about ongoing meat consumption)?

To better answer the above questions for six product categories—leafy greens, storage crops, small grains, chicken, pork, and beef —we selected a specific differentiated product (or set of products) and compared production at an approximated AOTM scale to the established conventional model. Our primary interest was in assessing the costs of production to determine where efficiencies in the alternative model could be harvested to glean market upside, with collective regional investment in the category. In other words, which food categories had the most potential for financial return on investment in regional market development?

Investment

It should be noted, while financial opportunity was the primary interest of this research, the members of the Cascadia Foodshed Financing Project include foundations, nonprofits, and individual investors keen to facilitate the development of a regional food system in the Pacific Northwest that is nutritious, equitable, restorative, and delicious, in addition to being financially prosperous for all supply chain participants. “Investment” in this research therefore refers to the collective investment of time, energy, and resources by members, potentially provided in the form of equity, program or mission-related investments or loans, credit enhancements such as guarantees, grants, or other support.

Investor summaries and research narratives, including relevant data and sources, are provided for each product category. The original Food Infrastructure Gap Analysis executive summary (in both English and Spanish) and full report are also available, including overview chapters for each of the same six product categories. All materials will be available at both www.cascadiafoodshed.org and www.ecotrust.org



Which food categories had most potential for financial return on investment in regional market development?

No-till wheat and rotational grains seem investment-ready; the protein categories, led by beef and chicken, appear promising; less opportunity for regional scale development in greens or storage crops.

Leafy Greens & Storage Crops

With regard to the specific question about which product categories warrant collective investment, it was relatively clear that neither leafy greens nor storage crops present obvious opportunity for market-oriented private investment. Although very successful as part of diversified mixed vegetable operations at the farmers’ market scale on the west side, and in the case of storage crops, at the commodity scale on the east side, there seems little profitable capital investment opportunity at the category level in the differentiated AOTM space,

even as the climate warms. Significant market expansion or systemic transformation of either of these sectors within the Pacific Northwest is unlikely in the short to medium term.

However, there may be a disruptive innovation opportunity in the leafy greens category, in the form of urban indoor, hydroponic agriculture and related technology innovation. Such opportunity is likely to be tightly focused on a high-margin product like micro-greens or herbs, rather than engendering a system-level shift. There may also be potential for market intervention in greens by enhancing supply chain coordination between small-to medium-scale organic diversified vegetable producers and retailers, including pre-harvest crop planning and multi-year contracting. The business feasibility and profitability of such a service has yet to be tested.

Protein

The three protein categories, beef, poultry, and pork, all offer the potential for successful regional market development in differentiated alternative production models. In our study of grass-finished, pasture-pen, and hoop-house product, we saw a significant need to consider risks and build collective commitment to long-term regional collaboration. In the case of grass-finished beef, the regional market is on a trajectory of continued growth, but requires regional market integration and supply chain management, as well as an effort to raise consumer awareness and comfort. Regarding poultry, a regional supply ecosystem may be viable if producers can collectively create frameworks that facilitate reduced costs in feed, on-farm labor, and processing for all. In the case of pork, there exist opportunities for individual producers to scale up. However, satisfying a significant proportion of regional demand would entail substantially rebuilding the regional industry, which is unlikely, but not impossible.

While there are additional issues unique to each protein category to be explored in the relevant chapters, it is worth highlighting that the challenges identified in the development of regional pastured poultry are consistent across all proteins. The chicken, pork and beef categories are highly dependent on sources, availability, and costs of three primary components: feed, labor and processing. Those are all areas ripe for pre-market development by foundations, nonprofits, and policymakers.

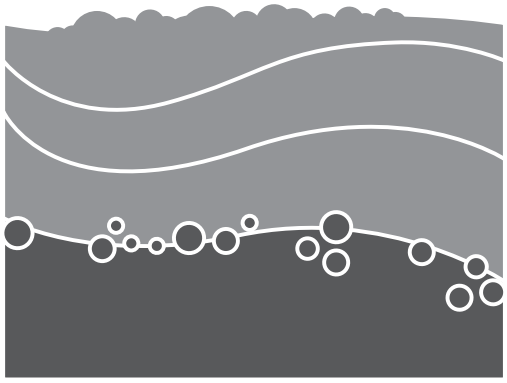
Small Grains & No-Till Wheat

One clear winner to emerge from the research as a category with regional market opportunity, as well as environmental and social benefit, is small grains, specifically no-till wheat and rotational cropping. No-till (also called direct seeding) refers to drilling wheat seeds directly into the soil following the previous crop. This practice differs dramatically from both conventional and organic wheat production, which both till (turn over) the soil before each planting, releasing soil carbon and creating the conditions for erosion.

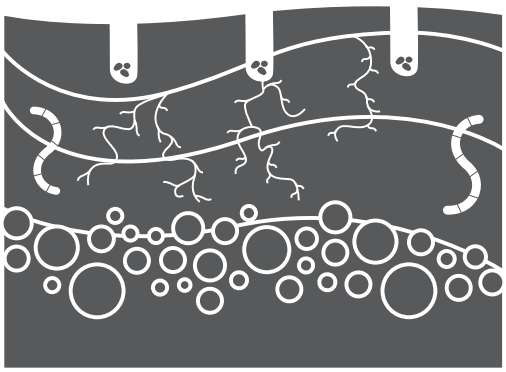
The difference between tilled and non-tilled soil

Tillage refers to the loosening up of the soil before planting in order to remove weeds that would otherwise be competing for nutrients in the soil, and to disrupt the regular cycles of their ongoing growth. However, the loss of underground root systems degrades soil quality over time. The soil becomes increasingly dry and thin, making it harder to hold both its structure and water, and therefore very vulnerable to erosion. Loss of underground root systems destroys habitat for vital micronutrients.

No-till soil leaves the existing root system undisturbed when planting, by drilling seeds directly into the soil, which allows for more natural restoration of nutrients. This method facilitates water retention better than tilled soil, allowing plants to take advantage of precious rainwater, and creates robust habitat for micronutrients over time. The primary disadvantages to no-till is that it takes at least 3-5 years to build soil structure, and makes use (albeit at much lower levels than conventional production) of chemical inputs to manage weeds.



Tilled Soil



Non-tilled Soil

No-till wheat production is most successful when rotating other grains such as barley and oats, legumes such as chickpea, oilseeds such as canola, and cover crops such as clover, in concert with wheat, rather than simply letting land lie fallow to recover. Some of the rotation crops, such as chickpeas, are profitable in themselves and have expanding markets. Others, such as the cover crops, are not marketable but may in some cases be used as pasture for grazing animals.

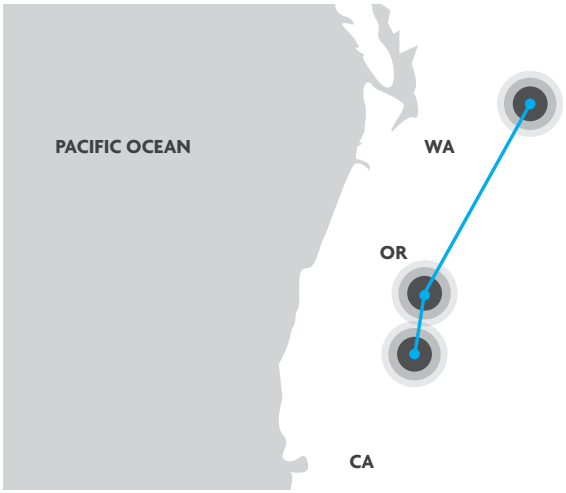
Although still reliant to some degree on herbicides and synthetic fertilizers, no-till and rotational cropping have been shown to build soil health, reduce erosion and nutrient runoff, and sequester soil organic carbon. Innovation in the pelletizing of organic compost for use by direct-seed drills could lay a path toward organic/no-till convergence.

Coordinated Supply

The Pacific Northwest has a great diversity of micro-climates, which support both a diversity of crops and staggered seasonality. If production was coordinated across the region to fulfill large-scale regional demand, several product categories could be timed to provide consistent availability (a key concern for large scale buyers) despite the seasonality of most alternative production systems.

For example, grass-finished beef is a seasonal product in the Northwest, but by coordinating production starting in far northern California and southern Oregon up to northeastern Washington, fresh

supply could theoretically be provided for about 10 months of the year. (Which is not to say that frozen beef isn't perfectly delicious when properly handled, and a much easier solution to fulfill demand in the near to mid-term, but chefs and retailers still prefer fresh.)



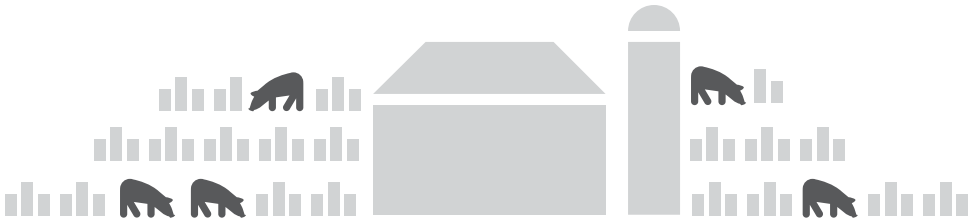
Coordinated regional production could provide year-round supply

Beginning in Northern California and moving north over the course of the season could facilitate fresh regional beef availability up to 10 months of the year.

The challenges of such regional integration are not insignificant—farmers and ranchers are remarkably independent, cultural barriers abound, and it is unclear who would play the role of coordinator. Embracing such complexity would be an enormous mind-shift, but does present the scaffolding of a robust regional food system.

Animal grazing has been shown to significantly improve soil health.

An interesting follow-on exploration would be in integrating small grain and beef production.



Rotational Grazing

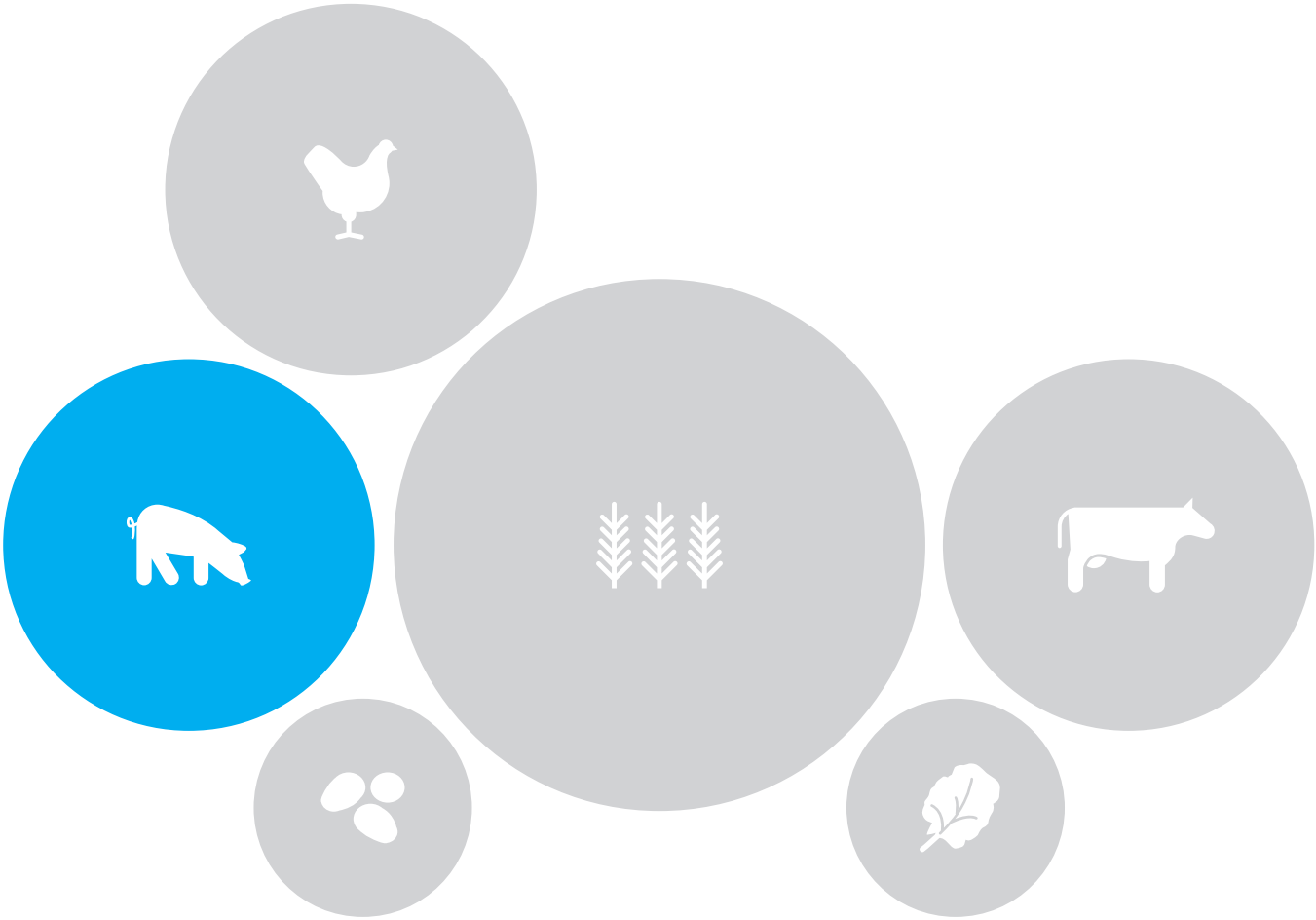
The idea of integrating grazing and crop production for the shared benefit of both the animal agriculture and crop sectors is a relatively new one in modern agriculture. The east side is particularly specialized in its production because it is home to much of the region's commodity agriculture, and would benefit from enhanced crop rotations, potentially including the integration of animal grazing, which has been shown to significantly improve soil health. This land stewardship thesis is currently being tested by Farmland LP. What if Burgerville or a regional institution like Bon Appetit Management Company were to help broker a conversation between entities such as Shepherd's Grain (buns) and Season's Peak beef (burgers) to integrate their soil stewardship way upstream?

Regional supply ecosystem coordination requires committed, long-term collaborators. Shifting production practices or expanding production significantly requires confidence on the part of the producer that the new or additional products will be sold. Buyers willing to engage in long-term crop coordination and forward contracting will be vital to creating confidence in new frameworks, and in stimulating large scale investment and behavior change.

As the CFFP considers launching a food investment fund potentially focused on coordinating regional food infrastructure or supporting the development of ag of the middle producers, we recommend prioritizing developing committed markets as a prerequisite step in any fund. Buyers must be willing to commit a portion of their spend on regional products generally, and to specific purchases with identified producers, before infrastructure or supply are actually needed.

Ecotrust is currently engaged in several projects, including the convening of a peer-to-peer network of institutional foodservice directors in the Northwest (www.food-hub.org/nwfba), and in a real-estate development project in Portland devoted to long-term collaboration on food system reform issues (www.ecotrust.org/redd), that will continue to spawn relevant experimentation focused on building long-term collaborations and supply chain coordination.

For additional information or insight into this research, please contact Amanda Oborne at Ecotrust, aoborne@ecotrust.org.



Differentiated Cost of Production in the Northwest:

An Analysis of Six Food Categories

PORK / June 2016

ecotrust

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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Cascadia Foodshed Financing Project

The Economics of Pacific Northwest Pork: Investor Summary

OVERVIEW

The pork industry is small-scale and relatively undeveloped in the Pacific Northwest. In Oregon, for example, recent years have seen a decline in both the number of farms and the total value of pork produced. Alternative pork producers in the Pacific Northwest (and elsewhere) tend to utilize hybrid artisanal production systems including barns, hoop houses, and pasture. To get to the scale needed to sell into mass markets, the Pacific Northwest alternative pork industry will require medium- to long-term investment in and coordination of low-cost feed and processing infrastructure accessible to small- to mid-size hog farmers; increasing the scale of existing hog-raising enterprises; and expanding the range of differentiated, strongly branded products available to consumers.

Pure Country Pork in Ephrata, WA -PHOTO BY AMANDA OBORNE

SUPPLY DRIVERS

- **Feed costs**–Feed is the number-one cost item for hog raising; the PNW is far from the markets for conventional feed. Though evidence indicates that locally milled feed may be cost competitive, additional research is needed.
- **Labor costs**–Labor costs for Northwest farmers are high, challenging the viability of labor-intensive production methods such as hoop house hog production.
- **Processing infrastructure**–There is limited pork processing infrastructure in the PNW that meets the needs of small to medium-scale hog producers. There may be opportunities to expand this infrastructure.

DEMAND DRIVERS

- Branding and product differentiation. There exist a small but robust group of differentiated, branded pork producers in the Northwest; data on the growth of this market is scarce.
- Price premiums. A study in Colorado shows some evidence that a minority of consumers (~6%) are willing to pay premiums of up to 20% for pork raised using alternative, non-confinement systems. Regionally specific data on this topic are scarce.

OPPORTUNITIES

The pork industry in the Pacific Northwest, in order to become a significant supplier of regional markets, needs some "industry building." In particular, the industry is in need of an affordable, regionally produced feed manufactured from locally grown grains such as wheat, barley, oats, and legumes, or waste from dairies and breweries. To meet demand, many of the smallest-sized hog producers (1–24 head), who comprise 89% of the total number of hog farms in the Pacific Northwest, would have to scale up production. One-off investments are unlikely to be successful over the long-term, without coordinated investment to build a Northwest pork industry.

Hoop house pork production; Paul Klingeman Sr. & Jr. -PHOTOS BY AMANDA OBORNE

- Seek opportunities to produce low-cost feed using local grains
- Look for highly skilled alternative hog raising operations seeking to scale up production
- Seek opportunities to invest in processing infrastructure that is accessible to small to mid-scale
- Look for final processors with strong brands seeking to expand

For more detail on the economics of pork production in the Pacific Northwest see the full narrative that accompanies this investor brief.

TABLE OF CONTENTS

Project Background

Consumers have demonstrated a willingness to pay a premium for food attributes such as "free-range," "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 pork. 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 grass-fed) 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 pork chapter from that report is included with this model/report as an addendum.

Introduction and Summary of Findings

The Pacific Northwest is an importer of swine products, suggesting that there may be a market opportunity in expanding regional hog raising to meet local demand for pork. However, to take full advantage of this opportunity would require reversing the dramatic decline in pork production in the region over the last two decades. It would require the rebuilding of a regional pork industry using alternative methods of production relatively new to the region, producing a differentiated product at premium prices to meet demand from regional consumers, predominantly located in metropolitan areas.

To sum up the contents of this paper, rebuilding the Northwest pork industry along these lines would most likely require the following investments:

1. The expansion to medium scale (~1,000 head) of at least 70 small-scale (by national standards) hog raising operations.
2. Development of a widely available, low-cost feed using regionally grown and milled grains and by-products, such as barley.
3. Expansion of the small existing network of locally and regionally focused processing (slaughtering and packing) facilities.
4. The further development of regional brands of fresh and processed pork and pork products (e.g., cured meats and sausages).
5. The ongoing active participation of retailers and other large-scale food buyers in sourcing from regional suppliers.

Thanks go to Paul Klingeman Sr. and Jr., Pure Country Pork in Ephrata, WA, for generous contributions to this research.
All photos by Amanda Oborne.

Some of these activities are already underway: for example, there is a growing group of regional pork processors with strong brands based on unique taste attributes (e.g., Olympia Provisions, Tails & Trotters, Pure Country Pork). Locally and regionally oriented retailers and foodservice operators are actively engaged in sourcing pork from regional suppliers (e.g. PCC Natural Markets, Bon Appetit Management Company).

However, there is little evidence for a current expansion of regionally oriented pork processing facilities, scaling-up of local and regional hog raising operations, or development of a widely distributed, reasonably priced pig feed based on regionally sourced grains or by-products.

While the rebuilding of the Northwest pork industry may be both possible and a worthy goal, it will require a high level of patience and medium- to long-term commitment on the part of investors, entrepreneurs, producers, extension agents, and established businesses at all links of the value chain. There already exist economically viable, locally and regionally oriented hog producers and pork processors, with the potential for expansion; but these individual niche producers do not add up to a fully functioning, locally and regionally oriented, alternative pork value chain. A single market intervention, or investment in a single firm, is highly unlikely to make a significant, systemic difference in reversing the ongoing downward trend in Northwest pork production.

Defining Pork of the Middle

Defining "Agriculture of the Middle" in the context of Pacific Northwest pork has two main components. First, we define the alternative production system that is most appropriate for Pork of the Middle in this region. Second, we define the scale of production that we can classify as Pork of the Middle.

Alternative Production System: Hoop House

This section describes what we mean by "alternative pork" in more depth. Alongside the trend towards market concentration discussed above in Section III.B, alternative or "niche" pork production systems have developed that seek to market pork to consumers concerned with food safety, environmental quality, and specific meat attributes including taste, juiciness, and low fat. Animal welfare, occupational health and safety, and an overall desire for food system reform are some other reasons why consumers may choose to buy pork produced under alternative production systems.

Alternative systems for hog raising and pork production are quite diverse. In general, they range from pasture-based, outdoor raising systems, which are land-intensive and use relatively few, simple shelter structures, to hoop house-based, indoor systems, which use relatively little land and more complex structures for gestation, farrowing, growing, and finishing. Each system has advantages and disadvantages; many producers use hybrid systems in which some pasture-based raising complements indoor, hoop house production.

Further, each system itself is internally diverse: some pastured systems include pigs as part of a multi-crop rotation, while others focus on pigs exclusively. Some hoop house systems rotate pigs through a succession of houses based on different phases of their lifecycle, while others consist of two houses, one for farrowing (sows and piglets) and one for growing pigs to market weight. In general, pasture-based systems tend to be favored by the smallest producers, and hoop houses tend to be used at somewhat larger scales. Though generalizations in this area, as in all areas of alternative agriculture, are difficult to make, we consider the hoop house raising system to hold more potential for "Pork of the Middle" than any other.

Hoop houses have become an increasingly popular form of alternative swine production. A hoop house consists of a series of arched metal frames, secured to ground posts and side walls or concrete walls about 4 to 6 feet above ground level, and covered with a polyethylene tarp that is stretched and secured (Gegner 2005). A standard hoop house size is 30 x 80 feet, or 2400 square feet total. The floor of hoop houses is lined with straw bedding to provide pigs with adequate warmth and an environment for rooting. Wintertime temperatures in hoop houses with a full cohort of pigs in deep-straw bedding have been measured upwards of 80 degrees Fahrenheit (SARE 2003). Straw bedding also allows for a medium in which to compost manure. Hoop houses can hold anywhere from 150-250 growing pigs, but a standard house capacity is 200 pigs, at 12 square feet per pig.

In general, hoop houses cost less per pig to supply shelter than confinement systems (Gegner 2005, SARE 2003); however, raising pigs in hoop houses is more labor- and management-intensive than confinement raising due to the increased needs for managing straw bedding and manure. A 2003 study notes:

Alternative systems relying on deep straw require careful farm management to minimize disease and provide the feed and bedding hogs need at different stages of life. In economist parlance, raising pigs in these systems means more variable costs – feed, bedding, labor – versus fixed costs such as confinement buildings. (SARE 2003)

The role of deep straw bedding in ensuring high animal welfare in hoop house hog raising is highly important. A study released by ATTRA on hoop house production states, “Deep bedding is key to the shelter’s performance. When in doubt, add more bedding” (Gegner 2005). Unlike pastured systems, hoop houses do not take up significant amounts of land, hence the rising cost of land in the Pacific Northwest does not play a major role in determining production costs. For details of the production costs associated with hoop house hog raising, please see Section VII below.

Hoop houses at Pure Country Pork in Ephrata, WA.

Scale of Production

It is difficult to define what the scale appropriate to "Agriculture of the Middle" means in the context of Pacific Northwest pork, because a hog farmer considered "mid-sized" by national standards would be considered very large scale in this region. Table 1 below displays the distribution of hog farm sizes by size class in the U.S. Pacific Northwest in 2012. Two things are noteworthy from this table. First, the overwhelming majority of farms are small: summing the smallest three categories, we find that over 97% carry fewer than 100 head of hogs in inventory. Third, we note that the largest category of farms is over 1,000 head – the "industrial" category of over 5,000 head, as defined by a seminal recent Pew research study (Schaffer, Koonnathamdee and Ray 2012) is not even displayed. Table 2 provides a comparison to the U.S. as a whole, demonstrating the much larger concentration of large farms in other parts of the country. We can conclude that the pork raising industry in the Pacific Northwest is, as of 2012 at least, relatively undeveloped.[1]

Size Class in Head	OR	WA	Total	% of Total
1 - 24	1,014	1,191	2,205	89.1%
25 - 49	85	65	150	6.1%
50 - 99	37	18	55	2.2%
100 - 199	21	10	31	1.3%
200 - 499	12	11	23	0.9%
500 - 999	1	4	5	0.2%
>=1,000	2	4	6	0.2%
TOTAL	1,172	1,303	2,475	

Table 1. Inventory of Hogs by Farm Size Class, U.S. Pacific Northwest, 2012

Size Class in Head	US Total	% of Total
1 - 99	48,700	71.3%
100 - 499	5,000	7.3%
500 - 999	2,300	3.4%
1,000 - 1,999	3,300	4.8%
2,000 - 4,999	5,700	8.3%
>=5,000	3,300	4.8%
TOTAL	68,300	

Table 2. Inventory of Hogs by Farm Size Class, U.S., 2012

1 Pork sales data by farm size in the Pacific Northwest is not sufficiently developed to be displayed here.

Given that the Pacific Northwest lacks a strong sector of mid-sized to large hog farms, to define Agriculture of the Middle in this context requires a rule of thumb based on income. McAdams (2015) defines Agriculture of the Middle producers as those who can support a family of four on at least twice the federal poverty level of $24,250/year; hence, producers who earn $48,500 in net income or more. In Oregon, producers with sales between $250,000 and $499,999 are the first to show an average net income in excess of two times the 2015 federal poverty level, with $80,931 in net income to the operation and $79,848 in net income to the operator (McAdams 2015).

We can use average production and sales statistics to reach a good rule of thumb for Agriculture of the Middle as applied to hog raising. In 2014, the average farrow-to-finish hog producer nationwide received a price of $78.65 per hundredweight of live hog (USDA 2015). In 2014, the average market hog weighed 285 lbs. at slaughter (NASS 2015). Hence, a good rule of thumb for the minimum farm size necessary to reach Agriculture of the Middle is 1,100 market hogs ($78.65 * 2.85 * 1,100 = $246,567). Gross income from 1,100 hogs is slightly less than $250,000, but for a farrow-to-finish producer[2], the difference may be made up by selling sows culled from the farrowing operation (see below for details of farrow-to-finish systems). Yet as Table 1 indicates, an operation with 1,100 hogs would be in the top 0.2% of the size distribution of farms in the Pacific Northwest. Clearly, if Pork of the Middle is to become significant in the Northwest, some scaling-up needs to be done.

Estimates of Regional Consumer Market Size

In this section, we estimate regional consumer market size at the retail and farmgate levels, for pork (conventional plus organic) in the Pacific Northwest. We use the total market size as a benchmark for calculating the market size of differentiated pork at varying premiums. The results of this exercise demonstrate that the size of the consumer market for pork in the Northwest is much greater than the volume of production. These results also demonstrate that reasonable estimates of consumer demand for differentiated pork remain small relative to the size of the total market.

The assumptions for our estimation of the size of the consumer market for organic pork in the Pacific Northwest are as follows. Annual pork consumption in the western United States, which includes the Pacific Northwest, usually tracks lower than national averages. In 2015, national annual average per capita pork consumption was 49.9 lbs. / person / year retail weight (Bentley and Buzby 2015). However, a recent (2005) study of U.S. pork consumption revealed that residents of the western United States consumed only 42 pounds of pork per capita, per year, which was 17.6% less than the national average of that year (51 pounds). Applying this regional difference to the more recent national consumption data, we estimate that Pacific Northwest residents in 2015 consumed 41.2 lbs. of pork / person / year.

2 For the definition of "farrow-to-finish" hog production, please see Section VII, Appendix, p. 10.

Pork prices and consumption vary by cut. The four major cuts of pork for which average retail prices are tracked are ham, chops, bacon, and "All Other" (Hahn 2016). We estimate the pounds of each major cut consumed by Pacific Northwest residents following a recent study that estimated the national percentage breakdown of pork consumption by cut (Davis and Lin 2005). 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. We estimate the farmer's share of this market by using the average farmgate share of the retail price, 22.7%, as reported by USDA (Hahn 2016).

Table 3 below presents estimates of regional market size for pork as a whole, the three most important cuts, and for fresh and processed pork as a whole. In the U.S. market as a whole, processed pork represents the majority of pork consumption. Processed pork products include smoked ham, bacon, sausage, lunchmeats, hotdog ingredients, and other similar products. Fresh pork products include fresh ham, chops, steaks, ribs, and offal. The most recent available estimates show that processed pork represents 62% of total market demand for pork, and fresh pork represents 38% of the total market (Davis and Lin 2005). The proportion of consumer spending on fresh vs. processed pork differs slightly from the proportion of consumption of fresh vs. processed pork, because the different types of pork are priced differently.

Table 3 below shows that the total annual retail market size for pork of all types in the Pacific Northwest is about $1.45 billion; the total size of the market at the farm gate is about $330.6 million. The total market size for fresh pork is about $560.4 million at the retail level and $127.2 million at the farm gate; for processed pork it is $896.1 million at the retail level and $203.4 million at the farm gate.

	2015 Annual Regional Per Capita Consumption (lb./person/yr)	2015 USDA Average Retail Price ($/lb)	Retail Market Size, Oregon and Washington ($ million)	Farmers' Share of Retail Market Size ($ million)
Ham3	13.7	$3.08	$467.1	$106.0
Chops	4.4	$3.86	$188.0	$42.7
Bacon	2.6	$5.45	$156.9	$35.6
All Other (Fresh and Processed)	20.5	$2.84	$644.5	$146.3
TOTAL	**41.2**	**-**	**$1,456.5**	**$330.6**
Fresh	15.7		$560.42	$127.2
Processed	25.5		$896.1	$203.4

Table 3. Estimated Retail Market Size, Fresh and Processed Pork, Oregon and Washington, 2015

Existing empirical studies reveal that many consumers state that they are willing to pay positive premiums for differentiated food products, including pork. For instance, a 2002 study at Colorado State (Grannis and Thilmany 2002) measured consumers' stated willingness to pay for

differentiated pork. The results revealed that 29.7% of the consumers surveyed were willing to pay a 10% price premium, and 6.25% of the consumers were willing to pay a 20% price premium, for differentiated pork chops.[3]

Using these figures, we can estimate the potential size of the regional consumer market for differentiated pork by cut at different price premiums. Table 4 below estimates the potential retail market size for pork at 10% and 20% price premiums, using the consumption and price data by cut from Table 3 above. The potential market size for differentiated pork sold at a 20% price premium over the USDA commodity average, across the Pacific Northwest, is approximately $109.24 million, of which approximately $41.51 million is fresh and $67.73 million processed.

Table 4. Estimated Potential Retail Market Size at 10% and 20% Price Premiums, Fresh and Processed Pork, Oregon and Washington

	Annual Regional Per Capita Consumption (lb./person/yr.)	Potential Per Capita Consumption, 10% Premium (lb./person/yr.)	Potential Retail Market Size, 10% Premium (million USD)	Potential Per Capita Consumption, 20% Premium (lb./person/yr.)	Potential Retail Market Size, 20% Premium (million USD)
Ham	13.7	4.1	$152.60	0.9	$35.03
Chops	4.4	1.3	$61.42	0.3	$14.10
Bacon	2.6	0.8	$51.25	0.2	$11.76
All Other (Fresh and Processed)	20.5	6.1	$210.56	1.3	$48.34
TOTAL	41.2	12.2	$475.83	2.6	$109.24
Fresh	15.7	4.6	$180.82	1.0	$41.51
Processed	25.5	7.6	$295.02	1.6	$67.73

In 2015, the average U.S. hog farmer received 22.7% of the retail price on average (USDA, Meat Price Spreads 2015).[4] Assuming this price share transfers to the Pacific Northwest, then from the market size figures given above, the total farmers' gross sales from 10% premium pork would be about $108 million, and the farmers' gross sales from 20% premium pork would be $24.8 million. Table 5 below presents the potential farm sales of differentiated pork by cut from the retail market sizes estimated in Table 4 above.

3 These findings are discussed further below in Section IV.3, Consumer Willingness to Pay.

4 There is no publicly available data on hog farmers' share of retail prices for the Pacific Northwest.

	Potential Gross Farm Sales, 10% Premium	Potential Gross Farm Sales, 20% Premium
Ham	$34.6	$8.0
Chops	$13.9	$3.2
Bacon	$11.6	$2.7
All Other (Fresh and Processed)	$47.8	$11.0
TOTAL	$108.0	$24.8
Fresh	$41.0	$9.4
Processed	$67.0	$15.4

Table 5. Estimated Potential Gross Farm Sales of Hogs at 10% and 20% Price Premiums, Oregon and Washington

The current pattern of hog sales in the Pacific Northwest shows that in order to satisfy regional demand for differentiated pork, substantial industry growth must occur. Table 6 below presents the value of sales of hogs raised in Oregon, Washington, and the regional total between 1997 and 2012. The table shows a fairly dramatic decline in the value of regional hog sales over the 2000s, from $14.4 million in 1997 to only $7.7 million in 2012. Assuming the average farmgate share of the final retail price, the 2012 level of regional hog sales would translate into $34.1 million in retail sales, and satisfy only 2.34% of total consumer demand for pork in the region in 2015. If all of the hogs sold in the region were sold as differentiated pork at a 20% price premium, they would satisfy only 31.2% of the differentiated market. To satisfy the entire regional differentiated market would require an additional 70 mid-sized (~1,100 head) hog producers, selling all of their product at premium prices.

	1997	2002	2007	2012
Oregon	$6,161,000	$3,540,000 (*)	$5,662,000	$3,195,000
Washington	$8,215,000	$6,803,000	$5,921,000	$4,542,000
TOTAL	**$14,376,000**	**$10,343,000**	**$11,583,000**	**$7,737,000**

(*) data may be incomplete due to missing data points

Table 6. Hog Sales by Value ($), Oregon and Washington, 1997-2012

Getting 70 new or existing small producers to scale up to the minimum necessary volume for Pork of the Middle – which is over 1,000 marketed hogs per year - may prove to be beyond the scope of a single investor: a more comprehensive industry-building effort may be called for. The next two sections look at the drivers of supply and demand for the regional pork industry in the Pacific Northwest and identify possible market interventions that could catalyze such an industry-building effort.

Supply Chain Drivers

Market Concentration

Over the last two decades, the pork industry in the Pacific Northwest has declined precipitously. Table 1 below demonstrates the decline in hog production with data from USDA (NASS 2015). Over the period 1997 to 2012, the production of pork in Oregon and Washington fell from $14.3 million to $7.7 million – a decline of 46%.

The most likely culprit for the decline in the Pacific Northwest regional pork industry is rapid market concentration at the national level. Today, fewer firms control a larger share of the U.S. hog market than at any time in our history. This concentration is happening at all links of the chain: raising, slaughtering and packing, and distribution (Hauter 2012). The reasons for the rise of concentrated hog production are many, but the availability of cheap feed due to low commodity prices, weak environmental regulations on manure management, economies of scale in production and processing, mergers and acquisitions at the meatpacker/processor level, and the Justice Department's failures to enforce antitrust laws against meatpackers are all forces moving the industry in this direction. The national trend at the producer level has been dramatic. In 1992, 30% of all U.S. hogs were raised on farms with more than 2,000 animals; by 2007, 95% of hogs were raised on farms this large (Hauter 2012).

In the U.S. hog industry, meatpackers wield a high degree of market power: as of 2012, the top four packers control 66% of all U.S. hogs. The power of the packers has led to the decline of independent hog producers and processors. At the production or raising stage, advance contract purchasing has rapidly replaced negotiated spot market purchasing; whereas in 1993, 87% of all hog sales were negotiated purchases, by 2007, 70% of all hogs were bought on contract, and 20% were owned outright by the packers (Hauter 2012). Contract purchasing reduces the autonomy of hog raising operations and leads to lowered purchase prices. The resulting cost pressures on producers lead them to cut corners in animal welfare, environmental protection, and working conditions (Schaffer, Koonnathamdee and Ray 2012, Hauter 2012). These cost pressures also make it very difficult for small- to mid-scale, alternative pork producers to compete.

The national trends in concentration at the slaughtering and packing levels are evident in the Pacific Northwest. Table 2 below presents data from the U.S. Census Bureau's County Business Patterns dataset for animal slaughtering facilities excluding poultry (NAICS category 311611) in the U.S. Pacific Northwest (Oregon and Washington). From 2000 to 2013 alone, the total number of animal slaughtering facilities declined by 22%. However, the number of large slaughtering facilities (50 or more employees) increased by 50%, while the number of the smallest facilities (less than 5 employees) declined 46%.

Number of Employees	2000	2013	Difference
1 – 4	57	31	-46%
5 – 9	13	19	46%
10 – 19	6	4	-33%
20 – 49	3	3	0%
50 or more	6	9	50%
Total	85	66	-22%

Source: US Census Bureau

Table 8. Number of Animal Slaughtering Facilities (except poultry), U.S. Pacific Northwest (OR and WA)

Market Differentiation

Though the Northwest pork industry has declined overall, one market segment appears to be emerging: sales of organic certified hogs. This nascent regional trend, suggested by the (scanty) data in Table 2 below, mirrors the growth in organic certified hog production nationwide, reflecting increased consumer concerns for health, food safety, environmental protection, and animal welfare. If organic sales are a "leading indicator" of market differentiation, then the hog market, regionally as well as nationally, may be poised for a revival of independent production through differentiated raising practices. The ongoing development of alternative pork production systems, described later in this paper, offer further evidence that differentiation is occurring in the locally and regionally oriented segments of the market.

Sales in Head		
	2011	2014
OREGON	-	-
WASHINGTON	-	652
US TOTAL	12,662	30,944

Sales in $		
	2011	2014
OREGON	$-	$-
WASHINGTON	$-	$208,352.00
US TOTAL	$4,504,215.00	$9,829,940.00

Table 9. Organic Hog Production, Oregon and Washington

Production Costs

Production costs are a major driver of the supply of pork. This section identifies three important drivers of the cost of production for Northwest pork: the supply of available, low-cost feed; the cost of farm labor; and the availability of low-cost processing accessible to small- to medium-sized producers.

1. Feed Supply

The Pacific Northwest appears to be at a disadvantage in pork production due to its long distance from the markets for feed grains conventionally used in hog raising: corn and soybeans. Are there alternative feed blends that can use the small grains – wheat, barley, and oats – that grow well in the Pacific Northwest?

A recent study from Iowa State suggests that small grains including wheat, barley, and oats, can in fact provide useful feedstuffs in swine raising operations (Sullivan, et al. 2005). Compared to corn, small grains are high in crude protein, lysine, and digestible phosphorus, which are all important nutrients for growing pigs. The higher lysine content in small grains entails a lower requirement of soybean meal in the pig's diet. The drawbacks of small grains are that they contain less metabolizable energy than corn, which has affected feed conversion efficiency in some instances. Straw from small grains can also be used as bedding in hoop houses.

The primary drawback of small grains is that they tend to be more expensive than corn, even in the Pacific Northwest where locally produced corn is scarce. The most important small grain for pig feed is wheat; the most important conventional feed grain is corn. Table 6 below reports average per-bushel prices received for corn, wheat, barley, and oats in the State of Washington over the decade 2005-2014 (NASS 2015). During this decade, the price of corn never exceeded the price of wheat. Corn prices tended to exceed barley and oats prices. However, the energy density of barley and oats are lower than that of corn, thus the feed requirements are higher, offsetting the lower unit costs at least partially. The lower soybean meal requirement from a small-grain-based diet provides another source of cost savings, given the high price of soybeans (US average $22.60/bushel in 2014). Prices in Oregon follow similar trends to those in Washington (not shown).

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Corn	$2.81	$3.72	$4.50	$4.56	$4.59	$6.08	$6.22	$6.69	$5.29	$5.10
Wheat (All)	$3.32	$4.49	$7.58	$6.26	$4.85	$6.24	$6.78	$8.07	$6.95	$6.55
Wheat (Spring)	$3.70	$4.74	$7.89	$7.10	$5.74	$7.15	$8.08	$8.51	$7.34	$7.22
Wheat (Winter)	$3.21	$4.42	$7.51	$6.08	$4.58	$6.03	$6.40	$7.96	$6.87	$6.42
Barley	$2.16	$2.88	$5.08	$3.49	$2.90	$3.66	$4.85	$5.53	$4.12	$3.54
Oats	$1.65	$1.90	$2.85	$3.08	$2.80	$1.90	$3.15	$3.50	$4.00	$2.55

Table 10. Prices of Small Grains and Corn ($/bu), 2005-2014, WA

Despite higher per-bushel prices, a locally milled feed blend using small grains may be price-competitive with blends using conventional grains. Table 5 below presents the composition of a series of sample diets for finishing pigs (150 – 250 lbs.) developed by a recent Iowa State study (Sullivan, et al. 2005). Six sample diets using three small grains – wheat, barley, and oats - are presented; each grain is assigned to a diet with High or Low levels of that grain. Table 5 presents the author's calculation of unit costs of these diets using 2014 conventional prices per bushel received in Washington State for each of the component grains, using U.S. average prices for soybeans ($22.60/bushel), for which Washington data is not available. Additives include dicalcium phosphate, limestone, salt, a mineral premix, and a fat soluble vitamin mix. The prices of additives are quoted from online retail sources and may be overstated if the hog producer is buying wholesale.

The results suggest that a regional feed based on barley or oats may be competitive with a conventional feed. The feed blend high in barley is the most price competitive ($0.12 / lb, highlighted in yellow) and the blend high in wheat is second-most competitive ($0.14 / lb). The wheat blend is price-competitive because the reduced need for feed additives offsets the higher cost per pound of the grain.

Though not conclusive, this simple thought experiment, based on an academic study of pig diets, indicates that a regionally grown and milled feed blend may be able to provide aspiring Northwest producers with a price-competitive input. Additional research in this area could include estimating the cost of producing a local or regional feed based on spent grains from breweries or dairies, or agricultural waste left in the field after harvesting small grains.

Table 11. Composition and Cost of Sample Feed Blends, Grains Only, WA (2014 prices)

	Lbs. of grain / blend					
Grain (lbs.)	Wheat (High)	Wheat (Low)	Barley (High)	Barley (Low)	Oats (High)	Oats (Low)
Wheat (Winter)	1,769	500	-	-	-	-
Barley	-	-	1,786	500	-	-
Oats	-	-	-	-	800	200
Corn	-	1,215	-	1,223	934	1,508
Soybean	195	244	175	235	225	250
Additives	36	41	39	42	41	42
Total	2,000	2,000	2,000	2,000	2,000	2,000
Total Cost (2014 WA)	$275.68	$298.59	$231.14	$285.29	$279.68	$300.20
Total Cost / Lb (2014 WA)	$0.14	$0.15	$ 0.12	$0.14	$0.14	$0.15
Ranking	2	5	1	4	3	6

2. Labor Costs

Labor costs are a major issue for Pacific Northwest agriculture in general. In particular, legal immigration channels require burdensome visa (H-2A) paperwork, high transportation costs, and high costs of temporary worker housing on top of wages. Labor costs are not the largest component of operating costs for alternative pork; however, the combination of high upfront costs of search, immigration, and housing, and the seasonal nature of much of the work ensures that they remain a burden to many farmers. All Northwest alternative pork producers interviewed for this study cited cost of labor as a key barrier to expansion.

3. Processing Capacity

Processing capacity is a key constraint on alternative pork production systems. Currently, small- to mid-scale alternative pork producers lack sufficient processing infrastructure to scale up production to meet existing niche market demand, leading alternative retailers to source a portion of their pork through conventional channels. Like all processing infrastructure, adequate throughput and utilization requires a critical mass of producers to be viable. Additional research should be done on current capacity to understand constraints and coordinate opportunities.

Drivers of Demand for Regional Pork

Introduction

Table 2 below presents estimates for the dollar value of statewide wholesale market demand for fresh and processed pork by market channel, collected from a recent report released by Ecotrust (Ecotrust 2015). In 2012, the entire State of Oregon produced and sold only $3.2 million worth of pork (NASS 2015), while consuming $170.6 million worth of pork. Even if all pork produced and sold in Oregon was consumed in Oregon (unlikely), the State of Oregon still "imported" at least $167.4 million worth of pork from other states in 2012: 98% of pork consumed in Oregon was not produced in Oregon. Though we do not have similar data for the State of Washington, the story is likely similar: Washington pork producers sold $4.5 million worth of pork in 2012 (NASS 2015), in a state with a population significantly larger than Oregon's - 7.06 million vs. 3.97 million (U.S. Census Bureau 2015).

Market Channel	Fresh	Processed	TOTAL
Retail	$50M	$54M	$108M
Foodservice	$21M	$45.6M	$66.6M
TOTAL	**$71M**	**$99.6M**	**$170.6M**

Table 12. Total Wholesale Demand by Market Channel, State of Oregon (2012)

Clearly there exists the potential for the Pacific Northwest to meet a larger proportion of its demand for pork than it currently does. The difficulty in meeting this market opportunity lies in the fact that the Pacific Northwest lacks a large-scale pork industry. As Section III.A above suggests, there may be good reasons for the region's lack of participation in the current trend toward market concentration: large-scale, industrial hog raising operations have created nuisances, environmental hazards, and conflicts between producers and communities (Schaffer, Koonnathamdee and Ray 2012, Platt 2006). Developing a regional pork industry sufficient to meet market demand will require that producers adopt ecologically responsible, as well as economical, methods of hog raising that are also price-competitive in regional markets. Since this possibility is remote, the development of branded, differentiated pork products at price premiums that consumers are willing to pay seems to be a more viable strategy. The next two sections cover branding and consumers' willingness to pay.

Branded Products

Developing local and regional brands can be one way of stimulating demand for differentiated pork products. Currently, there is no systematic dataset indicating the magnitude of the trend in market differentiation in Pacific Northwest pork. However, there exists a stable, and possibly growing, group of branded pork producers / processors in the Pacific Northwest, offering differentiated products at premium prices. Pure Country Pork is the most significant alternative supplier in Washington State, and offers its products under its own label as well as via popular brands such as Good Food Award winner Tails & Trotters.

As our research on production costs in Section VII of this paper clearly indicates, the prospects of alternative pork becoming price-competitive with commodity pork are remote. The possibilities of branded, differentiated products appear to be more promising. The next section addresses the question of what price premiums the consumer market might bear for differentiated products.

Consumer Willingness to Pay

Existing empirical studies reveal that many consumers state that they are willing to pay positive premiums for differentiated food products, including pork. For instance, a 2002 study at Colorado State (Grannis and Thilmany 2002) measured consumers' stated willingness to pay for differentiated pork. The results revealed that a significant number of consumers state willingness to pay price premiums for differentiated pork products. For instance, of the 1,400 participants, 406 consumers (29.7%) were willing to pay a 10% price premium for "naturally raised" pork chops and eighty-four consumers (6.25%) were willing to pay a 20% price premium. The study defined "naturally raised" as comprising two attributes: no confinement raising, and no antibiotics used.

These estimates should be taken as rough, ballpark figures only; the consumer willingness to pay data presented above from the Colorado State study (Grannis and Thilmany 2002) are subject to limitations. In particular, consumers' stated willingness to pay premiums for differentiated products often does not match their actual economic behavior. Further, estimates of consumer willingness-to-pay vary over time and space; there is no guarantee that Colorado consumers will behave similarly to Pacific Northwest consumers. In short, comprehensive data on the size of the market for differentiated food products at various price points is lacking. Additional research is needed in this area.

Newborn piglets (left) and six-month olds (right).

Conclusion and Recommendations

This study has provided a broad overview of the principal drivers of supply and demand for alternative pork production in the Pacific Northwest, and offered a primer on the most important alternative pork production system, the hoop house. The principal conclusion of this research is that while individual hog raising and pork processing businesses in this region may be profitable, the industry as a whole is in decline and will require a significant effort to rebuild.

The following are four examples of the types of potentially profitable pork-related businesses that may form part of an alternative supply chain for pork in the Pacific Northwest.

- A regional feed supplier using small grains, rotation crops, farm by-products, or waste from breweries, distilleries, or dairies to produce a reasonably priced feed (<$0.15/lb)
- A number of highly skilled small-scale hog raising operations seeking to scale up
- A year-round slaughter/processing plant willing and able to work with multiple small hog farms, and seeking to expand capacity
- A final processor with strong branding capacity, committed to sourcing from local suppliers

To play a catalytic role in rebuilding the Pacific Northwest pork industry to focus on alternative, differentiated production and processing, an impact investor should seek to deploy capital in all four of these types of businesses.

Appendix: A Model of Farrow-to-Finish Hoop House Production Costs

This appendix presents the Excel-based data model we originally developed to predict the costs and returns to alternative pork production. While we believe that the market-oriented information presented above in the main body of this document offers clearer guidance to investors than the detailed production cost data given below, intellectually curious investors may find the information presented in this model useful. If so, keep in mind that these data are to be taken not as precise estimates for predicting production costs, but rather as guidance for understanding the basic economics of alternative hog production systems.

Production System

The production system we have chosen to model in this study is a year-round, farrow-to-finish, hoop house production system. Farrowing refers to the bearing and nursing of a litter of piglets by a sow (mature female pig). The farrow-to-finish system refers to the raising of pigs from the farrowing stage until they are full-grown weight and ready to be slaughtered. It is distinct from two other major types of pig raising systems: farrow-to-feeder, which raises pigs from the farrowing stage until they are at "feeder" weight, around 60 pounds; and feeder-to-finish, which purchases pigs at feeder weight and raises them until they are at slaughter weight.

A typical farrow-to-finish pig raising operation consists of a number of sows (mature female pigs), each of which are bred for 2 or 3 years before culling (selling to be slaughtered). Each year, the sow gives birth to 1-2 litters of 7-10 piglets per year. A well-managed pig raising operation with healthy sows will usually gain about 2 litters per sow, per year, and will experience a 5-10% mortality rate among piglets. Hence, each sow will give birth to 14-20 piglets per year, of which 12-19 will survive to maturity.

The farrow-to-finish system has several advantages for an independent hog producer. First, the system does not require the purchase of large numbers of piglets, but rather a smaller number of sows. Second, the producer controls the entire lifecycle of the pig from its birth and weaning to its growth to slaughter at about 6-7 months (24-30 weeks) of age, allowing for ecologically responsible, economically efficient management practices to be implemented throughout the entire lifecycle. Third, farrow-to-finish systems are compatible with multi-crop farms; a small number of farrowing sows can fit into a crop rotation to provide consistent revenue throughout the year.

In general, farrow-to-finish production systems enjoy lower unit costs, and are thus more profitable, than other types of pig raising systems (Schaffer, Koonnathamdee and Ray 2012). A 2001 study corroborates: "Of the (production) systems, farrow-to-finish has the greatest long-run market potential and flexibility" (Kephart, et al. 2001). However, farrow-to-finish operations are also more capital- and labor-intensive than

other types of pig raising, since the entire lifecycle of the animal must be managed.

In the data model that follows, we assume a production system consisting of 100 sows, each of which bears two litters per year for two years, averaging 8 pigs per litter, at a 7.5% mortality rate. This litter size reflects the average litter size reported in Oregon over the years 2000-2015 (Washington data after 2010 is not available). The average in Washington over the years 2000-2009 is 8.5, which could serve as an alternative assumption.

For a farrow-to-finish production, gilts must be purchased each year. A gilt is a female pig who has not yet borne a litter (farrowed). We assume a system in which each gilt (sow) breeds for two years before being culled (sold). Each year, half of the sows are culled, and half are retained. Hence, our production system requires purchase of 50 gilts per year, and sale of 50 cull sows per year. The purchase price per gilt is assumed to be $210, reflecting the assumptions of a recent study at Iowa State (Kliebenstein, et al. 2004), adjusted to 2015 USD by the Producer Price Index for slaughter hogs and rounded up slightly (from $207). The sale price per cull sow is assumed to be $250, reflecting a price per hundredweight of $50 and a cull weight of 500 lbs. (USDA 2015). Given these assumptions about scale, litter size, and mortality rate, marketed output will be 1,480 hogs per year.

We assume the sows are artificially inseminated, hence there is no need for a boar; instead, boar genetics (semen) must be purchased for each litter and each sow. Artificial insemination is a common practice in the hog industry, due to the land and labor costs associated with boar management, the availability of high-quality boar genetics, and the reduced risk of diseases that boars may transmit (e.g. African Swine Fever, etc.).

The system we are describing is based on year-round, not seasonal, production. We choose to describe a year-round system because it ensures a more consistent flow of pork, which satisfies year-round market demand. However, year-round systems are more expensive per pig, and per cut of meat, than seasonal systems (Kliebenstein, et al. 2004). The factors that make year-round production more expensive are increased labor due to more intensive management; increased piglet mortality and disease; increased feed requirement (less efficient feed conversion); and increased need for hoop house bedding and climate control.

Production Costs

The conventional way to display costs of pork production is in dollars per hundredweight (hundred pounds) of live hog. However, cost units vary. Some authors (Stender, et al. 2009) display costs in terms of dollars per hundredweight of pork, and others display costs in terms of dollars per head, or per hog (Larson, Kleibenstein and Honeyman 2003). However, “dollars per live hundredweight” is the most common cost measure. We assume that the average market hog weighs 250 lbs. at slaughter. This rule of thumb reflects average market weights over 2000-2015 for Oregon, and 2000-2005 in Washington (NASS 2015), and

is a commonly accepted rule of thumb for market weight hogs.

The major cost categories for farrow-to-finish pork production are as follows in order of importance: feed costs, other variable costs, fixed costs, and labor costs.

1. Feed Costs

As noted above, the most important input to pig raising is feed: in farrow-to-finish production systems, feed may comprise up to 75% of total production costs (Kephart, et al. 2001). Feed absorbs a larger proportion of production costs in farrow-to-finish systems than in the other pig raising systems. For example, feed comprises an average of 65% of the cost of feeder-to-finish systems (Schaffer, Koonnathamdee and Ray 2012).

Feed cost is made up of two components: price per pound and conversion efficiency. Feed conversion efficiency is usually expressed as the pounds of feed necessary for each pound of live weight gain. It can range from 3 to 5 pounds of feed for every pound of live weight gain. Considering that each pig grows to 250-300 lbs. over less than 7 months, feed conversion efficiency matters tremendously for hog raisers' production costs. Cold climates, wasteful feeding systems, poorly balanced nutrition, and unhealthy pigs can all reduce feed efficiency. Efficient feed conversion is gained through feeding systems optimized for low wastage and nutritional balance, temperate or warm climates, and healthy pigs. In this model, we assume a feed conversion rate of 4 lbs. feed for each pound of weight gain, which follows a recent study of year-round, farrow-to-finish hoop house production (Kliebenstein, et al. 2004).

The costs of feed can vary considerably based on type and region. The enterprise budgets produced at Iowa State University cite feed costs for three types of feed that matches three stages in the lifecycle of the pig: nursery feed for piglets from weaning up to feeder weight of about 70 lbs., grower feed for feeder pigs up to about 150 lbs., and finisher feed for pigs up to market weight of 240-270 lbs. (Becker, Honeyman and Kliebenstein 1999, Larson, Kleibenstein and Honeyman 2003). Using the Producer Price Index for animal feeds to convert these estimates into 2015 USD, the costs per pound are $0.25, $0.21, and $0.18, respectively. Our simplified model assumes a fixed $0.20 / lb cost for feed. However, organic or specialty feeds may be more expensive: an organic, pastured pork producer we interviewed (Sturtevant 2015) cited $0.26 / lb.

2. Other Variable Costs

Most of the variable costs aside from labor are adapted from the 2004 Iowa State study (Kliebenstein, et al. 2004), with the exception of interest on working capital and boar genetics (semen) for breeding. The costs include breeding sows (gilts), boar genetics (Dhuyvetter, et al. 2014), straw bedding, veterinary and medicine costs, fuel and other utilities, repairs, record keeping, and interest on working capital (Ben-

son and Green 2011). All costs are corrected from 2003 to 2015 USF using the PPI. Interest on working capital is assumed to be 5.5%, evaluated on half of the cost of working capital (all variable costs, including labor).

3. Fixed Costs

We assume that two sets of structures are necessary for the farrow-to-finish operation: (1) farrowing barns, in which sows will gestate, give birth, and farrow piglets to weaning; and (2) finishing houses, in which weaned pigs will feed and grow to finished market weight. Some operations include intermediate houses in which weaned pigs are grown to feeder weight (~70 lbs.); some include a fourth type of house in which feeder pigs are grown from 70 to 150 lbs. For the sake of simplicity, we assume that there are only two types of houses.

We assume that both structures are hoop houses and cost the exact same amount to build and maintain. A 2004 study at Iowa State University (Kliebenstein, et al. 2004) cited $13,000 as the cost to build a hoop house structure; corrected for inflation to 2015 USD using the PPI, we assume $15,350 / house. Each farrowing barn holds 25 sows, each with a litter of piglets, and each finishing house holds 200 market weight hogs at one time, or 400 hogs per year. Hence, four farrowing barns and four finishing houses are needed at the scale of production we are considering.

We assume that miscellaneous equipment for both types of structures, including feeders, waterers, pipes, electric lights and indoor climate control, as well as manure storage and treatment facilities, costs $10,000. Since the land requirement is minimal, we assume the farm has no tractor, but rather an ATV with a trailer to haul equipment and feed. Transportation of finished hogs to market is contracted out and is thus part of variable costs. We assume the ATV and trailer together cost $7,500, and the farm only needs one unit of each.

4. Labor Costs

Labor costs can be measured in one of two ways: hours per pig from birth to slaughter, or hours per litter, including care/supervision/feeding for the farrowing sow. Following a recent study of organic pork production at Iowa State University (Kliebenstein, et al. 2004), we assume each litter (including sow) requires 13 hours of labor to raise, reflecting the authors' reported average for year-round farrow-to-finish, hoop house production. If each litter requires 13 hours of labor, then the total labor requirement per year is equal to the number of sows, multiplied by the number of litters per sow per year, multiplied by 13. The total number of hours is thus 13 * 100 * 2 = 2,600 hours per year, or 1.25 FTE assuming a 2,080-hour work-year. Labor is assumed to be paid $15 / hour.

5. Summary of Production Cost Assumptions

A summary of the assumptions behind our study is given below in Table 11. We assume a purchase price per live hundredweight of $125.00, and a purchase price for cull sows of $250. The purchase price assumption is arbitrary, but allows the model to clear a small profit margin of about 3% (see Table 12 below).

Model Inputs	
Number of Sows (Gilts) Purchased / Year	100
Cost / Sow (Gilt)	$210
Number of Litters / Sow / Year	2
Average Litter Size	8.0
Piglet Mortality Rate	7.5%
Feed-to-Weight Conversion Rate	4
Feed Cost / Lb	$0.20
Live Weight / Finished Hog	250
Person-Hours of Labor / Sow + Litter	13
Hoop House Unit Cost	$15,350
Farrowing Barn Unit Cost	$15,350
Equipment Unit Cost	$10,000
Vehicle Unit Cost	$7,500
Hired Labor? (Y/N)	Y
Hired Labor Wage	$15
Purchase Price / Cwt Live	$125

Table 13. Data Model Assumptions

Model Results

1. Hoop House Production

Model results are given below in Table 12. Notably, feed absorbs a substantial majority of total farm costs (72.6%). This finding is consistent with other studies of farrow-to-finish production systems, which tend to have the highest feed costs as a percentage of total costs (Kephart, et al. 2001). For another example, in the case of outdoor (pastured) farrow-to-finish systems, feed can absorb as much as 85% of total costs (Becker, Honeyman and Kliebenstein 1999). The second most important cost category is Other Variable costs, which absorb 10% of total costs, or $12.37 / hundredweight of live hog. Fixed costs and labor costs are about equal to other variable costs in importance (8.8% and 8.5% respectively). The break-even cost of production is $123.72 / cwt live hog. This estimate is comparable to the one generated by a 1999 study at Iowa State (Becker, Honeyman and Kliebenstein 1999), in which the authors found a break-even price of $133.41 / cwt ($55 / cwt in 1999 USD, adjusted upwards to 2014 USD by the PPI).

At the $125 / cwt price point, the net income of the farm is $17,253 / year. Total returns, including sales of cull sows, are $475,000; the profit margin is 3.6%. The cost of feed is the ultimate arbiter of returns at any price point. For each cent per pound that the feed price falls, returns increase by $16,625; break-even price falls by $4.49 / cwt. If the feed price were to fall to $0.10, the break-even cost of production would be $78.78 / cwt – almost able to break even at the U.S. average market price of $78.65 / cwt.

Table 14. Receipts, Costs, and Returns to Hoop House, Farrow-to-Finish Pork Production

Model Outputs: 100 Sows, $0.20 / lb. Feed					
Returns By Category	Per Litter	Per Finished Hog	Per Cwt Live Hog	Total Returns and Costs	% Total Cost / cwt Weight Gain
Gross Receipts	$2,312.50	$312.50	$125.00	**$475,000**	--
Feed Costs	$1,662.50	$224.66	$89.86	**$332,500**	**72.6%**
Labor Costs	$195.00	$26.35	$10.54	**$39,000**	**8.5%**
Other Variable Costs	$228.83	$30.92	$12.37	**$45,765**	**10.0%**
Fixed Costs	$202.41	$27.35	$10.94	**$40,481**	**8.8%**
Total Cost	$2,288.73	$309.29	$123.72	**$457,747**	--
Total Annual Returns	$23.77	$3.21	$1.28	**$17,253**	--

2. Comparison to National Averages

Table 13 below provides corresponding 2014 annual national averages for farrow-to-finish pork production from the USDA Economic Research Service (USDA 2015). The conventional model presented here assumes 5,000 hogs, sold at the national average market weight of 285 lbs. Sows are not considered in this model budget; all costs are expressed in dollars per hundredweight of live hog. The breakeven cost of production is $58.59 per live hundredweight, less than half the cost of production of the hoop house model described above. Feed costs, in particular, are much lower in the conventional model ($34.07 vs $89.86); differences in feed costs account for 86% of the difference in total costs between the two models.

The average market price per live hundredweight in 2014 was $78.65, which is 37% lower than the barely breaking-even $125 / cwt in our hoop house model above. The annual net returns are over fifteen times higher ($285,855 vs. $17,253). Net returns per hundredweight for the conventional model are $20.06, compared to $1.28 for the hoop house model. Profit margins are over seven times higher (25.5% vs. 3.6%).

Model Outputs: 5,000 Hogs			
Returns By Category	Per Cwt Live Hog	Total Returns and Costs	% Total Cost / cwt Weight Gain
Gross Receipts	$78.65	$1,120,763	--
Feed Costs	$34.07	$485,498	58.1%
Labor Costs	$7.72	$110,010	13.2%
Other Variable Costs	$5.97	$85,073	10.2%
Fixed Costs	$10.83	$154,328	18.5%
Total Cost	$58.59	$834,908	--
Total Annual Returns	$20.06	$285,855	--

Table 15. Receipts, Costs, and Returns to Conventional, Farrow-to-Finish Pork Production (U.S. Average)

Similar returns to alternative pork production can be earned, however, if feed costs are brought down. Consider the hoop house case presented above in Table 10, with two adjustments. First, suppose the pigs are fed a barley-based diet such as the lowest-cost feed blend presented in Table 5, which they purchase for $0.12 / lb. Second, suppose that the producers receive $94.38 / cwt, which is a 20% premium over the U.S. average purchase price of $78.65 reported in Table 11, reflecting the higher premium that consumers have stated willingness to pay from the study reviewed in Section IV.3 above.

The results of this lower-cost, premium price hoop house model are displayed in Table 12 below. The unit costs are $87.77 / cwt live hog. The producer earns $6.61 / cwt, which is still significantly lower than the $20.06 / cwt earned by the conventional producer described above. Feed costs are $53.92 / cwt, which are still 58% higher than the conventional feed costs quoted above. Total annual (net) returns are $36,959. Feed comprises 61.4% of total costs. Gross receipts are $361,706.

Model Outputs					
Returns By Category	Per Litter	Per Finished Hog	Per Cwt Live Hog	Total Returns and Costs	% Total Cost / cwt Weight Gain
Gross Receipts	$1,746.03	$235.95	$94.38	$361,706	--
Feed Costs	$997.50	$134.80	$53.92	$199,500	61.4%
Labor Costs	$195.00	$26.35	$10.54	$39,000	12.0%
Other Variable Costs	$228.83	$30.92	$12.37	$45,765	14.1%
Fixed Costs	$202.41	$27.35	$10.94	$40,481	12.5%
Total Cost	$1,623.73	$219.42	$87.77	$324,747	--
Total Annual Returns	$122.30	$16.53	$6.61	$36,959	--

Table 16. Receipts, Costs, and Returns to Hoop House, Farrow-to-Finish Pork Production, Low-Cost Feed Blend

In conclusion, feed is by far the biggest factor influencing pork producers' returns. However, it is not the only one. Other factors include: Higher feed efficiency (lower conversion rate)

- Heavier slaughter weight
- Lower labor requirement per litter (due to improved management)
- Lower piglet mortality
- Larger litters
- More efficient use of bedding, fuel, and utilities

3. Sensitivity Analysis

Can investments in hoop house pork production create living-wage jobs, while also paying a reasonable return to the owner of the farm? Can living-wage jobs and net farm returns be generated at purchase prices that consumers are willing to pay?

The pork producer we have chosen to model will employ an average of about 1.25 FTE, to tend 100 sows and litters. As stated above in Table 9, we assume that each sow and litter requires 13 hours of labor from gestation to the finished market hogs, and that each sow bears an average of 2 litters per year. Under those assumptions, the amount of labor required for the operation is 2,600 hours per year (=13 * 100 * 2), which is equivalent to 1.25 FTE, assuming a work-year of 2,080 hours. We assume that this labor is hired in at a wage; the farm owner engages in supervision and management tasks including overseeing maintenance and repairs, budgeting and financing.

We conduct a sensitivity analysis showing the net returns that farm owners will earn at different feed prices for a given wage and output price. Table 13 below examines the impact of feed prices on net farm returns, assuming that labor is hired at $15/hr and the marketed output is sold at $100 per hundredweight of live hog, a 28% markup over the average price for live hogs in the U.S. in 2014 (NASS 2015). $15/hr is well above the living wage threshold for a single adult in Grant County, WA; it is also considered to be a living wage for two adults and up to two children, if both adults are working at that wage (Glasmeier 2015).

The results in Table 13 demonstrate the sensitivity of farm returns to feed prices. If the feed price is $0.17/lb or above, the farm loses money. If it is $0.16/lb, the farm is still selling below cost of production, but earns a small positive net return from the sales of cull sows. With feed at $0.15/lb, the farm earns net returns sufficient to support a single adult at a living wage in Grant County, WA. With feed at $0.13/lb, the farm earns $54,486 in net returns, which exceeds a living wage for two adults and up to three children in Grant County, given that only one adult is working and the other is a homemaker (Glasmeier 2015). At a purchase price of $100/cwt, and a feed price of $0.13/lb, a farm producing 100 sows and litters can thus support a farm household in rural, central Washington State, while also paying a reasonable living wage to one full-time and one part-time employee.

Feed Price / Lb	Cost/Litter	Cost/Hog	Cost/cwt Live Hog	Returns
$0.18	$2,055.70	$277.80	$111.12	($28,639)
$0.17	$1,972.57	$266.56	$106.63	($12,014)
$0.16	$1,889.45	$255.33	$102.13	$4,611
$0.15	$1,806.32	$244.10	$97.64	$21,236
$0.14	$1,723.20	$232.86	$93.15	$37,861
$0.13	$1,640.07	$221.63	$88.65	$54,486
$0.12	$1,556.95	$210.40	$84.16	$71,111
$0.11	$1,473.82	$199.17	$79.67	$87,736
$0.10	$1,390.70	$187.93	$75.17	$104,361
$0.09	$1,307.57	$176.70	$70.68	$120,986
$0.08	$1,224.45	$165.47	$66.19	$137,611
$0.07	$1,141.32	$154.23	$61.69	$154,236

Table 17. Farm Net Returns by Feed Price: Labor Costs $15/hr, Output Price $100/cwt

However, these positive returns are highly sensitive to the output price. If the output price drops to $95/cwt (a 21% premium over the 2014 U.S. average) then the feed price that is required to sustain the farm household while also paying its worker/s $15/hour drops significantly. At this price point, the feed price must be $0.14/lb or below for the farm to make positive net returns. To reach the living wage threshold for a farm family with three children, the feed price must now be $0.11/lb or below. However, if the wage is lowered to $10/hr, then the farm can meet this threshold at a feed price of $0.12/lb. A wage of $10/hr is somewhat higher than the living wage for a single adult in Grant County ($9.24/hr).

This brief analysis shows the sensitivity of farm returns to feed prices and output prices. The net returns that the farm owner can earn, and the wage that the farm owner can afford to pay her or his employees, are very sensitive to the price of the most important input, the pig feed, and the price of the output. Farmers working in niche markets can adjust output prices to achieve desired returns if their product has a reputation for high quality or consumers are willing to pay premiums for sustainable production practices. However, relatively few farmers will be able to employ this strategy, since it demands a high level of management skill, and will entail escalating competition if many farmers choose to enter the same high-end market niche.

In short, in order for hoop house pork production to be economically viable at scale in the Pacific Northwest while paying reasonable returns to farm owners and living wages to farm employees, feed must be very affordable and consumers must be willing to pay premium prices.

Feed Price / Lb	Cost/Litter	Cost/Hog	Cost/cwt Live Hog	Returns
$0.18	$2,122.48	$286.82	$114.73	($60,497)
$0.17	$2,039.36	$275.59	$110.24	($43,872)
$0.16	$1,956.23	$264.36	$105.74	($27,247)
$0.15	$1,873.11	$253.12	$101.25	($10,622)
$0.14	$1,789.98	$241.89	$96.76	$6,003
$0.13	$1,706.86	$230.66	$92.26	$22,628
$0.12	$1,623.73	$219.42	$87.77	$39,253
$0.11	$1,540.61	$208.19	$83.28	$55,878
$0.10	$1,457.48	$196.96	$78.78	$72,503
$0.09	$1,374.36	$185.72	$74.29	$89,128
$0.08	$1,291.23	$174.49	$69.80	$105,753
$0.07	$1,208.11	$163.26	$65.30	$122,378

Table 18. Farm Net Returns by Feed Price: Labor Costs $15/hr, Output Price $95/cwt

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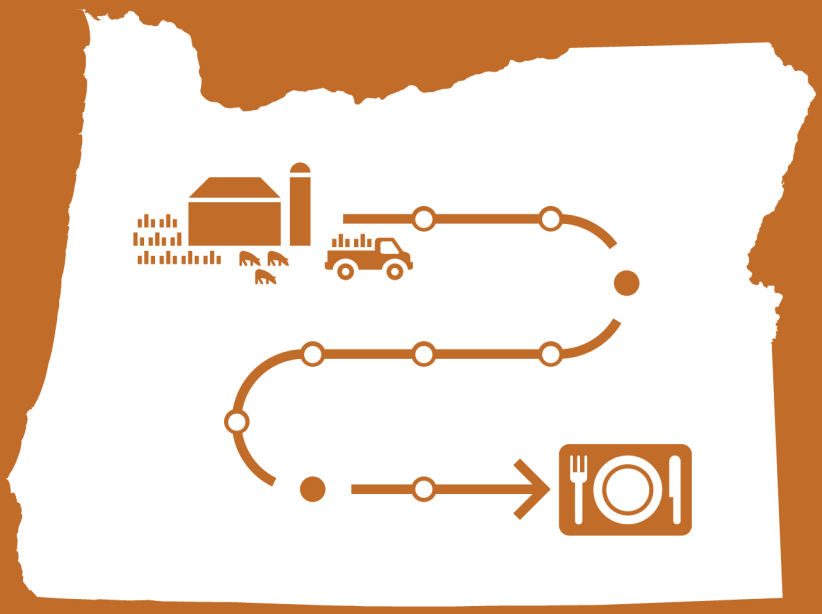
(Footnotes)

1 We assume that the retail price average for ham covers both fresh and smoked.

2 The proportions of spending by value on fresh vs. processed pork are not equal to the proportions of consumption by volume, because the breakdown of cuts of fresh vs. processed pork are different from one another.



Oregon Food Infrastructure Gap Analysis

Where Could Investment Catalyze Regional Food System Growth and Development?

Pork

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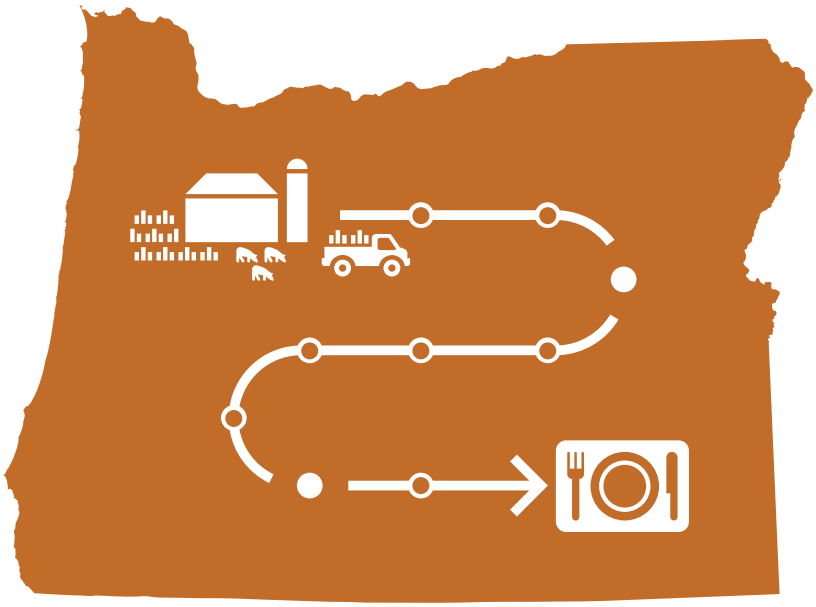


Oregon Food Infrastructure Gap Analysis

Where Could Investment Catalyze Regional Food System Growth and Development?

By Ecotrust, with Matthew Buck
Funded by Meyer Memorial Trust

April 2015

Project Team

Amanda Oborne, VP, Food & Farms, Ecotrust
Matthew Buck, Matthew Buck Consulting
Lauren Gwin, PhD, Associate Director, Center for Small Farms & Community Food Systems at Oregon State University
Michael Mertens, PhD, Director, Knowledge Systems, Ecotrust
Stacey Sobell, Director, Food & Farms, Ecotrust
Katy Pelissier, Program Coordinator, Food & Farms, Ecotrust
Angela Hedstrom, Farm to School Assistant, Ecotrust
Jocelyn Tutak, GIS Analyst, Ecotrust
Noah Enelow, PhD, Economist, Ecotrust
William Moore, Senior Developer, Ecotrust
Ryan Sullivan, Graphic Design, Paste in Place

Advisors

Jeff Harvey, CEO, Burgerville
Ashley Henry, Community Engagement Manager, Beneficial State Foundation
Sayer Jones, Director of Finance and Mission Related Investing, Meyer Memorial Trust
Nathan Kadish, Director of Investment Strategy, Ecotrust
John Klostermann, Director of Operations, Oregon Food Bank
Jason Lafferty, General Manager, SnoTemp
David McGivern, President, Northwest Food Processors Association
Mike Moran, General Manager, Columbia Plateau Producers (Shepherd's Grain)
Katie Pearmine, Strategic Sourcing Manager, Oregon Food Bank
Gary Roth, Marketing Director, Oregon Department of Agriculture
Richard Satnick, Owner, Dick's Kitchen

Stakeholders and Contributors

Hannah Ancel, ACCESS
Susan Arakelian, Beaverton School District
Mark Anderson, Champoeg Farm
John Boyle, New Seasons Market
Denise Breyley, Whole Foods Market
Sarah Brown, Oregon Tilth
Caitlin Burke, Hacienda CDC
Sarah Cantril, El Huerto del Familia
Cory Carman, Carman Ranch
Karla Chambers, Stahlbush Island Farms
Bridget Cooke, Adelante Mujeres
Eecole Copen, Oregon Health Sciences University
Mitch Daugherty, Built Oregon
Fernando Divina, Oregon Health Sciences University
Piper Davis, Grand Central Baking
Chuck Eggert, Pacific Foods
Lynne Fessenden, Willamette Farm & Food Coalition
Joel Fisher, Oregon Business Association
Gitta Grether-Sweeney, Portland Public Schools
Amy Gilroy, Oregon Department of Agriculture
Rick Gruen, Clackamas County
Greg Higgins, Higgins Restaurant
Alan Hummel, New Seasons Market
Franklin Jones, B-Line Sustainable Urban Delivery
Reg Keddie, Pacific Foods
Jill Kuehler, formerly Friends of Zenger Farm
Spencer Masterson, Oregon Food Bank
Michael Madigan, Bowery Bagels
Chrissie Manion Zaerpoor, Kookoolan Farms
Laura Masterson, 47th Avenue Farm
Sarah Masoni, Food Innovation Center, Oregon State University
Nellie McAdams, Friends of Family Farmers
Michelle McGrath, Oregon Environmental Council
Gretchen Miller, Oregon Food Bank
Sara Miller, Northeast Economic Development District
Michael Morrissey, Food Innovation Center, Oregon State University
Jim Myers, PhD, Oregon State University
Ivan Mulaski, Friends of Family Farmers
Tanya Murray, Oregon Tilth
Ron Paul, James Beard Public Market
Peter Platt, Andina
Madeleine Pullman, PhD, Portland State University
Jared Pruch, Cascade Pacific RC&D
Teresa Retzlaff, North Coast Food Web
Trudy Tolliver, Portland Farmers' Market
Chris Schreiner, Oregon Tilth
Lane Selman, Culinary Breeding Network
Wendy Siporen, Thrive
Emma Sirois, Healthcare Without Harm
Thomas Stratton, formerly Oregon Rural Action
Sarah Sullivan, Gorge Grown Food Network
Sharon Thornberry, Oregon Food Bank
Chris Tjersland, New Seasons Market
Katrina Van Dis, Central Oregon Intergovernmental Council
Lisa Vincent, Beaverton School District
Karen Wagner, formerly Oregon Rural Action
Bob Wise, Cogan Owens Greene
Philip Yates, ACCESS

8

Pork

8.1. Introduction to Pork at the National Level

US consumption of pork has been in a range from 48 to 52 pounds per capita since the mid-1970s, but declined in 2011 and 2012 to just under 46 pounds per capita.

US hog production is heavily concentrated in the Midwest and North Carolina.[139] The industry is dominated by very large farms with more than five thousand hogs each, which represented 83 percent of the US inventory in 2012. Total US pork production in 2013 was about 23 billion pounds from 112 million hogs.[140] The National Agriculture Statistics Service estimated the value of hog production in 2012 at about $22.2 billion.[141]

A report from the USDA Economic Research Service in 2008 outlines the industry flow and provides ratios used in later parts of this report.

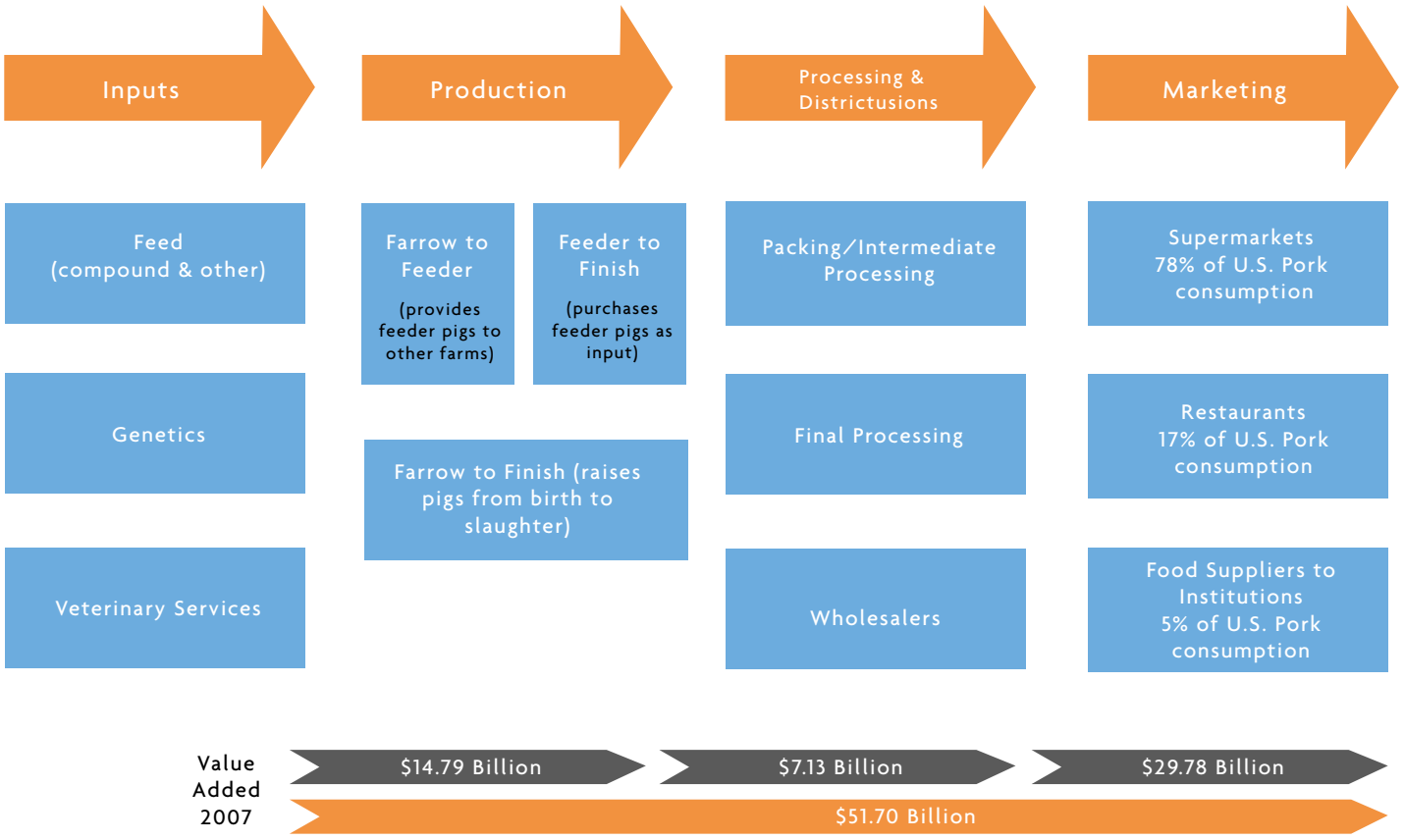


Figure 8.1: Pork industry process flow.

[139] "Overview (Hogs & Pork,") USDA, ERS, 2014.

[140] "Pork Facts," National Pork Producers Council, (n.d.).

[141] "Meat Animals Production, Disposition, and Income Final Estimates 2008-20012," USDA, NRSS, 2014.

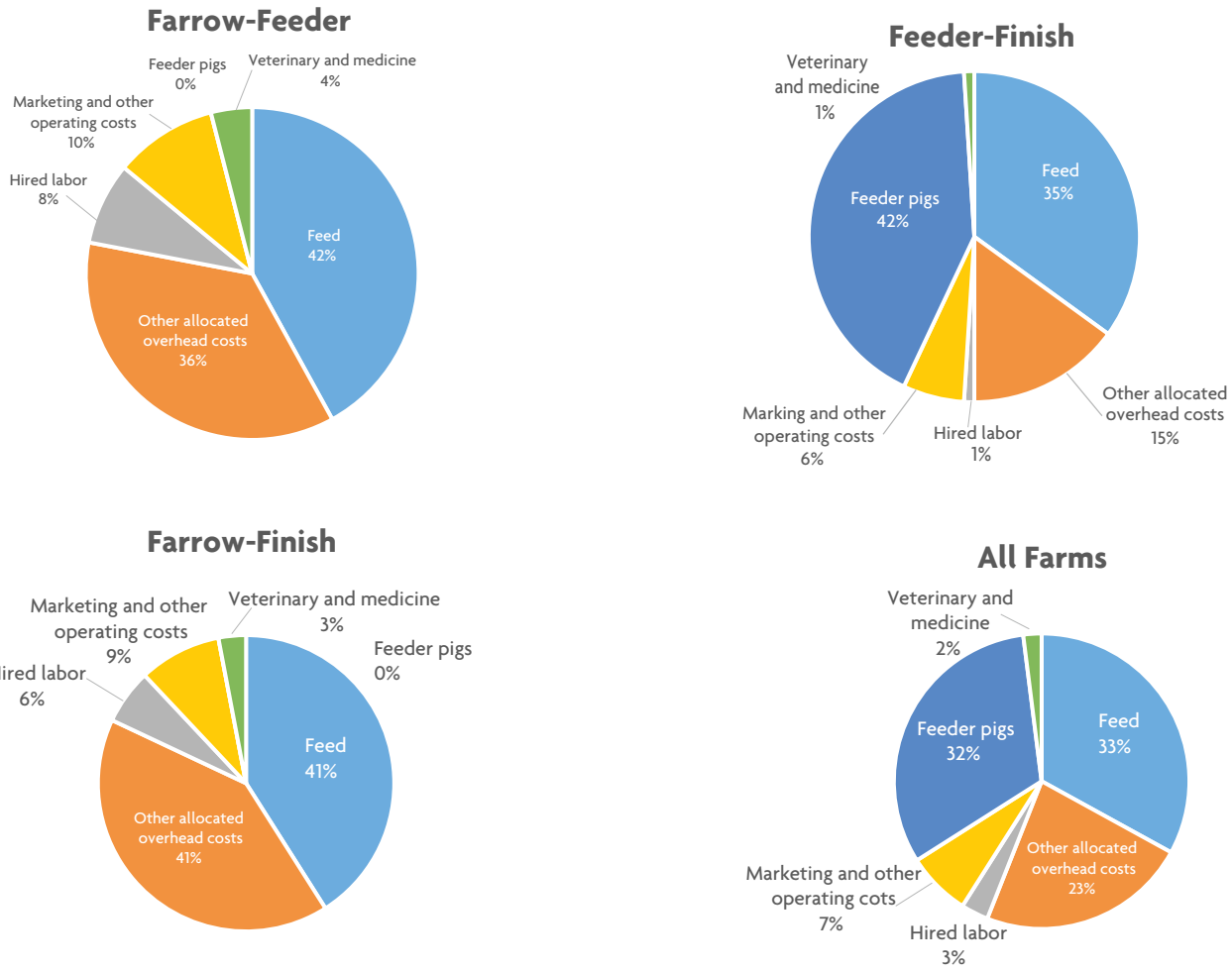
8.2. Segmentation, Key Issues, and Trends

There five basic production systems for hogs/pigs:

- Farrow to Finish: all stages from breeding through sale of a finished animal, approximately 240 to 270 pounds
- Farrow to Wean: breeding through sale of ten-to-fifteen-pound piglets
- Farrow to Nursery: breeding through sale of forty-to-sixty-pound "feeder" pigs
- Wean to Finish: purchase and feeding of ten-to-fifteen-pound piglets
- Finishing: purchase and feeding or forty-to-sixty-pound "feeder" pigs

Costs of production vary for the different production systems as seen in the graphic on the below.

Figure 8.2: Cost of pork production systems.



Common breeds of hogs raised include Yorkshire, Duroc, Hampshire, and Berkshire.

Most pigs end up sold directly to packers and delivered live to a buying station or processing plant. More than 95 percent are sold under a "carcass merit" system with pricing affected by ratios of fat to muscle. However, from a retail perspective, there is no corresponding grading system to alert customers to product differences (as with "select" or "choice" for beef).

Methods of production include:

- **Confinement:** Barns with areas to segregate pigs of different sexes and ages. Intensive production with large numbers of animals (eight hundred–plus). All feeds are provided. Often with easier-to-clean and disinfect hard surface flooring, sloped to facilitate collection and storage of liquid manure. Associated with use of "gestation crates" and "farrowing crates," which limit the movement of breeding and nursing sows. Very capital intensive to build or retrofit.

- **Hoop Houses:** Lower-cost structures with a frame and cover, open at one or both ends. Cement or earthen floors with straw or other bedding materials on top. All feeds are provided. Appropriate for one hundred to two hundred animals, which live in social groups. Requires more oversight to identify and segregate sick or injured animals. Requires more labor and expense to periodically remove used bedding and solid manure, and provide and spread fresh bedding.

- **Pasture:** Low- or no-structure costs. May be seasonal production. Pigs live outdoors with access to shade or shelter where appropriate, usually as part of a crop/livestock rotation system. Forage can meet a percentage of pigs' diet, but supplemental feeds must still be provided. Appropriate for smaller groups of animals. Hogs can engage in natural behaviors, but must be dispersed over a larger area to avoid concentrated environmental damage (from rooting and digging, etc.) and allow safe absorption of nutrients from manure. Some risk of exposure to disease/pathogens.

Consumer interest in alternatives to "conventional pork" has been stoked by:

- Concerns for food safety:
  - Routine use of antibiotics. (Use of hormones is prohibited under federal law for hogs.)
  - Consumer Reports studies found yersinia enterocolitica in 69 percent of tested pork samples, and additional incidences of salmonella, staphylococcus aureus, and listeria. More troubling is the fact that the majority of samples contained bacteria that were resistant to one or more antibiotics.

- Concerns for animal welfare with related advocacy by animal welfare organizations:
  - Discomfort with crowded conditions on very large "factory farms."
  - Discomfort with sows being immobilized for months in gestation or farrowing crates.
  - Routine manipulation of animals, including castration, tail docking, and teeth clipping.
  - Well-publicized videos showing mistreatment of animals.
- Concern for the environment:
  - Discomfort with the manure lagoons associated with large hog operations, each of which can hold 400,000 gallons of liquid manure. These are a source of odors and have contaminated ground and surface water, leading to algae blooms and fish kills.
- Interest in unique, high-quality, local foods and a desire to support local farm economies.

Farmers' desire to limit piglet mortality, a major source of loss, led to use of farrowing crates in confinement systems, which limit mobility in order to prevent the sow from accidentally crushing piglets against hard surfaces. However, deep, soft bedding has also been shown effective in reducing mortality.

In response to expressed consumer concern and initiatives passed in California and other states, since 2012 more than sixty of the world's largest food brands,[142] including McDonald's, Burger King, and Costco, have announced commitments to eliminate crates from their supply chains.

Alternatives to conventional pork discussed in this report include:

- Natural
- Organic
- Pasture Raised
- High animal welfare (Animal Welfare Approved, Certified Humane, Food Alliance, etc.)
- Local products from small and mid-sized farms offering one or more of the above attributes

8.2.1. Natural

As a marketing term, "natural" actually says very little about pork. The USDA has three requirements for use of "natural," which for pork all relate to handling of meat after the animal has been slaughtered—not to conditions under which the animal was raised:

- The product must be minimally processed
- It cannot contain any artificial ingredients
- It cannot contain any preservatives

[142] "Your Pig Almost Certainly Came from a Factory Farm, No Matter What Anyone Tells You," Matthew Prescott, Washington Post, 2014.

Most conventionally produced fresh pork meets these minimum requirements if it has not been packed with a marinade, tenderizer, or other ingredients. However, companies marketing branded pork (Niman Ranch, Applegate, etc.) typically have their own additional, internal program requirements. These can include:

- No antibiotics ("not ever"—with animals treated for health reasons sold conventionally)
- No feed containing animal protein or fat (often with allowances for milk)

These companies may also make humane animal handling claims, though criteria for those claims may not be public or may not be clear. Verification of requirements and claims also often happens internally, without the involvement of an independent auditor, and sometimes only with submission of affidavits.

8.2.2. Organic

"Organic" is regulated by the USDA and requires a third-party audit. USDA certified organic pork must come from cattle raised in compliance with the standards from the last third of gestation to slaughter.

- Feeds must be certified organic. Vitamin and mineral supplements must be approved.
- Forage must be grown without the use of synthetic fertilizers, herbicides, or pesticides.
- Genetically modified (GMO) feedstock and forage are prohibited.
- Hogs must have access to the outdoors, to appropriate shelter, and to clean dry bedding.
- Use of antibiotics is prohibited.
- Animals must also be slaughtered/processed under USDA or state equivalent certification.

There are currently very few certified organic hog producers. (In fact, a search using the Oregon Tilth directory for organic hog or pork producers returned no results in Oregon.) However, several smaller-scale hog farmers in Oregon do make "raised with organic practices" claims, while stating they are not organic certified. Reasons given for not seeking organic certification include the high cost of organic feeds and the added expense and administrative burden of going through the certification process.

However, a 2012 study at the University of Illinois[143] suggests:

> "there is a difference in prices based on the production of specialized pork products, i.e., certified organic pork. Those producers received $19.70 more per cwt. for market hogs than other producers. The regression

[143] "Determinants of Profitability in Niche Swine Production," Dwight Sanders, Ira Altman, Gary Apgar, Journal of the ASFMRA, 2012.

analysis shows that this same marketing association resulted in $13.47/cwt. increase in net margins for those producers. So, while producers are price-takers over time, they may be able to shift up their average price and increase profit margins by further specializing their production. Granted, meeting the more rigorous specifications and qualifications for "certified organic" pork is undoubtedly more costly; but, this analysis shows that producers who successfully meet those niche requirements are rewarded with higher net profits."

8.2.3. Pasture-Raised

Information on pasture-raised as a segment of the pork industry is difficult to collect. According to a 2014 **New York Times** article, "**Neither the United States Department of Agriculture nor the National Pork Producers Council has data on the number of pastured pigs, though in 2006, research done at Iowa State University estimated that the drift, as a group of pigs is known, numbered from 500,000 to 750,000.**"[144]

One source suggests that rotating hogs through production and wooded areas on a diversified farm operation to maximize forage opportunities can reduce purchased feed costs by as much as 50 percent.[145]

Founder Paul Willis is quoted in the **New York Times** article claiming Niman Ranch produces as many as half of all pastured pigs, and saying "We could sell 20 percent more than what we have in no time. This way of raising pigs is still a very small part of the business—400,000 hogs are killed each day and we can supply only 3,000 pigs a week." Niman Ranch customers include Chipotle restaurants and others.

However, the article also documents the difficulty smaller pasture-pork brands face trying to access markets, manage inventory, and deal with conditions of over- and under- supply while growing a business.

8.2.4. High Animal Welfare

There are a number of animal welfare claims paired with natural, organic, or pasture-raised pork claims. Food Alliance has, for example, certified Pure Country Pork (in Ephrata, Washington), and a number of other pork suppliers to the New Seasons Market grocery store chain.

8.2.5. Local Branded

The "local" segment of the market is represented by independent farmers marketing to consumers or to commercial food buyers (retail, restaurants, food service). There are a few independent producer brands in the Northwest (such as Pure Country Pork in Washington or Snake River Farms in Idaho), which have been successful accessing regional and even national markets. There do not appear to be any smaller regional pork brands involving multiple producer/

[144] "Demand Grows for Hogs That Are Raised Humanely Outdoors," Stephen Strom, New York Times, 2014.

[145] Insights on Beginning a Pastured Pork Operation," Agrowingculture, (n.d.).

owners. Carlton Farms (discussed in more detail below), which operates its own processing facility, dominates the local/regional market, with hogs reportedly sourced from Oregon, Washington, Idaho, and Canada.

8.2.6. Growth in Markets for Alternative Pork

Price differences for conventional and alternative pork observed in Portland December 2014 include:

	Loin Chops	Italian Sausage	Ham	Bacon
Major Grocer Generic or Store Brand	$5.99/lb. Boneless	$4.49/lb.	$1.89/lb.	$5.99/lb.
New Seasons Market Northwest Grown	$7.49/lb. Boneless	$5.49/lb.	$4.99/lb.	$7.99/lb.
Farm Direct—Heritage Farms Northwest OR, Pastured, Red Wattle Breed	$10.00/lb. Boneless	$9.50/lb.	$9.50/lb.	$10.50/lb.
Tails & Trotters Retail Store Northwest Grown, Hazelnut Finished	$10.00/lb. Bone-in	$10.00/lb.	$16.00	$12.50/lb.

Table 8.1: Price differences for conventional and alternative pork observed in Portland, December 2014.

As with other products studied in this report, despite the potential to realize higher prices overall for differentiated products, midsized and smaller scale farmers pursuing niche markets must earn a margin that enables profitability in spite of typically higher per unit production, processing, and marketing costs.

8.3. Demand for Pork in Oregon

Understanding market demand is critical to evaluating potential investments to increase production and profitability of local and alternative pork.

8.4. Consumer Spending on Pork

According to the Bureau of Labor Statistics, the average household (2.6 persons) in the western US spent $7,180 in 2013 on food at home (59 percent) and away (41 percent) in 2013.[146] This includes $163 spent on pork for at-home consumption. As noted above, US per capita consumption of pork is about forty-six pounds.

According to a 2005 report by the Economic Research Service, 38 percent of pork consumed domestically is fresh. The remaining 62 percent of consumption is of processed products, which industry figures divide roughly into ham (39 percent), sausage (25 percent), bacon (23 percent), or other "lunchmeats" (13 percent).[147]

[146] "Region of residence: Annual expenditure means, shares, standard errors, and coefficient of variation," Consumer Expenditure Survey, 2013.

[147] "Factors Affecting U.S. Pork Consumption," Christopher Davis and Biing-Hwan Lin, USDA, ERS, 2005.

Pork is primarily purchased at retail stores (78 percent). Approximately 82 percent of fresh pork and 76 percent of processed pork is consumed at home.[148]

Restaurants reportedly account for another 15 percent of fresh pork and 18 percent of processed pork. The remaining balances of 3 percent of fresh pork and 6 percent of processed pork are consumed through other foodservice venues.

In November 2013, the USDA Economic Research Service listed the value of pork at the farm level at $1.10, wholesale at $1.70, and retail at $4.06. This implies wholesale could average 42 percent of retail price.[149]

A number of sources indicate foodservice ingredient costs average 30 percent of the final price, but can range lower or much higher depending on the type of establishment. Schools and hospitals may be seeking to keep food costs closer to 20 percent. Fine dining establishments may be comfortable with food costs reaching 40 percent or more with a priority placed on high-quality ingredients.

Using population data and the figures above, it is possible to form estimates of the consumer market for pork in Oregon, at the county level or for municipalities. The estimates are separate for fresh and processed products, and represent averages for all pork products in each category.

According to ERS figures, the average price per pound paid for pork at retail in October 2014 was $3.10 for nonspecific pork products, $4.17 to $4.60 for fresh chops of various types, $4.60 for boneless ham, and $5.80 for bacon.[150]

However, given that producers developing branded pork programs to target local and regional markets will have to find markets for all cuts, the averages are worth considering.

Table 8.2: Estimated demand for pork.

Geographic Unit	Total Pork "Consumed"	Fresh Pork (38%)	Processed Pork (62%)
Oregon (pop. 3,919,020)	180M lbs.	68.4M lbs.	111.6M lbs.
Multnomah Co. (pop. 756,530)	34.8M lbs.	13.2M lbs.	21.6M lbs.
Jackson Co. (pop. 206,310)	9.5M lbs.	3.6M lbs.	5.9M lbs.
City of Bend (pop. 79,109)	3.6M lbs.	1.4M lbs.	2.2M lbs.
City of La Grande (pop. 13,048)	600K lbs.	228K lbs.	372K lbs.

Breakdowns for fresh and processed pork through retail and foodservice, and estimates for associated wholesale opportunities follow.

[148] "Factors Affecting U.S. Pork Consumption," Christopher Davis and Biing-Hwan Lin, USDA, ERS, 2005.

[149] "Overview: Meat Price Spreads," USDA, ERS, 2015.

[150] "Overview: Meat Price Spreads," USDA, ERS, 2015.

Geographic Unit	Total Fresh Pork	Fresh Pork: Retail (82%)	Fresh Pork at Home	Implied Wholesale (42%)	Fresh Pork: Foodservice (18%)	Implied Wholesale ($1.70 avg.)
Oregon (pop. 3,919,020)	68.4M lbs.	56M lbs.	$118M	$50M	12.4M lbs.	$21M
Multnomah Co. (pop. 756,530)	13.2M lbs.	10.8M lbs.	$22.6M	$9.5M	2.4M lbs.	$4M
Jackson Co. (pop. 206,310)	3.6M lbs.	3M lbs.	$6.2M	$2.6M	600K lbs.	$1M
City of Bend (pop. 79,109)	1.4M lbs.	1.1M lbs.	$2.4M	$1M	200K lbs.	$374K
City of La Grande (pop. 13,048)	228K lbs.	187K lbs.	$393K	$165K	41K lbs.	$70K

Geographic Unit	Total Processed Pork	Processed Pork: Retail (76%)	Processed Pork at Home	Implied Wholesale (42%)	Proc. Pork: Foodservice (24%)	Implied Wholesale ($1.70 avg.)
Oregon (pop. 3,919,020)	111.6M lbs.	84.8M lbs.	$128M	$54M	26.8M lbs.	$45.6M
Multnomah Co. (pop. 756,530)	21.6M lbs.	16.4M lbs.	$24.4M	$10.2M	5.2M lbs.	$8.8M
Jackson Co. (pop. 206,310)	5.9M lbs.	4.5M lbs.	$6.8M	$2.9M	1.4M lbs.	$2.4M
City of Bend (pop. 79,109)	2.2M lbs.	1.7M lbs.	$2.6M	$1.1M	500K lbs.	$850K
City of La Grande (pop. 13,048)	372K lbs.	283K lbs.	$425K	$179K	89K lbs.	$151K

Table 8.3: Implied wholesale opportunity for pork.

The dollar figures above are rough estimates. Consumer spending estimates account only for the resident population, and do not take into account spending by tourists, business travelers, or others who may be present or pass through. Consumer spending figures also do not account for purchases by entities such as schools, hospitals, nursing homes, or prisons that do not pass the cost of food directly to consumers. (These purchases are addressed in more detail below, where information is available.)

It should also be reiterated that the large majority of pork consumed comes from lowest-cost commodity producer/processors. This has bearing on interpreting the scope of the implied wholesale opportunities referenced above.

Industry figures are that 18 percent of packaged pork products bore a "natural" claim in 2010—up from 9 percent in 2004. Opportunities for local and regional pork producers to capture a share of that market or to push that percentage higher vary by marketing channel.[151]

8.5. Market Channels

Pork makes its way from farm to market through a number of channels both direct and wholesale.

8.5.1. Direct Market—Custom Exempt

Farmers with access to "custom exempt" slaughter and processing can sell "locker pork" directly to consumers—though technically they are selling whole live animals or shares of whole live animals (halves or quarters). Under state license, farmers are not able to sell pork by the piece or by the pound.

[151] "A Snapshot of Today's Retail Meat Case," 2010 National Meat Case Study Executive Summary, 2010.

As an example, Wood Family Farm in the Willamette Valley offers customers whole or half hogs with a "hanging weight" of about two hundred pounds The price per pound paid to the farm is $3.35. Slaughter and processing charges bring the final cost to about $4.50/pound or higher depending on requests for curing and smoking. A half hog will end up costing $450 or more, but will provide 40 to 50 wrapped packages containing 60 to 70 pounds of chops, bacon, sausage, and ham. This will typically fill a standard refrigerator freezer.

Locker pork requires a significant commitment on the part of the customer to make a large upfront purchase, and then store and make good use of a large quantity of meat.

A farmer may produce eight thousand hogs for her own use or to sell as locker pork in Oregon, representing 1.1 million pounds of wrapped pork (at an average yield of 137 pounds of retail cuts per animal). If accurate, that figure represents 0.6 percent of the pork consumed in Oregon.

Given challenges at the farm, processor, and consumer levels, it is difficult to imagine sales of locker pork increasing dramatically in the near future—though that would be a very desirable outcome. Regardless, there is an argument for promoting and educating consumers about the benefits of locker pork.

8.5.2 Direct Market—Under USDA License

Farmers with access to USDA-licensed slaughter and processing are also selling individual cuts of meat direct to consumer at farmers' markets, thorough buying clubs, and even online. Producers using USDA processing also have the option of selling product to distributors, restaurants, retailers, and institutions.

Selling individual cuts of meat has its own challenges, including inventory management, more complicated pricing, and the need to find viable markets for all parts of the animal. Farmers are often in locations remote from both processors and end markets, requiring travel to deliver animals for processing, to develop and maintain relationships with buyers, and, in some cases, to actually fulfill ongoing orders for meat. There is also a lot of work involved in developing sufficient scale to be able to engage the interest of retail and foodservice customers, and ultimately enter distribution.

Considering the number of processing facilities and with limited and somewhat dated survey data on throughput, it can be estimated that there are likely fewer than four thousand hogs slaughtered in Oregon under USDA inspection each year that are not dedicated to the Carlton Farms brand. That would suggest a total of about 550,000 pounds of finished pork representing 0.3 percent of Oregon consumption.

8.5.3. Processing/Manufacturing

There are few examples of food processors/manufacturers sourcing pork raised and processed in Oregon to be featured as an ingredient in products. This requires traceability to the farm and access to USDA-licensed processing necessary for sale of finished products across state lines.

Several independent butcher shops, such as Gartner's Country Meat Market and Otto's Sausage Kitchen, offer fresh sausages and other cured and smoked pork products—and appear to source raw pork primarily from Carlton Farms.

Companies notable in Oregon that offer high-end processed pork products nationally, such as Tails & Trotters and Olympic Provisions, source from Pure Country Pork (Washington) and Carlton Farms, respectively.

8.5.4. Retail

US Census County Business Patterns data indicate there were 763 grocery stores and 56 independent meat markets in Oregon in 2012. Many grocery stores are outlets of major chains like Safeway and Kroger, which are likely too large to integrate smaller local pork suppliers—but do carry natural and organic products from multiregional and national companies. As an example, Hemplers Foods Group in Ferndale, Washington, has been successful placing its branded pork products (including hams, bacon, and sausages) in Safeway and Fred Meyer Stores.

However, there are also about 80 independent or natural food stores, like New Seasons Market (12 stores), Market of Choice (9 stores), Whole Foods Market (8 stores in Oregon), Zupan's (4 stores), and about a dozen cooperative grocery stores (like People's Food or Oceana Natural Food), that may be interested in relationships with local suppliers.

Per capita consumption figures and other industry data suggest that the 80 independent stores in Oregon could be vending 14.3 million pounds of pork annually (about 5.7 million pounds fresh and 8.6 million pounds processed)—or the equivalent of 104,000 hogs. This is more than four times Oregon's current production.

New Seasons Market has its store-brand ham cured by Hemplers Foods Group, using pork raised by Pure Country Pork (Washington) and Rieben Farms in Banks, Oregon. It was reported in 2007 that Rieben Farm managed 120 farrowings per year, suggesting production of twelve hundred finished hogs.[152] News Seasons also reportedly assisted Rieben Farms with construction of new hoop houses in 2009.

8.5.5. Restaurants

US Census County Business Patterns data indicate there were 3,974 full-service restaurants (not including limited service "fast food") and 123 catering companies in Oregon in 2012.

[152] "Niche outlet for Oregon pork production," Stuart Lam, Pig Progress, 2007.

Restaurant usage of pork is strongly correlated with breakfast and bacon, with 37 percent of "eatings" associated with breakfast sandwiches or burritos, and another 23 percent represented by servings of bacon alone or on hamburgers.

However, in Portland and Oregon's wine country, a number of restaurants are known to buy whole and half hogs, to conduct their own butchery and to prepare their own charcuterie. These include Higgins, Ned Ludd, Country Cat, Ciao Vito, and others.

The top 10 percent may be considered "fine dining" and more likely to be engaged in procurement of local products (though primarily through wholesalers). However, it is clear that interest in local and natural pork is widespread across the industry—including with fast casual restaurant chains like Burgerville, Dick's Kitchen, Little Big Burger, and others. Therefore a 20 percent slice of restaurants may be worth considering.

ERS figures for pork consumption by venue suggest that restaurants nationally serve more than 886 million pounds of fresh pork and 1.7 billion pounds of processed pork annually.[153] Dividing those figures by the 232,000 venues suggests each operator buys an average 3,820 pounds of fresh and 7,300 pounds of processed pork annually.

Using that estimate for 794 Oregon restaurants (top 20 percent) suggests a $15 million market for 3 million pounds of fresh pork and 5.8 million pounds of processed pork—or the equivalent of 64,000 hogs. This estimate is likely conservative.

8.5.6. Farm to Hospital

Health Care Without Harm (HCWH) is an international environmental health organization that supports sustainable food procurement at hospitals and healthcare facilities, including sourcing of antibiotic-free meat. A 2008 report by HCWH indicated that 44 percent of 112 hospitals surveyed were buying some quantity of hormone- and antibiotic-free meat, and that another 47 percent had plans to start sourcing such products.[154]

A follow-on survey by Oregon Physicians for Social Responsibility in 2009 resulted in detailed reports of pork purchases from four Portland area hospitals. Combined, the four institutions represent about 1,325 hospital beds and reported purchasing about 20,000 pounds of fresh pork (primarily loin chops) and 73,680 pounds of processed pork annually (primarily bacon, pork sausages, and ham).
Extrapolating from those 4 institutions to Oregon's 33 private hospitals and 6,008 total hospital beds, this suggests hospitals could represent a market for

[153] "Factors Affecting US Pork Consumption," Christopher G. Davis and Biing-Hwan Lin, USDA, ERS, 2005.

[154] "Menu of Change: Healthy Food in Health Care," Health Care Without Harm, 2008.

91,000 pounds of fresh pork and 334,000 pounds of processed pork—or the equivalent of 3,100 hogs per year.

With an additional 12,403 beds in Oregon's licensed nursing care facilities, there is potential for the health care sector's demand to be even greater.

Conclusions should be tempered with the knowledge that price remains a major consideration for foodservice in healthcare. Most pork purchases reported are from large, conventional suppliers, such as SYSCO, Swift, and Hormel. The added value of local products from smaller farm suppliers may not be enough to justify paying a price premium.

8.5.7. Farm to School

School Food FOCUS is a national collaborative that is working with fifteen large school districts across the US (including Portland Public Schools and the Beaverton School District) to make school meals nationwide healthier, regionally sourced, and sustainably produced, and has made antibiotic-free meats a priority.

In Oregon, approximately 24 percent of school food budgets are spent on local food—the highest percentage in the nation. (USDA, 2014) Schools, with limited budgets and limited ability to prepare fresh foods, offer an interesting procurement challenge. Portland Public Schools (PPS) has enrollment of about 46,000 students, serves 11,000 breakfasts (24 percent participation) and 21,000 lunches daily (46 percent participation).

PPS does list Zenner's Sausage Company as a local/regional supplier, and features Zenner's all-beef hot dogs on menus. Zenner's also offers a full line of fresh and cooked pork sausages. Information was not available on the source of pork used in Zenner's products.

Offering 3-ounce portions of pork sausage or ham for 11,000 breakfasts would require 2,063 pounds of pork. Offering the same serving as part of a 21,000-lunch seating would require 3,938 pounds of pork.

Extrapolating to the 567,000 students enrolled in districts across Oregon suggests 25,500 pounds would be required each time pork sausage or ham was served for breakfast, and 49,000 pounds for each lunch. If sausage from local pork were featured monthly during the school year on both menus, that suggests a need for 3.6 million servings—670,000 pounds or the equivalent of 4,900 hogs.

Extending that scenario to serve sausage monthly to the approximately 190,000 students enrolled in Oregon universities and colleges suggests a need for another 225,000 pounds of pork per year—the equivalent of 1,640 hogs. Universities and colleges would also have more opportunity to utilize fresh pork in dining halls—for example, serving pull-pork or carnitas from less expensive pork shoulder roasts

The combined total for education is 895,000 pounds or about 6,540 hogs.

8.6. Demand Summary

Combining the estimates provided for retail, restaurants, hospitals, and educational institutions suggests there is potential demand in Oregon for about 24.4 million pounds of pork that offers a combination of desired attributes including: local/regional, antibiotic free, hoop house–raised or pasture-raised. This is the equivalent of about 120,000 hogs.

The total represents about 13.6 percent of pork consumed in Oregon—and more than five times the number of hogs produced in Oregon each year.

The breakdown by channel is approximately as follows:

- Retail: 59% ~14.3 million lbs. (40% fresh/60% processed) 104,000 hogs
- Restaurants: 36% ~8.8 million lbs. (34% fresh/66% processed) 64,000 hogs
- Hospitals: 1.5% ~425,000 lbs. (21% fresh/79% processed) 3,100 hogs
- Education: 3.5% ~895,000 lbs. (10% fresh/90% processed) 6,540 hogs

An unknown percentage of this demand is currently being met by Carlton Farms and by other small regional pork producers with access to USDA slaughter and processing. The online AMFIBI business directory estimates that Carlton Farms annual sales are between $12.5 and $15 million. A conservative estimate would be that existing regional pork brands are meeting less than 20 percent of the potential demand in Oregon identified above, and only by drawing large numbers of hogs from out of state.

8.7. Oregon Pork Production

The 2012 USDA Census of Agriculture shows a total of 1,172 farms in Oregon reported sales of hogs and pigs. The number of farms is down 20 percent from 2007 (294 fewer farms).

Oregon farmers sold a combined total of 23,063 hogs/pigs in 2012 with a total estimated value of $3.195 million. This is a 52 percent decline in the number of animals since 2007 (24,800 fewer), and a 44 percent decrease in total value (down $2.467 million).

Smaller-scale hog production tends to yield animals with weights below the conventional target of 240 to 270 pounds live-weight at slaughter. Using an average weight of 240 pounds with a standard yield of 57 percent for edible retail cuts, Oregon farmers produce enough hogs to generate 3.2 million pounds of finished pork.[155] This is sufficient to satisfy less than 2 percent of in-state consumption of pork. (Hog production is of similar scale in Washington, with some 27,000 animals sold in 2012, and appears to be growing rapidly in Idaho, with sales more than doubling from 66,000 animals in 2007 to 145,000 in 2012.)

[155] "How Much Meat?" Oklahoma Dept. of Agriculture, Food, & Forestry, (n.d.).

Of all farms reporting sales of hogs and pigs in 2012, 87 percent sold fewer than 24 head (1,014 farms). Combined, those smallest farms represented 5,465 head (an average just over 5 animals per farm).

The 143 farms in the low-middle, with sales between 25 and 200 head, sold a combined 8,118 animals (an average of 57 per farm).

Twelve farms in the high-middle, with sales between 200 and 500 head, sold a combined 3,203 animals (an averaged 267 per farm).

The 3 largest farms sold a combined 6,277 animals. One farm sold between 500 and 1,000 animals. Two farms sold over 2,000 animals. It is presumed that farms in this top tier either sell to Carlton Farms or have animals processed for sale to the New Seasons Market grocery store chain.

While there are probably opportunities for midsized and smaller farms to capture a larger share of Oregon's demand for both fresh and processed pork, the first step will have to be increasing hog production. The key questions are what it might take to incentivize producers to step up from 5 animals per year, to 50, to 250 and possibly beyond, what production systems are best suited for Oregon, and what capital costs might be involved.

8.8. Small Pork Producer Challenges

Hogs can be raised year-round, with farrowing of piglets timed to allow sequential harvest of finished hogs at about six months of age. However, some structure is required to support farrowing in winter months, which adds to both cost and labor.

A 2004 study of niche pork at Iowa State University notes:

> "One of the challenges for pork niche marketers is maintaining a steady supply of pork. Because most of the markets require that pigs be born outdoors or on bedding, a majority of the pigs are farrowed outdoors during favorable periods, such as late spring through early fall in the Midwest. Indoor farrowing is avoided because of high labor requirements, cold temperatures, lack of facilities, or high piglet disease. This creates a shortage of marketable pigs during the summer for many niche markets. Some niche markets will not accept new producers unless they agree to farrow pigs during the winter. Farmers have tried various approaches to improve alternative winter farrowing systems. Many involve using the outdoor farrowing huts in various indoor structures including pole barns, greenhouses, and hoop barns. Supplemental heat is essential."[156]

[156] "The Pork Niche Market Phenomenon," Mark Honeyman, R. S. Pirog, G. Huber, Animal Industry Report, 2004.

USDA SARE describes potential costs:

> "Originally developed in Canada, 'hoops' usually hold up to 250 hogs on an earthen floor that is heaped with a generous amount of bedding. The structures are topped with 15-feet-high steel arches covered with fabric tarps. Iowa State University researchers found that initial investment was about one-third cheaper for hoop barns than confinement barns. Confinement operations cost a producer $180 per pig space versus just $55 for a space in a hoop structure. Initial hoop barn construction costs vary from $9,000 to $16,200 to hold 200 head—compared to $150,000 to $200,000 for confinement structures that hold 1,000 head."

ERS figures from 2008 show feed representing 41 percent of production costs for a farrow-to-finish operation—and feed costs in the Northwest are another limiting factor for pork production. Other more recent estimates show feed running as high as 65 percent of all costs. One small-scale Washington producer in 2010 described feeding a pig 600 to 800 pounds of feed from wean to finish with feed at a cost of $290 per ton. In 2013, Wood Family Farm noted it was paying $590 per ton for feed.[157]

However, it is possible to grow or source and mill appropriate feeds in the Northwest. Rieben Farm in Banks, Oregon, grows two hundred acres of wheat, alfalfa, oats, and clover, which is milled on-farm for feed. Heritage Farms Northwest in Dallas, Oregon, raises its hogs on grass and clover pasture, and supplements their diet with wheat (purchased from a neighbor) and 10 percent soy meal for added protein.

A 2012 study at the University of Illinois on factors affecting the profitability of niche pork enterprises suggests:

> "Producers should focus on controlling costs, especially feed costs, and improving breeding and farrowing efficiency. Production efficiency is important throughout the farrow-to-finish enterprise. Feed conversion ratios are key in the grow-out phase and litters weaned per sow per year seem to be the more crucial variable to efficient breeding and farrowing. Years of niche experience (which is beyond the control of the producer) adds to the overall management efficiency of the operation. Finally, the one area where niche production differs from conventional production is supply chain partnering and further specialization of products. Overall firm profitability may be enhanced by carefully choosing marketing partners and targeting specialty markets within the niche pork segment."[158]

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[157] "How Much Does it Cost to Raise a Pig: July 2010," Bruce King, Meat, 2010.

[158] "Determinants of Profitability in Niche Swine Production," Dwight Sanders, Ira Altman, Gary Apgar, Journal of the ASFMRA, 2012.

8.9. Oregon Pork Processing

The Niche Meat Processor Assistance Network lists ten USDA slaughter facilities in Oregon that as of October 2012 are accessible to producers.

- Bartels Packing, Eugene
- Carlton Packing Co, Carlton
- Central Oregon Butcher Boys, Prineville
- Dayton Natural Meats, Dayton
- Malco's Buxton Meat, Sandy
- Marks Meats, Canby
- Mohawk Valley Meats, Springfield
- Mt. Angel Meat Company, Mt. Angel
- Oregon Beef Company, Madras
- Stafford's Custom Meats, Elgin

ODA reported in 2009 that Oregon is also home to:

- 50 USDA inspected meat processors (no slaughter—secondary processing only)
- 55 custom mobile slaughter trucks
- 12 custom slaughterhouses
- 86 custom meat processors

There are typically two models for plants: "slaughter-processing" companies that buy live animals and sell meat and "custom slaughter" companies that provide fee-for-service processing. The Agricultural Marketing Service notes:

> "The cost of acquiring hogs typically comprises 70 percent of the cost of the slaughter-processing company. This cost runs higher for niche hogs such as organic. The kill and cut costs for a large, well-capitalized multi-plant operation employing two shifts range from $10 to $12 per hog. Smaller plant costs are in the mid-teens. Most custom slaughter operations charge about $25 per pig broken into sub-primals with some a little higher, depending on the volume. Additionally, most packing plants have some sort of scheme to pay the producer for those edible items that he/she does not take. Normally these prices are at the low end of the commodity range for the items. All custom operations keep the "drop" or byproducts, which are worth $3 to about $8 per head, depending whether the pig is skinned. Another major challenge is that everybody wants to sell the loin, which represents just less than 20 percent of the carcass. There is really no romance in the hocks, spare ribs, back ribs or any shoulder meat that may be sold as fresh meat. Thus, with only about one-third of the pig being sold as fresh meat, the balance is further processed primarily into ham, bacon and sausage."

A 2009 study in Georgia concluded that a small slaughter-processing plant could be operated profitably:

> "The business model under consideration will process natural pork carcasses for sale in the wholesale and retail markets. The animals are slaughtered off-site and then returned to the plant for fabrication. The plant is assumed to operate 5 days a week year round. The expected processing throughput is 11 head per day. Based on these assumptions, the estimated annual head slaughtered would total 2,750. . . . Assumptions set forth in this analysis include a 78 carcass weight and 69 turnout of products available for sale from of a 260 lb. live weight animal. The resulting carcass is 203 , which is sold at an average price of $2.15 per pound. Other sales reflect the resulting products available after cutting at 69 of live weight, or 180 of product. The average price per pound utilized for other sales is $3.02, which represents a weighted average of historical sales by product per carcass. Operating and fixed costs were estimated for this venture based on historical costs and prior feasibility studies . . . the total projected operating costs total $1,170,924 and total fixed costs are estimated to be $56,665 per year. The resulting total annual costs are just under $1.228 million or $446.40 per head processed. Direct animal cost and labor and benefits represent the two largest expenditures of total operating cost at 37% and 22% respectively. Revenue projections were estimated based on current sales. It was assumed that 67% or the total output would be sold to a supermarket chain. The remaining 33% will be marketed to local retailers and through an on-site retail outlet. Average prices and cuts were utilized to project a price per pound . . . carcasses sold to the supermarket chain is assumed to be $2.15. . . . For all other sales, a blended average price of $3.02 is assumed. The projected product sales per carcass for other sales are assumed to be 180 pounds. Given the estimated revenue of $1.296 million and total cost for the facility of $1.227 million, the estimated net income is $68,868 for a return of $25 per head. The resulting return on investment is 20%."[159]

One major benefit of expanding hog production in Oregon would be increased need for year-round processing. That would help keep existing plants going in winter months, when they may be shuttered following the fall rush to harvest and process cattle. That would in turn help attract and retain skilled staff.

8.10. Support Infrastructure for Pork

Beyond processing capacity, it is important to consider other support infrastructure necessary for production and marketing of pork.

8.10.1. Feed

Feed is the major input for pork production, accounting for as much as 65 percent of production costs. A variety of feeds are used, including corn, barley, sorghum, oats, and sometimes wheat. Distillers' grain (spent barley from brewery operations) is also used. There is also a tradition of feeding hogs wastes and expired products from dairies, bakeries, and other food-processing

[159] "Feasibility of Locally Processed and Branded Pork Products in South Georgia," Audrey Luke-Morgan, The University of Georgia, College of Agricultural and Environmental Sciences, 2009.

businesses. Finding a regular, reliable, and cost-effective source of feed will be critical to scaling local pork production.

8.10.2. Rendering

As with beef, better access to rendering for wastes could reduce pork-processing costs and improve profitability.

8.10.3 Cold Storage

Costs to build dedicated cold-storage facilities may have to be considered.

8.10.4. Distribution

Smaller local or regional pork producers are unlikely to see their products carried by large broadline distributors such as Food Services of America or SYSCO. Once some scale is achieved, there may be opportunities to work with associated businesses, such as Fulton Provision Company (owned by SYSCO). There are also some smaller, specialty distributors that may offer more immediate support. These include companies like SP Provisions, and Nicky USA.

8.11. Paths Forward

There appear to be at least three paths forward for further development of local/regional hog production, processing, and marketing.

8.11.1. Farmer-Marketer Model

Pure Country Pork is a farrow-to-finish farm that raises hogs in open-air hoop houses using a deep-bedded straw system over a concrete slab (avoiding high infrastructure costs). The operation is Food Alliance certified for sustainable practices and humane animal care, and does not use antibiotics or feeds derived from animal proteins. Hogs are fed Non-GMO-certified Northwest grains and pulses (triticale, wheat, barley, and peas), with supplemental vegetable protein, flax seed, vitamins, and minerals. Manure is composted with straw and used to fertilize surrounding grain fields. Pictures on the farm website show hogs in the various stages of the operation and contribute to transparency. Pure Country markets pork direct to consumers, at a local farmers' market, and to natural food stores including twelve New Seasons Market stores in Oregon and ten PCC Market stores in Washington—as well as to customers as far away as Japan seeking high quality, natural pork. Pure Country raises small groups of hogs to customer specifications using custom feed regimes. (See Tails & Trotters below.) Owner Paul Klingeman is also a marketer for the White Trail hog pool, helping connect other regional producers and packers. Having lower infrastructure costs, market diversity, and customer loyalty has helped Pure Country weather cycles that have led other Northwest hog producers to close.

8.11.2. Brand Led Value Chain Model

Tails & Trotters is a fresh and processed pork wholesale, retail, and restaurant operation developed by entrepreneurs Aaron Silverman and Mark Cockcroft. (Aaron was also the owner of Greener Pastures Poultry, discussed in the chapter on chicken.) Tails & Trotters (T&T) differentiates its products with

a USDA-verified "hazelnut finished" feed regimen for its hogs. This creates unique flavor and marbling desirable for production of Tails & Trotters prosciutto, other high-end cured meats such as guanciale and pancetta, and specialty products such as pâtés and sausages. The company operates a small retail butcher shop and deli counter, but otherwise owns no infrastructure. Instead Tails & Trotters has worked carefully to develop "value chain" partnerships with a number of regional business partners. Over time these have grown to include: a hazelnut grower and packer, a mid-sized hog farmer (Pure Country Pork), a USDA-licensed slaughter and processing facility (Carlton Farms), a USDA-licensed secondary processing facility and regional meat distributor (Nicky's USA), an Oregon-licensed commercial kitchen, and a national distributor. Production began in 2009. The company won a national Good Food award for its "porkstrami" in 2012. Tails & Trotters now services wholesale accounts including butcher shops and some three dozen restaurants in Oregon and Washington. Using existing infrastructure has helped keep business investment costs low while the company developed products, markets, and sales to support further growth. Plans call for construction of a USDA-certified meat processing and curing facility.

8.11.3. Contracted Supply Pool Model

New Seasons Market operates a dozen natural food stores in the Portland area, and prioritizes local and regional products, which are identified in the store with shelf tags. New Seasons Market operates full service butcher counters and has capacity to receive and break down "primal cuts" of pork, beef, and lamb into retail cuts for the meat case. New Seasons Market contracts with Pure Country Pork and Rieben Farms for hogs, which are slaughtered and processed at Dayton Meats (owned by Chuck Eggert, CEO of Pacific Foods, who was one of the three founders and a lead investor in New Seasons Market). New Seasons Market fabricates fresh sausages in its stores, but contracts curing of hams to Hemplers Foods Group in Washington. New Seasons Market does purchase Carlton Farms products to fill the meat case, but is actively seeking additional local suppliers for meat products for its private label brand, and has even offered small loans to help suppliers expand. The company also has a preference for products that are third-party certified organic, Non-GMO, or under other programs that provide assurance for humane care and sustainability. News Seasons's close and committed relationship with farmers helps ensure supply and supports communication of the "farm story" to customers seeking high-quality, local, "values-added" products.

8.11.4. Analysis

There are no clear prospects for expanding or replicating the farmer-marketer model in Oregon in the immediate future with the rate at which hog farmers have been exiting production over the last five years and the fact that there is no farmer-led pork brand in the state operating at medium scale (as with Painted Hills Beef or Umpqua Valley Lamb). However, the space seems ripe for a farmer-entrepreneur to step forward, who might eventually work collaboratively with other farmer partners to develop markets and fulfill demand.

The brand-led value chain model also seems challenging. Tails & Trotters value proposition is based on a unique feeding regimen involving hazelnuts, which requires a relationship with the farm to achieve. Founder Aaron Silverman has said definitively that he did not see any farm in Oregon capable of delivering the number of hogs needed that would meet his specifications. Tails & Trotters has also—due to necessity—been willing to accept whole carcasses and work creatively to develop markets for fresh and processed products that will utilize all cuts from the animal. Other producers and purveyors of high-end cured meats, such as Olympic Provisions, offer gourmet quality—but meet ingredient needs at lower risk, buying only cuts needed from Carlton Farms.

The contracted supply pool model seems promising with the implicit market pull. The question is why a willing customer like New Seasons Market would have trouble finding suppliers of local pork to meet its goals. Part of the challenge may be perception—that hog farming as conventionally practiced is capital intensive and unpleasant (with confinement, manure lagoons, odors, etc.) reducing quality of life and leading to conflicts with neighbors. Part of the challenge is likely a commodity mindset, which dictates that Northwest hog producers will never be able to compete on cost with Midwest producers (due to scale and feed costs). And part is certainly a lack of knowledge and experience with relatively new hoop house and pasture systems.

Conclusions

Ecotrust's assessment of demand for local/regional pork products suggest a potential market for 120,000 hogs or about 24.4 million lbs. of fresh and processed pork. The total represents about 13.6% of pork consumed in Oregon, and more than five times the number of hogs currently produced in Oregon.

Oregon hog producers are likely meeting less than 1 percent of state demand for pork products and have a fourteen-times market development opportunity—though finished cost of goods will be a factor realizing that potential.

Pure Country Pork in Washington has shown it is possible to raise hogs in hoop houses profitably in the Pacific Northwest. There are also demonstrably willing buyers for additional hogs raised in that system.

The initial challenge may be perceptual. Why don't Oregon farmers see an opportunity to sell hogs or develop their own pork brands? Concerns about capital investment costs, feed costs, and quality of life likely play a role. A survey to assess perceived barriers, outreach to build awareness of potential opportunities, and education on hoop house and pasture production systems could be valuable.

The 120,000 hogs necessary to meet demand referenced above imply construction of some three hundred hoop houses at a minimum cost of $3.9 million ($13,000 per) for concrete slabs, metal bracings, covering materials,

and some interior fixtures. Additional costs may include fencing, feed storage, and milling facilities, loading docks, road building, etc.

Estimates are that 120,000 hogs will also consume 84 million pounds of feed. Since feed reportedly represents 41 percent to 65 percent of production costs, it is a significant challenge for commodity producers competing with large hog operations in the Midwest—but may be less of a factor for farmers pursuing local, regional, and other "values-added" opportunities. A number of Northwest producers are already operating their own small feed mills and utilizing local grain and pulse crops as inputs—and "closing the loop" by offering composted hog manure as fertilizer for crop production.

There are significant potential benefits to increasing hog production and processing in Oregon.

The Leopold Center for Sustainable Agriculture has estimated that for small facilities in Iowa each 1,000 hogs processed support 3.2 jobs and $110,361 in local wages. Applying that finding to the 120,000 hogs this report estimates might be required to meet demand for local pork suggests an industry that supports 384 jobs and $13,243,320 in local wages annually.

Grain and pulse producers would certainly benefit from a growing local market for animal feed. Demand from hog producers would also aid chicken producers, who would benefit from increasing availability and possibly reduced cost for feed.

In addition, a major benefit of expanding hog production in Oregon would be increased need for year-round slaughter and processing. That would help keep existing multispecies processing plants active in winter months, when they may be shuttered following the fall rush to harvest and process cattle. That would in turn help attract and retain skilled staff, spread operating costs to increase profitability and even reduce processing costs to producers, and even justify additional investment in equipment, facilities, and other capacity.

Expansion of hog production could therefore be valuable not only for its own sake, but also to support the development and profitability of both the chicken and beef industries.