

TO: Bill Vetter, Pierce County Council Performance Audit Committee
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FROM: Globalwise Inc.

CC: ARL Project Team

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SUBJECT: A Fresh Look at Pierce County Agriculture
Technical Memorandum #5 – Assessment of Long-Term Trends

Introduction

A multi-disciplinary team led by Barney & Worth, Inc. is taking *A Fresh Look at Pierce County Agriculture*. Members of the team bring extensive agricultural, scientific, legal, and economic expertise to the project.

The Washington State Growth Management Act (GMA) requires counties to designate Agricultural Resource Lands (ARL), which “have long-term significance for the commercial production of food or other agricultural products”. Pierce County places a high priority on protecting commercially viable agricultural lands, and has established these criteria for ARL parcels:

- Located in rural area of county (outside UGA)
- Five acres or greater
- Contain at least 50% “prime farmland” soils
- Grass/legume production yield of 3.5 tons per acre or greater
- 50% of abutting parcels larger than 1 acre
- Landowner may request the designation

The consultant team is analyzing the current condition of Pierce County’s agriculture sector and evaluating the effectiveness of the County’s zoning regulations for protecting agricultural lands. The County’s current ARL criteria will be revisited, with consideration given to alternatives. A series of technical memoranda are being prepared to illuminate different aspects of farmland protections.

This technical memorandum reviews long-term trends that will influence the future of agriculture in Pierce County. Each long-term trend has implications for the county and its farmers and ranchers.

Highlights

The key highlights of this analysis are presented in the table below.

Table 1
Overview of Agricultural Trends in Pierce County

Trend indicator	Direction of Trend	Potential Impact on Pierce County Agriculture
Public opinion on food health and safety	Consumer views are divided over the health and safety of food. Some are calling for a major change in the food system.	Fresh vegetables and fruits grown with organic/sustainable or conventional methods are all available in the county, to meet different consumer preferences. The demand for organic and non-GMO animal and poultry feed, as well as cage-free eggs has grown substantially.
Consumer expenditures for food	Pierce County shows stable food expenditures as a share of personal income.	Local agriculture needs greater increases in personal consumption so that farmers gain greater value from their local food sales.
Trends in locally marketed food	Farmers markets do not appear to be expanding, other market channels may be.	Robust local market expansion is necessary or there will be major financial stress on the small-scale farmers.
Main characteristics of food	Consumer opinion is divided the value of genetically modified food. There is growing attention to the need for calorie control.	This is positive for fresh vegetable and fruit consumption, and for both small and large farm production. May be negative for some meat producers but positive for others such as egg producers.
Transformative technologies	Many new technologies are adopted first by large-scale growers.	Favorable to most large farmers; secondary benefits are gained later by smaller growers.
Land and water connection	Both land and water are becoming scarce, expensive resources.	The effect is clearly negative for all agricultural producers.

The Age of Industrial Agriculture

The American food system traces a long path of industrialization with the strategies of specialization, standardization, and consolidation. The earliest examples are in food processing, most notably with the meat packing industry in the late 1800s.¹ After food processing, the crop and livestock production systems became industrialized with the adoption of mechanized equipment, chemicals, new production practices, and improved plant and animal genetics. Many parts of production agriculture still rely on human labor and some of this is difficult, repetitive, and may require fewer skills than other occupations. There is extensive effort to further mechanize and reduce the amount of field labor which is a huge cost and risk for farmers. This is true for such tasks as timely pruning and harvesting perishable crops.

Agricultural technologies are adapting to the digital and information-based era. The benefits of technology in agriculture are many and varied, and larger-scale producers often have easier access to

¹ See *The Jungle*, by Upton Sinclair.

and more opportunities to implement technological solutions. Given that the majority of Pierce County's farms and ranch operations are small- and medium-scale, they typically have slower adoption rates for technological solutions used elsewhere. For instance, berry producers in Skagit and Whatcom Counties have increasingly converted to the use of high tunnels, but this method isn't widely used in Pierce County. Smaller-scale farmers must be particularly good at adapting technological innovation to fit their needs while remaining profitable. A brief review is provided below on some of the latest technological innovations in agriculture.

Public Opinion and Consumer Demand Drive Which Foods are Produced

Until quite recently, the two main drivers in the U.S. food system have been price (reducing food costs from field to fork) and volume (increasing food supply). While these drivers still guide many American producers and agricultural support industries, the general public has increasingly expressed a concern with the ecological and social impacts of the food system. Advocates for change to the American food system point to deficiencies across the entire food supply system, from the agricultural producer to the direct consumer through supermarkets and restaurants.² Some argue that industrial/conventional agriculture must be modified or replaced with production practices that are more characteristic of some of the smaller-scale family farmers who rely on fewer inputs (e.g., chemicals) and machinery, and more diverse production systems.

Other observers are not convinced of these arguments. They believe that supplying affordable food to the world's growing population requires intensive, specialized, large-scale farms and agricultural supply chains.

The majority of consumers respond to this debate with their pocketbooks. Their consumption preferences and habits determine which farmers will thrive in the future. Currently, large-scale agriculture remains the dominant source of food for most consumers. If this trend continues over the next decade or more, Pierce County farming will likely trend downward, perhaps sharply. Alternatively, if consumers continue to shift to purchasing food from what is often described as the new, sustainable food supply system – especially within a 100 miles radius of Pierce County – the county's agriculture has a bright future.

Future food preferences of consumers are a challenge to predict because there are many independent variables in consumers' decision-making. Still, some major trends have been observed in consumers increasingly demanding healthy foods. For instance, a 2015 Nielsen survey that polled over 30,000 individuals found that 41 percent of Generation Z (under age 20), 26 percent of Generation X (age 35 - 49), and 16 percent of Silent Generation (age 65 plus) respondents were willing to pay more for sustainably produced food.³ The Organic Trade Association reports that 75 percent of Millennials (age 21 – 34) are primary drivers of organic food purchases, and for nearly every year since the 1990s organic food sales have increased by double digits. If the economy is strong and incomes increase at a moderate

² Some notable examples: *Fast Food Nation* (Schlosser 2001), *Omnivore's Dilemma* (Pollan 2006), *The End of Food* (Roberts 2008), and *American's Food* (Blatt 2008).

³ See Neilson, *We Are What We Eat: Healthy Eating Trends Around the World*, page 15.

to strong pace, Millennials and Generation X consumers are more likely to spend more of their disposable income on high quality, local and organic food.

Food safety trends and consumer beliefs regarding the safest methods of food production, packing/processing, and delivery also drive food preferences. The federal Food and Drug Administration's (FDA) Food Safety Modernization Act (FSMA), put into law in 2011, is a major overhaul of U.S. food safety. FSMA is just getting underway, and its efficacy is not yet known. Food safety will continue to attract consumer attention as both real and feared foodborne illness outbreaks are quickly disseminated in social and news media.

Other food issues are frequently in the news and on the minds of consumers. These include: the safety of genetically modified (GM) food, reports on cancer-causing foods, the relative benefits and merits of organic foods, dietary standards, and calorie-reduced diets.

Trends in Expenditures for Food

Technical Memorandum # 1 and 4 found that many Pierce County farmers believe higher prices are needed in order for them to financially succeed over the long-term. The U.S. Department of Agriculture provides the only data available regarding the share of income spent for food. Here, the analysis reviews the share of income spent on food to indicate if there is a positive trend in consumers' preferences for local and smaller-scale production.

Data on overall food expenditures as a percent of disposable income show U.S. consumers' food expenditures have remained relatively static but marginally downward since the early 2000s (see Table 2). One likely explanation for this downward trend is that health care expenditures are rapidly rising.

Personal income in Pierce County has been slowly rising in real (inflation adjusted) dollars. In the year 2000, the Pierce County per capita personal income was \$28,609. After adjusting for inflation using the consumer price index, the real per capita personal income in 2014 was \$31,770. This is an average increase of \$211 in real disposable income per year from 2000 to 2014. With such a minor increase in real disposable income per year per capita, it is unlikely that consumer patterns in food consumption will shift significantly toward more nutritious (and more expensive) food. However, consumption patterns may shift due to other factors such as concern over the quality or healthfulness of food they currently purchase.

Table 2

Percent of Total U.S. Personal Disposable Income Expended for Food

Year	Food at Home*	Food Away from Home**	Total
1990 - 1999	6.1 – 7.4	4.0 – 4.2	10.1 – 11.5
2000 - 2009	5.5 – 5.9	3.8 – 4.2	9.5 – 10.0
2010	5.5	4.0	9.5
2011	5.5	4.0	9.6
2012	5.4	4.1	9.5
2013	5.6	4.2	9.8
2014	5.5	4.3	9.7

* Food at home includes cash purchases from grocery stores and other retail outlets, including purchases with SNAP (Supplemental Nutrition Assistance Program, formerly the Food Stamp Program) and WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) Program vouchers and food produced and consumed on farms (valued at farm prices), but it excludes government-donated foods.

** Food away from home includes meals and snacks purchased by families and individuals and food furnished to employees, but it excludes food paid for by government and business, such as donated foods to schools, meals in prisons and other institutions, and expense-account meals.

Source: Calculated by the Economic Research Service, USDA, from various data sets from the U.S. Census Bureau and the Bureau of Labor Statistics.

Trends in Direct Sales for Local Food

Data on market growth for food grown in Pierce County and sold directly by farmers to consumers is limited. Data from one market channel – farmers markets – has been collected and analyzed by Washington State University.⁴ The data for 2014 and 2015 shows that all food sales, including processed food, sold at farmers markets in Pierce County for those farmers markets that reported, had a decline of 18 percent from \$1,672,857 in 2014 to \$1,365,507 in 2015. This finding needs to be read with these factors in mind: 1) this is only a one year comparison; 2) not all Pierce County farmers markets reported sales; 3) the markets that reported were open for fewer market days in 2015 than in 2014; 4) variation in weather can be a large factor both in terms of vendors at markets as well as customer attendance; and 5) sales at farmers markets are mainly cash sales and data is considered imprecise and likely underreported.

Farmers may be emphasizing sales utilizing other market channels. Pierce County farmers could be participating to a greater extent at Seattle area farmers markets, which are known to be more lucrative than those in Pierce County. Direct sales to retailers and restaurants, or direct sales at farm stands and CSA sales could be expanding and taking sales from local farmers markets. Additionally, farmers could be expanding sales in the wholesale market. Local sales are vital business for many Pierce County farmers, and advocates of the county’s agriculture need to make a better case for the critical importance of local markets for future agricultural prosperity.

Nationally, the USDA has analyzed direct-to-consumer sales.⁵ From 2007 to 2014, sales at farmers markets alone increased roughly 180 percent. Total direct-to-consumer sales, which include roadside stands, farmers markets, pick-your-own, on farm stores, and community supported agriculture (CSA) shares, increased 32 percent from 2002 to 2007 but decreased about one percent from 2007 to 2012.

⁴ Personal communication with Colleen Donovan, WSU Small Farms Program, May 26, 2016.

⁵ See USDA Economic Research Service, *Trends in U.S. Local and Regional Food Systems*, pages 3-5.

The fall-off in sales from 2007 to 2012 might be explained in part by the severe recession during that time period.

What is in Food?

Non-GM & Organic Food

A major debate is at hand regarding GM food. The science is hotly contested over genetically modified organisms (GMOs) and their safety for humans. Prominent scientific organizations such as the Society of Toxicology have found GM foods to be generally safe.⁶ Yet a recent Pew Research Center survey found that over half (57 percent) of U.S. adults believe that GM foods are generally unsafe to eat.⁷ Pierce County agriculture to this point in time has largely produced foods without biotechnology-derived genetic modification. Still, the trend in the local dairy, livestock, and poultry industries is to source more organic or non-GMO feed crops, as consumers are increasingly demanding this. Over 90 percent of the corn, soybeans and cotton produced in the U.S. come from GM seed – but soybeans and cotton are not grown in the county, and only a very minor amount of corn is produced here. Soybeans and corn are the primary constituents in U.S. grain-based feed. Some tomatoes and potatoes are from GM seed sources, but most small farmers are careful to not grow their crops from GM seeds or plant starts. The crops grown by the larger farms – cabbages, leafy greens, cucumbers, rhubarb, strawberries and related crops – are rarely, if ever, GM sourced.

Grain is not a significant crop grown in the county. Purchased grain, especially if it contains corn, which is fed to beef, lamb, hogs and other livestock is likely grown from GMO seed. Few local cattle producers certify their beef as organic and it can be difficult to find non-GMO grain. Grass-fed beef is free of GMOs. Pierce County's large egg farm has been increasing its organic egg production, and has been trying to source alternative feed grains.

Few growers in Pierce County have organic certification. Smaller farmers who rely on direct marketing typically follow many if not all organic protocols but they do not get the organic certification due primarily to the cost associated with certification. Smaller farmers rely on the opportunities they have for personal communication with their customers to explain their procedures for growing safe, healthy food. The larger farms grow crops with conventional (non-organic) methods and market these foods both locally and regionally. Larger farms follow food safety standards required of them by their buyers and will need to be compliant with the federal FSMA.

Calorie Intake

The rise of obesity and the medical warnings that excessive weight contributes to health problems are getting significant attention. Nutritional advice often comes with the recommendation to cut calories by adding foods high in fiber and increasing fruits and vegetable consumption. For persons needing to lose weight, the U.S. government suggests losing about one to two pounds per week by reducing caloric

⁶ See Society of Toxicology Position Paper "The Safety of Genetically Modified Foods Produced through Biotechnology",

⁷ See <http://www.pewinternet.org/2015/01/29/public-and-scientists-views-on-science-and-society/>

intake by 500 to 1,000 calories per day.⁸ A primary way to restrict calories is to increase consumption of fruits and vegetables. Unprocessed or minimally processed food is a common component of many healthy diet plans. These trends bode well for vegetable and fruit growers. Consumers may choose to make these lifestyle changes by shopping at farmers markets, joining a CSA, or seeking restaurants that feature healthy local foods when dining out.

Transformative Technology

Agriculture has a long history of adopting technology to increase yields and control costs. Technology is counted on to improve productivity (the amount of output for the inputs needed). Some of the more significant agricultural technology applications include: improved plant breeding; precision agriculture for applying the right amount of seed, fertilizers, and chemicals for variable field conditions; improved planting and harvesting equipment; low pressure irrigation systems to reduce water application; improved greenhouses/high tunnels using new construction materials; improved vaccines for livestock health and superior livestock genetic selection.

The pace of technology innovation is not slowing. Emerging technologies that have significant promise include:

- Adoption of digital/smart technology including greater automation
- Vertical /indoor farming
- Other scientific advances

Smart Technology and Automation

Computer-based information capture and reporting technologies are expanding across production, processing, and distribution sectors of agriculture. Precision farming, which has been in use in crop farming for over a decade, continues to grow in sophistication. Tractors, planting equipment, fertilizer applicators, harvest equipment, and irrigation systems are commonly integrated with information sharing to achieve this precision. The latest tool is Unmanned Aerial Vehicles (UAVs, also called drones) which collect crop data in real time and allow for nearly continuous field monitoring throughout the growing season. UAVs collect digital imagery in low-level flight which is sent in real time to managers. This data allows for analysis of plant growth, emerging plant diseases or stress, and intrusion by birds, deer, other animals and even unauthorized human activity. This monitoring has great potential to achieve optimal yields and also meet other data needs such as reporting for food safety/security. This technology is proving to be well suited for all types of field grown crops.

Greater automation of processes is becoming increasingly important in agriculture. The incentive is to substitute lower cost technology for higher cost and uncertain labor supply for perishable crops. Automation is becoming more common across many operations including livestock management, crop irrigation control, harvesting, post-harvest sorting and quality assurance in packing and processing.

⁸ See U.S. Department of Health and Human Services, National Institutes of Health. [Maintaining a Healthy Weight On the Go](#), page 5.

University and private sector work on robotics is advancing rapidly and appears ready to soon replace manual field labor in some vegetable and fruit crops.⁹

Use of wireless sensors is another aspect of smart technology in agriculture. Sensors are used in fields to monitor crop and environmental factors which include soil moisture, soil compaction, soil fertility, humidity, and air temperature. This data is used for many important decisions in precision agriculture, such as determining seeding rates, pest spray applications, and for efficient irrigation scheduling. Along with weather forecasting this aids in planning water requirements for days and weeks ahead.

Sensors are also widely used in confinement livestock facilities to check temperature, humidity, wind and solar radiation conditions which are all important to alleviate heat or cold stress on animals. Besides helping to optimize crop and livestock production and minimize inputs such as water and energy, labor required for field operations is also minimized and management time is freed for other tasks.

Use of most of the technology described here is generally most favorable to large-scale farmers due to its high capital and maintenance cost. However, over time the technology can become cost effective for medium-size farms, or smaller farms that find low cost substitutes. UVAs are an example where small scale farmers can use them to capture digital imagery for manual interpretation, and therefore forgo expensive data software that analyzes vast amounts of streaming data.

Indoor/Vertical Farming

Indoor farming includes greenhouses and high tunnels (hoop houses), which are now quite common. However, innovations are making this a more reliable part of crop production. Indoor farming can also utilize former agricultural buildings such as older dairy barns or non-agricultural buildings such as vacant warehouses. Optimal growing conditions may include suitable artificial lighting and the appropriate growing medium. The use of high tunnels and greenhouses is popular among small producers in Pierce County, particularly organic producers, who use them to start plants early and produce heat-loving crops. Pierce County also has a number of ornamental (horticulture) production facilities, and the majority of these operate large, commercial-scale greenhouses.

Currently, the large acreage farmers in the Puyallup Valley are utilizing very little indoor farming with greenhouses. However, it is impossible to predict that this would not become feasible given further technology advances in the next decade, and shifting demand for food with constraints for water, energy, arable land and other agricultural inputs. The U.S. has generally been lagging behind Canada in the adoption of greenhouse production facilities for high value crops, such as tomatoes and cucumbers.

Vertical farming is another aspect of indoor farming which generally refers to indoor farming within a city. Some proponents of vertical farming envision multi-story buildings with intensive crop production on each level. This production method is experimental at present, and if proven to be feasible it may start in vacant buildings that are easily modified to meet plant production requirements.

⁹ See Wall Street Journal article at <http://www.wsj.com/articles/robots-step-into-new-planting-harvesting-roles-1429781404>

A variant of vertical farming is rooftop farming which uses the flat roofs of commercial buildings for cultivation of annual crops. Tapping waste heat and carbon dioxide from a host building can substitute for gas heaters in a rooftop greenhouse operation. Alternatively high value crops can be grown in open air. Rooftop farming is favored by some restaurants that follow sustainable practices. This is a nascent trend but one that is worth monitoring. Cities and Pierce County might consider the suitability of government buildings for rooftop farming, through programs that directly help beginning and newer farmers gain valuable experience while also assessing whether this emerging practice has feasibility under local conditions.

Other Scientific Advances

New crops and varieties have also changed the face of Pierce County agriculture. Washington State University, Oregon State University and a number of local seed companies have been driving the development and promotion of new, high-value fruits and vegetables. For instance, researchers at WSU have been instrumental in promoting the adoption of ice-box watermelons and specialty dry beans, among other crops, and the Organic Seed Alliance has developed new, locally-adapted varieties of vegetable crops. Also, the Cascadia Grains Conference first held in Tacoma, and WSU's small grain breeding program based out of Mount Vernon have demonstrated increased interest in locally-grown cereal grains for craft baking, brewing, feed, and other uses.

The Land and Water Connection

Much is written about the rising global population and the downward trend in total land area suitable for tillage to produce crops. It is not realistic to address the global or even U.S. trend in arable (tillable) land supply and relate this to the need for cropland in just one county.

Previous technical memoranda have pointed out that the shrinking agricultural land base and rising land prices are detrimental to small-scale farmers who wish to establish their business. A further issue is reduced water supply for farming. Irrigation is important for nearly every food crop grown in Pierce County. In past generations, farmers had water rights because they were priority users of either surface water or ground water. In those earlier times there was no need for water storage and canal delivery systems to supply farmers.

Urban expansion is increasing demand for water and leads to the transfer of water rights out of agriculture when land is sold for non-agricultural purposes. In other cases, water rights are sold separately from the land. The Pierce County Agriculture Program recently held a forum where the Washington Department of Ecology stated that it is extremely difficult and expensive for land owners to obtain water rights.¹⁰ Use of municipal water for irrigation is very expensive so it is not a desirable option for farmers. The extent of water rights holdings on agricultural land has not been studied in Pierce County but it appears to be an impediment for further expansion of small-scale agriculture, in some areas of the county.

¹⁰ See <http://farminginthefloodplain.org/report-from-the-farm-forum-water-rights-and-irrigation/>

Summary and Conclusions

There are many forces that impact agriculture. Farmers and ranchers should expect new challenges and opportunities in the years ahead. Consumer demand, marketing channels, technology innovation, and key resource requirements all combine to shape the future. Small-scale farming is gaining importance in Pierce County. Some trend reviewed here (but certainly not all) are favorable to these small-scale farmers.

Perhaps most important will be the extent of future consumer interest in purchasing local, healthy food from small-scale farmers. Coupled with this increased consumer demand for “fresh” and “local” must be greater emphasis by farmers to reach the target market segments. Successful agricultural producers will also need to be innovators in producing high-value crops including the use of hoop houses and greenhouses, adopting new varieties and crops, and perhaps expanding partnerships with other farmers and buyers.

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