

OREGON AGRICULTURE, FOOD AND FIBER:
AN ECONOMIC ANALYSIS

Oregon State University
College of Agricultural Sciences
August 2021

Bruce Sorte, Extension Economist
Department of Applied Economics

Jeffrey Reimer, Professor
Department of Applied Economics

Gordon Jones, Assistant Professor
Southern Oregon Research & Extension Center

Oregon State University

Acknowledgements

For more than 20 years the Oregon Department of Agriculture has partnered with the Oregon State University College of Agricultural Sciences to produce and update this analysis and report. ODA has been a consistent and helpful supporter providing funding, ideas, reviews and when needed publication assistance. Most importantly ODA has always encouraged an objective and careful analysis, never requesting particular outcomes or larger estimates than the analysis indicated. We value this partnership and integrity very much.

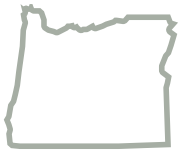


OREGON
DEPARTMENT OF
AGRICULTURE

The authors also thank the Oregon State University College of Agricultural Sciences for commissioning, funding and publishing this study. We appreciate the reviews and suggestions provided by Ms. Sunny Summers, Oregon Department of Agriculture, Dr. Bruce Weber, Oregon State University, and Dr. Paul Lewin, University of Idaho.

OREGON AG, FOOD AND FIBER AT A GLANCE

16 million
Acres dedicated to farming in Oregon



60%
Amount of private land used for farming in Oregon

95%+
Family held farms



25%
Net growth of agricultural exports since 2015



225
Agricultural commodities in Oregon



531,000+
Number of jobs associated with the agriculture, food and fiber industry



$42 billion
Total value of Oregon agriculture, food and fiber industry production



2,000
New farm and ranches established since 2012

Farmgate production
$5.5 billion





$288 million
In agritourism, direct sales and added value from farms



5.7%
Percentage of Oregon jobs on farms



Hemp biomass for extraction potential gross revenue (per acre)
$15-25,000

TABLE OF CONTENTS

Introduction 2

Basic Economic Impact Analysis 3

What businesses are included in the agriculture, food and fiber industry? 3

Oregon Farm and Ranch Overview 3

Table 1. Oregon farm and ranch highlights

Figure 1. Number of Oregon Farms, 1997-2017 4

Farms and Ranches by Type 5

Table 2. Farms and farmland by type

Farm and Ranch Ownership 6

Table 3. Farm and ranch ownership by legal status for tax purposes

Figure 2. Farm and ranch ownership

Organic farming and ranching 7

Table 4. Organic agriculture highlights

Farm agritourism, direct sales and value-added practices 8

Table 5. Farm direct sales to consumers

Table 6. Farm value-added practices 2017

Commodity Sales 9

Table 7. Oregon commodity sales 2012 and 2017 in current year dollars

Table 8. Oregon farmgate cash receipts 2009 & 2019 in 2020 dollars 10

Farm, ranch and fishing sales in 2019 11

Table 9. Oregon farm, ranch and fishing sales 2019

Processing 12

Table 10. Oregon agriculture, food and fiber processing top 20 sectors ranked by sales in 2019

Agriculture, food, fiber including backward and forward linkages 13

Table 11. Oregon agriculture, food and fiber industry in 2021 dollars

Economic dependency of Oregon on the agriculture, food and fiber Industry 14

Table 12. Exports both domestic (U.S. outside Oregon) and international for Oregon agriculture, food and fiber production basic sectors

Table 13. Oregon economic impacts of exports from the agriculture, food and fiber basic sectors in 2021 dollars 15

Economic footprint 16

Table 14. Oregon agriculture, food and fiber Industry economic linkages or footprint in 2021 dollars

TABLE OF CONTENTS

Special Sections 17

Oregon hemp 17

Current Production Systems in Oregon

Economic Estimates 18

Challenges and Opportunities

Oregon marijuana 19

Table 15. Oregon marijuana economic linkages or footprint in 2021 dollars

COVID-19 Pandemic 21

Farmgate Production

Figure 3. Potato Utilization July 2019 to June 2020 for Year over Year (YOY) - MY18/19 & 19/20 22

Processing

Retail trade - food and beverage stores 23

Food services and drinking places

Table 16. Food service industry during COVID-19 third quarter compared to 2019 24

Wildfires 25

Wine

Hemp

Hops

Recreational marijuana

Figure 4. 2020 Wildfire summary as of December 30, 2020

Figure 5. Responses (71 total responses) to OLCC survey Q4: How much of your marijuana inventory has been lost to fires or smoke damage? 26

Cattle and other livestock

Considerations 27

Notes for the Reader

This report provides a profile of the economic contributions of agriculture, food, and fiber in Oregon. Using specific measurements, some may be stand alone estimates while others may separate stand alone metrics such as value-added portion of sales.

Readers need to exercise care when adding one metric to another to avoid double counting. This can happen when a standalone estimate is combined with one of its components like adding the sales estimate to value-added or net product estimate, which is already a part of sales.

It is important to remember when jobs are discussed they include full and part-time jobs. If there are questions about definitions or about which measurements should or should not be combined, please contact one of the authors or another economist familiar with input-output analysis.

Additionally, the data with the same or similar labels in the tables may vary. The report makes every effort to be consistent, yet data sources from different agencies and the privately held economic modeling firm, IMPLAN, can differ due to methods of gathering data, the years represented and the commodities or sectors included in categories.

We welcome sources for more precise and reliable data; please contact the authors if you have suggestions to improve the estimates.

> The agricultural, food and fiber industry in Oregon is critical to the state's economic, social, and environmental health. This is an industry that benefits all Oregonians across both rural and urban locations of our state. What's more, the impact and innovation of Oregon agriculture is recognized globally and makes a difference in the lives of people around the world."
>
> -Dean Alan Sams, OSU College of Agricultural Sciences



> We cannot have a strong Oregon economy without a strong agricultural economy in the state. In addition to putting food on the tables of Oregonians and others around the country and world, the agriculture, food and fiber industry is linked to over half a million jobs statewide. The report focuses before the pandemic started, however does begin to look at the impacts of the pandemic as data was available for 2020. But the report does demonstrate conclusively the importance of agriculture to jobs and income in Oregon, through good economic times but maybe more importantly, through bad economic times as well."
>
> -Director Alexis Taylor, Oregon Department of Agriculture



INTRODUCTION

This report provides a series of estimates of the agricultural, food, and fiber industry's contributions to the larger Oregon economy. Some of the estimates include part of the supply chain (farmgate, agricultural support services and processing) and some include the whole supply chain (adding food retail sales and food services), as described or shown in the tables.

In addition to the basic economic impact analysis of the agricultural, food and fiber industry, which include the traditional crops that OSU and the USDA regularly track, two crops—hemp and recreational marijuana, that have not been legally grown in Oregon for 80 years and are now emerging parts of the agricultural industry—have been included in their own sections. The study also was completed during a time of a disastrous pandemic bringing worldwide health tragedies and severe economic shocks to economies and a time of severe wildfires in Oregon. The basic analysis can be read on its own since the four added sections—hemp, recreational marijuana, COVID-19 and wildfires stand alone and are not required to understand the basic analysis.

The most currently available data for the majority of the analysis was from the 2017 US Agricultural Census, based on a comprehensive survey of producers, and 2019 based on sampling surveys by the USDA. Public data sets were also used, combined with input-output modeling and data created by IMPLAN, a private economic modeling firm. While the COVID-19 pandemic may cause some changes in consumers' and producers' preferences and production, over the long term, major structural changes of Oregon's economy are unlikely to be immediate, which makes 2017 to 2019 an appropriate period for the study. It remains to be studied what workplace changes, methods of production and consumer behavior so significantly altered during 2020, will continue in the long term. Later in the report, specific impacts of the pandemic are discussed.

Key findings of the analysis include:

- Oregon's gross domestic product is 4.7% dependent on the farmgate production, agricultural support services, food processing and fiber processing industries and 6.8% of Oregon's jobs are dependent on those basic agriculture, food and fiber sectors.
- Throughout Oregon's economy 15.4% of sales, 20.3% of jobs and 12.9% of value-added is linked in some way to the agriculture, food and fiber industry with forward linkages of retail food sales and food service establishments included.
- Food processing is one of the two top performing manufacturing industries in Oregon.
- Oregon's principal operators of farms and ranches make up 1.3% of the total population and 2.0% of the workforce in Oregon. However, when principal operators, paid and unpaid on-farm workers are included, those percentage increases are 4.6% and 5.7% respectively.[1]
- Between the 2012 Agricultural Census and the most recent Agricultural Census completed in 2018 for 2017 production and published in 2019, using our estimate, the number of farms has increased by 5.5% and – for the first time – farmgate production exceeded $5 billion.
- Farmers and ranchers have increased efficiencies in their use of inputs (land, water, chemicals, etc.). The most current estimate ranks Oregon as 15th most efficient out of the 50 states while in 1960 it was 46th out of 50

This report profiles and then provides estimates of the economic effects based on sales, jobs, and the value-added portion of sales or net product for the agriculture, food and fiber industry.

Specifically, in this analysis we:

- Describe Oregon's agricultural industry (e.g. number of farms, ranches and crops by acres and sales).
- Estimate agriculture's "economic footprint" or the linkages in all Oregon industries to the agriculture, food and fiber industry.
- Calculate the extent to which Oregon's economy depends on agriculture, food and fiber exports.
- Discuss the implications of these findings for the future of the agriculture, food and fiber industry and the economy of Oregon.
- Provide some general comments on the emerging hemp and marijuana portions of the industry.
- Briefly discuss some effects of the COVID-19 pandemic and 2020 wildfires on the agriculture, food and fiber industry.

In sections of this report, we focus on farmgate sales, agricultural support services, food processing and fiber processing. In other sections we extend the analysis from the farmgate to dinner plate both in the home and in restaurants. Values are based on data that we gathered or estimated using an IMPLAN simulation model. The numbers appear to be precise but are estimates and are subject to limitations common to any analysis based upon a simulation model. Data sources have a range among categories and years so the reader will notice information that includes different labeling and dates, which reflect our efforts to provide the most reasonable estimates.

To improve accuracy, we have been careful not to "double count" economic activity. For example, if we included a farmgate sale as a direct effect along with its re-spending effects under the farmgate production category, we did not include it again as supplier or household spending effects as part of the food processing estimates. Readers can have confidence that the values estimated in this report are not the result of double-counting or over-inflation.

[1] U.S. Census Bureau 2014. Census of Agriculture 2012, Chapter 2. Tables 1 and 7. http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_US/usv1.pdf

BASIC ECONOMIC IMPACT ANALYSIS

What businesses are included in the agriculture, food and fiber industry?

Since the last report we have reconsidered what industrial sectors to include in the aggregated agriculture, food and fiber industry. We must include the farmgate and dockside production sectors (e.g. grain farming, beef cattle ranching and fishing), agricultural support services, food processing (e.g. frozen fruits, juices and vegetables manufacturing and seafood processing), and fiber processing (e.g. fabric mills and leather and hide tanning).

The industries that take agriculture, food and fiber products from the farmgate and/or processors to market or the consumers are not regularly reported as part of economic impact analyses. Economic analyses have typically focused on producer prices and backward linkages to suppliers. While the majority of food and fiber goods sold in retail trade (food and beverages) and used by food services and drinking places are from outside Oregon, significant portions of retail trade (food and beverages) and food services and drinking places sell and use Oregon products.

Oregon State University and the Oregon Department of Agriculture support these sectors both directly and indirectly. The Oregon Department of Agriculture regulates food stores and licenses and inspects nearly every type of food establishment in Oregon except for restaurants (county health departments inspect restaurants). Since the majority of inputs to the retail and food services and drinking places sectors are not produced in Oregon, a subtotal for the products that are all produced in Oregon has been provided in Tables 11 and 12.

Oregon Farm and Ranch Overview

Oregon is home to approximately 37,400 farms and ranches. This number is based on 2017 Agricultural Census estimate of 37,616 and the 2019 USDA estimate of 37,200 weighting the number more towards the 2019 small sample survey. It is notable that both estimates reverse a trend that began after 2002 of declining numbers of farms. A farm is defined as any place from which $1,000 of agricultural products were produced and sold, or normally would have been sold. These farms and ranches grow and raise over 225 different crops on 16 million acres. Oregon's principal producers on farms and ranches make up 1.3% of Oregon's population and more than 2.0% of Oregon's workforce. When paid and unpaid workers and non-principle producers are added to principle producers they are 4.6% of Oregon's population. Producers and hired workers comprise more than 5.7% of Oregon's workforce.[2]

While a farm or ranch is a business entity, much of the work may be contracted out to labor or other types of input suppliers. Over the years the decline of the number of farmers may have been exaggerated. Certainly, production efficiencies have reduced the need for farm labor. Yet, the changes in the operator to hired labor ratio and living arrangements for hired labor has moved "farmer" or farm labor residences off the farm though the work is still done on the farm. Whereas in the past each farm was very vertically integrated (on farm residents did all or most operations from soil preparation to harvest), now many of the steps in production e.g. spraying or baling, may be contracted out to other farmers or off farm contractors. Table 1 provides a snapshot of Oregon farms and ranches. Note the value of farm sales estimates are in current year dollars rather than real dollars indexed to a single year, the Producer Price Index for agricultural commodities does not consistently rise. Many years it falls so current year dollars can provide a reasonable approximation for comparative purposes.

As Table 1 shows, while the number of farms has increased the acreage continues to decline, with the USDA acreage estimate for 2019 at 15.8 million acres. The decline in acres may be considered in terms of the increasingly efficient use of inputs noted above and the increasing per acre productivity.

The number of farms increased during 2012-2017 but a notable pattern emerged. There were gains in the number of very small and very large farms (as measured in acres), but losses in the number of mid-sized farms. For example, farms 1-9 acres in size rose by 3,417 to the point that they now represent one-third of all Oregon farms.

Table 1. Oregon farm and ranch highlights

Category	1997	2002	2007	2012	2017
Number of farms and ranches	39,975	40,033	38,553	35,439	37,616
Total land in agriculture (millions of acres)	17.7	17.2	16.4	16.3	16.0
Total ag land and buildings value (billion dollars)	17.7	20.4	31.0	31.0	38.8
Average value/acre (dollars)	1,005	1,185	1,802	1,882	2,433
Market value of farm sales (billion dollars)	3.9	3.8	4.8	4.9	5.0
Net farm income (billion dollars)	0.67	0.50	0.86	0.96	0.74

Source: United States Department of Agriculture (USDA)-NASS Census of Agriculture and USDA Economic Research Service 2017 Census of Agriculture, Oregon State & County Data, Table 1 p. 7 and Table 5 p. 16.

[2] U.S. Census Bureau. Census of Agriculture 2017, Table 7 p. 279 and 52 p. 49.

Meanwhile, mid-sized farms between 50 and 179 acres, 180 to 499 acres, and 500 to 999 acres fell by 881, 289, and 101, respectively.

The very largest farms (2,000 or more acres) increased by 1.4 percent; such that Oregon gained 21 more very large farms between 2012 and 2017.[3]

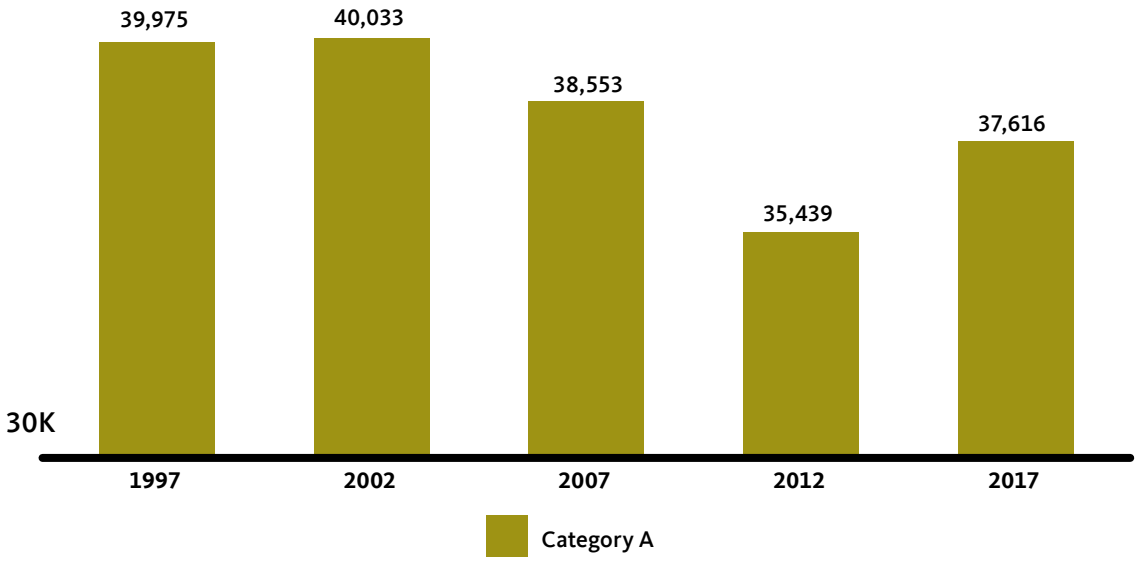
The rise in very small farms likely reflects growth in organic farming, value-added on-farm operations, direct sales, and agritourism. These are relatively labor-intensive activities.

The opposite likely happened with respect to the largest size class of farms. The rise in very large farms likely reflects consolidation as a means to attain economies of scale in production, and ultimately the ability to compete in a marketplace with intense price competition. Expensive technologies such as large GPS-guided machinery and large-scale irrigation systems require massive fixed-capital investments. With sufficient volume, however, the per unit cost of production can be quite low. Therefore, consolidation and high capital investments goes hand-in-hand with the high levels of volume necessary to accommodate low profit margins.

The rise in very small farms, however, suggests that interest in farming is growing across a broad swath of the population. Farmers with smaller acreages may be growing very high value specialty crops, or crops with attributes that consumers value such as local production. Alternatively, very small farms may be sustained by off-farm income earned by one or more family members.



Figure 1. Number of Oregon Farms, 1997-2017



Source: USDA NASS 2017 Census of Agriculture Oregon Highlights

[3] Rahe, Mallory, Number of Small Farms Increases Faster in Oregon 2019. OSU Extension and USDA NASS 2017 Census of Agriculture Oregon Highlights, Table 3, p. 11.

Farms and Ranches by Type

Oregon's variety of soils and climatic regions support a diverse agriculture, food and fiber production. Table 2 describes the number of farms and number of acres in two categories Animal Production and Crop Production. Beef cattle ranching and farming at 12,022 farms, is the most prevalent farming type. The majority of the range fed cattle produced in Oregon are raised east of the Cascades and require a number of private and public acres. Cattle ranching is changing like the rest of agricultural production. Since the 2012 Agricultural Census, Oregon has added 387 cattle ranches and the acreage has declined by 90,115 acres.

Farms with greenhouses, nurseries and floriculture production declined by 12% and acreage by 31% between 2012 and 2017. This may be caused by the lingering effects of the Recession. The declines have now turned around based on the increasing sales from that sector in the 2019 estimates and the significant increase in sales of hemp and marijuana, which was legalized in Oregon on July 1, 2015, when Measure 91 passed in 2014. Hemp and marijuana are covered in separate sections later in the report. Farms producing fruits and nuts have increased by 627 or 17% and acreage increased by 14,876 or 5% between 2012 and 2017, with the new hazelnut plantings of 31,281 acres, more than offsetting declines in a few other fruits and nuts categories.

Further reductions in acreage needed to sustain current or greater levels of output can be anticipated with additional mechanization of operations that were previously done by workers and development of new chemical methods of doing what used to be done by hand or machines e.g. thinning fruit.



Table 2. Farms and farmland by type 2017

Farm type	Number of farms	Number of acres
Animal Production	**20,924**	**10,059,533**
Beef cattle ranching and farming	12,022	8,323,042
Dairy cattle & milk production	269	90,757
Sheep and goat farming	2,569	205,397
Poultry and egg production	736	26,688
Hog and pig farming	434	11,586
Aquaculture	88	6,775
Other animal production	4,806	1,395,288
Crop Production	**16,692**	**5,902,789**
Fruit and nut farming	4,316	295,352
Greenhouse, nursery and floriculture production	2,775	171,566
Grain and oilseed farming	819	2,061,482
Vegetable and melon farming	1,111	342,530
Hay farming	5,415	1,535,081
Horses & other equine production	3,126	1,174,877
Other crop farming	1,680	220,411
Total	**37,616**	**15,962,322**

Source: USDA NASS, 2017 Census of Agriculture, Oregon State and County Data, Table 48 p. 46.

Farm and Ranch Ownership

Agricultural production in Oregon is almost entirely done by family owned businesses. According to NASS in the Census of Agriculture 2017, 90.6 percent of Oregon farms are owned by a family/individual or owned by a family-held corporation. In the Census of Agriculture 2017, NASS does not separate the partnerships farm category between related and unrelated people, yet it is likely that most of the farm partnerships reported in Table 74 are also family-held.

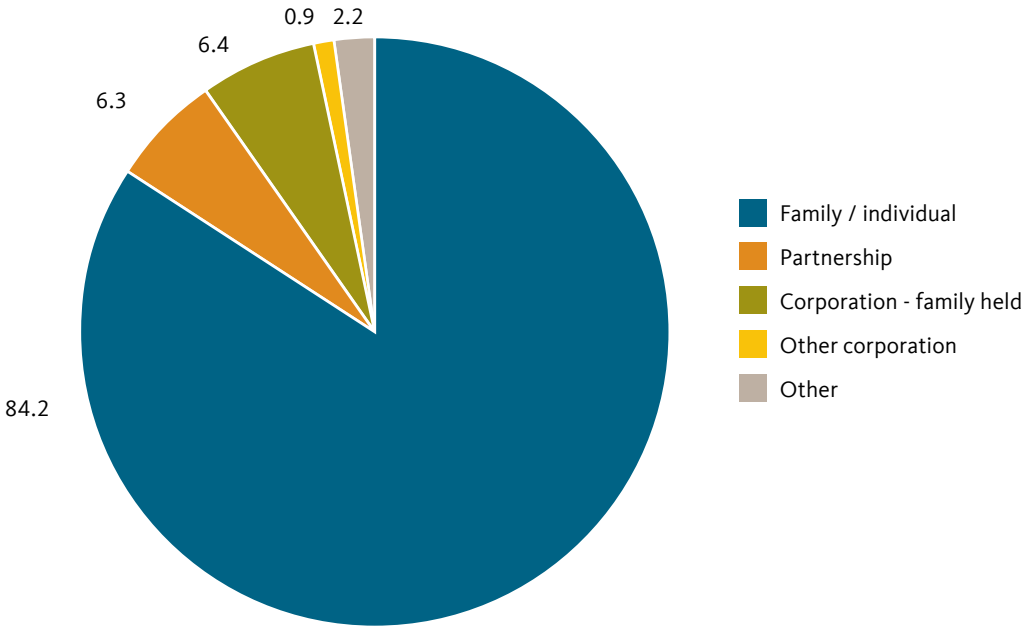


Table 3. Farm and ranch ownership by legal status for tax purposes

Type	Percent (%)	Number
Family/individual	84.2	31,673
Corporation - family held	6.4	2,416
Partnership	6.3	2,362
Other corporation	.9	336
Other	2.2	829
Total	**100.0**	**37,616**

Source: USDA-NASS, 2017 Census of Agriculture, Oregon State and County Data, Table 74 pp. 156-157

Figure 2. Farm and ranch ownership (%)



Organic farming and ranching

The organic industry as a whole grew substantially between 2008 and 2019, while the number of farms decreased and the size of farms increased. Organic farming has grown from a niche market to a segment of the market that includes very small farms to large corporate farms. Retail food chains and restaurants continue to expand their organic offerings and the majority of organic products are now sold through retail food outlets.[4] While the number of certified organic farms has declined by 31% between 2008 and 2019, the number of organic acres almost doubled between 2008 and 2014 and has only slightly decreased from 2014 to 2019. Of the 196,045 organically farmed acres in 2019, 58% were cropland and 42% were pastureland/rangeland. The average value of products sold per acre has increased from $1,161 in 2014 to $2,316 in 2019. Table 4 provides more details by year and across years from 2008 to 2019. The Census of Agriculture, which is completed every five years, provides some information on organic production and a more detailed organic survey is completed as a supplement to each Census of Agriculture in the following year per Table 4's source references.



During 2020, with the effects of the COVID-19 pandemic and as more food was prepared at home, organic sales and volume of production increased 16.8% and 17.5% respectively in the western region (12 states) of the U.S.[5] It is reasonable to expect Oregon's organic sales and production increased consistent with that twelve-state region.[6]

Organic production typically has higher gross and net revenue per acre than conventionally produced commodities. Organic production can be more labor intensive than conventional production thereby providing opportunities for workers, when opportunities in other industries especially in rural areas e.g. the timber industry, have been declining. The other side of the coin is that many organic products' sales can be more sensitive to consumer income level and to a lesser extent prices.[7] Organic vegetables can have a 40% to 70% price premium.[8]

The cost of production for organic farming can also be significantly higher than conventional production. Conventionally farmed products tend to be less sensitive to consumer income and prices. This is partially due to conventionally produced commodities often being intermediate goods that are just one part of the costs for processed food. Since they are only a part of the processor's cost structure and they are the basic ingredient, price changes tend to be accepted and/or passed along to consumers without proportional changes in the amount of conventionally farmed products that are purchased. Also, the availability of lower priced substitutes is an important factor in how sensitive a product is to price changes. There are more lower priced substitutes available to many consumers for organic products than for conventionally farmed products. Still, organic farming can provide some unique opportunities for the agricultural industry and individual producers whether they transition to entirely organic production or use it to diversify their product line.

Table 4. Organic agriculture highlights

Category	2008	2014	2019
Number of certified organic farms operated	657	525	455
Percent of total number of farms	1.7	1.5	1.2
Certified organic acres operated	105,605	204,166	196,045
Percent of total farmland	0.6	1.3	2.8
Value of organic products sold (million dollars)	156	237	454
Percent of total market value of farm sales	3.3	5.5	9.0

Source: USDA-NASS, 2007 Census of Agriculture; USDA-NASS and 2008 Organic Production Survey released in 2010, Table 1 p. 7;
2012 Census of Agriculture and 2014 Organic Survey re-released in 2016, Table 1 p. 7;
2017 Census of Agriculture and 2019 Organic Survey Table 1 p. 7.

[4] Maguire, Kelly B., Organic Market Overview, USDA Economic Research Service, September 10, 2020.

[5] Morning Ag Clip January 22, 2021, Organic Produce Network January 21, 2021, www.organicproducenetwork.com

[6] USDA is currently conducting a survey of organic growers in Oregon and the results may be available in February or March.

[7] Sustainability 2009, 1, 464-478; doi:10.3390/su1030464 sustainability ISSN 2071-1050 www.mdpi.com/journal/sustainability Article US Demand for Organic and Conventional Fresh Fruits: The Roles of Income and Price Biing-Hwan Lin 1 , Steven T. Yen 2 , Chung L. Huang 3 and Travis A. Smith 1, Author to whom correspondence should be addressed: E-Mail: tsmith@ers.usda.gov;

[8] Lucier, Gary and Wilma Davis, Vegetables and Pulses Outlook, VGS-365, US Department of Agriculture, Economic Research Service, December 17, 2020

Farm agritourism, direct sales and value-added practices

Food and services sold from the farm or within the region directly to consumers helps farmers earn a larger share of the food dollar.[9] Farmers' markets, farm to school programs, u-pick, farm share businesses, and on-farm lodging or events are examples of this increasing part of the agricultural industry. The percentage of farms selling directly to consumers has declined from 19% to 15%. However, the value of direct sales has increased by 91% in current dollars and the percentage of direct sales from farms with more than $50,000 of direct sales has increased from 54% to 76% of total direct sales. The remaining 24% of direct sales in 2017 were spread pretty evenly across the farms with direct sales of less than $50,000. The increased total direct sales and the greater percentage of those from the 251 farms selling more than $50,000 shows a trend similar to organic sales as they move more into the mainstream of the agricultural market.

Table 5 shows how these changes have progressed from 2007 to 2017 and also indicates the variable character of this segment of the market. These may be conservative estimates of direct sales from the farmgate for two reasons; 1) only production for human consumption is included so direct farm sales of products like flowers, plants and hay are not in these estimates[10] and 2) since the farms making direct sales are just 15% of the total farms, one or two larger producers deciding to make or stop making direct sales can have a significant, though usually temporary, impact on the total direct sales.

Table 5 focuses on sales directly to consumers. Another type of sales is not primarily made directly to consumers however 1,040 farms in Oregon capture an additional portion of the food dollar by selling directly to retail outlets, institutions and food hubs. They are typically larger farms with average annual sales per farm of $250,653 and total sales in Oregon of $260,679,000.[11]

Farmers who add value to their commodities can also increase their revenue and diversify their product line adding to the resilience of their operations. Table 6 summarizes the value-added practices in Oregon. When the data is available for hemp and marijuana production, the values in Table 6 can be expected to increase significantly.

The full effects of the pandemic on direct sales will not yet be clear without more data. Yet, despite major losses by the restaurant industry, consumers made more direct purchases from farmers and ranchers. This was accomplished through a variety of means, including online sales, community supported agriculture (CSAs), drive-through pick up at on-farm markets, and coordinating curbside drop off or home delivery. Member-owned food cooperatives and other non-traditional grocery stores also played a role. According to one source, some food co-ops experienced sales increases of 150% or more during the pandemic.[12]

Although Oregon's direct sales and value-added markets are not as mature as the same markets in the Northeastern U.S., Oregon is experiencing a similar increase in demand for direct purchases of food and value-added food. The question is whether that same level of demand will remain after the threat of COVID-19 diminishes or if consumers will return to their pre-COVID consumption patterns.

Table 5. Farm direct sales to consumers

	2007	2012	2017
Number of farms with direct sales	6,274	6,680	5,700
Value of direct sales (in thousand $)	56,362	44,177	84,272

Table 6. Farm value-added practices 2017

Value-added Practice	2017
Number of farms using value-added practices	1,481
Value of value-added sales (in thousand $)	203,968

Source: 2017 Census of Agriculture, Table 2 p. 10.

[9] Canning, Patrick, Food Dollar Series, USDA Economic Research Service, March 23, 2020. https://www.ers.usda.gov/data-products/food-dollar-series/

[10] USDA-NASS, Census of Agriculture - 2015 Local Food Marketing Practices Survey. https://www.nass.usda.gov/Publications/AgCensus/2012/Online_Resources/Local_Food/index.php

[11] 2017 Census of Agriculture, Table 2. p. 10.

[12] Schmidt, Claudia et al. NERCRD COVID-19 Issues Brief No. 2020-1, Farms with Direct Consumer Sales in the Northeast Region and COVID-19: Some Early Challenges and Responses, April 1, 2020.

Commodity Sales

Overall, total sales of Oregon agricultural commodities continues to grow. From 2012 to 2017, sales of Oregon commodities grew 2.5% percent as shown in Table 7. Table 7 is included primarily to demonstrate how sales driven by farmers' production decisions based on processor/consumer demand change over time. Using the USDA ERS conversion tool, Oregon farm production aggregated into two categories: animal products and crop products. These are shown adjusted to real dollars (2020) from 2009 to 2019 in Table 8.

As Table 8 indicates, while both animal and crop cash receipts in 2020 dollars grew between 2009 and 2019, animal products grew by 31% and crops grew 6%. Since animals receipts are 29.7% of total sales and crops receipts are 70.3% of total receipts, their growth rates need to be viewed by their starting point or the base from which they are growing and how sensitive the two categories' receipts are to price changes.

While price fluctuations and increases in many commodities have moderated over the last two years, the trend of increasing sales may continue:

- As global population and incomes have increased, demand for agricultural commodities is also expected to increase.
- Growth in agricultural productivity will determine how agricultural input, output, and land markets will adjust to increased demand.
- A continuation of recent productivity growth may allow the agricultural sector to respond to increased demand with little additional use of land and other agricultural inputs, but a slowdown in productivity growth could result in high agricultural commodity prices and additional environmental stress.[13]

Table 7. Oregon commodity sales 2012 and 2017 (in thousand $)

Commodity Group	2012	2017
All crops	**3,247,433**	**3,283,355**
Grains	570,142	343,911
Vegetables and melons	492,143	539,205
Christmas trees and short rotation woody crops	107,803	121,338
Nursery, greenhouse, floriculture, and sod	756,491	886,686
Fruits and nuts	517,166	621,147
Other crops and hay	803,688	780,068
All livestock, poultry, aquaculture & other	**1,706,919**	**1,723,466**
Poultry and eggs	127,481	126,466
Cattle and calves	894,485	977,404
Milk from cows	519,790	507,116
Hogs and pigs	3,195	3,431
Sheep, goats, wool, mohair, and milk	31,597	28,300
Horses, ponies, mules, burros, and donkeys	13,395	14,807
Aquaculture	22,490	42,974
Other animal products	94,486	22,968
Total sales	**4,954,352**	**5,006,821**

Source: USDA NASS 2012 Census of Agriculture and 2017 Census of Agriculture Table 2 pp. 9-10



[13] Sands, Ron 2014. With Adequate Productivity Growth, Global Agriculture Is Resilient to Future Population and Economic Growth, USDA Economic Research Service. https://www.ers.usda.gov/amber-waves/2014/december/with-adequate-productivity-growth-global-agriculture-is-resilient-to-future-population-and-economic-growth/

Table 8. Oregon farmgate cash receipts 2009 & 2019 in 2020 dollars

Oregon	2009		2019	
	$1,000	%	$1,000	%
All commodities	4,584,177	100	5,142,196	100
Crops	3,421,456	74.6	3,617,465	70.3
Animals and products	1,162,720	25.4	1,524,731	29.7

The projection that little additional use of land and other agricultural inputs will be needed to meet growing demand is significant and supported by the decrease in total land in agriculture and the increase in market value of farm sales shown in the tables throughout the report. Agricultural production will need to be increased and intensified to meet rising global demand and there is a high level of concern about the environmental impacts of agricultural intensification. Farming practices such as no-till, time-released fertilizer and precision farming can help reduce those impacts and levels of concern.

Over the last half century, Oregon agriculture has significantly increased the efficiency of how it uses inputs like land, water and chemicals in its production. Between 1960 and 2004, Oregon agriculture lead the nation in growth of efficient use of inputs with an average annual growth rate of total factor productivity (TFP) of 2.58%. From 1960 to 2004 Oregon moved from 46th most efficient in the nation in 1960 to 15th most efficient in 2004.[14]

While we have not found a similar long-term study ranking TFP by state, a 2012 global study of TFP showed Oregon continues to improve its use of inputs by 1-3% per year.[15] Since "It is widely agreed that increased productivity, arising from innovation and changes in technology, is the main contributor to economic growth in U.S. agriculture…,"[16] there appears to continue to be high returns to the research and development investment in the agriculture, food and fiber industry for consumers, producers, and ecosystems.



[14] USDA Economic Research Service. Agricultural Productivity in the U.S. Table 22—States ranked by level and growth of productivity. http://www.ers.usda.gov/data-products/agricultural-productivity-in-the-us.aspx#28268

[15] 15 Fuglie, Keith and Sun Ling Wang 2012. New Evidence Points to Robust But Uneven Productivity Growth in Global Agriculture. USDA Economic Research Service. https://www.ers.usda.gov/amber-waves/2012/september/global-agriculture/

[16] Fuglie, Keith and Nicholas RadaBall, 2013. Growth in Global Agricultural Productivity: An Update. USDA Economic Research Service. https://www.ers.usda.gov/amber-waves/2013/november/growth-in-global-agricultural-productivity-an-update/

Farm, ranch and fishing sales in 2019

Oregon has many agricultural sectors with large sales. The estimates in Table 9 were made by reconciling the USDA data with IMPLAN data. Both sets of data are useful. As mentioned earlier the USDA attempts a full agricultural census every five years and makes estimates from sample surveys between each five-year census. IMPLAN uses USDA and other public and private sources to build a national model that can be disaggregated to the state, congressional district, county and zip code levels. As the model is built and tested, IMPLAN makes sure all the sectors across the U.S. balance. Imports, exports, and locally consumed goods and services cannot exceed the control totals by study area. Table 9 combines both the USDA and IMPLAN data and methods.

Again, the reader will notice differences among the tables in the report. It is not always possible to reconcile the differences as we have done in Table 9 between or among data sources due to different time periods, categorizing schemes, and level of detail for the data sets' methods. There are also sources of on-farm income that contribute to the Oregon economy as noted on page 8 that are not included in Table 9. An example is farmers and ranchers "sell" or contract for services with state and federal agencies to improve ecosystems. An example is conservation services like planting additional trees in riparian areas. However, to be consistent with previous analyses, we have included those types of farm, ranch or fishing income sources that are directly related to food or fiber production. There is only one exception, which was also included in previous reports, for game related income like hunting leases that are shown as "Other" in Table 9.



Table 9. Oregon farm, ranch and fishing sales 2019

Commodity	Sales (in thousand $)
Grain farming	353,611
Seed crops	476,847
Oilseed farming	2,990
Vegetable and melon farming including potatoes	388,610
Fruit farming	659,881
Tree nut farming	89,840
Greenhouse, nursery, and floriculture production	955,166
Christmas trees	104,451
Sugar beet farming	16,836
All other crop farming - primarily hay	700,000
Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming	625,158
Dairy cattle and milk production	552,096
Poultry and egg production	150,349
Animal production, except cattle and poultry and eggs	111,424
Commercial fishing including ocean and Columbia River and Aquaculture	203,299
Other	3,594
Total	**5,394,152**

Sources: Oregon Department of Agriculture, Oregon Agricultural Statics, September 2020 and IMPLAN 2019 Data.

Processing

Oregon has many processing sectors with large sales. Oregon's food and fiber processing businesses use farm, ranch and fishing inputs to produce a wide variety of food and fiber products both produced in Oregon and from other states and countries. While some of the processing sectors are quite moderate in terms of sales and may or may not use Oregon inputs, in the future they may expand their use of Oregon inputs and are important to understand the scope of the industry.

Table 10 lists the top 20 processing sectors by sales. These sectors account for more than $15 billion or 83% of the total of more than $18 billion of sales from 68 sectors that are included in this analysis.



Table 10. Oregon agriculture, food and fiber processing top 20 sectors ranked by sales 2019

Rank	Sector	Sales ($)
1	Frozen fruits, juices and vegetables manufacturing	$2,388,015,170.84
2	Wineries	$1,189,770,190.23
3	Breweries	$1,087,990,995.57
4	Bread and bakery product, except frozen, manufacturing	$926,099,992.91
5	Cheese manufacturing	$913,897,951.19
6	All other food manufacturing	$891,196,388.72
7	Frozen specialties manufacturing	$888,752,039.08
8	Meat processed from carcasses	$799,702,175.88
9	Canned specialties	$790,349,293.39
10	Coffee and tea manufacturing	$756,008,606.24
11	Canned fruits and vegetables manufacturing	$555,899,841.99
12	Fluid milk manufacturing	$549,715,688.80
13	Seafood product preparation and packaging	$544,180,667.85
14	Dehydrated food products manufacturing	$538,466,017.09
15	Flour milling	$496,968,210.52
16	Other snack food manufacturing	$452,432,991.38
17	Other animal food manufacturing	$385,597,723.68
18	Cookie and cracker manufacturing	$300,234,286.15
19	Breakfast cereal manufacturing	$299,829,011.56
20	Bottled and canned soft drinks & water	$289,595,473.04

Source: IMPLAN 2019 Data

Agriculture, food, fiber including backward and forward linkages

A major theme of this report is that one type of activity leads to a cascade of activities both backward to suppliers and forward to other economic sectors. Backward linkages are well understood as the agricultural, food and fiber industry purchases inputs like fertilizer or custom haying to create the goods and services they sell. Forward linkages are sometimes less obvious. For example, Oregon has a comparative advantage in the production of certain types of wine grapes. Large-scale production of these grapes has enabled a series of activities in other sectors, including agricultural support services, winemaking, wine marketing and distribution, winery tourism, and wine consumption within the hospitality industry. An activity in one sector has enabled a great deal of activities in subsequent sectors.

To apply data to this theme, we break the Oregon agricultural and food sector into six different sectors. These are farmgate production, agricultural support services, food processing, fiber processing, food and beverage sales at stores, and food and beverage sales in service establishments (such as restaurants and bars).

Table 11 summarizes the direct economic effects of these six industries. The data used to create Table 11 is from the most current IMPLAN model, which is based on a combination of public and private databases from 2019. The results of the analysis were adjusted to make the estimates in 2021 dollars using IMPLAN's sector specific inflation or deflation indexes.

Output-Sales are the gross revenue received by the producer for output sold times the producer price for goods or services. The sales calculations can include double counting. If fertilizer is used to produce a farmgate product, its costs are included in farmgate sales.



Then, if the farmgate products are processed the fertilizer costs are once again included in the sales of the processed food since the farmgate product with the fertilizer cost is a part of the costs for the processed food. This makes value-added a much better metric for estimating net economic value of a sector or industry. Value-added is how much the producer adds to the value of the product beyond inputs that are purchased from suppliers. Its components are employee compensation, proprietor income, taxes on production, and other property income e.g. depreciation, corporate profits, net transfer payments, dividends, etc. Value-added as estimated by IMPLAN is the same as Gross Domestic Product (GDP). Jobs throughout this report include both full and part-time jobs.

Table 11. Oregon agriculture, food and fiber industry in 2021 dollars

Aggregated Industry	Output-Sales ($)	Oregon %	Full & part-time jobs	Oregon %	Value-added or Net Product ($)	Oregon %
Farmgate production	5,505,123,712	1.2	74,564	2.9	2,829,883,118	1.1
Agriculture support services	831,633,818	0.2	17,156	0.6	681,938,861	0.2
Food processing	18,091,704,137	3.9	44,939	1.7	3,609,254,661	1.4
Fiber processing	579,379,322	0.1	4,194	0.2	199,159,659	0.1
Subtotal	25,007,840,449	5.4	140,853	5.4	7,320,236,299	2.8
Retail trade - food and beverage stores	2,866,358,727	0.6	38,931	1.5	1,727,135,936	0.7
Food services & drinking places	14,323,376,176	3.1	191,516	7.3	8,187,063,080	3.2
Total agriculture, food and fiber	**42,197,575,352**	**9.1**	**371,300**	**14.2**	**17,234,435,315**	**6.7**
Total all Oregon sectors	**462,551,186,133**	**100**	**2,615,030**	**100**	**258,706,924,739**	**100**

Note: Retail trade is the margin or difference between the selling price from the food store and the cost the store paid for the food. To keep the table from becoming too complicated the percentages were not extended beyond one decimal place. Any rounding adjustments were made in Agricultural support services and/or Food services & drinking places, by no more than .1% plus or minus. Also, a 3% upward adjustment to IMPLAN estimates for Farmgate Production was made to reconcile IMPLAN and USDA 2019 estimates.

Economic dependency of Oregon on the agriculture, food and fiber industry

Determining what "drives" the Oregon economy, or the extent to which each major industrial sector is critical to that economy, can be estimated in different ways. One approach, called export base theory, suggests that economies are primarily dependent on the goods and services they export to bring in outside money that supports growth and economic vitality. The IMPLAN model we used for this report is an input/output model that relies on export base theory. We used it to calculate how a change in demand from outside Oregon both in the U.S. and internationally can cause economic changes in the state.

Table 12 provides estimates of the extent to which Oregon products are exported outside state borders. These estimates do not distinguish whether an export might have gone to another U.S. state or to another country. Exports in 2019 expressed in 2021 dollars are compared to those which occurred in 2015, the year of the last report. Between 2015 and 2021 the value of farmgate production exports fell from 3.3 billion to 3.1 billion (a 6.4% decline). This analysis cannot determine the precise reason for this fall. However, one reason may be the U.S.- China trade war that began in 2018. Products that were likely impacted include Oregon wheat, hazelnuts, sweet cherries, and beef.

Table 12 shows that exports from other sectors tended to rise from 2015 to 2021, including food and beverages (a 15.7% rise), fiber manufacturing (a 150% rise), and agricultural support services (a 64.9% rise). Altogether, agriculture, food, beverage, and fiber exports rose by 13.7% (Table 13).

Table 12 also reports the role of agriculture in Oregon's overall exports. Between 2015 and 2021 total exports of all Oregon exports fell by 8.8%, from $139.5 billion in 2015 to $127.3 billion in 2021. However, the share that agriculture, food, beverage, and fiber exports had of this total rose from 10.9% to 13.6%. Oregon's food and beverage sector played an outsize role in this rise.



We estimated the economic impacts of the agriculture, food and fiber exports throughout Oregon and summarized those impacts in Table 13. In Tables 12 and 13, we included just the exports and just the basic components of the agriculture, food and fiber industry and did not include the directly related forward linkages.

Structural economic adjustments or long-term impacts are likely if agricultural, food and fiber exports change. While exports are critical to an economy it is important to remember that the closer to a finished good that Oregon can bring a product the greater the economic effect. If a commodity can be used by an Oregon food processor to produce food that

Table 12. Exports both domestic (U.S. outside Oregon) and international for Oregon agriculture, food and fiber production basic sectors

Industry	Output - Sales ($) 2021	Output - Sales ($) 2015
Farmgate production	3,109,828,192	3,322,418,438
Agriculture support services	432,834,508	262,526,873
Food processing	13,231,897,818	11,438,482,582
Fiber processing	561,436,677	224,571,877
Total agriculture, food and fiber exports	**17,335,997,195**	**15,247,999,770**
Total all Oregon exports	**127,251,871,249**	**139,501,045,083**
Agriculture, food and fiber exports as a % of Oregon exports	**13.6**	**10.9**

can be exported or is purchased in lieu of an imported food (import substitution) the economic effect will be much greater than exporting the commodity right from the field or range.

Table 13 presents various measures of the economic impacts associated with the agriculture, food, beverage, and fiber sectors. These include the gross sales of a sector, the number of people employed in a sector, and value-added. Value-added is a useful measure because it avoids double counting and identifies the level of income uniquely produced by a sector.

Food and beverage exports had by far the largest economic impact. They resulted in $23.4 billion worth of sales, 91,191 full- and part-time jobs, and a value-added of $7.9 billion (Table 14).

Agricultural farmgate production was in second place, with $5.8 billion dollars of sales, 68,248 full- and part-time jobs, and value-added of $3.2 billion. Fiber manufacturing and agricultural support services had much smaller impacts; together their exports contributed about $1.74 billion worth of sales, 17,332 jobs, and value-added of $965 million.

Overall, exports of agriculture, food, beverage, and fiber were important contributors to the Oregon economy. The last row of Table 14 shows that they contributed 6.7%, 6.8%, and 4.7% to Oregon's sales, employment, and value-added, respectively.



Table 13. Oregon economic impacts of exports from the agriculture, food and fiber basic sectors in 2021 dollars

Industry	Output-Sales ($)	Employment - Full & part-time jobs (#)	Net Income or Product ($)
Farmgate production	5,786,758,545	68,248	3,237,276,126
Agriculture support services	811,231,873	11,198	570,463,584
Food processing	23,407,484,429	91,191	7,863,634,127
Fiber processing	924,199,286	6,134	395,062,688
Total agriculture, food and fiber exports	**30,929,674,133**	**176,771**	**12,066,436,525**
Total all Oregon exports	**462,551,186,133**	**2,615,030**	**258,706,924,739**
Agriculture, food and fiber exports as a % of Oregon exports	**6.7**	**6.8**	**4.7**

Economic footprint

The output, jobs and value-added profiled in Table 11 are associated with a number of other expenditures and jobs in the Oregon economy beyond the portion of production that is exported. That portion of production that is used within Oregon can substitute for imports of goods and services from other states or countries and retain those dollars within Oregon. The total sales, jobs and value-added from direct expenditures on all agricultural, food and fiber goods and services plus the indirect expenditures to suppliers of the agricultural, food and fiber industry plus the induced expenditures, including purchases for food, medical services, retail goods, and other spending made by proprietors and employees of the agricultural, food and fiber industry comprise the economic footprint of the industry. We have combined these three types of effects – direct, indirect and induced in Table 14 for simplicity of presentation and shown them again as sales, jobs and value-added. Thus, we see in Table 14 that more than $9.186 billion in sales across the Oregon economy is associated with the sales of more than $5.505 billion from farmgate production reported in Table 11. These expenditures "rippling" through the economy is often called the ripple effect or economic footprint of a particular industry. While changes to the economic footprint may not cause the type of structural economic adjustments that changes to exports may cause, economic footprint changes can seriously disrupt the Oregon economy.



Table 14. Oregon agriculture, food and fiber Industry economic linkages or footprint in 2021 dollars

Aggregated Industry	Output-Sales ($)	Oregon %	Full & part-time jobs	Oregon %	Value-added or Net Product ($)	Oregon %
Farmgate production	9,186,121,277	2.0	94,719	3.6	4,768,344,241	1.8
Agriculture support services	1,548,028,509	0.4	21,365	0.8	1,087,036,576	0.4
Food processing	28,369,755,722	6.1	101,029	3.9	9,344,188,964	3.6
Fiber processing	959,853,298	0.2	6,384	0.2	409,368,288	0.2
Subtotal	40,063,758,806	8.7	223,497	8.5	15,608,938,069	6.0
Retail trade - food and beverage stores	5,658,848,716	1.2	55,752	2.1	3,266,958,373	1.3
Food services & drinking places	25,471,388,781	5.5	252,173	9.7	14,477,622,425	5.6
Total agriculture, food and fiber	**71,193,996,303**	**15.4**	**531,422**	**20.3**	**33,353,518,867**	**12.9**
Total all Oregon sectors	**462,551,186,133**	**100**	**2,615,030**	**100**	**258,706,924,739**	**100**

Note: Retail trade is the margin or difference between the selling price from the food store and the cost the store paid for the food. To keep the table from becoming too complicated the percentages were not extended beyond one decimal place. Any rounding adjustments were made in Agricultural support services and/or Food services & drinking places, by no more than .1% plus or minus. Also, a 3% upward adjustment to IMPLAN estimates for Farmgate Production was made to reconcile IMPLAN and USDA 2019 estimates.

SPECIAL SECTIONS

Oregon hemp

Hemp is unique among Oregon crops because of its recent federal legalization in 2018, the great interest from producers and the general public, and nascent status of research into its uses and production techniques. However, with state and federal regulations still in flux, producers face challenges with dynamic markets and profitability. The uncertainty around regulations and prices, a dearth of applied production research, and an influx of producers inexperienced with field-scale agriculture are significant challenges for the industry. As early growing pains are resolved e.g. creation of the Oregon State University Global Hemp Innovation Center, hemp will likely be an even more valuable part of Oregon's agricultural landscape. The intent of this section is to provide a general overview of current production practices, a summary of some economic aspects, and a review of challenges and opportunities facing the hemp industry in Oregon. Many of the estimates in this section are based on field experience and discussions with growers. Again, the authors would appreciate reference to sources of more precise data.

There are many potential harvestable products from the hemp plant. Currently, however, nearly all Oregon hemp is grown for essential oils (primarily cannabinoids e.g. cannabidiol [CBD] or cannabigerol [CBG]) contained within the flowers. The flowers are either sold directly for consumption by inhalation (smokable flower) or are processed (biomass) to extract desired compounds which are then used in a range of retail products (i.e. edible candies or tinctures, ointments, cartridges for vaporization, etc.)

Current Production Systems in Oregon

Many of the production practices used in Oregon echo the intensive production system used to grow marijuana, yielding a high-cost, labor-intensive crop. While this system may be appropriate for smokable-flower markets, the associated costs are too high given recent biomass prices for revenue to exceed costs.

What follows is a brief overview of common production systems in Oregon. Bear in mind that hemp is a very "new" industry with only two crops harvested since the federal legalization of hemp production in late 2018. Because of this, there is no strong agreement on what constitutes best production management practices, and a diversity of production systems have been employed in Oregon thus far.



A producer will source feminized hemp seed, which in many cases has been bred and grown in Oregon, Colorado, or elsewhere. The feminization of seeds is viewed as critical because hemp is a dioecious crop (having both male and female individuals plant parts), and producers aim to grow fields of unpollinated female flowers intending to maximize cannabinoid content, and in some cases smoking quality. Seeds are then propagated in greenhouses prior to transplanting outdoors by hand or tractor in June or July. Plant spacing varies, but 4' by 6' is common. Plastic mulch is often used for weed control as no herbicides are specifically labeled for use in Oregon, and drip irrigation is the most common method to supply water when supplemental irrigation is required. Fertigation is also common.

Most hemp currently grown is photoperiod sensitive and will begin to flower triggered by diminishing day length following the summer solstice. Some hemp varieties, called "autoflower", have been bred to be day-neutral and can produce a crop over a shorter season (~75 days) as compared with the more common full-season types. As flowering is initiated, growers will scout their fields and rogue out any male plants which escaped the seed feminization process and to identify and remove any hermaphroditic plants to prevent pollination and seed production in the final crop.

Insect pests, like corn earworm, can cause significant economic damage to hemp crops. Producers are limited in their pest control options because no pesticides are currently labeled for hemp in Oregon. Therefore, growers must rely on a "Guide List" provided by the Oregon Department of Agriculture, which identifies pesticides that are not specifically prohibited from use on hemp. Fungal pathogens cause mold and mildew problems for the crop, but these are primarily an issue in situations where the flowers are exposed to moisture such as overhead irrigation or fall rains before harvest.

Indicators for proper harvest timing are not well-developed. Growers balancing crop yield and quality risk exceeding the legal total THC content limit of 0.3% as cannabinoids accumulate with maturity. Growers aiming for smokable flower markets tend to be less concerned with target CBD/CBG concentration and rather focus on the appearance and aroma of the flowers, while growers of biomass for extract often attempt to maximize the concentration of CBD/CBG while avoiding the legal THC threshold. Oregon regulations require that fields be sampled and tested for potency no more than 28 days prior to harvest to ensure compliance with the THC limit. Flower destined for the smokable-flower market is harvested by hand, and growers are experimenting with mechanical harvest for biomass hemp crops.

Following harvest, the crop must be dried to prevent degradation. Drying strategies range from hanging plants in a shed or barn to industrial-scale belt driers and repurposed hop drying facilities. In the case of smokable flower, further processing is required to trim away leaves before drying. Once dry, hemp flower or biomass can be held without apparent degradation prior to sale or further processing. Biomass requires an extraction step. This is done in specialized facilities using an extractant like ethanol or supercritical carbon dioxide. Extracted hemp oil may be purified to various degrees to remove impurities and isolate desired compounds. Approximately five percent of growers are currently processing the hemp beyond the drying and trimming stage. More vertical integration of the processing steps like doing the CBD extraction on farm may help farmers increase their net revenues in the future.

Economic Estimates

Oregon Department of Agriculture reports that 64,000 acres of hemp were registered in Oregon for the 2019 season. An estimated 52-70% of those registered acres were planted (G. Jones, unpublished). Of the planted acreage in 2019, one estimate made by the political advocacy organization Vote Hemp indicated that 50-60% of planted hemp acreage would be harvested nationwide. Reported crop failure caused by mildew and elevated THC concentrations and labor and drying constraints compounded by a lack of buyers at harvest time further reduced the percentage of harvested hemp that could be sold. Using the above values, between 16,500 and 27,000 acres of hemp may have actually been harvested during the 2019 season.

The value of the crop depends on the market into which it is sold. Here we will detail two markets: commodity biomass for extraction and the direct-marketed smokable flower. These two markets are the best or most optimistic scenarios. Yet they are illustrative of the potential for hemp when the producer invests in capturing more of the value of the finished product and is able to sell the product, which can be highly uncertain.

For both, we will assume a yield of 1,800 pounds per acre at 10% CBD. Estimated commodity biomass prices in November 2019 were $0.85 to $1.40 per percentage point of CBD per dry pound which would result in gross revenue of $15,300 to $25,200 per acre.

If producers are willing to spend considerable effort in trimming the flower and marketing that smokable flower, significantly greater revenue can be expected. Approximately 50% of the flower yield is lost to trimming, and prices for high-quality smokable flower have ranged from $200 to $300 per pound. Thus 1,800 pounds of harvested yield per acre becomes 900 pounds of trimmed flower, and gross revenue could range from $180,000 to $270,000 per acre. Although no precise estimates are available, many growers entered the 2019 season with the intention of selling into the biomass market. However, by harvest prices for biomass hemp had fallen such that some growers worked to sell their crop as smokable flower. In seasons since 2019, many growers have targeted the smokable flower rather than biomass market.

Challenges & Opportunities

Uncertainty in the regulatory environment surrounding hemp production and the use of its flower and essential oil extracts is a significant challenge for this nascent industry. This instability in regulations has prevented many risk-averse companies from fully engaging in hemp markets. Once federal regulations are finalized and implemented, the true scale of both supply and demand for hemp products will become clearer.

Hemp production is at a disadvantage compared with other crops as hemp was not afforded the research focus applied to other species during the eight decades since its prohibition. At nearly every step

of the production process, questions linger about best practices, and the research needed to provide agronomically-reasonable and economically-viable solutions has not been conducted. Particularly critical is genetic research. Meeting the 0.3% maximum requirement for THC is very important and difficult to project based on timing of planting to harvest. Varieties that could reliably meet the 0.3% requirement could provide a great deal of stability for growers. This need for research does provide a valuable opportunity for research institutions, like OSU, to engage with the industry and guide production and marketing practices toward a sustainable trajectory. However, the scope and cost of the systems-type research required is extensive and high. The private sector funding for the research will require a great deal of additional support from government agencies, foundations and non-profit organizations.

The significant opportunity for hemp includes quite a breadth of potential uses for the crop and its products. The potential medicinal or therapeutic uses of cannabinoids and other hemp flower extracts have not been fully explored, with CBD and CBG appearing to be only the beginning. Pharmacological research documenting the uses of cannabinoids will be an area of great opportunity to possibly expand and strengthen markets for Oregon hemp. Other plant parts such as seed and fiber are known to be valuable as human and livestock feed, for textiles, construction materials, and myriad other uses. As processing capacity and demand expands, these will likely become important markets for hemp in our region, as well.

Oregon marijuana

In 2015 recreational marijuana became legal in Oregon following the legalization of medical marijuana in 1998 and decriminalization of marijuana possession back in 1973.[17] With an annual farmgate value of $200-$300M and retail sales of $1.1B in 2020,[18] marijuana has quickly become a major crop in Oregon.

The marijuana market remains in the early stages of development. Producers are attracted to the crop due to high potential profit per acre and the fact that it's an annual crop. When grown indoors or in greenhouses the timing of the growth stages can be managed much better than when it is grown outside, allowing the producers to distribute their harvests throughout the year. This means that producers can move in and out of the market given that they satisfy the OLCC stringent licensing requirements.

Recent years have seen imbalances in supply and demand. In 2019, Oregon's demand for marijuana was only 50% of its production but this ratio improved to 65% by 2020.[19] As consumer interest continues to stabilize this balance may improve over time. One factor that would upend the market is if the federal government were to legalize marijuana. This might provide an outlet for Oregon's current excess supply, but production might also migrate to other states, upsetting the market structure.

At present, Oregon has 2,504 active marijuana licenses including for laboratories (20), processors (289), producers (1,239), retailers (750), wholesalers (205) and researchers (1), with another 851 in process.[20]

Data on sales at different stages of the supply chain are incomplete. Since marijuana has not been legalized nationally, agencies such as the USDA National Agricultural Statistics Service do not report on marijuana production and sales. While the Oregon Liquor Control Commission (OLCC) collects significant data, it is focused on harvest amount and retail sales. It is more regulatory than descriptive and tends to emphasize the balance of supply and demand, changes in prices, and harvest timing and levels. These reflect concern about excess supply reaching the illicit market.

Below we combine the available data with IMPLAN model structure to estimate the economic impact of recreational marijuana. This analysis relies on OLCC data on retail sales and cannabis transfer weights. Note that the OLCC data primarily summarize recreational marijuana production and sales. Medical marijuana producers who supply three or more patients also must report their sales to the OLCC. Suppliers drop in and out of the OLCC's Cannabis Tracking System sometimes monthly, which means that production and sales data are not always consistently reported. Those reporting difficulties should not significantly diminish the usefulness of this report, however.

Table 15. Oregon marijuana economic linkages or footprint in 2021 dollars

Aggregated Industry	Output-Sales ($)	Employment - Full & part-time jobs (#)	Net Income or Product ($)
Farmgate production	382,222,090	3,243	217,810,716
Wholesale trade	264,395,635	1,507	140,862,072
Processing	374,200,981	812	126,111,113
Retail trade	383,824,442	4,176	225,434,489
Total	**1,404,643,148**	**9,738**	**710,218,390**

[17] Oregon Liquor Control Commission, 2019 Recreational Marijuana Supply and Demand Legislative Report.

[18] Ibid. p. 2. And Perry, Douglas, Oregon marijuana sales soared to new heights in 2020, topping $1 billion overall; Multnomah County led the way, The Oregonian/OregonLive, January 7, 2021. https://www.oregonlive.com/marijuana/2021/01/oregon-marijuana-sales-soared-to-new-heights-in-2020-topping-1-billion-overall-multnomah-county-led-the-way.html

[19] 2021 Recreational Marijuana Supply and Demand Report, Oregon Liquor Control Commission, February 1, 2021, p. 3. https://www.oregon.gov/olcc/Docs/Legislative_docs/2021-Supply-and-Demand-Report.pdf

[20] OREGON LIQUOR CONTROL COMMISSION Marijuana License Applications, June 21, 2021, https://www.oregon.gov/olcc/marijuana/Pages/Recreational-Marijuana-Licensing.aspx

IMPLAN does not include marijuana supply chain information so the linkages between retail sales and farmgate sales were estimated using information from related studies done for Colorado and Michigan. Portions of total sales were allocated along the supply chain using existing IMPLAN sectors (e.g. greenhouse, nursery, and floriculture production) and adjusting production functions (e.g. increasing the use of electricity). Care was taken to avoid double counting. This multi-sector approach provides visibility to the key parts of the supply chain.

Two approaches were taken to estimate industry employment. The first relied on direct counting of jobs by the Oregon Employment Department, specifically the calculation of covered employment in recreational marijuana.[21] This calculation may not include some portions of agricultural employment so may under-represent true marijuana sector employment. The second approach was to run employment projections with the IMPLAN model.

The approaches yield very similar estimates of how the marijuana sector affects employment. Estimates based on the direct counting of jobs compared very well to IMPLAN estimates that accounted for relatively indirect employment effects in other sectors.

The marijuana supply chain was broken into four parts: farmgate production, wholesale distribution, processing, and retail sales. Some businesses are vertically integrated and carry out these steps within a single entity. Alternatively, some of these steps may be skipped or are very small. Examples include a farmer selling directly to a retail outlet, a retailer who grows their own inventory, and a farmer who develops their own seed for the following year.

For this analysis indoor, production was divided between buildings and greenhouses. Building and greenhouse production can realize significantly higher revenues than outside production. Based on Colorado data, greenhouse production can be 60-70% more energy efficient than production indoors primarily due to reduced lighting costs.[22] In Oregon, approximately 57% of the marijuana is grown outside, 24% indoors, and 19% in a combination of the two.[23] Indoor production can be done inside a solid walled building or a greenhouse. Annual harvests average one for outside production, 2-3 for greenhouse production, and 3-4 for indoor production.[24] Production costs are typically lower for outside production, and many indoor and greenhouse producers also have outside operations. Outdoor marijuana harvest is primarily in October. Like other seasonally dependent crops a large inventory of outside-grown marijuana is available for sale right after harvest which drives prices down.

Approximately 50% of the total annual marijuana production is harvested in October. Recreational producers make about one-third of the annual sales that they make to wholesalers and processors of useable marijuana in October and November. Recreational producer sales to retailers remain relatively constant across all twelve months of the year.[25]

To estimate marijuana's economic effects in the IMPLAN model, $900M of sales were assumed, which is between the $795M of sales in 2019 and the $1.1B of sales in 2020. The higher consumption in 2020 was caused in part by the COVID-19 pandemic and may have been temporary. The $900M estimate is used for illustrative purposes and reflects the fact that consumption may fall as the pandemic subsides.[26]

The model predicts that $900M in sales would be allocated as follows: $243M by growers (27%), $153M by wholesalers (17%), $252M by processors (28%), and $252M by retailers (28%). Since IMPLAN is a linear model, the reader can adjust the estimates to accommodate other proportions for each link in the supply chain.

These estimates are imprecise due to the need to rely in part on assumptions and data from other studies.[27] Existing sectors from IMPLAN that were modified included: Vegetable and melon farming for outside and part of mixed production, Greenhouse, nursery and floriculture production modified twice to use for indoor and greenhouse production, Wholesale - Grocery and related product wholesalers for wholesaling, Flavoring syrup and concentrate manufacturing for processing, and Retail - Food and beverage stores for retailing.

Table 15 shows the economic linkages if retail sales total $900 million. A total of 9,738 jobs is associated with the sector, with most of those in retail trade (4,176) followed by farmgate production (3,243). Total value-added is $710M with most of this accruing to retail trade ($225M) followed by farmgate production ($217M). These values represent earnings made by employees and proprietors involved with marijuana.

Dividing the total value of output of $1.4B by the assumed $900M of sales yields a multiplier of 1.6 (1.6 = $1.4B/$900M). This is in line with many agricultural and food studies, but may be overly low for a crop that is labor intensive and has a high value at the retail level. While we visited with people involved in the industry, more work is necessary to improve this estimate, including in-person visits to all levels of the supply chain. It is likely the multiplier would increase at least modestly with more information and analysis.

[21] Tauer, Guy. Oregon's Marijuana Industry and Employment Trends, State of Oregon Employment Department, June 8, 2020.

[22] Kolwey, Neil et. al Cannabis Energy Efficiency Policies and Programs Presentation, Southwest Energy Efficiency Project

[23] OLCC, 2019 Recreational Marijuana Supply and Demand Report Table 1 p. 7.

[24] Evergreen Economics sponsored by Energy Trust of Oregon, Energy Trust of Oregon Residential Grow Light Research Project, May 11, 2018, p. 46.

[25] OLCC, Transfer weights spreadsheet for usable marijuana, 2021.

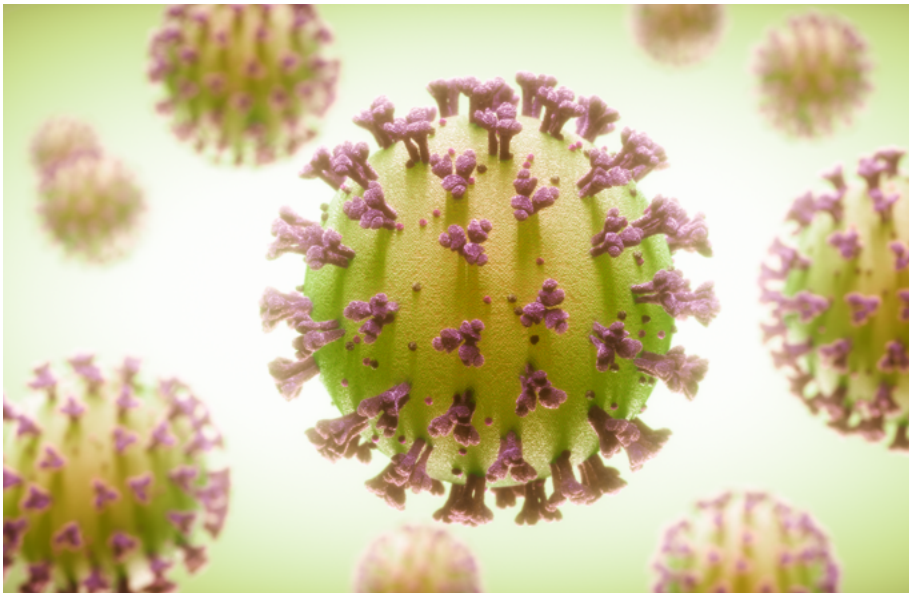
[26] 2021 Recreational Marijuana Supply and Demand Report, Oregon Liquor Control Commission, February 1, 2021, p. 13.

[27] Knudson, William and Steven Miller, The Market For And Economic Impact Of The Adult-Use Recreational Marijuana Industry In Michigan, Michigan State University, March 2020, p. 13.

COVID-19 Pandemic

Workers in the field, production lines, and food services suffered the greatest impacts of the pandemic in the agriculture, food and fiber industry. Workers often needed to commute together in carpools, were at workstations in close proximity to each other, lacked resources and medical coverage for sick leave and care, and often lived more closely with family members and friends, so isolation if COVID-19 exposure was expected or if a worker had COVID-19 was very difficult.[28] Infection and death rates by county showed, and still do, that agriculture-dependent counties especially when they had large farmgate production and processing sectors were severely impacted.[29] Mandated closures of inside dining and drinking places, forced layoffs and business closures that particularly affected the service workers in full-service restaurants and bars.

Businesses across the agriculture, food and fiber supply chain also experienced major disruption in operations and again especially in restaurants and bars; dramatic decline in revenues, closures, and significant changes to production processes, such as transitioning to take-out orders and outside dining. While we do not have sufficient data yet to provide complete estimates of the impacts of COVID-19, particularly in terms of permanent losses and changes, we can provide some preliminary estimates and future projections for recovery. Below we discuss those impacts through major components of the agriculture, food and supply industry.



Farmgate Production

Producers and workers, once the severity of the pandemic was understood, adapted production practices, including increasing hand washing/sterilizing stations, physical distancing during work and breaks, encouraging workers to stay at home if they suspected illness, testing, and advocating for priority in receiving vaccinations. However, how quickly and completely these safety measures were adopted varied a great deal among businesses and regions.

Support agencies provided information and equipment to assist workers, producers and communities.[30] In some ways, agricultural production and processing were better prepared to address the pandemic than many industries since food safety requirements were already in place. However, given how labor intensive agriculture production and processing can be, the agricultural industry faced some of the greatest challenges.

Producers' financial impact varied depending on their mix of their crops/livestock and their primary customers. While farmgate sales declined to the lowest point in more than a decade, "Overall, net farm income in the United States is expected to increase by 43% from 2019 to $119.6 billion, the USDA estimated. Farmers will see the highest level of net farm income, a broad measure of profitability, since 2013, the agency said."[31]

This was due to the payments, assistance and policy-based safety nets from all levels of government including the Coronavirus Aid, Relief, and Economic Security Act or CARES Act[32] and the two follow-on direct support acts of Congress, agency-based financial support e.g. USDA and NOAA, and extensive and regular government information and policies like extended unemployment benefits and rental eviction moratoriums. Since Oregon's farmgate production has a lower percentage of commodity crops like soybeans and corn and is more diverse in terms of crops grown, when net farm income reports for Oregon are available, we expect the net farm income to be somewhat lower than the national averages.

Still, while production processes were severely affected on farms and ranches the financial impacts were for many quite modest. Producers who were very dependent on full-service dining businesses purchasing their products experienced the most negative impacts. Prior to the pandemic, consumers spent 54.8% of their food expenditures on

[28] Martinez, Jennifer, COVID-19 Farmworker Study Preliminary Data Brief September 21, 2020, Oregon Community Foundation, University of Oregon, and CASA of Oregon plus others that can be found at www.covid19farmworkerstudy.org

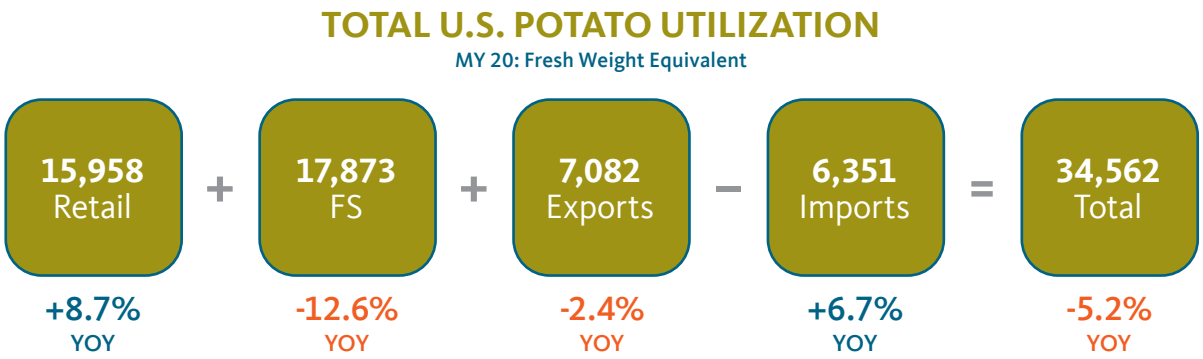
[29] Davis, Rob, Where Oregon's top 35 workplace COVID-19 outbreaks happened – and the few OSHA inspected, The Oregonian/OregonLive, November 29, 2021.

[30] Davis, Rob, Where Oregon's top 35 workplace COVID-19 outbreaks happened – and the few OSHA inspected, The Oregonian/OregonLive, November 29, 2021.

[31] Pitt, David,Federal checks salvage otherwise dreadful 2020 for US farms, Farm cash receipts are forecast to decrease nearly 1% to $366.5 billion, the lowest in more than a decade. Associated Press, January 3, 2021.

[32] U.S. Department of the Treasury, https://home.treasury.gov/policy-issues/coronavirus

Figure 3. Potato Utilization July 2019 to June 2020 for Year over Year (YOY) - MY18/19 & 19/20



Source: Marketing Year 20 Sales & Utilization Report, Potatoes USA

food prepared away from home.[33] However, during the early months with mandated closures and consumer concerns, those expenditures declined dramatically and many restaurants disappeared. "Monthly sales for retail and food services show that food and beverage store sales for the first eight months of 2020 were up 12.2 percent compared to 2019, but sales for food service and drinking places during the same time were down 20.9 percent compared to 2019."[34]

Food service and food store impacts affected some farmgate sales more than others. Probably the best example is potatoes, for which there was a 5% decline in the utilization of potatoes grown in the U.S. and sold at retail and foodservice (FS) during the July 2019 – June 2020 marketing year (MY20).

Despite the 9% increase in sales through retail, the decline occurred due to the 13% decrease in sales to the foodservice sector and 2% decrease in exports. In terms of use of the U.S. crop the decline was further compounded by a 7% increase in imports."[35]

While there are optimistic outlooks for controlling COVID-19, there is still significant uncertainty. This year potato producers in the Columbia Basin are being offered three percent lower prices than last year and they are experiencing a four percent increase in fertilizer prices.[36]

Another example is how sheep producers were affected by the pandemic. Sheep producers were especially impacted since they did not have significant markets outside of the full-service sector. Lamb is consumed relatively more during certain holiday periods and in fine-dining establishments, both of which were adversely impacted by the COVID-19 pandemic.[37]

Seafood was also one of the more impacted sectors, with 31% decline in ex-vessel revenue, 74% of aquaculture, aquaponics and allied businesses experiencing lost sales, processors (especially large processing ships) struggling with outbreaks and the necessary facility modifications, export markets declining 18%-20%, heavy reliance on full-service dining as a primary point of sale (potentially as much as 65% of a producer's market) and charter services shutdown.[38, 39]

During the pandemic, consumers may have learned how to prepare special meat and crops at home. Yet, there are mixed views on how likely it is that the consumer will work to prepare more specialized food at home in the future. Consumers may to some extent prepare the more unique types of food or they may purchase the more easily managed of the specialized foods for preparation at home and return to restaurants to enjoy the more difficult-to-prepare foods.[40]

Processing

The Oregon Office of Economic Analysis provides a good summary of how COVID-19 affected food processing and they project full recovery post pandemic.[41] It was found that the Oregon food manufacturing experienced large job losses so far this year, larger than in the typical state. Around half of these losses are likely due to the NORPAC bankruptcy and closure of most of their facilities in the Willamette Valley. The other losses were likely due in part to the fact that food processing facilities across the state regularly showed up on COVID-19 outbreak lists. This resulted in temporary shutdowns and reduced operations.

Particularly during the early stages of the COVID-19 pandemic, as some of the more serious shutdown measures were necessary,

[33] Martin, Anikka, Food Prices & Spending, Economic Research Service, USDA, February 16, 2021.

[34] Dong, Xiao and Eliana Zeballos, COVID-19 Working Paper: The Effects of COVID-19 on Food Sales, Economic Research Service, USDA, February 2021.

[35] Potatoes USA, Foodservice Losses Hurt U.S. Potato Sales, Morning Ag Clips, November 20, 2020.

[36] King, Anna, Cut and fried: Northwest spud farmers take a deep hit on their contracts, OPB News/Northwest News Network, April 4, 2021.

[37] American Lamb Board, 2020 Sheep Industry Review, March 28, 2021 with summary available in Morning Ag Clips March 29, 2021.

[38] U.S. Fishing and Seafood Industries Saw Broad Declines Last Summer Due to COVID-19, January 15, 2021.

[39] University of Washington News/Gund Institute for Environment at University of Vermont, U.S. Seafood Industry Flounders Due to COVID-19, November 23, 2020.

[40] Ibid.

[41] McMullen, Mark et al, Oregon Economic and Revenue Forecast, Office of Economic Analysis December 2020, November 18, 2020, pp. 12-14.



processors had to pivot very quickly to provide their products in different amounts (schools closed and half pint milk portions' demand plummeted), rates, and prices with some increasing as for meat and some declining as for seafood.

In the future, modifications to processing plants both in terms of facilities and practices from this pandemic should enhance food safety, employee health, production flexibility and like farmgate production, better prepare food processing for pandemics or similar shocks in the future. However, it is uncertain to what extent, as mentioned earlier, the pandemic has accelerated the mechanization of food processing and the eventual impacts to the labor force of that mechanization.

In the years ahead, it is expected that food manufacturing in Oregon will fully recover, unlike many other manufacturing subsectors in Table 10. The state is expected to maintain a competitive edge within the industry.[42]

Retail trade: food and beverage stores

Retail trade, as noted earlier, has experienced increased sales during the pandemic. Both backward linkages (suppliers) and forward linkages (delivery services) have also benefited from these increased sales. Workers once again were at significant risk interacting with customers and co-workers necessitating facility modifications and operational adjustments. In many food stores the whole sales process changed to include online shopping, curbside pick-up, and delivery services. These changes are likely to be permanent. Some food stores were already doing Beta tests of these practices prior to the pandemic and were better prepared to make large shifts in those directions. Food stores are moving forward developing "dark stores" which do not include facilities for consumer in-store shopping and are focused only on curb-side and delivery services - part of the permanent restructuring driven by the pandemic.[43]

Another lasting impact is how suppliers provide produce, baked goods and other products that were previously supplied in bulk. Consumers may have permanently reduced their willingness to purchase food that is openly accessible to all the shoppers in the store. Suppliers are moving quickly to develop packaging systems, typically using plastic coverings to replace open displays and accessible food products. While biodegradable plastics are available for these purposes, they are too expensive at this point for this type of application while still allowing the supplier to maintain a profit margin.[44] Environmental concerns and consumer preferences will be at cross purposes and may lead to further disruption in the food industry. This is an area research and development can provide significant return on monetary and non-monetary investments; both for already packaged food and beverages like bottled water and now soon-to-be package food like corn on the cob, bananas, etc.

Food services & drinking places

This part of the food industry has three major sectors: full-service restaurants, limited-service eating places, and other special food services, such as food service contractors, caterers, and mobile food services; and drinking places. While the limited food service establishments were well positioned to provide take-out orders and delivery services, most full-service restaurants and a major portion of special food services were not. Some full-service restaurants and special food service operations closed and many adapted. In all types of food services, workers could be severely impacted in ways and for reasons similar to workers in farmgate production and processing. Projections for full recovery of the food service sector to pre-pandemic levels vary widely. However, most industry people suggest significant recovery by 2022 and full recovery within three years. As the reader considers whether that recovery has taken place it is important to watch both the number of sales and the prices. It may be that the number of sales recovers with a much slower recovery in prices there by creating an extended period of low gross and net revenues. Some people in the food industry believe the consumer may become even more interested in consuming food at home that is prepared away from home and delivered.[45] Larger fast-food chains may purchase small full-service dining businesses for their prized real estate/locations and further develop their fast service menu thereby reducing the local economic benefits of food services.

[42] McMullen, Mark et al, Oregon Economic and Revenue Forecast, Office of Economic Analysis December 2020, November 18, 2020, pp. 12-14.

[43] Ledsom, Alex,The Rise Of 'Dark Stores': Grocery Shopping In Covid-19, Forbes, Sept. 13, 2020

[44] Duda, Sammy - Duda Farm Fresh Foods, COVID-19 and Produce: How the Pandemic Reshaped Production, Distribution, and Consumer Demand - Presentation video, Food Supply Chain Disruptions During COVID-19 Pandemic - Lessons Learned and Future Implications, Mississippi State University Webinar, March 18, 2021.

[45] Plourd, Phil, After the Storm - Presentation video, Supply Chain Disruptions During COVID-19 Pandemic - Lessons Learned and Future Implications, Mississippi State University Webinar, March 18, 2021.

Table 16. Food service industry during COVID-19 third quarter compared to 2019

Food Service Sector	Output-Sales ($B)			Full & part-time jobs (000)			Value-added or Net Product ($B)		
	2019	Q3 2020	% Change	2019	Q3 2020	% Change	2019	Q3 2020	% Change
Full-service	5.418	4.339	-19.9	77.7	55.0	-29.2	3.302	2.684	-18.7
Limited Service	5.248	5.015	-4.4	66.8	58.3	-12.7	2.517	2.549	+1.3
Other special food services	3.077	2.344	-23.8	47.1	33.1	-29.7	2.036	1.636	-19.6
Total	**13.743**	**11.698**	**-14.9**	**191.1**	**146.4**	**-23.4**	**7.908**	**6.869**	**-13.1**

As larger corporate limited-service food service businesses absorb smaller family-owned businesses some of the economic effects will be similar for local economies like those from employees' wages and their spending. However proprietor income may shift back to states where corporate headquarters are located and to payments to investors. This negative effect could be felt the most in rural communities with their higher percentage of small business.

Using IMPLAN data, Table 16 provides some indication of the economic effects of COVID-19 among the three food service sectors between 2019 and the third quarter of 2020. It shows the direct impacts to those three sectors. However, the third quarter of 2020 provided significant increases over the second quarter of 2020 and after a winter setback, food services are once again experiencing increases. As shown in the table, the full-service restaurants and other special food services had the greatest losses even through the third quarter.

The total industry loss comparing 2019 with the third quarter level of 2020 and including all three sectors' direct losses shown in the table while adding supplier and employee/proprietor income effects were: sales $2.45B(13.743-11.698), employment 44,700(191.1-146.4), and value-added $1.039B(7.908-6.869). Again, other special food services and full-service food services experienced the greatest losses, while limited-service restaurants had relatively smaller losses in sales and in employment and experienced a small gain in value-added or income.

Even considering the very limited data we have from 2020, detailing COVID-19's effects on business adjustments and consumer preferences for the future, some projections may still be possible.

1. Processors and many farmers and ranchers will retain the facility modifications and most of the practices developed during the pandemic, further increasing food safety and reducing food recalls in the future.
2. Processors, farmers, and ranchers will continue to mechanize their operations thereby reducing work forces and opportunities for semi-skilled workers. Communities heavily reliant on agricultural production and processing may need to focus on finding alternatives for those workers sooner than later.
3. Other special food services and full-service dining will recover in less than three years. Away-from-home dining is as much about the experience as the food.
4. Consumers have gained a great deal of knowledge and skills related to purchasing and preparing food. Producers, processors, food service, and retail food businesses that continue adapting to how consumers intend to use their knowledge and skills can be more successful as the economy recovers and if another pandemic emerges better prepared to address it.

Wildfires

The 2020 wildfire season in Oregon was devastating, at least nine-people killed, more than 1.2 million acres burned, mostly in eight counties (Clackamas, Douglas, Jackson, Klamath, Lane, Lincoln, Linn, and Marion). Southern Oregon was especially devastated, with entire communities destroyed. The fires are estimated to have destroyed more than 5,000 homes and other buildings.[46]

The agriculture, food, and fiber sectors were significantly impacted by wildfires, although the total effects have not been completely tabulated. However, some farmers and ranchers suffered losses that, even considering the initial estimates, are very serious and likely to extend for years. The crops and livestock most affected included wine grapes, hemp, hops, recreational marijuana, tree fruit, and cattle.

Testing labs have been backlogged with samples of these crops to test and determine the damage. Concerns range from affecting the taste of the food produced from the crops to the crops absorbing toxic chemicals in the smoke from the burning structures.

Wine

Viticulturists and vintners in Oregon have a long history of sharing knowledge, which was especially helpful in addressing the effects of the wildfires. Laboratories and scientists were ready to assist at places like Oregon State University and other public agencies and private labs and consultants to assist. Some of the crop was discarded and some required additional costs to produce the wine, like carefully extracting the juice without the skins.[48] New filtering techniques were developed and some wineries purchased grapes away from smoke affect regions to supplement their production. Novel ways of marketing that could meet COVID-19 precautions like virtual tastings helped offset some of the COVID-19 losses. Still, the Oregon Wine Board estimates approximately a 20% decline in wine industry revenues due to the pandemic and wildfires.[49]

Hemp

The Oregon State University Global Hemp Innovation Center is investigating how wildfires impacted the 2020 hemp crop. In Jackson County, for example, there are 6,300 registered hemp acres that might have been affected by smoke tainted with heavy metals from burning houses, such as chromium and arsenic.[50]

Hops

The uncertainty continues as to how severe the economic impacts were to the hop industry; "I don't think we know enough [about the effect of smoke and ash on hops]," adds Tom Shellhammer, brewing chemist at Oregon State University. "I think we can look to the wine industry and use that as a guidepost, but the grape analogy only goes so far."[51] While some hops have been rejected by buyers, rather than discarding them, they have been held in inventory with growers hoping to sell them to other buyers.[52] Even the worst case, in terms of losses is projected to be modest.

Recreational marijuana

Fire and smoke destroyed recreational marijuana crops. Twenty percent of marijuana businesses or 408 businesses received evacuation notices.[53] Primarily, outdoor recreational marijuana growers were affected by the wildfires. OLCC conducted a survey of marijuana growers in September 2020. Figure 5 shows how the respondents' crops were affected by the wildfires.[54]



Figure 4. 2020 Wildfire Summary as of December 30, 2020[47]

[46] Ibid. p. 3.

[47] Governor's Wildfire Economic Recovery Council, Recovering & Rebuilding from Oregon's 2020 Wildfires, January 4, 2021, p.10.

[48] Alberty, Michael, Willamette Valley winemaker taps Wonka power to trump wildfire smoke, The Oregonian/OregonLive, February 27, 2021.

[49] OWP Staff, Economic Impact Long-term growth trajectory in 2019 encounters 2020 headwinds, March 1, 2021.

[50] Gewin, Virginia, How the West's wildfires impact crops, Civil Eats, October 20, 2020.

[51] Dailey Paulson, Linda, HOPS AND SMOKE: HOW HAVE WILDFIRES IMPACTED THIS YEAR'S CROP?, Spirited, December 2, 2020.

[52] Ibid.

[53] Crombie, Noel, Oregon's marijuana businesses face threat from devastating wildfires; 1 in 5 under some evacuation level statewide, The Oregonian/OregonLive, September 9, 2020.

[54] OLCC, OLCC Recreational Marijuana Licensee Wildfire Impact Survey September 2020 Wednesday, September 23, 2020.

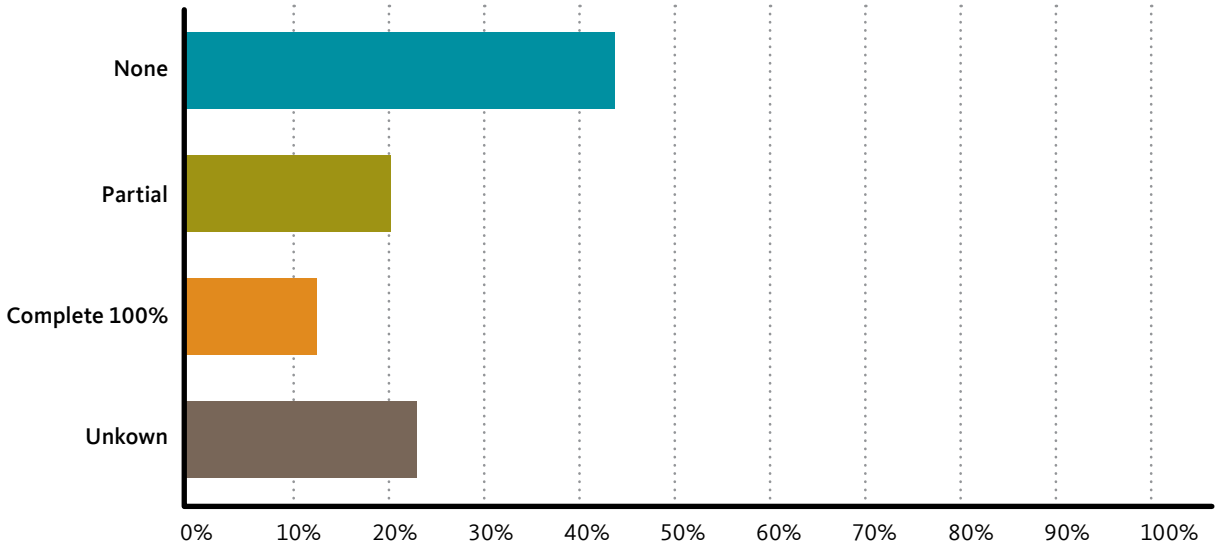


Figure 5

Figure 5 above details responses (71 total responses) to OLCC survey Q4: How much of your marijuana inventory has been lost to fires or smoke damage? Marijuana inventory would include seeds, clones, plants, and any other marijuana item subject to CTS tracking.

In the comments portion of the survey, growers indicated they were waiting for test results and trying to assess their losses. It is helpful to the industry that production is diversified among indoor, greenhouse and outdoor operations, a number of growers produce in multiple types of facilities or sites.

Cattle and other livestock

Wildfires burned both private and public grazing land east of the Cascade Mountains in 2020. The east side fires tended to be earlier than the devastating Labor Day fires in Western Oregon. Ranchers in Central and Eastern Oregon, have a long history of managing wildfire threats. While there were very large fires this year, e.g. Lionshead in Jefferson County burning more than 200,000 acres, for most of the eastern counties it was a normal fire year. “Normal” means every year wildfire burns not only private range land, it burns public land. Grazing permits on public land both on open range and in forested areas, are integral parts of many cattle ranch operations.

When a wildfire burns land that has permitted grazing, the cattle need to be excluded from the burned areas until the land recovers, usually taking one to two years. The public agencies work to find open permits in other locations that ranchers can use. Burned areas are fenced by businesses under contract with the public agency. If there is no additional public land available, ranchers will search for privately leased land and then determine whether the extra cost of the private land can be offset by the extra weight gain of the cattle or to allow the sale of the cattle to be timed to reach a high point in the market. If that analysis turns out negative, the rancher will sell the cattle earlier than planned. Either way, if no permitted land is available in close proximity, the rancher loses revenue that would have been realized without the wildfire.

The OSU Eastern Oregon Agricultural Research and Extension Center is experimenting with ways to manage where cattle graze with radio collars and initial results have been positive enough to increase the size of the study in 2021. This more precise and less expensive approach may prove very valuable in reducing rancher costs and improving rangeland recovery.

West of the Cascades, there were an abnormally high number of large fires that affected not only beef cattle and dairy cattle but also other livestock. Many of the farmer/ranchers that were impacted had relatively small operations and in many cases were able to move their livestock out of the fires’ paths. At the same time, they often lost facilities and equipment and very productive grazing land. Not only will they need to replace facilities, they also will need to lease land and/or feed through normal grazing times and may be forced to sell their livestock earlier than planned.

A number of programs both at the state and federal levels are currently working to assist people with wildfire losses in Oregon. When the reports of that assistance are completed, a great deal more precision beyond the general comments above will become available. The majority of scientists working on recovery, prevention and adaption to wildfires only expect the costs of wild fires as the climate changes to become more severe.

Climate change and the effects of past management practices have led to a consistently increasing risk of wildfires to Oregon farmers and ranchers. Management practices will need to adapt even more quickly to avoid larger losses in the future. The pace at which farmers and ranchers are required, for financial or policy reasons, to make these changes will be very important in avoiding major disruptions to the farmers’ and ranchers’ operations. Thereby maintaining a reasonably stable financial position.

Considerations

The pandemic and Oregon wildfires are vivid examples of recent challenges confronting the food and agricultural sector. Some of these setbacks may be temporary, however, relative to other long-trending challenges or "headwinds" to the sector. A partial list would include:

- Labor availability and cost, making it harder for some operations to find people who will perform physically demanding work.
- A slowly warming climate that is leading to reduced soil moisture, increased wildfires, and situations of severe drought such as in the Klamath Basin.
- A stronger U.S. dollar against the currencies of other countries, raising the cost of Oregon products to overseas buyers, while lowering the cost of imports from other countries into Oregon.
- Rising feed costs that adversely affect livestock and poultry producers.
- The need for succession plans as farming transitions to a younger generation.

Along with these challenges to the sector are strengths or "tailwinds" such as:

- A strong pace of economic recovery in the United States and rest of world following the pandemic.
- A continuing comparative advantage in many crops including seed crops, hazelnuts, pears, wine grapes, hops, potatoes, onions, mint, cherries, wheat, as well as beef and dairy.
- Increases in Oregon agricultural productivity as documented in this report.
- Ending of the trade war as the U.S. improves cooperation with World Trade Organization (WTO) and possibly rejoins the Trans-Pacific Partnership (TPP), a preferential trade agreement involving the United States and 11 other countries from North and South America and Asia.
- A recent commitment by China to expand purchases of U.S. agricultural products and other goods.
- A growing population with higher incomes in many parts of the world, which will raise demand for certain agricultural and food products.

On the last point, per capita income is growing in many countries while the current global population of 7.8 billion is projected to rise to 10 billion people by 2050.[55] Oregon consumers and producers will experience these adjustments primarily through changes in prices of the different foods that they buy or sell. The diet of people around the world may need to adjust as changes in global supply and demand lead to changing prices in local markets. Some of the global population with higher incomes may be able to consume foods that their ancestors never did. Meanwhile, consumers with lower incomes may be forced to get their calories and nutrients in less costly ways.

Feeding a larger, mostly wealthier global population will require research to increase the efficiency of food production. Land, water, and labor in agriculture will need to be used more intensively, all while adapting to climate change.[56] Capital investment in agriculture will be required to purchase new technologies that conserve scarce inputs like water and labor.

In a world with rising food demand, Oregon is well positioned to contribute to solutions and grow its markets as a result. Oregon's diversity of crops, experience innovating in water management, extensive public and private research capacity in agriculture, and geographic position should provide opportunities to expand and create new agriculture, food and fiber businesses.

This report demonstrates that without export markets, Oregon agriculture would be much smaller than it is, and employ far fewer people. For many products, Oregon is likely to remain highly competitive in terms of price, quality, and consistency of supply.

This report also demonstrates that adding value to Oregon's products all along the supply chain creates a great deal of prosperity within Oregon. Adding value is important for maximizing the net revenues from increased demand. Oregon products are sold into an extremely competitive global marketplace where savvy buyers have alternative suppliers to choose from.

As such, product differentiation, branding, and marketing will likely be ever more important. If that challenge is met, Oregon can keep food processing as one of the top manufacturing industries in Oregon and reinforce the whole supply chain.

A challenge for smaller communities dependent on agriculture is how to balance a now accelerated mechanization and the associated reduction in jobs, with the benefits in terms of increased efficiency and lower prices for food. Knowing that global demand is increasing sufficiently to absorb a great deal of increased supply can be part of that solution.

While the global marketplace looms large for the future of this sector, local food systems can also be emphasized and developed in parallel. Policy changes may be needed to enable practices that are more appropriate for local food systems. One example is smaller and more dispersed meat processing facilities that are licensed and inspected by Oregon inspectors, rather than those requiring federal oversight.

Overall, the Oregon food and agriculture industry is well positioned for the future and will continue to contribute importantly to Oregon's economy and to communities of all sizes. There will always need to be day-to-day reactions to short-run food-related problems, but there also needs to be a big-picture focus on what is needed to meet demand in export and local markets in the future.

The industry will not remain static, as the set of activities which are both profitable and environmentally sustainable will change over time. The pandemic and wildfires have presented a test of the sector's resilience in many ways. When faced with challenges such as this, production and management processes can be transformed as a result. The result is a more resilient and successful agriculture, food and fiber industry.

[55] Ranganathan, Janet, Richard Waite, Tim Searchinger and Craig Hanson, How to Sustainably Feed 10 Billion People by 2050, in 21 Charts, World Resources Institute, December 5, 2018.

[56] Ibid