2017 AGRICULTURAL WORKFORCE

Agricultural economy
Covered employment
Wages in agriculture
H-2A and prevailing wages
Employment practices
Labor force dynamics

Employment Security Department
WASHINGTON STATE

Labor Market and Economic Analysis
September 2019

2017 Agricultural Workforce Report

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Executive summary

Agriculture is a major component of the Washington state economy, with agricultural activities traditionally playing a larger role in the state than in the nation as a whole. With 35,700 farms covering 14.7 million acres, state agricultural production for 2017 was estimated at $10.6 billion. From 2007 to 2017, agriculture's share of the Gross Domestic Product (GDP) was higher in Washington state, with a state share of 1.60 percent compared to the national share of 1.05 percent for 2017. From 2015 to 2017, GDP per employee was also higher in Washington state than at the national level. While state and U.S. agricultural shares of GDP and employment varied over time, GDP shares have increased overall since 1998, with employment shares largely following a decreasing trend.

Covered employment and wages in agriculture

Total average annual covered agricultural employment in Washington state grew approximately 2.6 percent annually, from 75,763 in 2007 to 97,810 in 2017. During this period, Washington state's average annual wages for covered agricultural employment grew approximately 1.7 percent annually, from $24,412 in 2007 to $28,991 in 2017. By agricultural industry at the state level, apple orchards had the highest level of average annual covered employment in 2017 (25,074), while cattle feedlots had the highest average annual covered wages ($46,077).

Washington state is composed of six agricultural reporting areas. In 2017, two of these areas, South Central Area 2 and North Central Area 3, accounted for more than half (52.4 percent) of the total average annual covered employment in agriculture. By size of contribution, South Eastern Area 5, Western Area 1, Columbia Basin Area 4 and Eastern Area 6 provided the remaining covered agricultural employment.

From 2007 to 2017, average variable covered agricultural employment grew from 28,907 to 39,808, or 37.7 percent. By agricultural reporting area, North Central Area 3 had the highest share of variable employment at 54.9 percent in 2017. Variable agricultural employment in Washington state tends to be associated with production and harvest patterns, and for 2017 peaked in the summer, with higher levels of employment through the early fall.

Focusing on the five largest agricultural industries by employment in Washington state (apple orchards, other noncitrus fruit farming, postharvest crop activities, all other miscellaneous crop farming and other food crops grown under cover), average annual hourly wages and annual weighted median hourly wages tended to show fairly steady growth from 2008 to 2017. For 2017, the other food crops grown under cover industry had both the highest average hourly wage ($16.75) and the highest weighted median hourly wage ($14.52).

Prevailing wages and employment practices in agriculture

From the 2017 Agricultural Peak Employment Wage and Practice Employer Survey, ESD was able to determine prevailing wage rates for cherries, pears and blueberries. In 2017, the prevailing wage rate for cherry tree pruning was $12.50 per hour, and $13.38 per hour for cherry thinning. Cherry harvest ranged from $3.50 to $6.00 per lug, with wage rates dependent on cherry type and lug size. Pear tree pruning was $12.50 per hour and thinning $13.38 per hour. For pear harvest, the prevailing wage per bin was $22 for Bartlett, $21 for Bosc and $26.50 for D'Anjou. The prevailing wage for blueberry harvest was $11.00 per hour.

Similar to the 2016 survey results, the 2017 survey indicates that it is not a prevailing practice to provide housing to non-working family members of workers for the surveyed commodity activities. It is also not a normal or common practice to have a minimum productivity standard or experience requirement.

Agricultural labor force dynamics

Agriculture's mobile workforce was measured by employment transfers within the agricultural sector and movements between agriculture and other sectors. In 2017, the agricultural sector accounted for a higher share (27 percent) of inter-industry transfers, compared to 17 percent for nonfarm industries. Intra-industry transfers were 6 percent for agriculture and 4 percent for nonfarm industries.

Employment transfers were often associated with wage changes. In 2017, average hourly wage rates in agriculture were 28 cents lower after an inter-industry transfer and 22 cents lower after an intra-industry transfer. For nonfarm industries, post transfer average hourly wage rates decreased by 72 cents for inter-industry and increased by $1.12 for intra-industry.

Although some agricultural industries experienced declining employment with rising wages, there was insufficient evidence of labor shortages using certain criteria. The thresholds for the results provided are less strict, and while the results give some insight into the possibility of agricultural labor shortages, they are not definitive and should not be viewed as proof. Statewide, six agricultural industries with a more than 3 percent growth in wages and at least a 5 percent decrease in employment were reported. Between 2016 and 2017, mushroom production had the largest decrease in employment (11.8 percent), with a wage increase of 8.4 percent. Goat farming had the largest increase in wages (16.2 percent), with associated employment decreasing by 7.1 percent. Four agricultural reporting areas and ten counties had agricultural industries with at least a 25-percentage point gap between falling employment and rising wages.

Data sources

Multiple data sources were used for this report. Estimates can change with the data source; however, overall trends tended to be consistent among the sources cited.

The **Quarterly Census of Employment and Wages** (QCEW), produced by the U.S. Bureau of Labor Statistics (BLS) and the Washington State Employment Security Department (ESD), provides monthly industry employment and quarterly wage data for workers covered by the unemployment insurance (UI) system. Covered employment includes all hired agricultural labor except small farm operators, non-resident aliens, independent contractors and corporate officers. QCEW data comes from employers' quarterly tax reports, and is specific to worksite (employer location).

The **UI Wage File** is based on employer reports to ESD, and includes quarterly wage and hour data for covered workers. Employer reports for the UI Wage File are by firm, rather than worksite. Consequently, wage data for firms with multiple worksites can include information on workers who do not work at the physical location listed in the UI Wage File.

The U.S. Bureau of Economic Analysis (BEA) provides information on **Gross Domestic Product (GDP) and Personal Income**. BEA farm employment data contain farm output characteristics and estimates of the number of employees, rather than jobs as in QCEW and UI data.

Conducted by ESD and the University of Washington's Survey Research Division, the **2017 Agricultural Peak Employment Wage and Practice Employer Survey** details wage rates and employment practices offered to U.S. seasonal, local or migrant workers. These workers must have performed activities for which at least one employer filed a job order to hire foreign workers through the U.S. Department of Labor's (DOL) Temporary Agricultural Foreign Labor Certification Program, or the H-2A program. DOL, in tandem with ESD, also provides information through foreign labor certification fiscal year performance summaries on the number of H-2A applications submitted and workers requested.

Data derived from the **Annual Statistical Bulletin** highlight characteristics of Washington state's agricultural sector. Compiled and produced by the U.S. Department of Agriculture's National Agricultural Statistics Service, the bulletin includes information on the number of farms and associated acreage, number of crops and record-setting harvests.

Report background

The *2016 Agricultural Workforce* report represented a significant shift from previous reports, both in terms of methodology used and content covered. This report follows the approach from the *2016 Agricultural Workforce* report, using the same analytic methods and including a section on possible labor shortages. *Appendices 2, 3* and *4* provide more detailed information on the methodology used. In addition, information from the U.S. Department of Agriculture's National Agricultural Statistics Service was included to provide highlights on Washington state's agricultural sector.

For the purpose of this report, agricultural industries are defined using the North American Industry Classification System (NAICS). NAICS is the federal statistical agency standard for classifying businesses when collecting, analyzing and publishing statistics related to the nation's business economy.[1] This report uses a subset of NAICS Sector 11 to focus on agriculture. *Appendix 1* provides the NAICS codes used for analysis.

ESD lists six agricultural reporting areas in Washington state. The use of these reporting areas when examining the agricultural economy allows for a more regional view that can sometimes uncover patterns not apparent at the state level.

Western Area 1
Clallam, Clark, Cowlitz, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, San Juan, Skagit, Skamania, Snohomish, Thurston, Wahkiakum and Whatcom

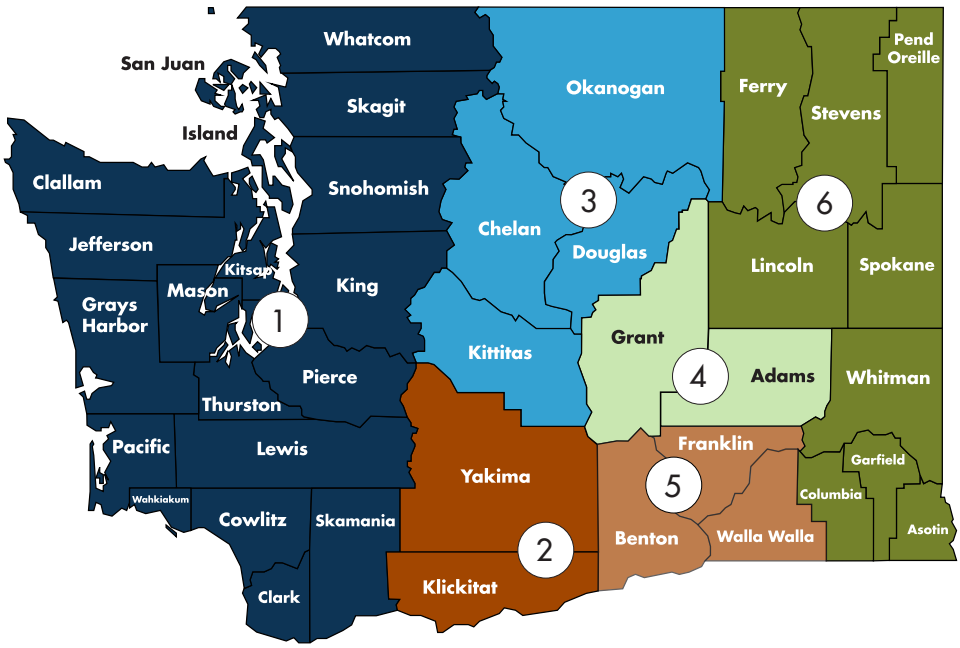
South Central Area 2
Klickitat and Yakima

North Central Area 3
Chelan, Douglas, Kittitas and Okanogan

Columbia Basin Area 4
Adams and Grant

South Eastern Area 5
Benton, Franklin and Walla Walla

Eastern Area 6
Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Spokane, Stevens and Whitman



[1] United States Census Bureau, https://www.census.gov/eos/www/naics/.

Overview of Washington state's agricultural economy

In Washington state, more than 300 crops are harvested, and a variety of livestock is raised. There were 35,700 farms covering 14.7 million acres in 2017, with an average farm size of 412 acres. Agricultural production in Washington state was valued at $10.6 billion for 2017.

In 2017, state production of hops, spearmint oil, wrinkled seed peas, apples, blueberries, concord grapes, sweet cherries and pears ranked highest in the nation. Dry edible beans set a production record of 2.8 million cwt and a record for acres harvested (190,000 acres). A record 78.9 billion pounds of hops were harvested from 38.4 million acres. Blueberries had a record 13,700 acres harvested. Eggs also had a record-breaking year in 2017, with 2.1 billion eggs produced.[2]

According to the U.S. Bureau of Economic Analysis (BEA), Washington state's 2017 Gross Domestic Product (GDP) was approximately $479.2 billion, adjusted for inflation. *Figure 1* shows state and national GDP share, employment share and GDP per employee for the agricultural sector. At approximately $7.7 billion, agricultural farms accounted for 1.60 percent of the state's total GDP.

Washington state's overall GDP per employee was 18.3 percent above the nation for 2017, and 24.7 percent above for the agricultural sector. At the state level, the agricultural sector's GDP per employee was 33.5 percent above the construction industry and 108.1 percent above accommodation and food services. However, these two industries accounted for a greater share of the state's GDP than the agricultural sector.

Figure 1. Comparison of state and national major indicators for farms
U.S. and Washington state, 2007 through 2017
Source: U.S. Bureau of Economic Analysis (BEA), series: SAGDP9N, SAEMP25N

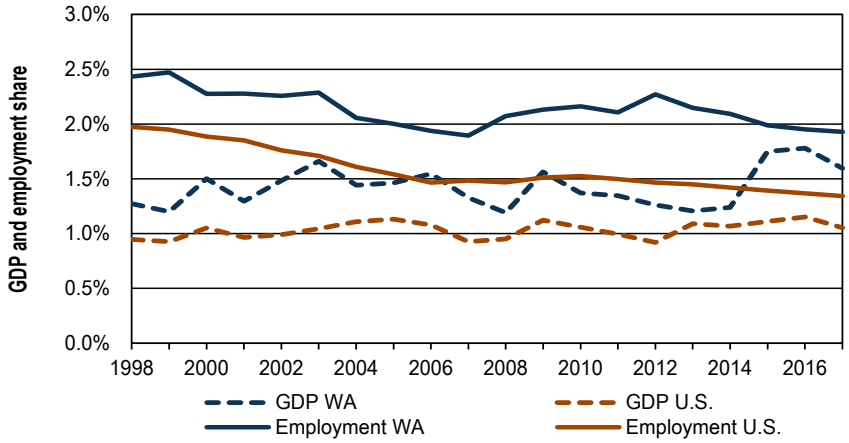
Economic indicator	Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
GDP share	WA	1.33%	1.19%	1.56%	1.37%	1.35%	1.26%	1.21%	1.24%	1.75%	1.78%	1.60%
	U.S.	0.93%	0.95%	1.12%	1.06%	0.99%	0.92%	1.09%	1.07%	1.11%	1.15%	1.05%
Employment share	WA	1.89%	2.07%	2.13%	2.16%	2.11%	2.27%	2.15%	2.09%	1.99%	1.95%	1.93%
	U.S.	1.48%	1.47%	1.51%	1.52%	1.50%	1.47%	1.45%	1.42%	1.39%	1.37%	1.34%
GDP per employee (thousands of dollars)	WA	67.6	55.6	71.6	64.1	64.9	57.0	57.9	61.4	93.0	97.3	90.1
	U.S.	54.3	56.5	65.1	62.6	59.7	56.8	68.0	68.2	72.9	76.9	72.3

Agricultural activities play a more significant role in Washington state than in the nation.

[2] 2018 Washington Annual Statistical Bulletin (October 2018) 5 USDA, National Agricultural Statistics Service – Northwest Regional Office.

The agricultural sector's share of GDP and employment is historically higher in Washington state than at the national level. *Figure 2* provides a summary of these measures from 1998 through 2017. Overall, both the state and U.S. agricultural share of GDP tended to increase over time, while the employment share followed a decreasing trend.

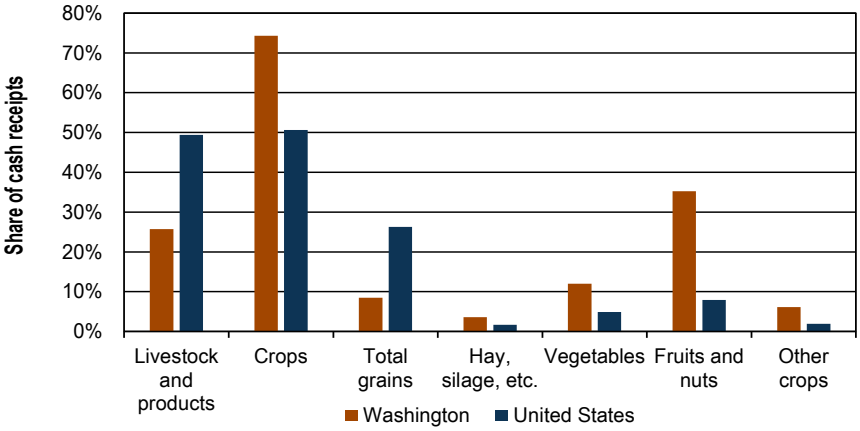
Figure 2. Historical agricultural share of GDP and employment
U.S. and Washington state, 1998 through 2017
Source: U.S. Bureau of Economic Analysis (BEA), series: SAGDP9N, SAEMP25N



From 1998 through 2017, agriculture accounted for a larger share of GDP and employment in Washington state than the nation.

Figure 3 shows the structure of the economy at both a state and national level by showing the distribution of cash receipts in 2017 for major agricultural industries. Livestock and products accounted for a larger share of cash receipts in the U.S., while crops had a larger share in Washington state. Within crops, the cash receipt shares associated with production of total grains were larger at the national level, while shares for hay, silage, etc.; vegetables, fruits and nuts, and other crops were larger in Washington state.

Figure 3. Structure of the agricultural economy based on cash receipts
U.S. and Washington state, 2017
Source: U.S. Bureau of Economic Analysis (BEA) – Farm Income and Expenses, series: SAINC45



In 2017, Washington state cash receipt shares for hay, silage, etc., vegetables, fruits and nuts, and other crops were higher than national levels.

Covered employment and wages in agriculture

Total agricultural employment

Over the past decade, average annual agricultural employment in Washington state has increased, from 75,763 jobs in 2007 to 97,810 jobs in 2017, or approximately 2.6 percent annually. This data is limited to workers covered by UI, which accounts for the majority of total agricultural employment. *Figure 4* details total average annual covered agricultural employment at the state level, as well as by agricultural reporting area. Employment is also provided for the top three industries by area.

Figure 4. Total average annual covered employment in the top three industries ranked by employment, statewide and agricultural reporting area*
Washington state, 2007 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW

Industry by area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Statewide											
Total	**75,763**	**77,401**	**82,088**	**80,201**	**82,057**	**87,757**	**87,046**	**92,211**	**94,994**	**97,098**	**97,810**
Apple orchards	20,841	21,859	23,851	24,135	23,918	26,393	25,251	27,257	26,730	25,833	25,074
Other postharvest crop activities	12,030	11,656	13,038	12,408	12,920	13,857	14,335	14,893	15,187	14,754	15,193
Other noncitrus fruit farming	12,613	12,215	13,735	12,601	12,470	13,446	13,088	14,423	14,749	14,052	12,221
Western Area 1											
Total	**10,993**	**11,207**	**10,967**	**11,009**	**11,117**	**11,256**	**10,931**	**11,189**	**12,245**	**13,761**	**14,468**
Other food crops grown under cover	46	57	69	74	104	91	83	255	1,059	2,286	3,091
Berry (except strawberry) farming	1,865	2,154	2,160	2,208	2,278	2,442	2,182	2,221	2,396	2,623	2,436
Nursery and tree production	2,234	2,249	2,075	1,974	1,950	1,869	1,819	1,807	1,780	1,677	1,795
South Central Area 2											
Total	**23,101**	**24,675**	**25,808**	**25,007**	**26,329**	**28,325**	**28,359**	**30,713**	**31,689**	**32,714**	**31,456**
Apple orchards	6,101	6,423	7,048	7,114	7,717	8,464	8,048	8,844	8,905	8,759	8,645
Other postharvest crop activities	5,436	5,466	6,012	5,888	6,331	6,910	7,158	7,641	7,618	7,499	7,246
All other miscellaneous crop farming	2,698	3,688	3,301	2,970	3,380	3,434	3,444	3,499	3,664	4,554	4,490
North Central Area 3											
Total	**17,301**	**16,857**	**18,948**	**18,209**	**18,593**	**18,903**	**18,612**	**20,117**	**20,086**	**19,759**	**19,761**
Apple orchards	7,347	7,517	8,452	8,524	8,132	8,119	7,760	8,705	8,288	8,379	7,778
Other noncitrus fruit farming	5,102	4,814	5,372	4,834	4,970	5,161	5,163	5,406	5,588	5,446	5,048
Other postharvest crop activities	3,767	3,471	4,086	3,860	3,946	3,935	4,116	4,186	4,448	4,258	4,833
Columbia Basin Area 4											
Total	**9,741**	**9,819**	**10,400**	**10,190**	**10,531**	**11,874**	**11,915**	**12,743**	**12,690**	**12,308**	**12,631**
Apple orchards	3,195	3,321	3,727	3,546	3,438	4,474	4,149	4,499	4,313	3,715	3,743
Other postharvest crop activities	948	936	981	816	908	1,121	1,284	1,280	1,342	1,290	1,386

Industry by area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Other noncitrus fruit farming	1,303	1,260	1,391	1,304	1,362	1,270	1,235	1,362	1,267	1,194	1,264
South Eastern Area 5											
Total	**13,236**	**13,409**	**14,494**	**14,301**	**13,961**	**15,792**	**15,608**	**15,777**	**16,218**	**16,072**	**16,720**
Apple orchards	4,094	4,528	4,571	4,903	4,558	5,247	5,204	5,118	5,141	4,891	4,822
Farm labor contractors and crew leaders	156	228	593	521	723	804	986	1,230	1,569	1,697	2,062
Grape vineyards	1,476	1,518	1,639	1,545	1,611	1,733	1,862	1,713	1,764	1,887	1,842
Eastern Area 6											
Total	**1,384**	**1,428**	**1,468**	**1,480**	**1,512**	**1,597**	**1,621**	**1,669**	**2,063**	**2,481**	**2,775**
Other food crops grown under cover	0	0	0	0	0	0	0	60	482	954	1,269
Wheat farming	585	609	620	627	658	686	663	612	566	534	508
Floriculture production	151	150	157	158	158	160	160	157	166	155	141

*The summation of employment in the agricultural reporting areas does not always add up to state total covered employment. This is because location codes for some employers are unknown.

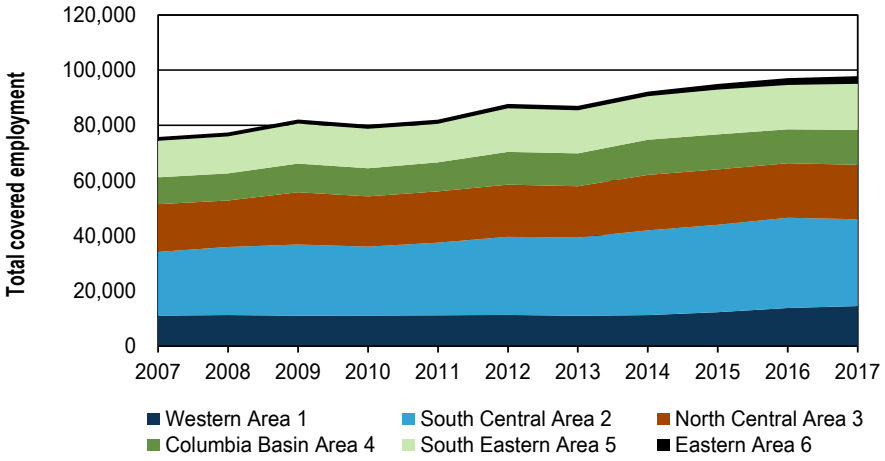
From 2007 to 2017, covered agricultural employment in Washington state grew by more than 20,000.

Statewide, apple orchards, other postharvest crop activities and other noncitrus fruit farming were the industries with the highest employment. Washington state leads the nation in apple production, accounting for 65.8 percent of the nation's apples. In 2017, the state produced 3.8 million tons of apples worth $2.4 billion. Apple orchards had the most jobs for a single industry both at the state level and in four of the six agricultural reporting areas.

Of the six agricultural reporting areas, South Central Area 2 had the largest average annual covered employment during 2017, with 31,456 jobs. Apple orchards, other postharvest crop activities and all other miscellaneous crop farming were the largest industries by employment for the area.

Figure 5 shows reporting area shares of total average annual covered agricultural employment from 2007 to 2017. Although total average annual covered agricultural employment increased during the time period, each agricultural reporting area's share of employment remained steady.

Figure 5. Total average annual covered employment in agriculture
Washington state agricultural reporting areas, 2007 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW

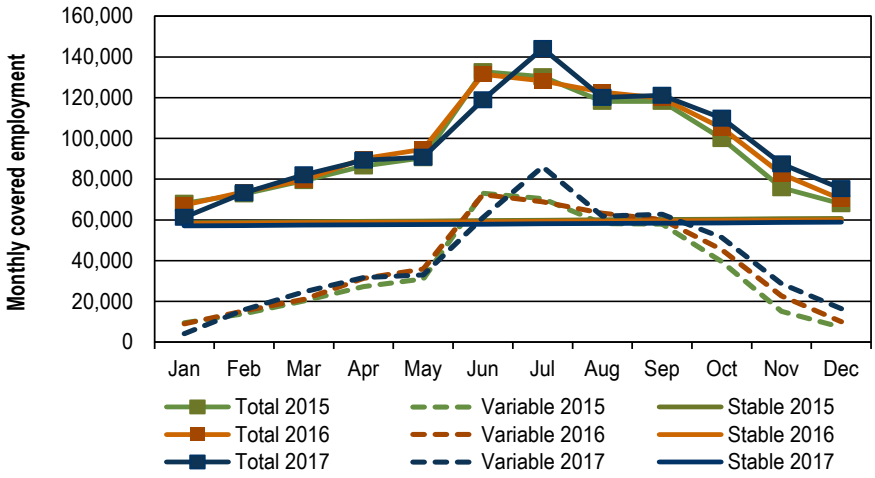


South Central Area 2 accounted for the largest share of covered agricultural employment in Washington state over the past decade.

Estimated variable and stable covered employment

The agricultural sector has variable and stable components of employment. The variable component of employment can relate to certain production and harvest activities determined by a crop's growing season. *Figure 6* reflects employment trends and growing seasons from 2015 through 2017. While the stable component of employment was fairly regular, variable employment was influenced by the production cycle of crops such as apples, cherries and other tree fruits. Peak variable employment occurred during the summer and early fall, the height of the production cycle when most of the harvesting happens.

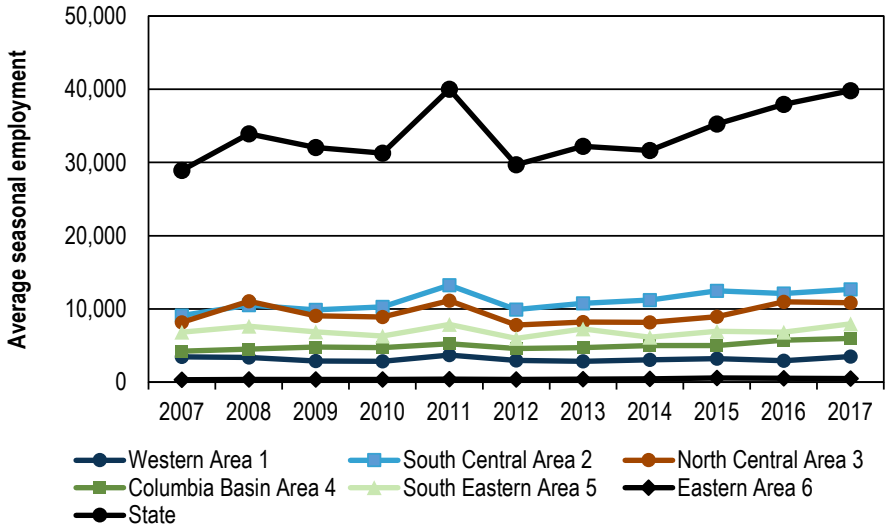
Figure 6. Monthly variable, stable and total covered employment in agriculture
Washington state, 2015 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW



Influenced by crop production cycles, variable employment in agriculture tended to be highest during the summer and early fall.

Figure 7 shows a regional breakout of average annual variable covered agricultural employment since 2007. With the exception of a peak in 2011, average annual variable covered employment has been gradually increasing throughout the state. In 2017, average annual variable covered employment in agriculture statewide was almost 40,000 jobs. Washington state's average annual variable covered agricultural employment grew from 28,907 in 2007 to 39,808 in 2017, approximately 4.2 percent annually. South Central Area 2 had the highest variable employment for 2017 at 12,657, followed by North Central Area 3 (10,844).

Figure 7. Average annual variable covered employment in agriculture*
Washington state and agricultural reporting areas, 2007 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW

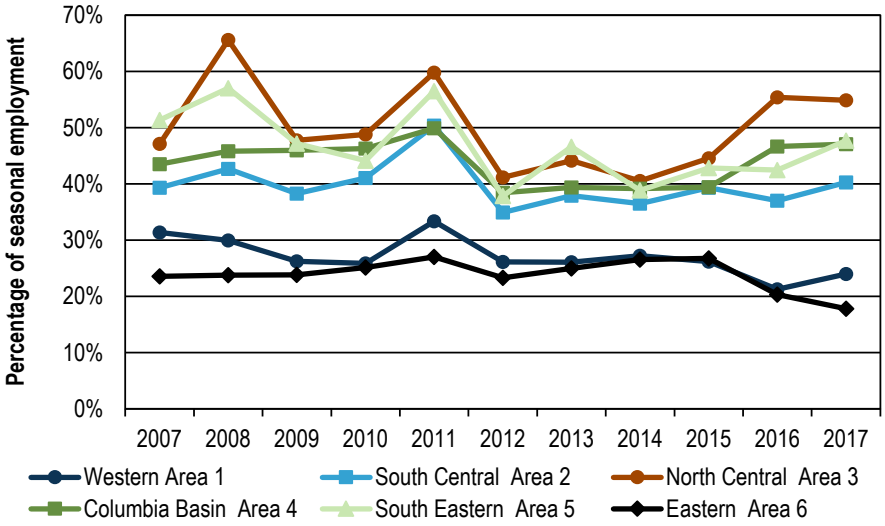


*The summation of variable employment across agricultural reporting areas does not add up to state total employment. This is because variable adjustments are based on statistical models that depend on levels of aggregation.

Following a peak in 2011 and subsequent dip in 2012, variable agricultural employment for the state tended to grow year-to-year.

To show the seasonal distribution of the agricultural workforce, *Figure 8* gives the percent of total average annual agricultural employment that is variable by reporting area. Variations in trends may have been due to weather impacts or market changes. In 2017, North Central Area 3 (54.9 percent) and South Eastern Area 5 (47.7 percent) had the highest percentage of variable employment. While share of variable employment has been fairly stable over time for most of the agricultural reporting areas, North Central Area 3 and Columbia Basin Area 4 saw an increase of about 10 percentage points between 2015 and 2017.

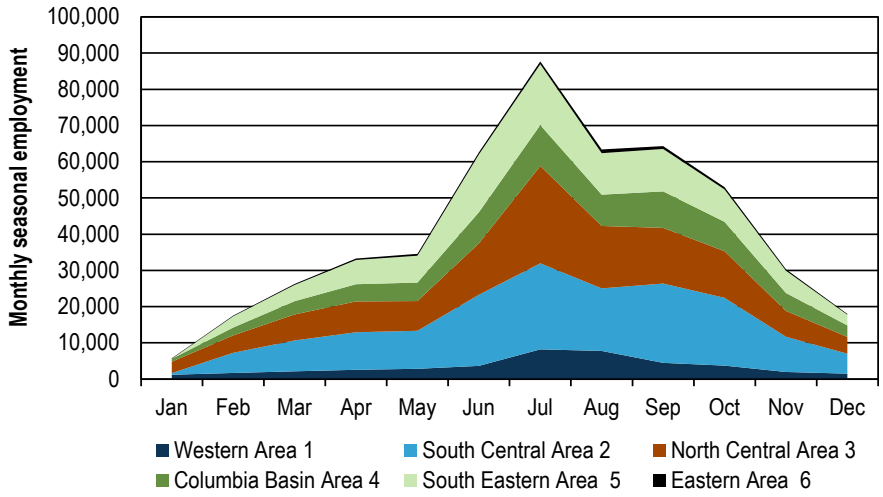
Figure 8. Percentage of variable covered employment in agriculture
Washington state agricultural reporting areas, 2007 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW



Variable agricultural employment percentages were highest in North Central Area 3, South Eastern Area 5, Columbia Basin Area 4 and South Central Area 2.

Focusing on 2017, *Figure 9* gives a monthly view of variable covered employment by agricultural reporting area. Variable employment tended to peak in July, with higher levels of employment through October. North Central Area 3 had the highest variable employment in a single month, with 26,879 in July.

Figure 9. Monthly variable covered employment in agriculture*
Washington state agricultural reporting areas, January 2017 through December 2017
Source: Employment Security Department/LMEA, U.S. Bureau of Labor Statistics, QCEW

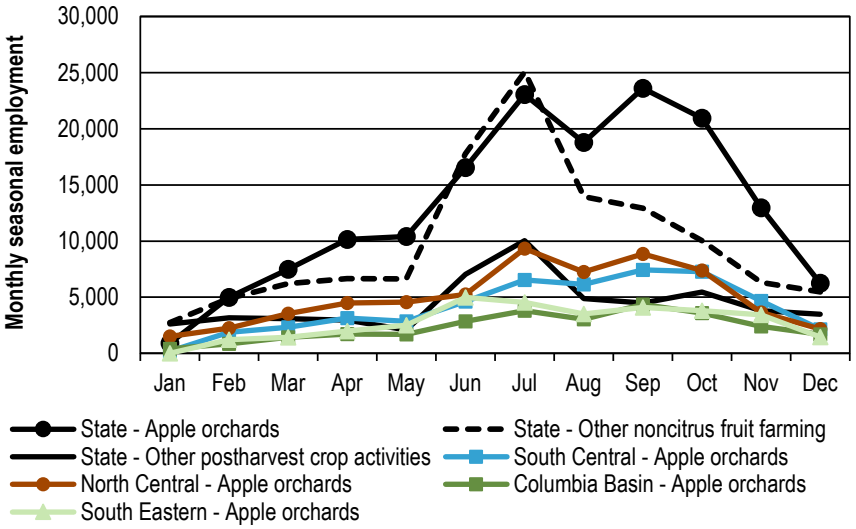


*Total variable employment at the state level is not the same as the summation of variable employment across agricultural reporting areas. This is because statistical estimation for variable employment depends on levels of aggregation.

For 2017, regional variable employment in agriculture tended to be highest in July.

As shown in *Figure 10*, variable employment peaks can change by month, industry and agricultural reporting area. At the state level, the apple orchards and other noncitrus fruit farming industries had the most notable changes in monthly variable employment. For example, apple orchards had a longer span of raised variable employment compared to other agricultural industries.

Figure 10. Monthly variable covered employment by select agricultural industries Washington state and selected agricultural reporting areas,* January 2017 through December 2017
Source: Employment Security Department/LMEA, U.S. Bureau of Labor Statistics, QCEW



*Western Area 1 and Eastern Area 6 were omitted due to their low levels of variable employment.

At a state level, the apple orchards industry had the longest surge in variable employment.

Average annual wages

Average annual covered wage data have been adjusted to 2017 dollars using the BLS Employment Cost Index (ECI). *Figure 11* shows average annual covered wages for Washington state and its agricultural reporting areas, broken out by each area's top three industries by earnings. From 2007 to 2017, average annual covered wages in agriculture increased approximately 1.7 percent annually, from $24,412 to $28,991. From 2016 to 2017, growth in statewide agricultural wages was approximately 3.2 percent. South Central Area 2 had the highest average annual wage in 2017 at $30,721.

Figure 11. Average annual covered wages in agriculture's top three industries (adjusted to 2017 prices)*
Washington state and agricultural reporting areas, 2007 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW

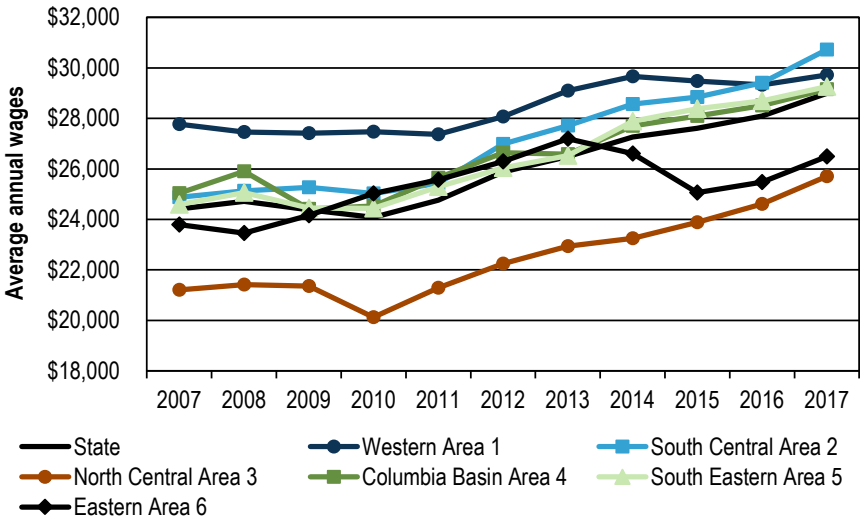
Industry by area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Statewide											
Total	**$24,412**	**$24,715**	**$24,380**	**$24,086**	**$24,760**	**$25,881**	**$26,490**	**$27,269**	**$27,614**	**$28,089**	**$28,991**
Cattle feedlots	$36,740	$44,520	$37,814	$38,091	$35,818	$43,614	$42,851	$45,299	$45,586	$44,650	$46,077
Potato farming	$36,799	$38,084	$37,825	$38,226	$38,478	$38,290	$38,632	$39,217	$39,301	$40,565	$40,100
Dairy cattle and milk production	$32,464	$32,915	$33,585	$33,727	$33,357	$33,947	$34,610	$35,514	$36,334	$36,602	$37,042
Western Area 1											
Total	**$27,775**	**$27,458**	**$27,415**	**$27,473**	**$27,363**	**$28,075**	**$29,093**	**$29,663**	**$29,478**	**$29,331**	**$29,725**
Soil preparation, planting and cultivating	$53,899	$50,844	$49,582	$51,049	$52,956	$48,909	$50,744	$48,846	$48,054	$46,965	$48,777
All other animal production	$29,501	$31,210	$29,863	$24,044	$29,604	$30,020	$30,490	$30,558	$33,374	$37,497	$41,186
Potato farming	$43,351	$42,002	$40,836	$41,211	$40,339	$40,183	$40,997	$40,379	$39,864	$42,609	$39,405
South Central Area 2											
Total	**$24,873**	**$25,135**	**$25,264**	**$25,030**	**$25,434**	**$26,984**	**$27,708**	**$28,572**	**$28,839**	**$29,403**	**$30,721**
Potato farming	$31,797	$36,247	$28,311	$26,184	$28,193	$28,887	$37,860	$40,311	$42,278	$34,640	$48,046
Dairy cattle and milk production	$32,994	$33,635	$34,417	$34,653	$35,082	$36,023	$36,451	$37,186	$38,353	$38,937	$39,869
Cattle feedlots	$32,273	$46,398	$28,770	$29,466	$25,082	$38,039	$35,754	$38,357	$39,987	$37,140	$36,723
North Central Area 3											
Total	**$21,209**	**$21,412**	**$21,358**	**$20,123**	**$21,292**	**$22,249**	**$22,942**	**$23,246**	**$23,880**	**$24,611**	**$25,711**
Other postharvest crop activities	$27,851	$27,805	$28,556	$26,477	$27,755	$29,037	$29,076	$30,781	$30,093	$31,469	$32,715
Hay farming	$24,382	$25,317	$26,418	$27,988	$30,261	$30,178	$30,993	$29,470	$31,402	$32,360	$30,600
Fruit and tree nut combination farming	$19,074	$17,141	$15,852	$14,077	$15,549	$15,953	$22,087	$23,679	$26,184	$25,264	$26,989
Columbia Basin Area 4											
Total	**$25,040**	**$25,907**	**$24,413**	**$24,534**	**$25,644**	**$26,646**	**$26,585**	**$27,707**	**$28,096**	**$28,514**	**$29,153**
Cattle feedlots	$38,814	$42,712	$44,908	$45,902	$46,799	$45,199	$44,851	$48,691	$48,400	$46,180	$51,857
Soil preparation, planting and cultivating	$35,025	$36,807	$36,603	$40,655	$38,109	$42,274	$43,780	$42,053	$47,103	$46,665	$44,986
Dairy cattle and milk production	$34,721	$33,899	$34,260	$35,057	$35,145	$35,578	$36,852	$38,288	$38,978	$39,405	$39,650
South Eastern Area 5											
Total	**$24,594**	**$25,057**	**$24,448**	**$24,444**	**$25,293**	**$26,038**	**$26,524**	**$27,884**	**$28,388**	**$28,699**	**$29,264**
Other vegetable and melon farming	$31,330	$32,471	$33,301	$38,906	$36,971	$37,439	$38,840	$40,607	$41,329	$44,519	$47,572
Cattle feedlots	$40,274	$43,671	$43,871	$42,650	$43,667	$45,256	$45,097	$45,224	$45,921	$46,210	$44,720
Potato farming	$36,183	$37,930	$37,482	$38,704	$38,907	$38,623	$39,071	$40,303	$40,053	$44,451	$42,981
Eastern Area 6											
Total	**$23,792**	**$23,460**	**$24,165**	**$25,027**	**$25,563**	**$26,296**	**$27,199**	**$26,605**	**$25,064**	**$25,471**	**$26,491**
Soil preparation, planting and cultivating	$41,654	$39,068	$41,434	$50,656	$42,217	$34,606	$36,434	$29,625	$42,280	$50,661	$44,384
Other postharvest crop activities	$30,368	$31,352	$40,235	$35,582	$40,208	$37,797	$41,852	$41,881	$44,854	$43,742	$43,287
Farm labor contractors and crew leaders	$20,231	$29,699	$24,340	$12,230	$20,788	$16,248	$16,857	$28,428	$33,873	$37,451	$34,918

*Wages are adjusted to current prices in 2017 using the ECI price index for construction, extraction, farming, fishing, and forestry developed and used by BLS for wage adjustments.

From 2007 to 2017, average agricultural wages for the state grew by approximately 1.7 percent annually.

Figure 12 gives a graphical representation of average annual agricultural wages by area from 2007 to 2017. In general, wages have been trending upwards. By reporting area, there were some decreases in average annual wages, in particular, North Central Area 3 during 2010 and Eastern Area 6 during 2015. Average annual wages for both regions have been increasing since then. Regional wage differences are likely associated with the unique industry and crop composition of each area.

Figure 12. Average annual covered agricultural wages (adjusted to 2017 prices)
Washington state and agricultural reporting areas, 2007 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW



Barring a few drops by region, agricultural wages in Washington state have been trending upwards.

Average hourly wages by industry

Covered average annual hourly wages are presented in *Figure 13* for the five largest agricultural industries by employment in Washington state: apple orchards, other noncitrus fruit farming, postharvest crop activities, all other miscellaneous crop farming and other food crops grown under cover. With the exception of other food crops grown under cover, the selected industries tended to show fairly steady growth. For all five industries, average annual hourly wages increased from 2008 to 2017. For 2017, the other food crops grown under cover industry had the highest average annual hourly wage ($16.75), followed by all other miscellaneous crop farming ($16.57).

Figure 13. Covered average annual hourly wages for the top five agricultural industries by employment (adjusted to 2017 prices)
Washington state, 2008 through 2017
Source: Employment Security Department/LMEA; NGTS, UI Wage File

Industry	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Apple orchards	$12.73	$12.76	$12.65	$12.88	$13.67	$13.67	$14.31	$14.66	$14.86	$15.60
Other noncitrus fruit farming	$13.07	$13.14	$12.94	$13.21	$14.05	$14.22	$14.61	$14.72	$15.43	$16.09
Postharvest crop activities	$14.46	$14.40	$14.58	$14.67	$15.05	$15.31	$15.34	$15.38	$15.60	$16.00
All other miscellaneous crop farming	$12.82	$13.50	$13.90	$13.82	$14.23	$14.38	$14.74	$15.09	$15.69	$16.57
Other food crops grown under cover	$14.77	$15.98	$15.61	$15.82	$15.74	$15.05	$17.39	$17.32	$16.70	$16.75

From 2008 to 2017, average annual hourly wages tended to increase steadily for the selected industries.

Median hourly wages by industry

Median hourly wages were weighted to better reflect differences in hours worked by individuals in agricultural industries. Since the Adverse Effect Wage Rate (AEWR) used to ensure a minimum average hourly wage rate for H-2A workers is also weighted, using a weighted median makes comparisons more straightforward.

Figure 14 shows covered annual weighted median hourly wages over time for the selected agricultural industries, as well as their relationship to the AEWR. For the majority of the five chosen agricultural industries, weighted median hourly wages tended to increase steadily from 2008 to 2017. The other food crops grown under cover industry was less stable in its growth and experienced several dips in weighted median hourly wages, notably in 2011, 2013 and 2016. However, in 2017 this industry also had the highest weighted median hourly wage ($14.52), followed by other noncitrus fruit farming at $14.24. The AEWR was below the annual weighted median hourly wage for the five chosen agricultural industries in both 2016 and 2017.

Figure 14. Covered annual weighted median hourly wages for the top five agricultural industries by employment (adjusted to 2017 prices)
Washington state, 2008 through 2017
Source: Employment Security Department/LMEA; NGTS, UI Wage File

Industry	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Adverse effect wage rate	**$11.64**	**$11.68**	**$12.35**	**$11.90**	**$12.14**	**$13.17**	**$12.79**	**$13.13**	**$13.07**	**$13.38**
Apple orchards	$11.41	$11.45	$11.36	$11.49	$12.18	$12.20	$12.88	$13.18	$13.42	$14.01
Other noncitrus fruit farming	$11.46	$11.53	$11.39	$11.61	$12.20	$12.41	$12.88	$13.18	$13.71	$14.24
Postharvest crop activities	$11.86	$11.92	$11.86	$11.96	$12.35	$12.57	$12.69	$12.88	$13.16	$13.54
All other miscellaneous crop farming	$10.84	$11.26	$11.40	$11.36	$11.72	$11.93	$12.35	$12.78	$13.23	$13.85
Other food crops grown under cover	$13.12	$13.25	$12.98	$12.21	$13.34	$12.80	$14.67	$14.75	$14.28	$14.52

In 2017, the other food crops grown under cover industry had the highest weighted median hourly wage at $14.52.

Prevailing wages and employment practices

When agricultural employers cannot attract enough local workers for seasonal jobs, they can seek additional domestic or foreign workers through the federal Agricultural Recruitment System (ARS) or the H-2A program. The ARS allows employers to file job orders for domestic workers at their local WorkSource (employment services) office. WorkSource then recruits and refers workers from other regions in the state, or other states, upon request.[3]

H-2A is an employment-related visa that allows individuals to work for a particular employer. The H-2A program allows employers to hire foreign workers on a temporary basis to perform agricultural work when there are not enough domestic workers available. In order to use the H-2A program, employers must first show they were unable to recruit enough domestic workers by filing a job order through the ARS.[4]

Employers who file job orders through the ARS must describe anticipated job duties and the conditions of employment. Job orders must also contain assurances that workers who live outside the area of intended employment will have similar wages, benefits and employment standards to local workers. This is intended to prevent the use of foreign or out-of-state U.S. workers from lowering wages and employment standards for local workers.

Federal regulations at 20 CFR 653.501 require that wages offered to workers hired through the ARS must not be less than the "prevailing wages" in the area of intended employment or the applicable federal or state minimum wage, whichever is higher.

According to the federal regulations at 20 CFR 655.122, the average hourly wages paid to workers hired through the H-2A program must be the highest of the AEWR,[5] the prevailing hourly wage or piece rate, the agreed-upon collective bargaining wage, or the federal or state minimum wage. This applies to cases except where a special procedure is approved for an occupation or specific class of agricultural employment, regardless of whether an employer pays a piece rate or an hourly rate for a given commodity activity. The U.S. DOL Office of Foreign Labor Certification (OFLC) annually publishes the AEWR in a Federal Register notice, at which time it becomes effective for all workers hired through the ARS or the H-2A program. The AEWR in Washington state was $13.38 per hour in 2017 and $14.12 per hour in 2018.[6]

[3] For more information, see U.S. Department of Labor, Employment and Training Administration. "Agricultural Recruitment System (ARS)." www.doleta.gov/programs/ars.cfm (accessed July 16, 2018).

[4] For more information, see U.S. Department of Labor, Employment and Training Administration. "H-2A Temporary Agricultural Program." www.foreignlaborcert.doleta.gov/H-2A.cfm (accessed July 16, 2018).

[5] The AEWR is equal to the annual weighted average hourly wage rate for all non-supervisory field and livestock workers in a given region.

[6] For more information, see U.S. Department of Labor, Employment and Training Administration. "Adverse Effect Wage Rates — Year 2017." www.foreignlaborcert.doleta.gov/adverse.cfm (accessed July 2, 2018).

Regulations contained at 20 CFR Part 655, subpart B, and 20 CFR Part 653, subpart F, define the "prevailing" and "normal or common" practices for seasonal U.S. agricultural workers that DOL may allow in job orders filed through the ARS. To establish allowable wages and practices, ESD reports on what employers offer or use for the week of the most recent growing season where they had the most workers (the peak week of employment).

Establishing prevailing wages

DOL provides funding for State Workforce Agencies (SWAs) to conduct surveys that help regional offices determine allowable wages and practices for job orders through the ARS or H-2A program. DOL's Employment Training Administration (ETA) Handbooks 385 and 398, which refer to SWAs as State Employment Services Agencies (SESAs), provide guidelines for these surveys.

Federal guidelines encourage SWAs to conduct prevailing wages and employment practices surveys for any commodity activity to which one or more of the following conditions apply:

1. One hundred or more workers were employed in the previous season, or are expected to be employed in the current season;
2. Foreign workers were employed in the previous season, or employers have requested or may be expected to request foreign workers in the current season, regardless of the number of workers involved;
3. The crop activity has an unusually complex wage structure, or there are other factors affecting the prevailing wage which can best be determined by a wage survey; or
4. The crop or crop activity has been designated by the national office as a major crop or crop activity either because of the importance of the production of this crop to the national economy, or because large numbers of workers are employed in the crop activity in a number of different areas in the country.[7]

ESD, the SWA for Washington state, does not have administrative data on the number of workers employed nor comprehensive data on wage structures at the commodity activity level. Consequently, job descriptions contained in H-2A job orders are used to determine which commodity activities to analyze from the surveys.

SWAs calculate the prevailing wage according to one of two rules. The first is the 40 percent rule, which states that if 40 percent or more of the seasonal U.S. workers surveyed for a given activity receive the same pay rate, then it becomes the prevailing wage. If two separate wage rates apply to 40 percent of U.S. seasonal workers surveyed for an activity, then both are prevailing wage rates.

[7] U.S. Department of Labor, Employment and Training Administration. Handbook No. 385. Washington, D.C.: GPO, 1981: p. I-115.

The second rule is the 51 percent rule, which applies when no single wage rate covers 40 percent of the workers in the survey sample. This rule requires arranging wage rates from highest to lowest and counting the number of workers who receive each wage rate. Then, SWAs calculate the cumulative number of workers in the sample until 51 percent of all workers are covered. The wage rate that includes the worker in the 51st percentile of the wage distribution becomes the prevailing wage.

If there is not a single unit of payment for workers who perform a given activity (e.g., some workers are paid by the pound and some are paid by the hour), SWAs determine which pay unit applies to the largest number of workers. SWAs then determine the prevailing wage according to either the 40 percent or the 51 percent rule from among workers who receive the most common pay unit.[8]

Establishing prevailing and normal or common practices

A practice is prevailing if at least 50 percent of all employers who also hire at least 50 percent of all U.S. seasonal workers use the practice for a given commodity activity. The following practices are subject to the prevailing threshold: the provision of family housing to non-working family members, transportation and subsistence costs, and frequency of payment.

There is no specific quantitative threshold for normal or common practices. Instead, normal or common means, "situations which may be less than prevailing, but which clearly are not unusual or rare. The degree to which a practice is engaged in (or a benefit is provided) should be determined to be close to what is viewed (and measured) as 'prevailing,' but the degree by which the practice or benefit is measured and degree of proof needed to establish its acceptability for H-2A purposes is not as formal or stringent as 'prevailing' calls for."[9]

The following practices are subject to the normal or common threshold: minimum productivity standards, provision of tools and equipment, employee qualifications (e.g., experience) and the positive recruitment of U.S. nationals. Note also that minimum productivity standards only apply to activities for which the prevailing wage is a piece rate.[10]

Because H-2A regulations already establish requirements for other employment practices in agricultural job orders, ESD only surveys employers regarding the provision of family housing, minimum productivity standards and experience requirements. SWAs must

[8] U.S. Department of Labor, Employment and Training Administration. Handbook No. 385. Washington, D.C.: GPO, 1981: pp. I-116 – I-117.

[9] U.S. Department of Labor, Employment and Training Administration. Handbook No. 398. Washington, D.C.: GPO, 1988: p. II-7.

[10] U.S. Department of Labor, Employment and Training Administration. Handbook No. 398. Washington, D.C.: GPO, 1988: p. II-10.

survey both H-2A and non-H-2A employers concerning the provision of family housing and minimum productivity standards, but only non-H-2A employers concerning experience requirements.

Note that ESD only reports the number and percentage of employers and workers who offer or receive a benefit, or who are subject to an employment practice. Ultimately, DOL's Regional Administrators use their discretion when making normal or common practice determinations.

Submitted H-2A applications in Washington state

From 2000 through 2013, ESD focused its prevailing wages and employment practices surveys on activities associated with growing apples, cherries and pears. This focus was largely due to the small number of commodity activities for which ESD received H-2A applications.

In 2015, ESD increased the number of commodities covered in the survey to better align with submitted job orders. The survey included the following: apricots; beans (fresh and dry); bees; beets; blackberries; blueberries; cabbage; carrots; collard greens; corn; goats; grapes; grass crops; green onions; herbs; kale; leeks; lettuce; mustard greens; nectarines; nursery crops (e.g., flowers, shrubs, transplants and trees); peaches; plums; pluots; radishes; raspberries; sheep; spinach; strawberries and zucchini. For 2016 and 2017, ESD structured the surveys to be more open-ended, allowing employers to report for any commodity.

The increase in H-2A applications over the last few years is the main reason ESD broadened the scope of the survey. *Figure 15* shows the number of H-2A applications and workers requested for Washington state and nationwide.[11] In 2007, 26 applications were submitted in Washington state. By 2017, the number of applications submitted had increased more than 700 percent to 210 applications. During the same time period, the total number of H-2A workers requested in the state increased by more than 1,000 percent, from 1,688 in 2007 to 18,920 in 2017. The average number of workers requested per application varied, ranging from an average of 65 workers per application in 2007 to 177 workers in 2011, with an average of 90 workers per application in both 2016 and 2017.

[11] For more information about the national data, see U.S. Department of Labor, Employment and Training Administration. "OFLC Performance Data" www.foreignlaborcert.doleta.gov/performancedata.cfm (accessed January 10, 2019).

Figure 15. H-2A applications submitted and workers requested*
U.S. and Washington state, 2007 through 2017
Sources: Employment Security Department, Employment Connections Division – Foreign Labor Certification Program; U.S. Department of Labor, Office of Foreign Labor Certification, Fiscal Year Performance Summaries

Year	Washington				United States			
	Employer applications submitted	Percent change	Workers requested	Percent change	Employer applications submitted	Percent change	Workers requested	Percent change
2007	26	N/A	1,688	N/A	7,740	N/A	80,413	N/A
2008	34	30.80%	2,513	49.90%	8,096	4.60%	86,134	7.10%
2009	30	-11.80%	1,882	-25.10%	7,857	-3.00%	91,739	6.50%
2010	25	-16.70%	2,981	58.40%	7,378	-6.10%	89,177	-2.80%
2011	18	28.00%	3,182	6.70%	7,361	-0.20%	83,844	-6.00%
2012	33	83.30%	3,953	24.20%	8,047	9.30%	90,362	7.80%
2013	55	66.70%	6,194	56.70%	8,388	4.20%	105,735	17.00%
2014	82	49.10%	9,047	46.10%	9,405	12.10%	123,528	16.80%
2015	114	39.00%	12,125	34.00%	10,339	9.90%	145,874	18.10%
2016	146	28.10%	13,148	8.40%	8,684	-16.00%	172,654	18.40%
2017	210	43.84%	18,920	43.90%	10,097	13.99%	206,156	19.40%

*N/A means not applicable, as 2007 is the base year for comparison. U.S. DOL reports national data according to the federal fiscal year. Washington state data do not include applications submitted for sheepherder, goat herder and beekeeper jobs.

More than eight times as many H-2A applications were submitted in Washington state in 2017 than in 2007. The number of H-2A workers requested was more than 11 times greater in 2017 than in 2007.

Prevailing wages for Washington state

The number of workers in a survey sample required to make a prevailing wage determination depends on the estimated population size for a given commodity activity. When the estimated population of workers for a commodity activity is greater than or equal to 100 and less than or equal to 2,999, the sample must include a minimum of between 100 and 600 workers in order to publish a prevailing wage. When the estimated population of workers is greater than or equal to 3,000, the sample must include at least 15 percent of the estimated population to publish a prevailing wage.[12]

Figure 16 presents prevailing wages for those commodity activities for which ESD could make a determination from the results of the 2017 Agricultural Peak Employment Wage and Practice Employer Survey. When prevailing wages are hourly rates lower than the AEWR, employers must pay workers hired through the ARS or H-2A program the current AEWR. For piece rates, ESD also surveyed for the hourly earnings guarantee, which is the minimum an employer must pay to an agricultural worker, regardless of activity or amount of work. According to federal guidelines, employers who hire workers through the ARS or the H-2A program can pay the AEWR or the prevailing piece rate to workers engaged in commodity activities

[12] U.S. Department of Labor, Employment and Training Administration. Handbook No. 385. Washington, D.C.: GPO, 1981: p. I-114.

for which the prevailing wage is a piece rate. Regardless of which pay rate they use, employers who use the ARS or H-2A program to hire workers must ensure their average hourly wage rate in a given week is equal to or greater than the AEWR.

The prevailing wage rate for cherry pruning was $12.50 per hour, and $13.38 per hour for cherry thinning. Cherry harvest ranged from $3.50 to $6.00 per lug, with wage rates dependent on cherry type and lug size. For example, yellow cherries tend to be harvested in a 20-pound lug as they are more sensitive to bruising and harvesters must take greater care. For pear harvest, the prevailing wage was $22 for Bartlett, $21 for Bosc and $26.50 for D'Anjou per 47"x47"x24.5" bin. Pear tree pruning was $12.50 per hour and thinning $13.38 per hour. The prevailing wage for blueberry harvest was $11.00 per hour.

Figure 16. Prevailing wages by commodity activity*
Washington state, 2018
Source: Employment Security Department/LMEA, 2017 Agricultural Peak Employment Wage and Practice Employer Survey

Crop	Activity	Prevailing wage rate	Unit	Hourly earnings guarantee	Dimension
Blueberries	Harvesting	$11.00	Hourly	N/A	N/A
Cherries (all)	Tree pruning	$12.50	Hourly	N/A	N/A
Cherries (all)	Tree thinning	$13.38	Hourly	N/A	N/A
Cherries/Dark Red	Harvesting	$4.00	Lug	$13.30	20 pounds
Cherries/Lapin	Harvesting	$4.00	Lug	$13.30	20 pounds
Cherries/Red	Harvesting	$6.00	Lug	N/A	30 pounds
Cherries/Skeena	Harvesting	$3.50	Lug	$13.38	20 pounds
Cherries/Sweetheart	Harvesting	$4.00	Lug	$13.38	20 pounds
Cherries/Yellow	Harvesting	$6.00	Lug	$13.30	20 pounds
Pears (all)	Tree pruning	$12.50	Hourly	N/A	N/A
Pears (all)	Tree thinning	$13.38	Hourly	N/A	N/A
Pears/Bartlett	Harvesting	$22.00	Bin	$13.38	47"x47"x24.5"
Pears/Bosc	Harvesting	$21.00	Bin	$13.38	47"x47"x24.5"
Pears/D'Anjou	Harvesting	$26.50	Bin	$13.38	47"x47"x24.5"

*Results include only commodity activities for which ESD received a sufficient sample size according to federal guidelines.

Two hourly prevailing wage rates were equal to the 2017 AEWR of $13.38.

Prevailing and normal or common practices for Washington state

The only practice in the 2017 survey subject to the prevailing determination was the provision of housing to non-working family members and whether that housing is free. The majority of employers answered "no" for the provision of family housing for those crop-variety-activities with a sufficient sample size. It follows that the provision of free family housing is also not a prevailing practice. This is similar to results from the 2016 survey.

ETA Handbook 398 does not specify a threshold for normal or common practices. However, DOL's Office of Foreign Labor Certification advises that at least 33 percent of employers in a sample must report having any standard or practice before said practice is allowable as "normal or common." ESD applied this to minimum productivity standards and experience requirements.

ESD first determined if at least 33 percent of employers in the sample had a minimum productivity standard or experience requirement, reporting the most common quantifiable standard given by employers. As in 2016, minimum productivity standards and experience requirements were not normal or common for any commodity activity in 2017. Although the number of employers responding to the survey increased from 696 in 2016 to 820 in 2017, more employers responded "no" or skipped the employment practice questions entirely, resulting in "no findings."

Agricultural labor force dynamics

Inter- and intra-industry employment transfers

Washington state's agricultural sector has many seasonal changes resulting from weather and geographical characteristics that may prompt worker movement. Many agricultural workers perform a variety of jobs and work for more than one employer in the course of a year. Workers may stay in agriculture, or they may leave for reasons such as health or employment in another industry. Workers may choose to transfer to higher paying industries such as construction, or to industries like services and retail where labor demand is typically more stable. Agriculture's mobile workforce can be measured by looking at overall labor force counts, inter- and intra-industry employment transfers, and post transfer average hourly wage rates.

Figure 17 details agricultural and nonfarm transfers and average hourly wage rates. During 2017, more inter-industry transfers occurred in the agricultural sector, with 27 percent of the agricultural workforce moving into or out of another industry compared to 17 percent for nonfarm industries. Intra-industry transfers were 6 percent for agriculture and 4 percent for nonfarm. Average hourly wage rates in agriculture were about 28 cents lower after an inter-industry transfer and 22 cents lower after an intra-industry transfer. For nonfarm industries, post transfer average hourly wage rates decreased by 72 cents for inter-industry and increased by $1.12 for intra-industry.

Figure 17. Inter- and intra-industry employment transfers
Washington state, 2017
Source: Employment Security Department/LMEA, UI Wage File and QCEW

Industries	Annual employment	Average hourly wage rates	Inter-industry transfers	Inter-industry post transfer average hourly wage rate	Intra-industry transfer	Intra-industry post transfer average hourly wage rate
Nonfarm	2,928,930	$29.36	494,236	$28.64	110,869	$30.48
Agriculture	106,842	$18.26	28,603	$17.98	6,439	$18.04

Agriculture had higher rates of both inter- and intra-industry transfers, suggesting a more mobile workforce.

Labor shortages

Agricultural labor supply in Washington state has historically included temporary migrant labor, often from Mexico. One study from 2014 suggests that demographic composition, institutional, governmental and economic changes in the U.S. and Mexico have resulted in decreases in migration rates, impacting agricultural employers' ability to meet seasonal labor needs.[13] Nationwide, there has been a large increase in demand for temporary migrant agricultural workers. According to the U.S. Department of Homeland Security, the number of H-2A visas increased from 283,580 in 2015 to 412,820 in 2017.

Previous research, detailed in *Appendix 3*, used a threshold of simultaneous occurrence of rising wages (40 percent or more) and falling employment (50 percent or less) as an indicator of a labor shortage.[14] This research guided the methods and definitions used in this report to aid in identifying evidence of labor shortages in agricultural industries at the state and regional level.

When measuring statewide, no agricultural industries met the pre-established criteria for labor shortages. *Figure 18* presents the six agricultural industries at the state level that were closest to the threshold, including those industries with an over-the-year average annual wage growth and employment level decrease of more than 3 percent and at least 5 percent, respectively, from 2016 to 2017.

Between 2016 and 2017, agricultural covered employment in Washington state increased by 0.7 percent, while wages increased by 3.5 percent. By industry, mushroom production had the greatest change in employment with a decrease of 11.8 percent, while wages increased 8.4 percent. At 16.2 percent, goat farming had the largest increase in wages, with associated employment decreasing by 7.1 percent.

[13] Perloff, Jeffrey M., Fan, Maoyong, Gabbard, Susan, and Pena, Anita Alves. (2014). "Why Do Fewer Agricultural Workers Migrate Now?". IRLE Working Paper No. 117-14. http://irle.berkeley.edu/files/2014/Why-Do-Fewer-Agricultural-Workers-Migrate-Now.pdf.

[14] Hertz, T., and S. Zahniser. 2013. "Is There A Farm Labor Shortage?" American Journal of Agricultural Economics 95 (2): 476-481.

Figure 18. Agricultural industries with rising average annual wages and falling average annual employment*
Washington state, 2016 and 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW

Industry	Employment			Wages		
	2016	2017	Change	2016	2017	Change
Soil preparation, planting and cultivating	642	591	-7.9%	$32,577	$34,031	4.5%
Broilers and meat type chicken production	29	27	-6.9%	$31,345	$32,977	5.2%
Hay farming	1,315	1,240	-5.7%	$30,577	$32,129	5.1%
Mushroom production	417	368	-11.8%	$26,060	$28,240	8.4%
Berry, except strawberry, farming	2,795	2,625	-6.1%	$25,492	$26,781	5.1%
Goat farming	28	26	-7.1%	$13,678	$15,891	16.2%

*Statewide industries that had more than three percent average annual wage growth and an average annual employment decrease of at least five percent.

No agricultural industries showed evidence of labor shortages using the criteria for simultaneous rising average annual wages and falling average annual employment.

Figure 19 presents the same labor shortage analysis of wage and employment changes for agricultural reporting areas, showing those industries with a percentage point gap of at least 25 between rising average annual wages and falling average annual employment. With a 45.1 percent increase in average annual wages and a 21.1 percent decrease in average annual employment, the other food crops grown under cover industry in South Central Area 2 met the criteria, suggesting evidence of a labor shortage.

Figure 19. Agricultural industries with rising average annual wages and falling average annual employment*
Washington state select agricultural reporting areas, 2016 and 2017
Source: Employment Security Department, LMEA; U.S. Bureau of Labor Statistics, QCEW

Area	Industry	Employment			Wages		
		2016	2017	Change	2016	2017	Change
Western Area 1	Other postharvest crop activities	150	111	-26.0%	$25,750	$29,002	12.6%
	All other miscellaneous crop farming	488	396	-18.9%	$25,622	$28,604	11.6%
	Other noncitrus fruit farming	45	38	-15.6%	$14,098	$16,938	20.1%
South Central Area 2	Potato farming	80	54	-32.5%	$34,640	$48,046	38.7%
	Soil preparation, planting and cultivating	266	179	-32.7%	$29,520	$30,418	3.0%
	Other food crops grown under cover	190	150	-21.1%	$15,532	$22,539	45.1%
Columbia Basin Area 4	Hay farming	446	394	-11.7%	$29,813	$34,185	14.7%
Eastern Area 6	Nursery and tree production	75	65	-13.3%	$21,563	$24,336	12.9%

*Agricultural industries with a 25 or more percentage point gap between rising average annual wages and falling average annual employment by select agricultural reporting areas.

The other food crops grown under cover industry in South Central Area 2 met the criteria for a labor shortage average annual employment.

Figure 20 provides a more localized analysis using county-level data, presenting industries with a 25 or more percentage point gap between rising average annual wages and falling average annual employment. One county had an agricultural industry meet the criteria to indicate a possible labor shortage. The other food crops grown under cover industry in Yakima county had an increase in average annual wages of 63.4 percent and a decrease in average annual employment of 17.8 percent, a gap of more than 80 percentage points.

While the results provided give some insight into the possibility of agricultural labor shortages in Washington state, they are not definitive and should not be viewed as proof of a labor shortage.

Figure 20. Agricultural industries by county with rising average annual wages and falling average annual employment*
Washington state, 2016 and 2017
Source: Employment Security Department, LMEA; U.S. Bureau of Labor Statistics, QCEW

County	Industry	Employment			Wages		
		2016	2017	Change	2016	2017	Change
Adams	Other vegetables (except potato) and melon farming	111	65	-41.4%	$39,307	$41,569	2.7%
	All other miscellaneous crop farming	173	116	-33.0%	$23,953	$28,793	16.7%
	Soil preparation, planting, and cultivating	38	37	-2.6%	$48,092	$63,474	28.2%
	Postharvest crop activities (except cotton ginning)	157	131	-16.6%	$30,459	$35,697	13.8%
Chelan	Other food crops grown under cover	76	62	-18.4%	$20,558	$23,750	12.2%
Clark	Berry (except strawberry) farming	60	42	-30.0%	$13,231	$15,930	16.9%
Grant	Hay farming	357	306	-14.3%	$28,053	$33,603	16.3%
Pend Oreille	Other food crops grown under cover	26	25	-3.9%	$15,148	$19,755	26.6%
Snohomish	Berry (except strawberry) farming	22	20	-9.1%	$10,020	$12,617	22.3%
Walla Walla	Hay farming	80	64	-20.0%	$27,965	$30,498	5.9%
	Soil preparation, planting, and cultivating	36	28	-22.2%	$12,681	$15,407	18.0%
Whatcom	Beef cattle ranching and farming	32	24	-25.0%	$22,907	$24,141	2.3%
	Postharvest crop activities (except cotton ginning)	105	71	-32.4%	$23,643	$28,610	17.5%
Whitman	All other miscellaneous crop farming	26	23	-11.5%	$19,868	$27,488	34.3%
Yakima	Beef cattle ranching and farming	80	54	-32.5%	$33,635	$48,046	38.7%
	Other noncitrus fruit farming	5,660	4,071	-28.1%	$23,633	$24,518	0.7%
	Other food crops grown under cover	157	129	-17.8%	$14,556	$24,494	63.4%
	Hay farming	127	100	-21.3%	$28,225	$31,486	8.3%
	Soil preparation, planting and cultivating	263	178	-32.3%	$28,805	$30,348	2.3%

*Industries by county with a 25 or more percentage point gap between rising average annual wages and falling average annual employment.

Of the 39 counties in Washington state, one had an agricultural industry with wage and employment changes that indicated evidence of a labor shortage.

Appendices

Appendix 1. Agricultural industry NAICS codes

Following the 2017 North American Industry Classification System (NAICS), analyses tended to reflect the economic sector level for Agriculture (11 NAICS) or industries within the sector (six-digit NAICS). For this report, all industries within the economic subsectors (three-digit NAICS) of forestry and logging (113 NAICS) and fishing, hunting and trapping (114 NAICS) were excluded, as well as those within the industry group (four-digit NAICS) of support activities for forestry (1153 NAICS). *Appendix figure A1-1* lists the agricultural industry NAICS codes used for analysis.

Appendix figure A1-1. Agricultural industry NAICS codes used for analysis
United States, 2017
Source: Employment Security Department/LMEA; U.S. Census Bureau, NAICS

6-digit NAICS	Industry
111110	Soybean farming
111130	Dry pea and bean farming
111140	Wheat farming
111150	Corn farming
111191	Oilseed and grain combination farming
111199	All other grain farming
111211	Potato farming
111219	Other vegetable and melon farming
111331	Apple Orchards
111332	Grape vineyards
111333	Strawberry farming
111334	Berry, except strawberry, farming
111335	Tree nut farming
111336	Fruit and tree nut combination farming
111339	Other noncitrus fruit farming
111411	Mushroom production
111419	Other food crops grown under cover
111421	Nursery and tree production
111422	Floriculture production
111940	Hay farming
111991	Sugar beet farming
111998	All other miscellaneous crop farming
112111	Beef cattle ranching and farming
112112	Cattle feedlots
112120	Dairy cattle and milk production
112210	Hog and pig farming
112310	Chicken egg production
112320	Broilers and meat type chicken production
112330	Turkey production

6-digit NAICS	Industry
112340	Poultry hatcheries
112390	Other poultry production
112410	Sheep farming
112420	Goat farming
112910	Apiculture
112920	Horses and other equine production
112930	Fur-bearing animal and rabbit production
112990	All other animal production
115112	Soil preparation, planting, and cultivating
115113	Crop harvesting, primarily by machine
115114	Other postharvest crop activities
115115	Farm labor contractors and crew leaders
115116	Farm management services
115210	Support activities for animal production

Appendix 2. Decomposition of seasonal and variable employment

Stable and variable employment estimates for this report were produced using time series decomposition models from R, an open source language and environment for statistical computing and graphics.[15] Estimates result from the disaggregation of covered employment by industry levels for both the state as a whole and by agricultural reporting area.

The level of aggregation determines stable and variable employment shares (fraction of employment). Generally, the shares of variable employment are lower for employment time series with less classification detail (e.g., two-digit NAICS) than series with greater classification detail (e.g., six-digit NAICS). The main reason for this is that all employment movements between series with greater classification detail are variable employment (e.g., employment movements between the 111331 and 111339 industries) but become stable employment if they are within the same aggregated series (e.g., 1113 industry group). However, some exceptions can be attributed to model performance and to the limited coverage of detailed series.

Using standard statistical tools for time series decomposition, employment time series can be split into four basic components:

1. **Seasonal**: regular and predictable employment changes that recur each calendar year, caused by seasonal factors, which can include natural factors (changes in weather, regular variations in crop activities, etc.), administrative measures (starting and ending of the school year) and social, cultural or religious traditions (fixed holidays such as New Year's Day).
2. **Cyclical**: employment changes attributed to the business cycle in general or specific events.
3. **Trend**: shifts in long-term employment growth driven by fundamental structural changes and productivity trends in industries, rather than the cyclical fluctuations in employment.
4. **Irregular**: random employment changes not picked up by regular seasonal and cyclical components (e.g., non-regular seasonality, weather variation and labor strikes).

Decomposition of employment for each point in time (e.g., months) is:

Employment = combined trend + seasonal + irregular

where combined trend refers to trend + cycle.

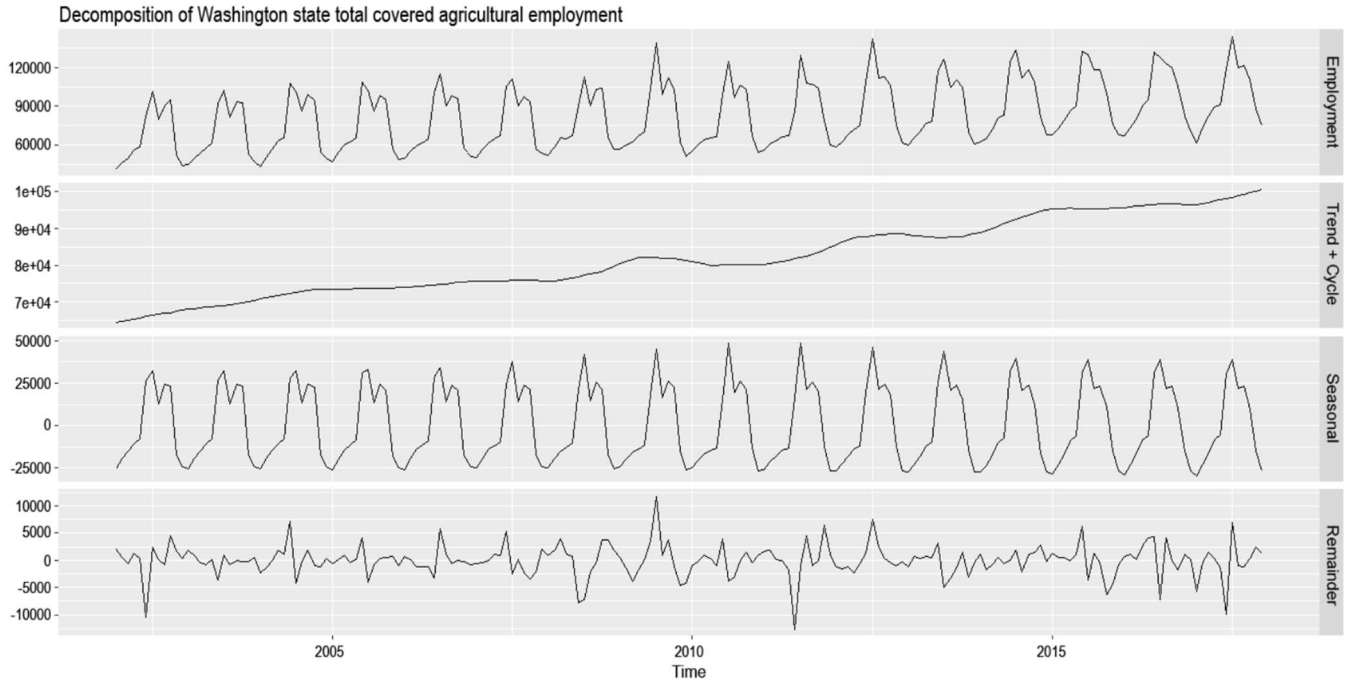
[15] www.r-project.org/about.html

There are two steps in the process of time series decomposition:

1. Splitting of series between combined trend, seasonal and irregular components.
2. Splitting of the combined trend into trend and cyclical components.

The results of the decomposition of total agriculture employment are presented in *Appendix figure A2-1*.

Appendix figure A2-1. Total covered agricultural employment and its main components
Washington state, 2002 through 2017
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, QCEW



For the decomposition, trend expresses the movement of the mean. The three other components are variances around the mean. The totals of the seasonal components are close to zero in each year. The totals of cyclical components are eventually equal to zero for the entire period, but not for each year. The totals of irregular components are close to zero for the entire period. For the most part, the differences between zero and totals for seasonal and irregular components cancel each other out for the entire period. As a result, totals of variances around the mean for the entire period are close to zero.

Yearly minimum employment values were calculated for the three variable components of seasonal, cycle and irregular. These three components were then normalized by subtracting the yearly minimums from actual values and, through the decomposition, summarized as one measure of variable employment. As stable employment is the difference between variable employment and the original covered employment, only a series with positive stable employment for all months is deemed "non-failed" and considered for inclusion.

In short, three variables were transformed from being variances around means (positive and negative) to positive differences from minimums, defined for each year. Initial employment was decomposed into the two components of stable employment (based on annual minimums) and variable employment (positive variances from minimums). These two components can be interpreted as nonseasonal employment (stable) and generalized seasonal employment (variable), where seasonality combines regular seasonal variations with related irregular and cyclical components.

Appendix 3. Application and limitations of Hertz and Zahniser's (2013) criteria that defines labor shortages

Hertz and Zahniser's (2013) criteria defining labor shortages consists of identifying a simultaneous increase in wages (40 percent or more) and decrease in employment (50 percent or less) in a geographic area.[16]

As in Hertz and Zahniser's work, QCEW data was used for this report's labor shortage analysis. However, employer records and quarterly wages were used instead of aggregated suppressed data and weekly wages. Quarterly data for 2016 and 2017 were aggregated to create average annual employment and average annual wages (totals of quarterly wages divided by average annual employment). To make wages comparable from 2016 to 2017, the BLS ECI of 1.0299 was used. Only those industries with a minimum employment of 20 were included for analysis.

Hertz and Zahniser's (2013) criteria hinge crucially on the classical assumption of unidirectional movement of labor supply and wage, i.e., labor supply increases (decreases) when wages increase (decrease); they regard a significant decrease in employment in response to a wage increase as a sign of labor shortage. Even if this theoretical assumption is valid in principle, it is often challenging to find empirical evidence that supports the theoretical relationship for the following conceptual and practical reasons.

First, even when the theory is valid, the relationship may only hold in the long run. In other words, there must exist a certain time lag between a shock and an adjustment to the shock. For instance, when there is a wage rise in agriculture, it takes time for workers to respond to the change in the labor market, as the response requires a series of steps such as recognition of the change, acquisition of new skill sets, application submission and job interview and so on. Thus, a contemporaneous comparison between wage and labor supply may not reveal the relationship that is expected in principle.

The second reason is more practical. Data available to researchers are the end result of past and immediate changes in wages, employers' production costs, workers' skills, job opportunities, preferences and other factors that affect the supply and demand of labor. In other words, what researchers observe in the available data may not be the result of an immediate change in one factor but of past or immediate changes of several other factors. For example, when the AEWR increases the number of workers in cherry orchards does not necessarily increase if a late frost reduces the production of cherries in a region. Thus, it is the researchers' challenge to isolate the effect of wage changes on employment from the effect of the other factors, which is lacking in Hertz and Zahniser's approach.

[16] Hertz, T., and S. Zahniser. 2013. "Is There A Farm Labor Shortage?" American Journal of Agricultural Economics 95 (2): 476-481.

In fact, correlation analysis reveals a negative relationship between wages and employment, which appears to contradict the main premise of Hertz and Zahniser's approach: if wages increase then employment increases. ESD's correlation analysis may suggest that the number of workers demanded by agricultural employers has more influence in the agricultural labor market than the number of agricultural workers working or willing to work in agriculture.

Appendix 4. Analysis of employment transfer

Agricultural employment transfers were analyzed using UI Wage File data from fourth quarter 2016 through fourth quarter 2017. The following were calculated for all pairs of consecutive quarters:

a. Number of workers, wages, hours and hourly wages for the base quarter. Hourly wages were calculated by dividing cell wages by cell hours.

b. Number of workers that had existed in the base quarter but disappeared in the next quarter, along with their wages, hours and hourly wages.

c. Number of workers that had not existed in the base quarter but appeared in the next quarter, along with their wages, hours and hourly wages.

d. Matrices of workers that showed movement from one industry to another. For each industry pair, number of workers, wages and hourly wages before and after the movement were calculated.

e. Number of workers that moved (within an industry) from one employer to another. For each industry, wages, hours and hourly wages before and after the movement were calculated.

Data was then annualized. For wages and hours, each category was totaled for all quarters. Hourly wages were produced by dividing wage totals for each year by hour totals. Annual averages were calculated for job counts. Because of this process, quarterly and annual indicators for hourly wages and employment were available for each six-digit NAICS industry. The following indicators served as the basis for the employment movement analysis:

a. Moved out of industry and wage file (lost)

b. Moved in industry and wage file (new)

c. Moved from an industry to other industries (inter-industry transfer out)

d. Moved from other industries to an industry (inter-industry transfer in)

e. Moved inside industry from one employer to another (in-industry transfer)

Two challenges stemmed from the nature of the data. Employer NAICS codes were used to identify workers' movements between sectors and industries. Although an employer may have multiple business activities each corresponding to a different NAICS code, the UI Wage File allows only one NAICS code for each employer ID. As a result, workers can be identified as experiencing industry transfer without a job change due to NAICS code changes associated with their employer.

The other challenge comes from the employees' side. An individual may work for multiple employers. For those workers, the "primary job" was defined as the job with the longest working hours in a given quarter, and having different primary jobs in two consecutive periods was considered an employment transfer. Consequently, an employment transfer can occur even when the new primary job is not a new job for a given worker. This can lead to an overestimation of employment dynamics.

Appendix 5. Glossary of terms

Adverse Effect Wage Rate

Used in wage determinations for both the federal Agricultural Recruitment System (ARS) and H-2A program, the Adverse Effect Wage Rate (AEWR) is equal to the annual weighted average hourly wage rate for all non-supervisory field and livestock workers in a given region. The AEWR is published annually by the U.S. Office of Foreign Labor Certification (OFLC). In Washington state, the AEWR was $13.38 per hour in 2017 and $14.12 per hour in 2018.

Average and (weighted) median hourly wages

Average hourly wages were calculated by dividing total wages by total hours for each industry, while median hourly wages refer to hourly wages for the median (middle) worker. Because this median can be biased by differences in the hours worked by individuals, a weighted median hourly wage was calculated by arraying hourly wages and repeating each observation in line with the associated number of hours worked, then selecting the median value.

Covered employment

Covered employment refers to those workers covered by the unemployment insurance system, including all hired agricultural labor except for small farm operators, non-resident aliens, independent contractors and corporate officers.

NAICS

The North American Industry Classification System (NAICS) is used by federal statistical agencies to classify businesses for the purpose of collecting, analyzing and publishing statistical data related to the U.S. business economy. Estimates depend on the level of aggregation by NAICS used. Two-digit NAICS refers to the economic sector level, three-digit NAICS to the economic subsector, four-digit NAICS to the industry group and six-digit NAICS to the industry.