

Economic Contribution of Irrigated Agriculture Supported by the Columbia Basin Project



May 2022

Prepared For:

South Columbia Basin Irrigation District

East Columbia Basin Irrigation District

Quincy Columbia Basin Irrigation District

Prepared by:



Highland Economic, LLC
2425 NE 59th Ave, Suite 13103
Portland, OR 97213
(503) 894-9474

TABLE OF CONTENTS

Executive Summary.....	ES-1
CBP Agricultural Production.....	ES-2
Importance of Irrigation Water.....	ES-3
CBP Economic Contribution.....	ES-4
Fiscal Impacts.....	ES-6
Other CBP Benefits.....	ES-8
Recreation.....	ES-8
Economic Opportunity for Rural Areas & Minority Populations.....	ES-9
Agricultural Production and Profit Values in CBP Through Time.....	ES-10
Food Security.....	ES-11
1 Introduction.....	1
1.1 Data Sources & Methods.....	2
1.2 Study Area.....	3
1.3 Report Organization.....	3
2 Socioeconomic Profile.....	4
2.1 Population and Demographics.....	4
2.2 Economic Base.....	8
2.2.1 Employment.....	8
2.2.2 Income.....	11
2.3 Tax Base.....	14
2.3.1 Property Tax.....	14
2.3.2 Sales and Use Tax.....	14
3 Regional Agricultural Profile.....	16
3.1 Agricultural Production.....	16
3.1.1 Land Area.....	16
3.1.2 Value of Agricultural Production.....	18
3.1.3 Value of Irrigation Water.....	22
3.2 Agricultural Employment and Income.....	25
3.2.1 Farming.....	25
3.2.2 Agricultural Support and Product Processing.....	30
4 Economic Contribution of the CBP Agricultural Economy.....	34

4.1 Methodology & Data Sources 36

 4.1.1 Data Sources 37

4.2 CBP Crop Production Value and CBP-Supported Animal & Processing Values..... 38

4.3 Total Economic Contribution Estimates..... 42

5 Economic Contribution of CBP-Related Recreation..... 47

 5.1 Methodology..... 47

 5.2 Estimates of Recreation Visitation in the CBP 48

 5.2.1 State Parks & Columbia National Wildlife Refuge 48

 5.2.2 Recreation Expenditures in the CBP 51

 5.3 Economic Impact of CBP-Related Recreation Spending 53

6 Fiscal Contribution of CBP-Supported Agriculture & Recreation..... 55

7 Other Benefits of the CBP 56

 7.1 Economic Opportunity for Rural Areas & Minority Populations 56

 7.2 Recreation Benefits..... 56

 7.3 Agricultural Gross Production & Profits Through Time 57

 7.4 Food Security 58

8 Bibliography 60

LIST OF TABLES

Table 2-1: Population Growth, Past and Projected	4
Table 2-2: General Population Race & Ethnicity	6
Table 2-3: Agricultural Producer Race and Ethnicity	6
Table 2-4: Migrant and Seasonal Farmworkers	7
Table 2-5: Full and Part-Time Employment in 2019	8
Table 2-6: Non-Farm Employment by Industry in 2019.....	10
Table 2-7: Median Household Income, 2019.....	12
Table 2-8: Income by Industry, annual average from 2015-2019.....	13
Table 2-9: Property Tax, Assessed Value and Levy, FY 2021	14
Table 2-10: Sales and Use Taxes	15
Table 3-1: Land by CBP District and County.....	17
Table 3-2: Average Annual CBP District Acres by Crop Type	18
Table 3-3: Sales of Agricultural Products, 2017 (in thousands)	19
Table 3-4: Average Annual CBP District Production Value by Crop Type	21
Table 3-5: Average Annual Rainfall by County (Inches).....	23
Table 3-6: Average Annual Water Requirement by Crop and Location (Inches).....	23
Table 3-7: Wage and Salary Employment in Farming Industries, 2019	27
Table 3-8: Wages in Farming Industries, 2019 (in millions)	29
Table 3-9: Employment in Agricultural Support and Processing Industries, 2019	31
Table 3-10: Wages in Support and Processing Industries, 2019 (in millions)	33
Table 4-1: Estimated Annual CBP Crop Production Value by IMPLAN crop category	40
Table 4-2: Estimated Annual CBP-Supported Animal Production Value	41
Table 4-3: Estimated Food Processing/Manufacturing Value Reliant on CBP Crop Production	42
Table 5-1: Average Annual Total Visitation to Major Recreational Sites in the CBP	49
Table 5-2: Recreator Trip-Related Expenditures per Person Visit, 2021 dollars	52
Table 5-3: Total Annual Estimated Recreation Expenditures, 2020 Dollars	53

LIST OF FIGURES

Figure ES-1: Study Area Counties.....	ES-2
Figure ES-2: CBP Production Values by Crop	ES-2
Figure ES-3: Irrigation = Higher Economic Value	ES-3
Figure ES-4: Total Annual Employment and Annual Income Supported by CBP Irrigation Infrastructure (Direct, Indirect, & Induced)	ES-4
Figure ES-5: Distribution of Direct, Indirect, and Induced Effects by Source and Location.....	ES-7
Figure ES-6: Distribution of CBP-Supported Tax Revenues by Location and Source	ES-7
Figure ES-7: Acreage & Cumulative Crop Farm Sales and Profits	ES-10
Figure 1-1: Study Area Counties	3
Figure 2-1: Farm Employment in 2019	9
Figure 2-2: Unemployment, 2011-2020.....	11
Figure 3-1: Irrigated Cropland and Agricultural Sales per Acre, 2017	20
Figure 3-2: CBP Acreage and Production Value by Crop.....	22
Figure 3-3: Average Rental Rates for Irrigated and Non-Irrigated Land	24
Figure 3-4: Agricultural Economy of Grant and Lincoln Counties Compared	25
Figure 4-1: Total Employment and Annual Labor Income (Direct, Indirect, Induced) Supported by CBP Irrigated Agriculture.....	35
Figure 4-2: CBP Crop Production Value (By IMPLAN crop category)	39
Figure 4-3 Local Employment Supported by the CBP	43
Figure 4-4 Local Income Supported by the CBP	43
Figure 4-5 Elsewhere in Washington, Employment Supported by the CBP	44
Figure 4-6 Elsewhere in Washington, Income Supported by the CBP	44
Figure 4-7 Elsewhere in Nation, Employment Supported by the CBP	45
Figure 4-8 Elsewhere in Nation, Income Supported by the CBP.....	45
Figure 4-9 Source of Economic Effects: Crop Production, Animal Production vs. Food Processing.....	46
Figure 5-1 Total Employment Supported by CBP-Supported Recreation Facilities	54
Figure 5-2 Total Labor Income Supported by CBP-Supported Recreation Facilities.....	54
Figure 6-1 Estimated Total Tax Revenues Supported by the CBP by Source.....	55
Figure 6-2 Estimated Total Tax Revenues, % by Jurisdiction	55
Figure 7-1 CBP Irrigated Acreage & Cumulative Farm Sales and Profit through Time	58

EXECUTIVE SUMMARY

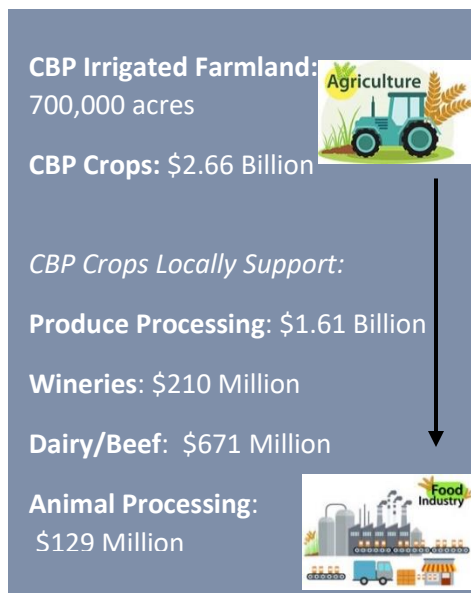
The Columbia Basin Project (CBP) is a Bureau of Reclamation irrigation project located in east central Washington. Originally authorized by Congress to irrigate 1,029,000 acres, CBP infrastructure of reservoirs and canals currently irrigates about 700,000 acres annually in Adams, Franklin, Grant, and Walla Walla Counties. The primary crops grown include hay, potatoes, corn, wheat, beans, orchard fruits, grapes, herbs, onions, grass seed, and vegetables.

The estimated annual value of crops in the CBP is \$2.66 billion dollars annually, or a value of approximately \$3,800 per acre.¹ CBP crops are vital inputs to other key food production sectors in the east central region of Washington State: dairy and beef cattle production, animal processing, frozen food and other food processing sectors, and wineries. **Further, a portion of CBP crops are used to produce animal products valued at \$671 million annually, while other CBP crops are used by regional food industries to produce food products valued at \$2.0 billion annually** (note: total animal and food processing production value in the region is over \$6.0 billion annually; the combined \$2.671 billion is the estimated value of animal and food processing production reliant on CBP crops). Unless otherwise noted, all dollar values in this analysis are expressed in 2021 dollars.

CBP irrigation infrastructure and the agricultural production and food processing it supports underpin substantial economic activity in the region, throughout the State of Washington, and even the rest of the nation. The purpose of this report is to quantify the economic contribution of lands irrigated by the CBP as well as the recreation supported by CBP reservoirs and associated fish and wildlife areas. Recreation at sites created by CBP irrigation infrastructure, such as Banks Lake, Potholes Reservoir, Columbia National Wildlife Refuge, and Scootney Reservoir, results in recreational spending in the local economy that also supports numerous businesses and economic sectors. The report estimates the employment, income, and tax revenues supported by the CBP at the local, state, and national levels.

The study region is six counties: Adams, Franklin, Grant, Walla Walla, Lincoln, and Benton counties. Adams, Franklin, and Grant have the vast majority of CBP-irrigated acreage. Walla Walla has some CBP irrigated acreage; agricultural land in Lincoln is authorized by Congress to receive CBP irrigation water (although the project has not been completed to reach lands in Lincoln), and Benton is closely tied with

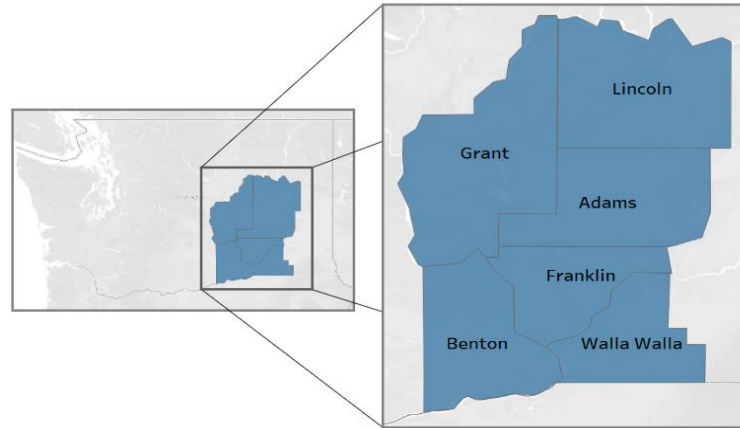
ANNUAL AGRICULTURAL PRODUCTION VALUES



¹ This compares to \$1.44 billion in crop revenue estimated in a comparable study in 2010; even adjusting for inflation the CBP current crop production value has risen 48% in value. Animal production and food processing supported by the CBP was estimated in the 2010 report at \$1.25 billion, or \$1.56 billion, after adjusting to 2021 dollars. The 2010 animal production and food processing values did not include dairy or animal processing that were included in this report.

the economy of the other counties as the regional hub of the tri-cities of Kennewick, Pasco and Richland spans both Benton and Franklin counties.

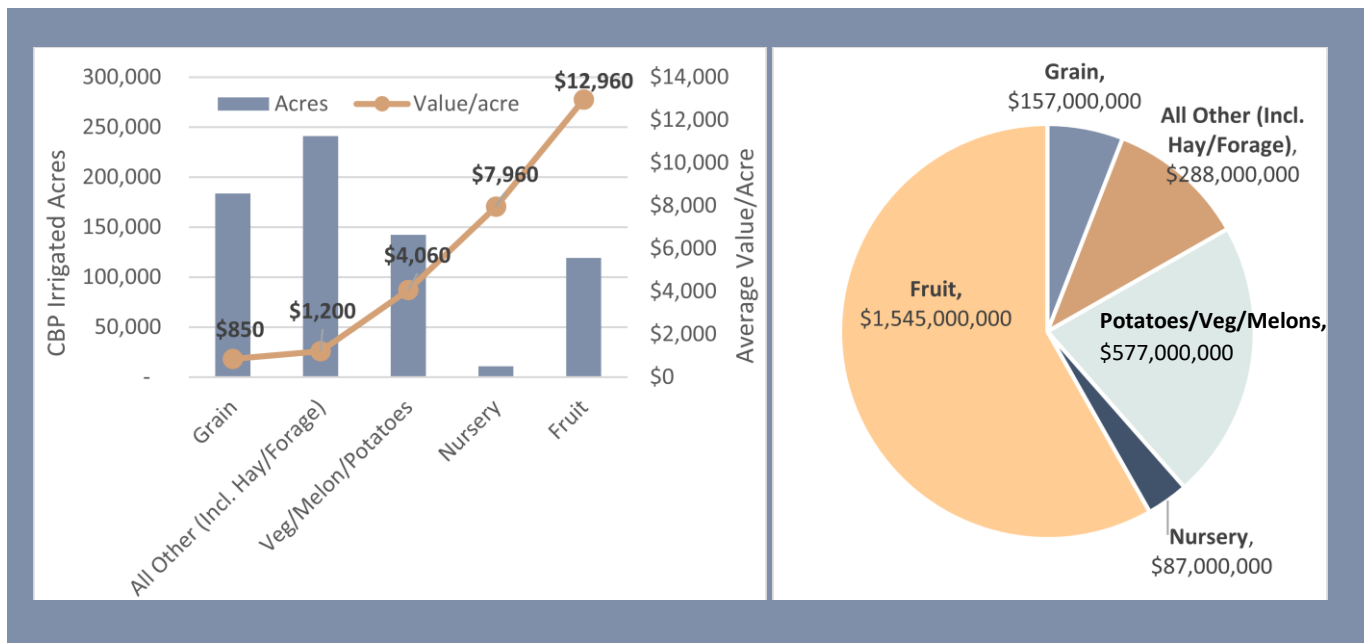
Figure ES-1: Study Area Counties



CBP AGRICULTURAL PRODUCTION

Total CBP crop production value is estimated at \$2.66 billion annually. CBP fruit and vegetable production of approximately \$2.1 billion annually accounts for 80% of total CBP crop production value on just 37% of CBP irrigated acreage due to its high value per acre (nearly \$13,000 per acre for fruit). A diverse array of fruits and vegetables are produced, including apples, cherries, grapes (table and wine grapes), peaches, berries, melons, squash, carrots, cauliflower, asparagus, celery, lettuce, onions, sweet corn, and potatoes. Approximately three-quarters of vegetable value is from potatoes and onions. Nursery crops are limited in acreage but have the next highest value per acre, at nearly \$8,000 per acre. Grain, hay, and other field crops account for over 60% of irrigated acreage and 17% of total crop

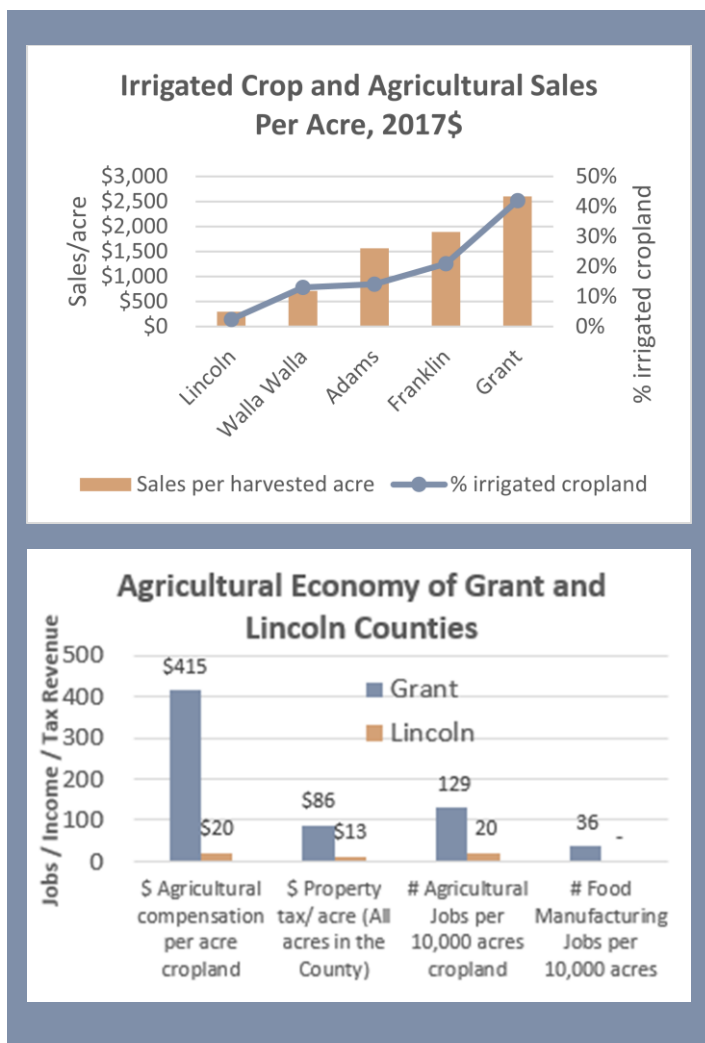
Figure ES-2: CBP Production Values by Crop





production value; while providing a lower sales value per acre, these crops are necessary as inputs for high-valued dairy and beef production and are also vital for soil health and rotation with vegetable and other crops.

Figure ES-3: Irrigation = Higher Economic Value



IMPORTANCE OF IRRIGATION WATER

The figures below highlight the importance of irrigation in supporting high value agricultural production. For example, irrigated grain acres (including dry bean production) produce crops valued at approximately \$850 per acre; this is approximately double the value produced on dryland grain acreage.² The figure highlights the relatively low countywide average sales per crop acre for Lincoln County (from the 2017 Census of Agriculture), where only 7% of lands are irrigated. In Franklin, Grant, Adams, and Walla Walla counties, CBP irrigation water not only increases the yields of grain crops, but also enables production of the high value fruit, vegetable, nursery, and other diverse crops planted in the CBP service areas.

As shown in the upper part of figure ES-3, as more cropland is irrigated, the sales value produced per acre increases dramatically. This relationship highlights the importance of irrigation water from the CBP in increasing agricultural production value per acre. Higher agricultural production values also translate into greater net economic value

² The average per acre production value of irrigated grain acres (approximately \$850) was calculated by estimating total value of grain farming in CBP acres (\$156.9 million) and dividing it by the average annual CBP acres in grain farming (183,588). The yield for irrigated grain is based the reported yields in CBP districts. NASS reported yields for Lincoln County, where irrigation is limited, are approximately half those reported in CBP districts.

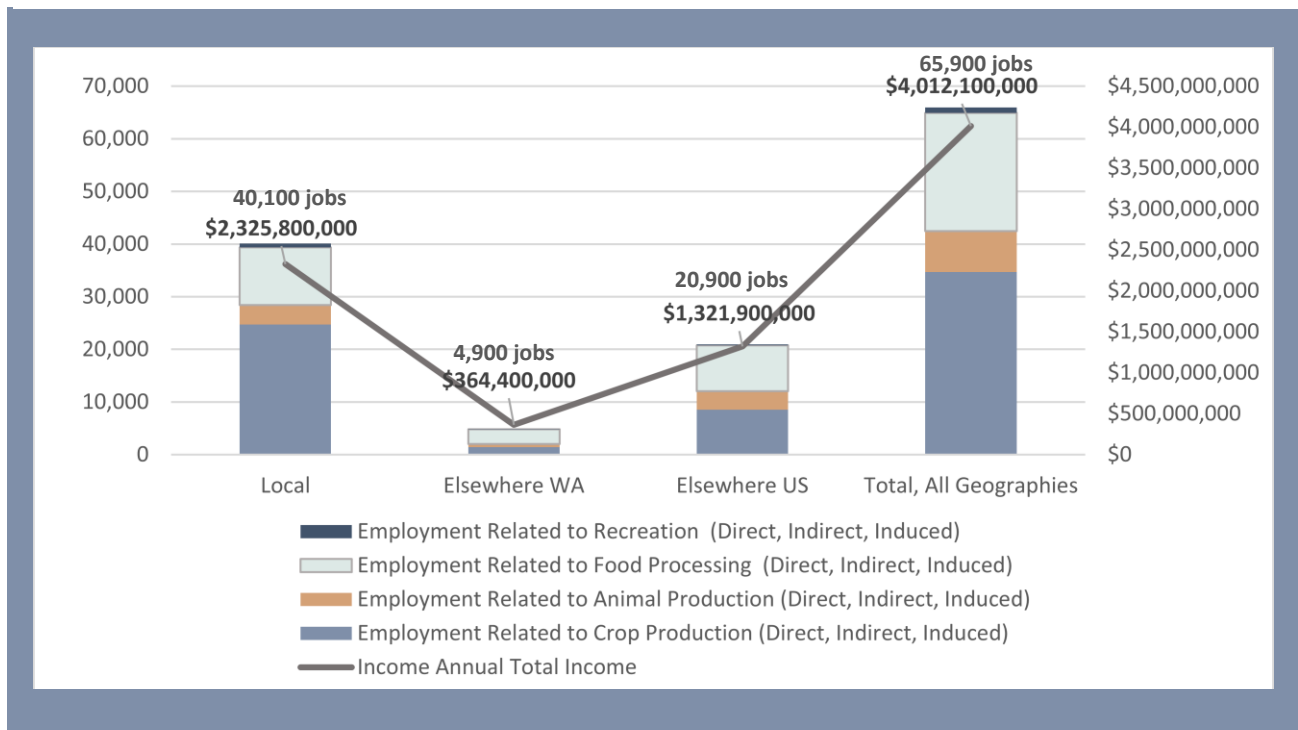
to farmers and greater economic activity supported in diverse sectors throughout the region.

The economic conditions in Lincoln County compared to Grant County highlight the importance of the CBP to overall economic development in east central Washington. As shown in the lower part of Figure ES-3 comparing the agricultural economies of Grant and Lincoln counties, agricultural compensation (including to proprietors and farm laborers) per acre of farmland is over 20 times higher in Grant County, while property taxes for all acreage in the county (agricultural and otherwise) and the number of farm jobs per acre is approximately 6 times higher in Grant County. Grant County also has a robust food processing industry that does not exist in Lincoln County.

CBP ECONOMIC CONTRIBUTION

CBP crop production supports economic activity throughout the local region, as well as throughout the rest of Washington State and the nation. The total economic contribution of the CBP includes: 1) the direct effects on farms of agricultural jobs and income supported by irrigated crop production, 2) the indirect effects in other sectors of jobs and income supported by farms purchasing inputs such as seed, fertilizer, and farm equipment necessary for crop production, and 3) the induced effects in other sectors such as real estate and health care resulting from the spending of employee wages. There are also additional economic effects of the CBP: CBP crop production is a vital input and makes possible substantial local animal production and food processing, and CBP irrigation infrastructure provides water-based recreation opportunities that support a thriving local recreation economy; these values are also included in Figure ES-4. The total economic contribution (direct, indirect, and induced) of each

Figure ES-4: Total Annual Employment and Annual Income Supported by CBP Irrigation Infrastructure (Direct, Indirect, & Induced)



TYPES OF ECONOMIC EFFECTS

Direct: Farm jobs and income related to irrigated crop production.

Indirect: Jobs and income at businesses supplying inputs, such as fertilizer, machinery, seeds to the CBP-irrigated farms.

Induced: Jobs and income at businesses such as retail stores and service providers supported by the spending of CBP-related income.

Forward-Linked: Jobs and income in industries reliant on CBP crop production, such as animal production and food processing, and reliant on CBP infrastructure, such as water-based recreation. This analysis shows the effects on forward-linked animal production and processing industries reliant on CBP as a direct effect, and then estimates the direct/indirect effects of this animal production and processing.

these types of effects is summarized in the figure below, as estimated using an IMPLAN model of the six-county region. While all direct, on-farm jobs and income supported by the CBP and many of the indirect and induced job and income effects are in the local, six-county region, substantial indirect and induced employment and income elsewhere in the state and nation are supported as well. Economic effects elsewhere are due to the purchase of inputs and supplies from throughout the state and nation to support CBP-related economic activities. For example, farm equipment purchased from a manufacturer in the Midwest would support manufacturing jobs and income in the Midwest, as well as the indirect and induced jobs and income linked to that manufacturing. **In the local region, the CBP supports an estimated 40,100 jobs (full and part-time jobs) and nearly \$2.33 billion in income (including total employee compensation and proprietor income) annually³.** Elsewhere in Washington State, an estimated 4,900 jobs and \$364 million in income are supported annually, while elsewhere in the nation, 20,900 jobs and \$1.32 billion in income may be supported annually (estimation of effects elsewhere in the nation is less certain). Note that in the absence of the CBP, economic activity would fall by less than this amount as many people directly or indirectly employed in CBP-related activities would engage in other

economic activities.

As shown in Figure ES-5, **in the local area approximately 60% of all jobs and income supported by the CBP are related to crop production, with approximately 30% related to food processing, and 10% related to animal production and recreation supported by the CBP.**

Elsewhere in Washington and the United States, all jobs and income supported are indirect and induced effects related to supplying inputs to the CBP region to support crop and animal production, food processing, and recreation occurring in the CBP region. Elsewhere in Washington, approximately 60% of

³ This compares to estimates of 28,500 jobs and \$1.6 billion in income (\$2.0 billion in 2021 dollars) supported in the local area in a comparable study from 2010. Nationally, the 2010 report estimated 38,900 jobs and \$2.4 billion in income (\$3.0 billion in 2021 dollars). The estimated employment and income is higher in this report partly due to the increased current value of crop production, and partly due to higher values of processing supported. This report also uses multi-regional input output analysis, which was not available for IMPLAN in 2010, which allows for greater accuracy of estimation of economic contribution elsewhere in Washington State (but not for the Nation).

economic effects are related to supporting food processing in the CBP region, 30% related to supporting CBP crop production, and 10% related to supporting animal production in the CBP region. Elsewhere in the United States, over 80% of effects are related to supporting CBP food processing and crop production.

Direct animal and crop production employment are estimated using data from the Bureau of Economic Analysis on agricultural employment in the region; indirect and induced employment effects are estimated using IMPLAN economic modeling software.

FISCAL IMPACTS

Economic activity associated with CBP-irrigated crop production results in tax payments to local, state, and federal levels of government. As shown in the figure below, the overwhelming majority of tax revenues associated with the CBP are experienced at the federal level. Federal-level taxes include personal income tax, corporate income tax, social insurance taxes (such as Medicare and social security), and excise and custom taxes. At the state level, tax payments include sales tax, property tax, and social insurance taxes. At the local level, governments receive property tax and sales tax payments.

Accounting for the tax revenues from all direct, indirect, and induced activity resulting from CBP crop production, associated animal and food processing, and associated recreation, **the revenues to all government jurisdictions related to CBP production are estimated to total approximately \$1.29 billion annually, with 68% of these tax revenues accruing to the federal government.** Note that in the absence of the CBP, tax revenues would not fall by this amount as many people directly or indirectly employed in activities associated with the CBP would engage in alternative economic activities that would generate tax revenues.

In nearly all jurisdictions (with the exception of local governments elsewhere in Washington), approximately half of the revenues are related to crop production (dark blue bars in the chart). The tax revenues associated with just the direct crop production in the CBP region, not including the indirect and induced effects of crop production or any other linked activity, are estimated at \$238.1 million annually across all jurisdictions. In other words, approximately 10% of the gross crop production value of approximately \$2.66 billion is paid in the form of taxes to local, state, and federal governments (primarily the federal government in the form of income taxes and social insurance payments).

Figure ES-5: Distribution of Direct, Indirect, and Induced Effects by Source and Location

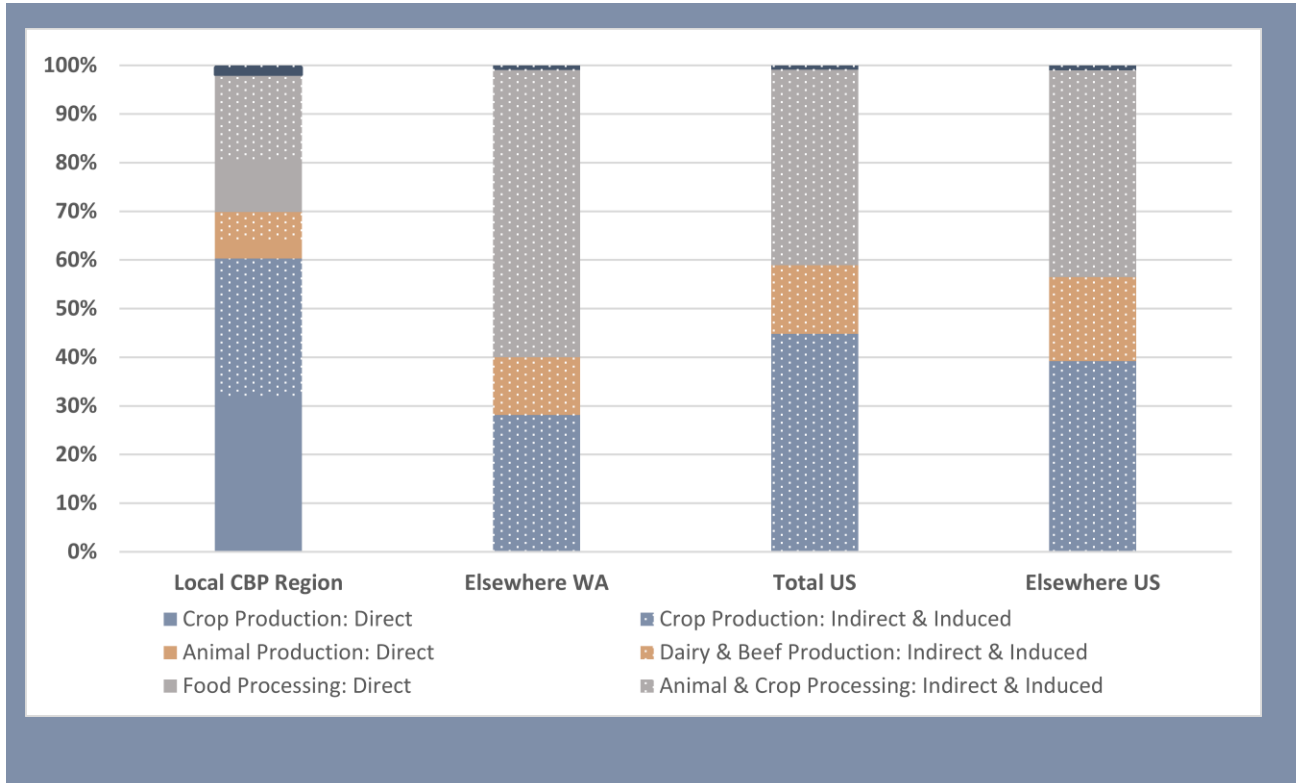
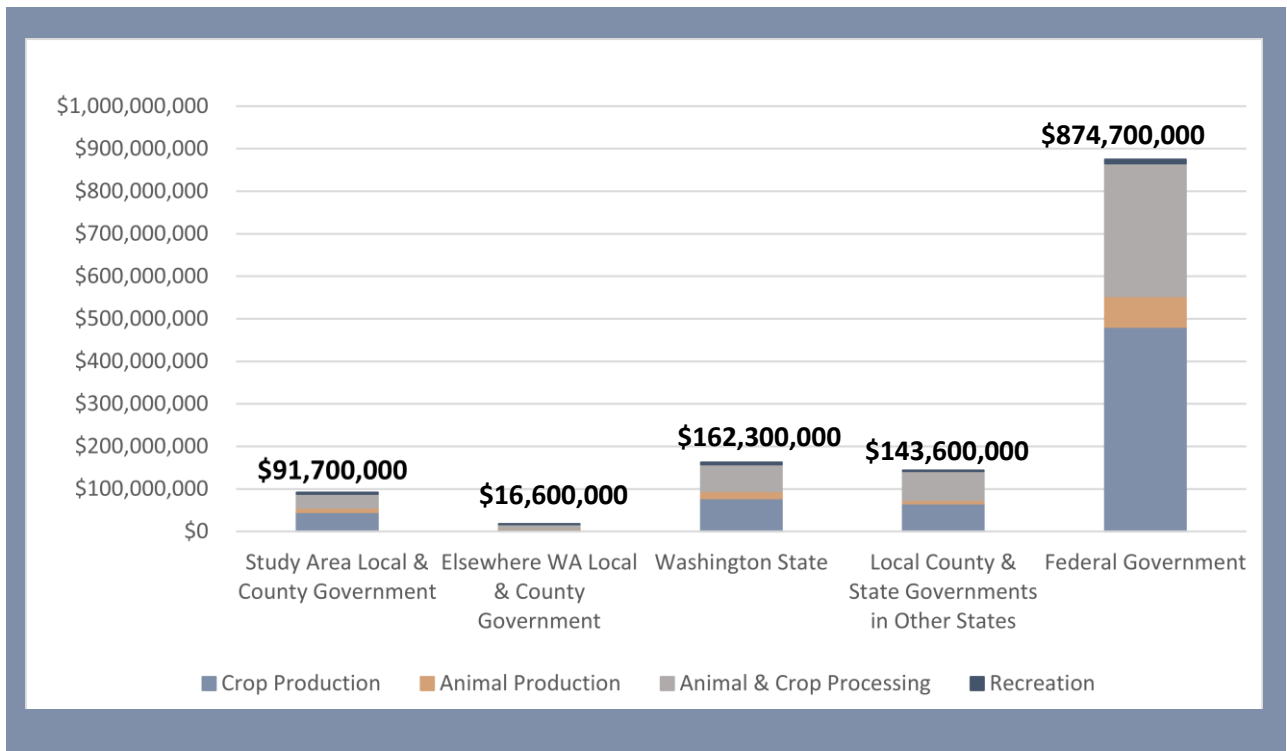


Figure ES-6: Distribution of CBP-Supported Tax Revenues by Location and Source



OTHER CBP BENEFITS

There are other social benefits of the CBP. In particular, the CBP provides economic opportunity to rural and minority populations, particularly Hispanic populations. The CBP infrastructure also provides water-based recreational opportunities, which both support the local recreation economy and provide social and recreational enjoyment for locals and non-locals. Finally, review of the publicly available financial data for the CBP indicates high levels of agricultural profit through time.



Recreation

CBP RECREATION VALUE OF \$30 MILLION+

- CBP irrigation reservoirs provide opportunities for recreation, estimated at 1.1 million to 1.6 million visitors annually (not including Roosevelt Reservoir).
- Value of recreation opportunities to recreators is estimated to be at least \$30 million annually, while recreation spending is estimated to support 750 job and \$26.7 million in annual income.

Irrigation-related infrastructure of the Columbia Basin Project (CBP) creates significant opportunities for recreation. The reservoirs intended for irrigation water storage can also be used for water-based recreation, including: hunting, fishing, boating, swimming, camping, and wildlife viewing. Key components of CBP infrastructure such as Banks Lake and Potholes Reservoir support water-dependent recreation at Potholes State Park, Steamboat Rock State Park, Columbia National Wildlife Refuge, and Scootenev Reservoir. In addition to these recreation destinations, public boat launches, municipal parks, and concessioner resorts throughout the CBP region offer recreational opportunities that are made possible because of CBP water and CBP irrigation facilities. In total, based on the available visitation data and interviews with local recreation managers, this study estimates that there are approximately **1.1 million to 1.6 million recreation visits annually in the region supported by CBP infrastructure (not including Lake Roosevelt⁴)**. Visitation is likely even higher due to recreation occurring on private lands, such as through hunting leases.

There are two types of benefits of this recreation: 1) economic activity generated through recreation-related expenditures in the local economy, and 2) the net economic benefit to recreators of the opportunity to recreate (i.e., the value of the recreation experience, less the cost of recreational expenditures). Based on other studies of expenditures by recreation visitors to the region,

⁴ We focus on the CBP irrigation infrastructure that is necessary solely for agricultural production and do not include Lake Roosevelt, which is formed by Grand Coulee Dam. In addition to serving agriculture, Grand Coulee Dam is the largest hydropower facility in the United States, generating more than 21 billion kilowatt-hours of electricity each year (US Bureau of Reclamation, 2021).

this study estimates that the CBP-supported recreation visitors spend between \$31.6 million and \$129.2 million annually in the local area. We take the mid-point of this expenditure estimate, or approximately \$80 million, to highlight **the potential economic contribution to the region of CBP-supported recreation: approximately 750 jobs and \$26.7 million in annual income.** As illustrated above, this economic contribution of recreation is relatively small relative to the economic contribution of crop/animal production and associated food processing. However, recreation opportunities are an important aspect of quality of life, and the recreational opportunities supported by CBP irrigation infrastructure provide value and enjoyment to over one million visitors a year. Based on numerous studies of the value of recreation for hunting, fishing, boating, and general recreation, a reasonable estimate of the net value to recreators (benefits less trip expenditures noted above) per recreator day is at least \$30 per visit. Applying this to the over one million annual recreation visits supported by the CBP infrastructure indicates **over \$30 million in annual net value to recreators is provided at water-based recreation areas created by CBP facilities.**

CBP SUPPORTS RURAL & HISPANIC POPULATIONS

- CBP supports 40,100 jobs in a predominantly rural region of Washington, where approximately 50% of the population is Hispanic.
- Employment supported by the CBP represents over one-third of all employment in Grant, Franklin, and Adams counties, and may support approximately 70,000 people in the local area.

Economic Opportunity for Rural Areas & Minority Populations

This study estimates that approximately 40,100 jobs are supported in the CBP local region, primarily in the counties of Franklin, Grant, and Adams. This represents over one-third of the employment (approximately 105,000 jobs according to the Bureau of Economic Analysis) in these three counties. Based on Census data, there are approximately 216,400 people living in these three counties; if, proportionate with employment, one-third of the population is supported directly or indirectly by the CBP, this would represent over 70,000 people in the region living in a household wholly or partially supported by the CBP. Said differently, **the farming, food processing, and recreation-related employment made possible by the CBP likely provide rural economic opportunity for approximately 70,000 people in the study area.**

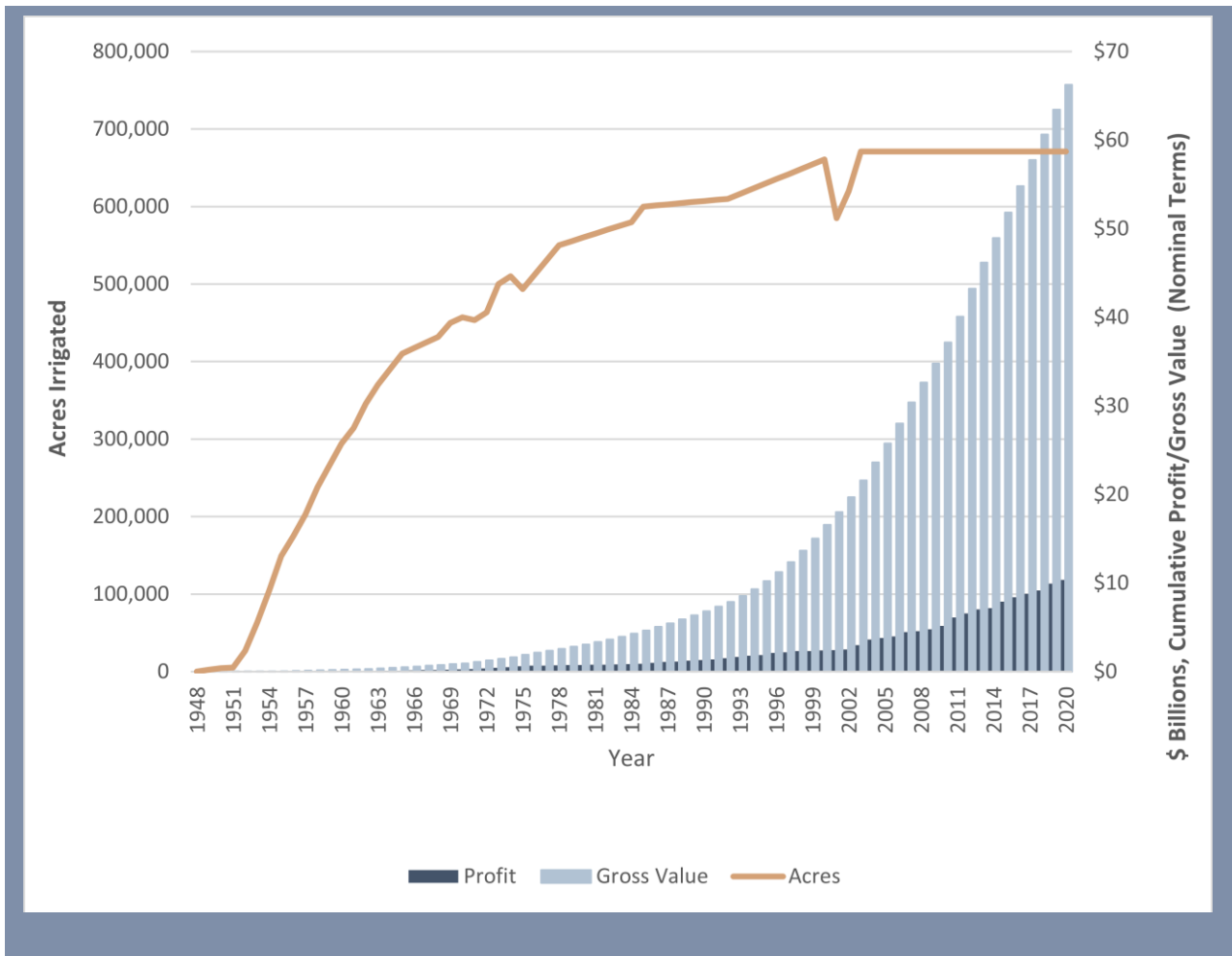
Approximately 50% of the population of Franklin, Grant, and Adams counties is Hispanic, while for the State as a whole only 14% of the population is Hispanic. **The jobs and people economically supported by the CBP are thus likely disproportionately minority populations.** This study

estimates that approximately 14,400 farm jobs are created by CBP-irrigated agriculture, and agricultural farmworkers are overwhelmingly Hispanic. Data from the 2017-2018 National Agricultural Worker Survey for the Northwest region (an eight-state region including Washington) indicates that 78% of agricultural workers in this region are foreign-born (primarily from Mexico). CBP agriculture can provide opportunities for immigrants to take the first step in achieving greater economic security for themselves and their families.

Agricultural Production and Profit Values in CBP Through Time

Previous annual reports prepared by the Bureau of Reclamation have documented acreage irrigated by the Columbia Basin Project (CBP) and estimated the gross value of crops produced from the project. Using data presented in available reports and interpolating the missing data points, the cumulative gross revenue of crops produced by CBP’s irrigated acreage is approximately \$66.7 billion from 1948 through 2020 (this amounts to approximately \$108.8 billion in 2021 dollar values). The US Department of Agriculture’s Economic Research Service (ERS) maintains estimates of farm profitability as a percentage of gross revenue as part of their Farm Income and Wealth Statistics for Washington State producers (USDA ERS 2021). Based on this dataset, and adjusting to account solely for crop production, annual profit from 1948 to 2020 accounted for between -2% (loss of 2%) to 47% of gross revenue to the operator, with an average of nearly 21% annually. Thus, the CBP project has likely generated approximately \$10.4 billion in cumulative profit from 1948 to 2020 (this amounts to approximately \$18.1 billion in 2021 dollar values).

Figure ES-7: Acreage & Cumulative Crop Farm Sales and Profits Thru Time



Food Security

The CBP provides irrigation water for crops and associated animal production valued at over \$3.3 billion annually. This level of farmgate production value equates to approximately 2.7% of all American food grocery store purchases, representing approximately the food purchases of 8.9 million Americans. While in reality much of the production from the CBP is currently exported, these figures highlight the magnitude of the food produced in the CBP and the number of people that can be supported by this food production.

The importance of the CBP is likely to only grow in the future as drought, warmer temperatures, and severe weather events threaten agricultural production in other key agricultural production regions. In Washington State, overall vulnerability of agricultural production to a changing climate is expected to be low in the CBP where irrigation water supplies are available (Snover, Mauger, Whitely Binder, Krosby, & Tohver, 2013). This is not the case for many other regions in the world. For example, California is a key American agricultural production area (particularly for vegetables, fruits, and nuts) facing numerous challenges related to water scarcity, water quality, and rising temperatures. Based on the relatively low climate-related risks to agricultural production in the Columbia River Basin, researchers at the Agriculture Climate Network are already studying how future reduced agricultural production in California could be offset by increased vegetable production in the Columbia River Basin (Maureira, 2020).

With an abundance of water forecasted and a lengthening of the growing season, the Columbia Basin region is particularly well suited to face climate change, especially when compared to many other agricultural producing regions. Due to the anticipated decrease in agricultural production in other parts of the nation and world due to rising temperatures and water shortages associated with climate change, the potential additional output produced by the CBP under climate change highlights the likely growing importance of CBP food production in the future.

CBP SUPPORTS FOOD SECURITY

- CBP food production value is equivalent to the grocery store purchases of 8.9 million Americans (2.7% of all grocery store purchases).
- CBP food production is reliable and resilient to climate change, providing a long-term, highly stable food supply relative to other western food production regions.



1 INTRODUCTION

The Columbia Basin Project (CBP) is a Bureau of Reclamation irrigation project located in east central Washington. Originally authorized by Congress to irrigate **1,029,000 acres, the project currently irrigates about 700,000 acres annually in Adams, Franklin, Grant, and Walla Walla Counties.**⁵ Water is diverted at Grand Coulee Dam, which is a multi-purpose dam that in addition to storing irrigation water also provides hydropower electricity, flood control, municipal water supply, and recreational opportunities. Primary irrigation facilities in the CBP are the Feeder, Main, West, East Low, and Potholes Canals; Banks Lake and Dry Falls Dam; Billy Clapp Lake and Pinto Dam; and Potholes Reservoir and O`Sullivan Dam. The CBP includes over 300 miles of main irrigation canals, 2,000 miles of laterals, and 3,500 miles of drains and wasteways (U.S. Bureau of Reclamation, 2020). The primary crops grown include hay, potatoes, corn, wheat, beans, apples and other orchard fruits, grapes, herbs, onions, grass seed, and vegetables.

Three irrigation districts manage and distribute the irrigation water from CBP: East Columbia Basin Irrigation District (ECBID), Quincy Columbia Basin Irrigation District (QCBID), and South Columbia Basin Irrigation District (SCBID). ECBID lands are split between Adams and Grant Counties, QCBID's lie mainly in Grant County with a small portion in Adams County, and SCBID lands are in Franklin and Grant Counties with a small portion in Walla Walla County. Additionally, there are approximately 49,000 acres of "other CBP lands" in Grant County served by CBP water through groundwater service contracts (CBP water recharges groundwater, which is then used to irrigate these lands). Lands originally authorized by Congress to be included in the CBP that are not presently served are primarily located in counties currently served by the CBP (Adams, Franklin, Grant, and Walla Walla) as well as in Lincoln County, Washington. These counties, in addition to Benton County, which is closely tied to the Franklin County economy⁶, constitute the six-county study area.

The purpose of this study is to quantify the economic contribution of irrigated lands and recreation supported by the CBP. This includes impacts to employment, income, and tax revenues supported directly and indirectly by the CBP at the local, state, and national levels. In addition to quantifying the direct economic impacts (in terms of jobs, income, and taxes), this study also quantifies the secondary (indirect and induced) economic impacts that arise from spending related to the direct economic activity and ripple out through the local regional, state, and national levels.

⁵ The second phase of the CBP project was 'shelved' in the early 1990's due to the Endangered Species Act and associated moratorium on additional water withdrawals from the Columbia to protect salmon. This moratorium was lifted in 2003.

⁶ The tri-cities is the major urban area in the region, and is located in both Franklin and Benton counties.

This study also explores environmental justice considerations relating to the CBP, and how the economic activity supported by the CBP plays a key role in supporting Hispanic residents of the study area due to their high participation in local agricultural production. This study also highlights the importance of



irrigation to the economic development in the region, focusing on how agricultural production and overall economic activity differ between Grant and Lincoln counties. These two adjacent counties are both predominantly agricultural counties with a similar land area in farms, but with very different levels of irrigation.

1.1 DATA SOURCES & METHODS

This study relies on crop data from the three CBP irrigation districts: Quincy, East, and South Columbia Basin Irrigation Districts; these data include total acreage irrigated by crop over approximately the past ten years. Yield, price, and animal production data are from the U.S. Department of Agriculture’s National Agricultural Statistics Service, while other demographic and economic data are from local, state, and national agencies such as the Census Bureau, the Bureau of Labor Statistics, and the Bureau of Economic Analysis. Recreation data are from recreation management agencies.

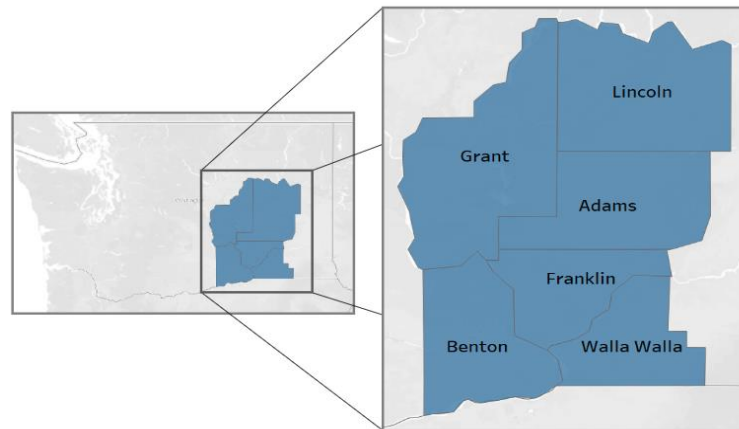
In addition to quantifying the direct economic impacts on farm employment and income, this study uses an IMPLAN model to quantify the secondary (indirect and induced) economic impacts that ripple out through the local regional, state, and national levels (a multi-regional input-output analysis method is used to estimate impacts at the state and national levels).

- **Direct impacts:** Economic effects in the sector under study, such as crop production, animal production, food processing, or recreation.
- **Indirect impacts:** Economic ripple effects of farm production are experienced in varied sectors and are derived from farm spending on inputs such as equipment, fertilizer, seed, and agricultural services.
- **Induced impacts:** Economic ripple effects are derived from employees and proprietors of farm businesses and other linked businesses spending their wages on goods and services; these induced impacts tend to be concentrated in retail, services, real estate, and financial industries.
- **Forward linked impacts:** The study also estimates the economic impacts of regional industries that are heavily reliant on CBP crop production as necessary inputs to their operations, including dairy farming, beef cattle production, animal processing, wineries, frozen fruit and vegetable food processing, and cheese manufacturing. There are many other food processing sectors in the region that use CBP crops as inputs; however, this analysis focuses on the sectors where CBP crops account for a relatively high proportion of inputs to the production process.

1.2 STUDY AREA

The study focuses on Adams, Franklin, and Grant counties where the vast majority of acreage is CBP-irrigated acreage is located. However, the study area region for the economic impacts analysis includes a six-county area: Adams, Franklin, Grant, Walla Walla, Lincoln, and Benton counties. Walla Walla County has some CBP irrigated acreage; land Lincoln County is authorized by Congress to receive CBP irrigation water (although currently there is no land in Lincoln County irrigated with CBP water), and Benton County is closely tied with the economy of the other counties as the tri-cities of Kennewick, Pasco and Richland span both Benton and Franklin counties.

Figure 1-1: Study Area Counties



1.3 REPORT ORGANIZATION

The remainder of this report is divided into four sections. Section 2 presents a regional socioeconomic profile in terms of population, demographics, economic base, and tax base. Section 3 outlines the regional agricultural profile in terms of land, agricultural products produced, and employment and income associated with agricultural production. Section 4 presents the economic contribution of the CBP-supported agricultural economy. Section 5 presents the economic contribution of CBP-supported recreation. Section 6 presents the tax revenues, or fiscal, contribution of the CBP to local, state, and federal governments based on the economic activity estimates. Section 7 presents other benefits of the project, including benefits related to economic opportunity for rural areas and minority populations, recreation opportunities, and food security.

2 SOCIOECONOMIC PROFILE

This section explores the population, demographics, economic base, and tax base of the study area, all of which provide a foundation to understanding the economic impacts of the CBP. The profile of the local study area is often compared against Washington State to provide context. The study region is six counties: Adams, Franklin, Grant, Walla Walla, Lincoln, and Benton counties. Adams, Franklin, and Grant have the vast majority of CBP-irrigated acreage. Walla Walla has some CBP irrigated acreage; agricultural land in Lincoln is authorized by Congress to receive CBP irrigation water (although the project has not been completed to reach lands in Lincoln), and Benton is closely tied with the economy of the other counties as the regional hub of the tri-cities of Kennewick, Pasco and Richland spans both Benton and Franklin counties.

2.1 POPULATION AND DEMOGRAPHICS

According to the 2020 Census, the six-county study area had a total population of approximately 497,000 people, which grew 15% from its 2010 population of 430,500 (a growth rate of 1.4% annually over 10 years). The study area comprises about 6.4% of the state's total population. Table 2-1 outlines the population by county, as well as Washington State. As shown in the table, the largest population growth has been, and is expected to continue to be, in Franklin and Benton counties where the Tri-Cities of Kennewick, Pasco, and Richland are located. Growth for 2020 to 2040 in Adams and Grant counties, however, is expected to be robust and above the Washington State average. No growth is expected in Lincoln County and low growth is expected in Walla Walla County. Franklin County (which had a smaller population than Grant County in 2020) is expected to grow larger than Grant County before 2040.

Table 2-1: Population Growth, Past and Projected

Area	2010 Population	2020 Population	Project 2040 Population	Annual Growth 2010-2020	Annual Growth 2020-2040
<i>Primary CBP Counties</i>					
Adams County	18,728	20,613	25,062	1.00%	1.00%
Franklin County	78,163	96,749	158,574	2.20%	2.50%
Grant County	89,120	99,123	132,995	1.10%	1.50%
<i>CBP County Subtotal</i>	<i>186,011</i>	<i>216,485</i>	<i>316,631</i>	<i>1.53%</i>	<i>1.92%</i>
<i>Other CBP Counties</i>					
Benton County	175,177	206,873	250,524	1.70%	1.90%
Lincoln County	10,570	10,876	10,848	0.30%	0.00%
Walla Walla County	58,781	62,584	67,457	0.60%	0.40%
<i>Other County Subtotal</i>	<i>244,528</i>	<i>280,333</i>	<i>328,829</i>	<i>1.38%</i>	<i>0.80%</i>
Region Total	430,539	496,818	645,460	1.44%	1.32%
Washington State	6,724,540	7,705,281	9,242,022	1.40%	0.90%

Sources: (U.S. Census Bureau, 2010), (U.S. Census Bureau, 2020), (State of Washington Office of Financial Management, 2018)

In Adams County, the largest population center is Othello, with a population of 7,364 people (36% of the county population). Franklin County's largest city is Pasco with 59,781 people (62% of the county

population), which together with Kennewick and Pasco in Benton County, comprises the Tri-Cities region and is the largest population center in the study area. Moses Lake is Grant County's largest city with 20,366 people (21% of the county population). Lincoln County's largest population center is Davenport, containing 1,734 people (16% of the county population). The most populous city in Walla Walla County is the City of Walla Walla (31,731 people), representing 51% of the county's population.

Table 2-2 provides the racial breakdown of the study area, as well as the proportion of the population that is ethnically Hispanic or Latino (note that all races can be of Hispanic or Latino ethnicity, so the percent distributions are presented separately). Compared to the state, counties with substantial CBP irrigated acreage (Adams, Franklin, and Grant) generally have higher proportions of Hispanic and Latino populations. With the exception of Lincoln County (where there is no irrigation from CBP currently), the fraction of Hispanics and Latinos is 9 to 50 percentage points higher in the study area counties than in Washington more broadly. Regarding race, the proportion of all non-white racial groups, with the exception of the American Indian and Alaska Native population, tend to be smaller in the study area than the state as a whole. The proportion of American Indian and Alaska Native populations is higher in Adams, Grant and Lincoln counties, and slightly lower than the state average in Franklin and Walla Walla counties.

Table 2-3 shows the proportion Hispanic/Latino of agricultural producers (farm operators) according to the 2017 Census of Agriculture. For the primary CBP-supported agriculture counties (Adams, Franklin, and Grant), a larger proportion of producers are Hispanic or Latino compared to the average in Washington. For farmworkers, Hispanics make up the vast majority of agricultural workers nationwide. The 2017-2018 National Agricultural Workers Survey found at the national level that 87% of farmworkers classified their ethnicity as Hispanic or Latino (JBS International, 2021). Farmworkers are also predominantly Hispanic or Latino in the study area. The prevalence of migrant and seasonal workers also indicates how CBP economic activity is benefiting economically disadvantaged populations. As shown in Table 2-4, the proportion of farmworkers that are migrants in Adams and Grant counties is similar to the state (around 25%), while Franklin County has a much higher proportion of migrant workers (38%). This suggests that the economic impacts of CBP agriculture in Franklin County may provide disproportionate support to migrant workers compared to Washington's agricultural workers as a whole.

Table 2-2: General Population Race & Ethnicity

Population	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Benton	Lincoln	Walla Walla	Other Regional Counties, Subtotal	Region Total	WA
Race										
White alone	88.5%	89.9%	92.1%	90.8%	90.0%	93.8%	91.4%	90.5%	90.6%	78.5%
Black or African American alone	2.2%	2.8%	1.8%	2.3%	1.8%	0.6%	2.2%	1.8%	2.0%	4.4%
American Indian and Alaska Native alone	6.2%	1.7%	2.3%	2.4%	1.3%	2.0%	1.4%	1.4%	1.8%	1.9%
Asian alone	1.4%	2.4%	1.2%	1.8%	3.3%	0.5%	1.7%	2.8%	2.4%	9.6%
Native Hawaiian and Pacific Islander alone	0.1%	0.4%	0.2%	0.3%	0.3%	0.1%	0.4%	0.3%	0.3%	0.8%
Two or more races	1.7%	2.7%	2.4%	2.5%	3.3%	2.8%	2.8%	3.2%	2.9%	4.9%
All Races	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Hispanic/Latino Ethnicity										
Hispanic or Latino population	64%	54%	43%	50%	24%	4%	23%	23%	35%	14%
Non-Hispanic or Latino population	36%	46%	57%	50%	76%	96%	77%	77%	46%	57%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Sources: (U.S. Census Bureau, 2020; U.S. Census Bureau, 2019)

Table 2-3: Agricultural Producer Race and Ethnicity

Population	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Benton	Lincoln	Walla Walla	Other Regional Counties, Subtotal	Region Total	WA
Hispanic/Latino Ethnicity										
Hispanic or Latino	6%	8%	9%	8%	10%	2%	2%	6%	7%	5%

Source: (USDA NASS, 2017)

Table 2-4: Migrant and Seasonal Farmworkers

Population	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Benton	Lincoln	Walla Walla	Other Regional Counties, Subtotal	Region Total	WA
Operations with hired workers	263	399	721	1,383	416	335	318	1,069	2,452	10,484
Operations with migrant workers	15	98	154	267	79	4	23	106	373	1,245
Total hired workers	3,404	13,208	42,925	59,537	15,881	1,153	11,226	28,260	87,797	228,588
Number of migrant workers	929	5,038	10,979	16,946	4,115	37	1,970	6,122	23,068	56,348
Workers hired <150 days	2,484	10,200	31,170	43,854	11,118	704	8,142	19,964	63,818	170,752
% of operations with migrant workers	6%	25%	21%	19%	19%	1%	7%	10%	15%	12%
% migrant workers	27%	38%	26%	28%	26%	3%	18%	22%	26%	25%
% of workers hired <150 days	73%	77%	73%	74%	70%	61%	73%	71%	73%	75%

Source: (USDA NASS, 2017)

2.2 ECONOMIC BASE

2.2.1 Employment

In 2019, the six-county study area employed over 262,000 full- and part-time workers, representing about 6% of the state's total (U.S. Bureau of Economic Analysis, 2020). Of these, about 22,000 were farm-related workers, representing 8% of the study area total employment. The level of farm employment for the study area was fairly consistent from 2015 to 2019. Employment statistics for the study area, the state, and the nation are shown in Table 2-5 below.

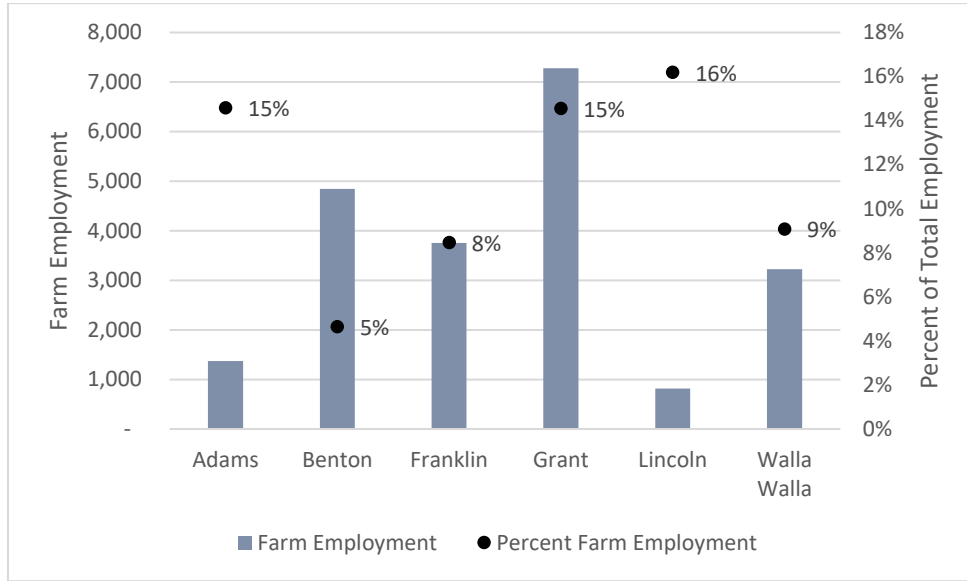
Table 2-5: Full and Part-Time Employment in 2019

Geography	Total Employment	Farm Employment		Non-Farm Employment	
	Jobs	Jobs	Percent	Jobs	Percent
<i>Primary CBP Counties</i>					
Adams	9,840	1,435	15%	8,405	85%
Franklin	43,940	3,717	8%	40,223	92%
Grant	50,380	7,331	15%	43,049	85%
<i>CBP County Subtotal</i>	<i>104,160</i>	<i>12,483</i>	<i>12%</i>	<i>91,677</i>	<i>88%</i>
<i>Other CBP Counties</i>					
Benton	116,100	5,387	5%	110,713	95%
Lincoln	4,967	804	16%	4,163	84%
Walla Walla	36,827	3,342	9%	33,485	91%
<i>Other County Subtotal</i>	<i>157,894</i>	<i>9,533</i>	<i>6%</i>	<i>148,361</i>	<i>94%</i>
Study Area Total	262,054	22,016	8%	240,038	92%
Washington	4,593,480	92,764	2%	4,500,716	98%
United States	201,644,200	2,601,000	1%	199,043,200	99%

Source: (U.S. Bureau of Economic Analysis, 2020)

Figure 2-2 below illustrates that the majority of farm jobs were in the study area are in Grant, Benton and Franklin counties (about 16,000 jobs, or three-quarters of the six-county total). Farm jobs in Adams, Grant, and Lincoln counties comprise roughly 15% of all employment in each respective county, while in Benton, Walla Walla and Franklin counties farm employment is a slightly smaller proportion of total employment (5% to 9% of all jobs). By comparison, only 2% of all jobs in WA and only 1% of jobs nationwide are farm jobs (U.S. Bureau of Economic Analysis, 2020). This comparison highlights the relative importance of farm employment in the study area.

Figure 2-1: Farm Employment in 2019



Source: Highland Economics’ analysis of (U.S. Bureau of Economic Analysis, 2020)

Aside from farming, other large employment sectors in the study area include manufacturing (over 19,000 jobs), retail trade (25,000 jobs), health care and social assistance (over 26,000 jobs), and local government (27,000 jobs). Construction employs a larger proportion of workers in Franklin and Lincoln counties. Health care employment is particularly high in Walla Walla County. Lincoln County has proportionally higher employment in local government than the other counties. Total jobs by industry are shown in Table 2-6 below. In the table below, and many that follow in Section 3, data for some counties is suppressed (indicated by an ‘S’ in the table); for regional totals including such counties, we include a ‘+’ after the estimate to indicate that the sum of the available data is the minimum, and that the actual value may be higher due to suppressed values.

Table 2-6: Non-Farm Employment by Industry in 2019

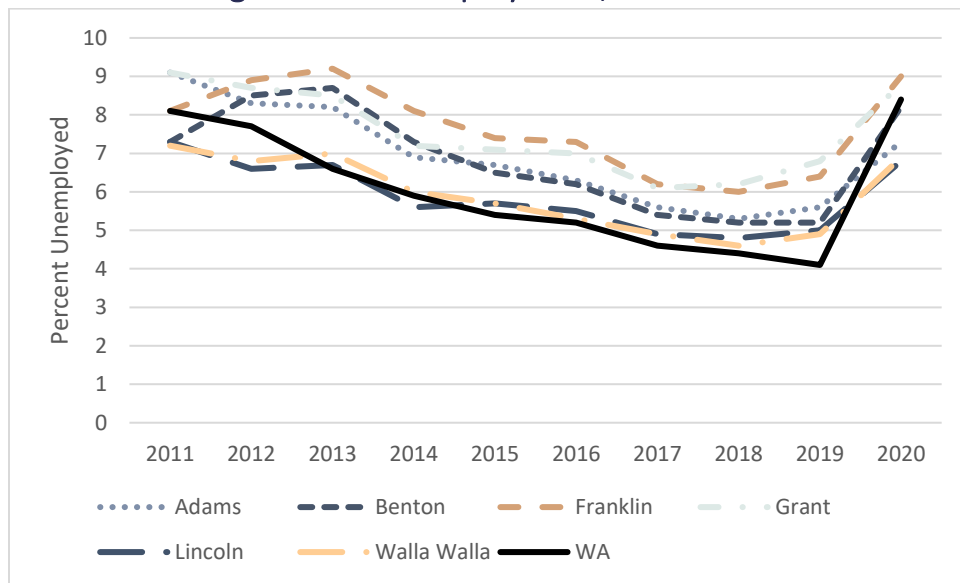
Industry	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Benton	Lincoln	Walla Walla	Other Regional Counties, Subtotal	Region Total
Nonfarm employment	8,405	40,223	43,049	91,677	110,713	4,163	33,485	148,361	240,038
Private nonfarm employment	6,691	33,104	34,135	73,930	97,736	2,929	27,641	128,306	202,236
Forestry, fishing, and related activities	521	S	S	521+	S	S	S	0+	521+
Mining, quarrying, and oil and gas extraction	22	S	S	22+	S	S	S	0+	22+
Utilities	S	S	21	21+	164	S	142	306+	327+
Construction	233	3,054	2,163	5,450	9,353	388	1,447	11,188	16,638
Manufacturing	1,154	3,909	4,831	9,894	5,067	S	4,439	9,506+	19,400+
Wholesale trade	S	2,100	1,717	3,817+	1,756	232	768	2,756	6,573+
Retail trade	857	4,342	4,473	9,672	12,010	374	3,032	15,416	25,088
Transportation and warehousing	S	S	1,629	1,629+	2,254	S	717	2,971+	4,600+
Information	19	192	589	800	845	29	364	1,238	2,038
Finance and insurance	152	802	987	1,941	3,682	112	1,099	4,893	6,834
Real estate and rental and leasing	393	1,514	2,080	3,987	4,034	S	1,283	5,317+	9,304+
Professional, scientific, and technical services	169	1,208	1,265	2,642	11,345	213	S	11,558+	14,200+
Management of companies and enterprises	33	50	77	160	606	0	S	606+	766+
Admin. & support and waste mgmt & remediation services	187	1,655	2,214	4,056	11,693	113	864	12,670	16,726
Educational services	S	753	322	1,075+	1,183	S	1,572	2,755+	3,830+
Health care and social assistance	S	3,616	3,374	6,990+	15,022	S	4,903	19,925+	26,915+
Arts, entertainment, and recreation	58	706	578	1,342	2,386	71	S	2,457+	3,799+
Accommodation and food services	502	2,386	2,856	5,744	8,555	147	S	8,702+	14,446+
Other services (except government and govt enterprises)	386	2,327	1,971	4,684	5,374	249	1,805	7,428	12,112
Government and government enterprises	1,714	7,119	8,914	17,747	12,977	1,234	5,844	20,055	37,802
Federal civilian	38	482	781	1,301	754	61	1,334	2,149	3,450
Military	50	232	242	524	528	27	146	701	1,225
State and local	1,626	6,405	7,891	15,922	11,695	1,146	4,364	17,205	33,127
State government	71	1,701	838	2,610	1,567	49	1,891	3,507	6,117
Local government	1,555	4,704	7,053	13,312	10,128	1,097	2,473	13,698	27,010

Note: "S" indicates where data was suppressed in the original dataset to avoid disclosure of confidential information; estimates are included in higher-level totals.

Source: Highland Economics' analysis of (U.S. Bureau of Economic Analysis, 2020)

The unemployment rate provides a useful indicator of the health of an economy. Figure 2-1 shows the unemployment rate for the six counties and Washington as a whole. As shown in the graph, the unemployment rate for the six counties was generally higher than the state over the last decade (with some exceptions for Lincoln, Walla Walla, and Adams counties for certain years). On average during this decade, Adams, Franklin, and Grant counties had unemployment rates that were roughly 1% to 1.7% higher than the state average (6%) while Lincoln and Walla Walla counties' rates were similar to Washington as whole. The trend in unemployment during the last decade was a general decline, both for the six counties and the state; however, that trend ended when rates began to rise in 2019 (in the counties but not the state) and increased sharply in 2020, a trend that was common nationwide during the coronavirus pandemic.

Figure 2-2: Unemployment, 2011-2020



Source: (U.S. Bureau of Labor Statistics, 2021)

2.2.2 Income

As shown in Table 2-7 median household income is lower in each of the six counties than the state as a whole, ranging from 65% to 95% of the state's value. While Washington's median household income is 17% higher than the US, most of the study area counties are 8% to 23% lower than the national median. Franklin and Benton counties are the exception, which have median household incomes that are higher than the US.

Table 2-7: Median Household Income, 2019

Geography	Median Household Income
Adams	\$50,292
Benton	\$72,084
Franklin	\$66,215
Grant	\$57,855
Lincoln	\$56,892
Walla Walla	\$60,252
Washington	\$76,828
United States	\$65,443

Note: Values were adjusted for inflation to 2021 dollars using the Consumer Price Index.

Source: (U.S. Census Bureau, 2019)

On average from 2015-2019, total compensation in the six county study area was approximately \$13.3 billion per year for all types of employment (U.S. Bureau of Economic Analysis, 2020).⁷ In the individual counties, farm compensation comprised 2% to 10% of all income, totaling approximately \$650 million annually (U.S. Bureau of Economic Analysis, 2020).⁷ The study area comprised about 6% of the state's total compensation but 32% of the state's farm compensation. Table 2-8 below breaks down the income by industry for each county and the state.

⁷ Annual values were adjusted for inflation to 2021 dollars using the Consumer Price Index prior to averaging.

Table 2-8: Income by Industry, annual average from 2015-2019

Industry	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Benton	Lincoln	Walla Walla	Other Regional Counties, Subtotal	Region Total	Washington
Total compensation (\$000s) ^A	420,469	2,027,482	2,314,630	4,762,581	6,640,718	168,370	1,720,305	8,529,393	13,291,973	292,525,658
Farm compensation (\$000s) ^A	42,389	133,314	235,675	411,377	129,547	8,082	101,007	238,636	650,014	2,056,082
Farm compensation	10%	7%	10%	9%	2%	5%	6%	3%	5%	1%
Nonfarm compensation	90%	93%	90%	91%	98%	95%	94%	97%	95%	99%
Private nonfarm compensation	63%	68%	59%	63%	79%	46%	66%	76%	71%	79%
Construction	2%	7%	4%	5%	8%	7%	3%	7%	7%	6%
Specialty trade contractors	1%	6%	2%	4%	4%	2%	3%	4%	4%	3%
Manufacturing	19%	11%	16%	14%	5%		16%	7%	10%	10%
Durable goods manufacturing	1%	2%	7%	4%	1%		5%	2%	3%	8%
Nondurable goods manufacturing	17%	9%	9%	10%	4%	0%	12%	6%	7%	2%
Food manufacturing		8%	6%	6%	1%			1%	3%	1%
Wholesale trade		8%	5%	6%	2%	11%	3%	2%	3%	5%
Retail trade	6%	8%	6%	7%	6%	5%	5%	6%	6%	8%
Health care and social assistance		8%	6%	6%	12%		17%	9%	8%	10%
Ambulatory health care services	6%	4%	3%	4%	6%	1%	4%	5%	5%	4%
Government and government enterprises	27%	26%	31%	28%	19%	49%	28%	21%	24%	20%
Federal civilian	1%	3%	4%	3%	2%	3%	9%	3%	3%	3%
State and local	26%	23%	26%	25%	17%	46%	19%	18%	20%	15%
State government	1%	6%	2%	4%	2%	2%	9%	3%	3%	5%
Local government	25%	16%	24%	21%	15%	43%	10%	15%	17%	10%

A/ Annual values were adjusted for inflation to 2021 dollars using the Consumer Price Index prior to averaging.

Source: Highland Economics' analysis of (U.S. Bureau of Economic Analysis, 2020).

For non-farm sectors, the largest wage paying industries are similar to the largest employers. These include manufacturing (especially non-durable goods), local government, retail trade, and health care and social assistance. The proportion of wages in agricultural and forest support industries tends to be higher than the state average, as it does in the food manufacturing and wholesale trade industries.

2.3 TAX BASE

This section describes the tax base for the study area. Economic activity supports the tax base by fostering property ownership and property values (which generate property taxes), stimulating the sale of goods (which results in sales taxes), and generating income (which results in income taxes). In the study area, property taxes and sales taxes are levied at the local (city and county) and state level, while income taxes are collected at the state and national levels.

2.3.1 Property Tax

Property taxes are based on the assessed value of a property and the rate at which that value is taxed by various districts in the county. Common taxing districts include the county government, roads, cities, schools, hospitals, libraries, ports, fire departments, and parks & recreation. The CBP contributes to property taxes by increasing the value of land through irrigation and by providing income to property owners that allows them to pay their property taxes. Table 2-9 below shows the total assessed value and levied property taxes by county. Benton County has the highest total assessed property value, while Grant County collects the largest sum of property taxes. The average combined tax rate for the counties ranges from 0.1% to 1.25% of the total assessed value.

Table 2-9: Property Tax, Assessed Value and Levy, FY 2021

Category	Total Assessed Value	Total Property Tax Levied
<i>Primary CBP Counties</i>		
Adams	\$2,385,179,541	\$29,321,495
Franklin	\$10,066,109,464	\$100,685,113
Grant	\$13,440,750,820	\$147,888,758
<i>Primary CBP County Subtotal</i>	<i>\$25,892,039,825</i>	<i>\$277,895,366</i>
<i>Other CBP Counties</i>		
Benton ¹	\$22,360,652,009	\$24,816,015
Lincoln	\$1,644,771,201	\$18,617,631
Walla Walla	\$6,994,579,034	\$87,097,721
<i>Other CBP County Subtotal</i>	<i>\$31,000,002,244</i>	<i>\$130,531,367</i>
Region Total	\$56,892,042,069	\$408,426,733

1/ Benton County data is for FY 2020, as FY 2021 data were not available.

2.3.2 Sales and Use Tax

Sales and use taxes are based on the sale and use of property and goods. All sales of tangible property in Washington are taxed the minimum rate of 6.55%, upon which localities can levy additional sales tax (with certain statutory limitations). Adams, Benton, Franklin, and Lincoln counties levy additional sales taxes of 1.5% (for an effective total sales tax rate of 8%), Grant County has an additional 1.7% sales tax (total rate of 8.2%), and Walla Walla County charges an additional 2.2% (total rate of 8.7%) (MRSC,

2020).⁸ As Table 2-10 shows, the six counties generate nearly \$844 million in sales and use taxes annually, of which Benton County accounts for roughly 60% (WA Office of Financial Management, 2019).⁹

Table 2-10: Sales and Use Taxes

Category	Sales Tax Rate ¹	Taxable Retail Sales ²	Sales & Use Tax Receipts ³
<i>Primary CBP Counties</i>			
Adams	8.0%	\$370,847,918	\$21,483,509
Franklin	8.0%	\$1,771,382,070	\$106,594,457
Grant	8.2%	\$2,412,548,750	\$134,042,588
<i>Primary CBP County Subtotal</i>	<i>N/A</i>	<i>\$4,554,778,738</i>	<i>\$262,120,554</i>
<i>Other CBP Counties</i>			
Benton	8.0%	\$4,499,103,353	\$502,757,601
Lincoln	8.0%	\$145,760,061	\$8,430,561
Walla Walla	8.7%	\$1,114,725,214	\$70,456,193
<i>Other CBP County Subtotal</i>	<i>N/A</i>	<i>\$5,759,588,628</i>	<i>\$581,644,355</i>
Region Total	N/A	\$10,314,367,366	\$843,764,909

1/ These do not include any sales taxes that other local entities (such as cities or transit districts) impose. Source: (MRSC, 2020)

2/ Average from 2016-2020. Annual values were adjusted to 2021 dollars using the Consumer Price Index prior to averaging. Source: (WA Department of Revenue, 2021)

3/ Data is from Fiscal Year 2016. Values were adjusted to 2021 dollars using the Consumer Price Index. Source: (WA Office of Financial Management, 2019)

⁸ These do not include any sales taxes that other local entities (such as cities or transit districts) impose.

⁹ Data is from Fiscal Year 2016 (the most recent available). Values were adjusted to 2021 dollars using the Consumer Price Index.

3 REGIONAL AGRICULTURAL PROFILE

This section explores the study area's agricultural profile in terms of the extent and character of production and the jobs and income associated with agricultural activity. The agricultural production is defined by its acreage and location, the value of production, and the value of irrigation water. The evaluation of agricultural employment and income includes on-farm work, industries that support farming activity, and industries that add value to agricultural goods. This profile provides information on agricultural production in each of the region's counties, except for Benton County as there is no CBP land in Benton County. As noted above, Benton County is included in the study area as it is closely linked economically to the CBP production area.

3.1 AGRICULTURAL PRODUCTION

This section describes the acreage of agricultural lands, the crops grown, and the value of the agricultural goods produced. This section also explores the value of irrigation water, and specifically the additional agricultural production value made possible by irrigation.

3.1.1 Land Area

Of the approximately 700,000 acres irrigated in the CBP, about 99% are located in Adams, Grant, and Franklin counties. Table 3-1 outlines the irrigated land in each county, the amount of CBP-irrigated land by county, and the share of CBP irrigated acreage relative to total irrigated land in each county. CBP lands comprise the majority of irrigated acres in Adams, Franklin, and Grant Counties but only a small portion of Walla Walla County's irrigated acres. The table also highlights the relatively small proportion of irrigated land in Lincoln County.

Table 3-1: Land by CBP County

Metric	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Lincoln	Walla Walla	Other CBP Counties, Subtotal	CBP County Total
Land in farms (acres) ^A	972,095	615,274	1,041,582	2,628,951	1,181,197	702,537	1,883,734	4,512,685
Harvested cropland (acres) ^A	363,578	248,297	568,572	1,180,447	398,485	260,568	659,053	1,839,500
Total irrigated area (acres) ^A	127,913	188,119	448,040	764,072	29,512	101,678	131,190	895,262
Percent cropland irrigated in county	35%	76%	79%	65%	7%	39%	20%	49%
Total CBP acres in county ^B	77,865	178,140	438,031	694,035		4,537	4,537	698,572
CBP % of irrigated acres in county	61%	95%	98%	91%		4%	3%	78%

A/ Source: (USDA NASS, 2019)

B/ Source: District-reported (ECBID, QCBID, SCBID) assessed acreage by County, plus the estimated 49,000 acres supported by CBP groundwater service area contracts.

Table 3-2 below shows the average annual acreage by district and crop type, as reported by district patrons.¹⁰ High-value crops (vegetables, fruit, and greenhouse/nursery) make up 39% of all district acres. The largest category of district acres is for “All other crop farming,” which consists primarily of hay. QCBID has the largest acreage of vegetable and melon farming, while SCBID has the most acres in fruit farming and greenhouse/nursery/floriculture production. Other CBP lands include 49,000 acres in Grant County that are irrigated with groundwater recharged with CBP water; these acres have groundwater service contracts with the Bureau of Reclamation.

¹⁰ ECBID and QCBID provided data from 2010-2020 (East Columbia Basin Irrigation District, 2021; Quincy-Columbia Basin Irrigation District, 2021). SCBID provided data for the years 2008, 2009, 2010, 2015, and 2021 (South Columbia Basin Irrigation District, 2021).

Table 3-2: Average Annual CBP District Acres by Crop Type

Crop Type (IMPLAN Crop Category)	ECBID	QCBID	SCBID	Other CBP Lands ¹¹	Total
Oilseed farming	135	689	0	40	864
Grain farming (including grain corn and dry beans)	54,014	72,228	43,386	13,961	183,588
Vegetable and melon farming (Including potatoes)	32,601	49,683	38,966	20,872	142,122
Fruit farming (including orchards, vines, and other non-melon fruits)	2,642	44,106	70,858	1,622	119,228
Tree nut farming	1	0	4	-	5
Greenhouse, nursery, and floriculture production	2,436	3,283	4,802	366	10,887
Sugar beet farming	381	315	0	6	702
All other crop farming (including alfalfa hay and forage)	57,259	95,031	76,752	12,134	241,176
Total	149,469	265,335	234,768	49,000	698,572

Sources: (East Columbia Basin Irrigation District, 2021; South Columbia Basin Irrigation District, 2021; Quincy-Columbia Basin Irrigation District, 2021) For ECBID and SCBID, data is an average of data spanning the years 2010 to 2020. For SCBID, the data is an average of the years 2008, 2009, and 2015 (2010 and 2021 data were excluded due to inconsistencies).

3.1.2 Value of Agricultural Production

In 2017, the five-county area (the six county study area minus Benton County where there are no CBP authorized lands) produced an estimated \$3.6 billion in agricultural sales, comprising 37% of the state's total (USDA NASS, 2019). Around three-quarters of sales came from crops while one-quarter came from sales of livestock products.¹² Table 3-3 outlines the sales by county and the state as reported in the 2017 Census of Agriculture. NASS does not publish data that would identify an operation; in cases where NASS has suppressed data for a county, the table shows an 'S' or the analysis approximated the suppressed data, in which case the estimate is indicated with an asterisk (*) after the estimate. For regions containing counties with suppressed data, regional totals were not feasible to estimate and are indicated in the table with 'N/A' for not available.

¹¹ These are 49,000 acres of lands that are dependent on groundwater recharged by CBP irrigation water (these lands have groundwater service contracts with the Bureau of Reclamation). These lands are located in the CBP in Grant County.

¹² Due to suppressed data, Walla Walla County was excluded from this calculation. NASS does not publish data that would identify an operation (for example, if there is only one producer of a particular commodity in a county).

Table 3-3: Sales of Agricultural Products, 2017 (in thousands)

Metric	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Lincoln	Walla Walla	Other CBP Counties, Subtotal	CBP County Total	WA
Total sales (000s)	\$363,876	\$631,598	\$1,938,897	\$2,934,371	\$130,237	\$526,236	\$656,473	\$3,590,844	\$9,634,461
Average sales per acre	\$374	\$1,027	\$1,861	\$1,116	\$110	\$749	\$348	\$796	\$656
<i>% of total sales</i>									
Crop sales	71%	74%	76%	75%	91%	S	N/A	76%*	72%
Grains, oilseeds, dry beans & peas	26%	6%*	6%	8%	77%	17%	29%	11%*	10%
Vegetables, melons, potatoes	21%	27%	13%	17%	5%	13%	12%	16%*	11%
Fruits, tree nuts, and berries	14%	30%	47%	39%	1%	47%	38%	38%*	38%
Other crops and hay	N/A	11%	8%	9%	9%	S	N/A	9%*	9%
Livestock	29%	26%	24%	25%	9%	S	N/A	24%*	28%
Cattle and calves	12%	12%*	17%	15%	8%	S	N/A	15%*	11%
Milk from cows	17%*	14%	8%	6%	0%	0%	0%	6%*	11%

Source: (USDA NASS, 2019)

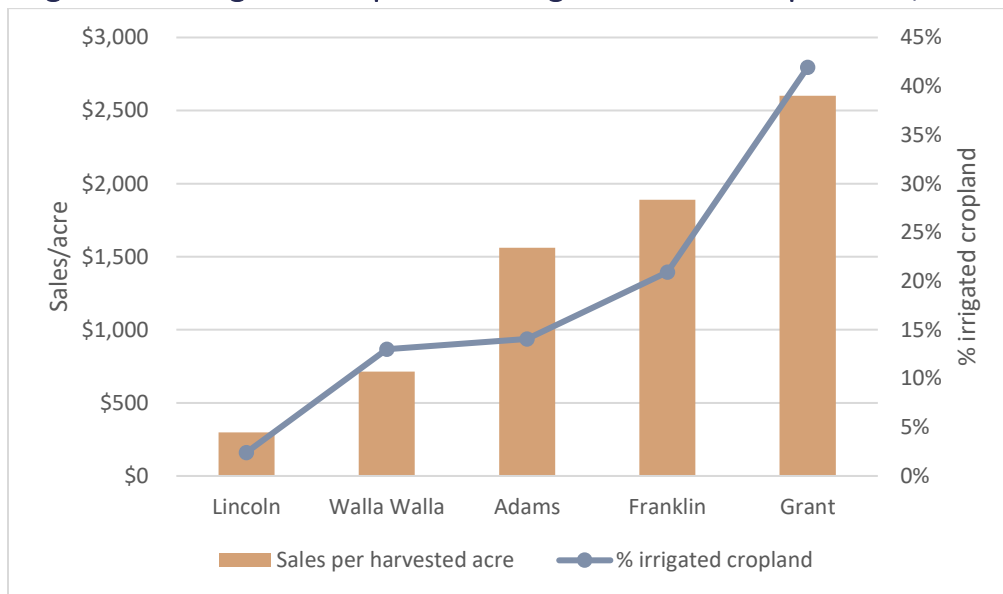
S = Data suppressed by NASS.

* = Data suppressed by NASS but approximated by Highland Economics.

N/A = Regional subtotal not available due to suppressed data for counties of the region.

The counties comprise less than 30% of the state’s land in farms but produce about 37% of the state’s sales, highlighting that the region generates more agricultural sales per acre than the state average. Looking at the third row of Table 3-3 (average sales per acre), it is evident that Franklin and Grant Counties have especially high sales per acre. This is due to the relatively higher percentages of vegetable and fruit crops grown in those counties and the higher proportion of irrigated acreage compared to dryland acreage. By comparison, Lincoln County, which grows primarily grain and hay crops, has much lower sales per acre. The higher sales per acre, as well as the prevalence of high-value crops, is highly related to irrigation water availability. This is evident in Figure 3-1 below, which compares the sales per harvested acre in each county to the proportion of all farmland that is irrigated cropland. As shown in the graph, as the irrigated land becomes more prevalent, the sales value produced per acre increases. This relationship highlights the importance of irrigation water from the CBP in increasing agricultural production value per acre. Higher agricultural production value per acre also generally translates into greater net economic value to farmers and also greater economic activity supported in diverse sectors throughout the region.

Figure 3-1: Irrigated Cropland and Agricultural Sales per Acre, 2017



Source: (USDA NASS, 2019)

Using the acreages in Table 3-2, we estimate the annual value of production based on publicly available data on yields and prices (as is further described in the Methodology section). The current total annual value of CBP crop production is estimated at \$2.66 billion. Of this, approximately 11% is generated in ECBID, 38% is generated in QCBID, 45% in SCBID, and 5% in other CBP lands. About 58% of the total value is fruit crops, most of which are produced in SCBID and QCBID. Vegetables are the next largest source of value (22%), with significant value produced in each area of the CBP.

Table 3-4: Average Annual CBP District Production Value by Crop Type

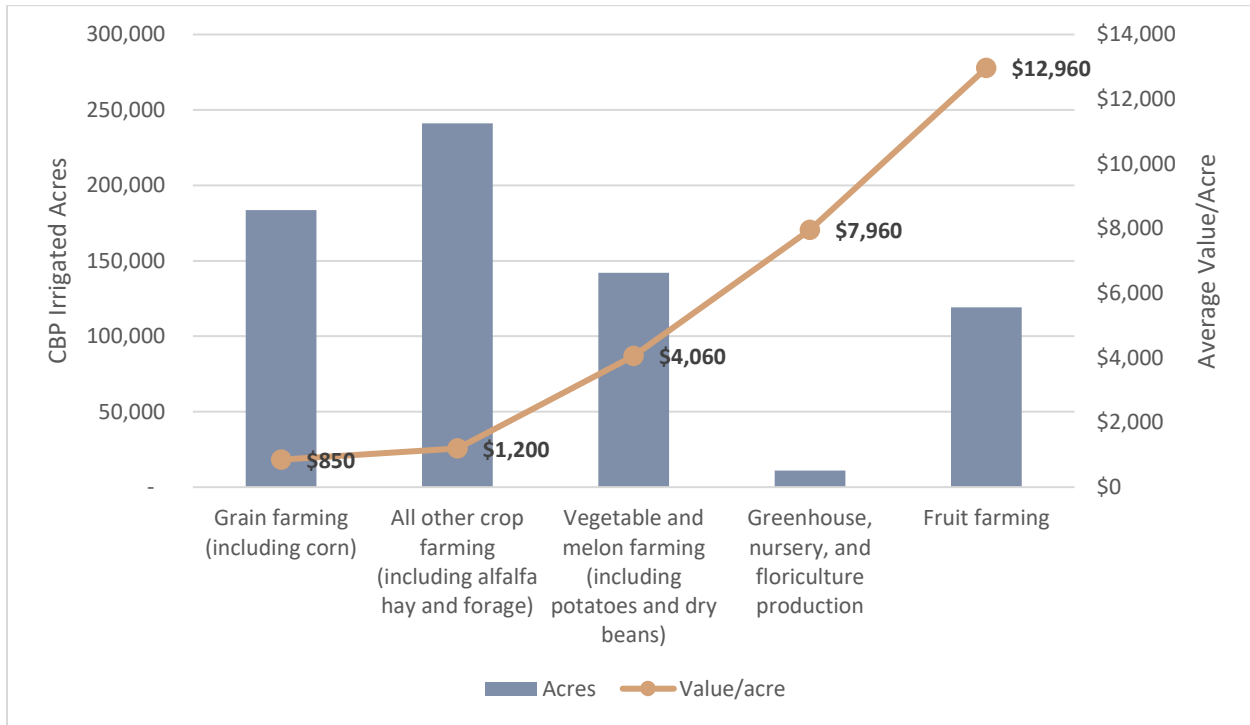
Crop Type (IMPLAN crop category)	ECBID	QCBID	SCBID	Other CBP Lands ¹³	Total
Oilseed farming	\$100,000	\$200,000	\$0	\$0	\$300,000
Grain farming (including grain corn and dry beans)	\$46,400,000	\$62,800,000	\$36,100,000	\$11,600,000	\$156,900,000
Vegetable and melon farming (including potatoes)	\$148,600,000	\$166,600,000	\$175,000,000	\$87,100,000	\$577,300,000
Fruit farming	\$37,100,000	\$611,700,000	\$874,900,000	\$21,700,000	\$1,545,400,000
Greenhouse, nursery, and floriculture ¹⁴	\$9,700,000	\$57,000,000	\$17,300,000	\$2,600,000	\$86,600,000
Sugarcane and sugar beet farming	\$900,000	\$700,000	\$0	\$0	\$1,600,000
All other crop farming (including alfalfa hay and forage)	\$61,900,000	\$115,400,000	\$96,600,000	\$14,500,000	\$288,400,000
Total	\$304,700,000	\$1,014,400,000	\$1,199,900,000	\$137,500,000	\$2,656,500,000

Source: Highland Economics analysis of district crop acreage data and NASS yields and prices.
Totals may not sum due to rounding.

¹³ These are 49,000 acres of lands that are dependent on groundwater recharged by CBP irrigation water; these lands are located in the CBP in Grant County.

¹⁴ Note that the per acre value of production in this sector varies widely, such that while SCBID has fewer acres than ECBID, it has much higher value.

Figure 3-2: CBP Acreage and Production Value by Crop



Source: Highland Economics analysis of (USDA NASS, 2019).

3.1.3 Value of Irrigation Water

As is evident in Figure 3-1 above showing the relationship between irrigated water and agricultural sales value per acre, the availability of irrigation water allows farms to increase the value of agricultural production from their land. Irrigation makes it possible to grow high-value crops, such as fruits and vegetables that would otherwise be impossible in the CBP region of eastern Washington that receives very little rainfall. As Table 3-5 below indicates, annual rainfall in the area ranges from 9 to 15 inches per year. When compared to the crop requirements (shown in Table 3-6 below), it is clear that, in an average year, rainfall alone is not capable of meeting the full water needs of crops in the study area in almost all cases.¹⁵ In most cases, the crops grown in the region and shown in Table 3-6 require at least 25 inches of water in an average year. As a result, irrigation plays a critical role in crop production in the study area.

¹⁵ The one exception being peas in Walla Walla County. Additionally, most of the rainfall in the region occurs in the winter and spring whereas crop water needs are spring through fall.

Table 3-5: Average Annual Rainfall by County (Inches)

County	Average Annual Precipitation (in inches)
Adams	11
Franklin	9
Grant	9
Lincoln	14
Walla Walla	15

Table 3-6: Average Annual Water Requirement by Crop and Location (Inches)

Crop	George, Grant County	Lind, Adams County	Legrow, Walla Walla County	Odessa, Lincoln County
Alfalfa	37.5	39.3	40.9	39.2
Apples	35	N/A	39.0	N/A
Asparagus	N/A	N/A	34.4	N/A
Bluegrass seed	N/A	17.8	17.2	18.7
Concord Grapes	N/A	N/A	29.9	N/A
Dry Beans	18.9	19.3	21.9	20.2
Field Corn	25.0	27.5	27.9	28.3
Hay	40.4	17.8	N/A	N/A
Lawn	36.1	38.6	39.1	38.5
Onions	22.4	32.4	28.6	28.0
Pasture	29.7	31.1	33.1	31.2
Peas	14.8	15.2	12.0	16.8
Peppermint	24.4	N/A	22.3	N/A
Potatoes	25.5	27.0	25.5	27.4
Shepody Potatoes	N/A	N/A	26.2	N/A
Spring Grain	24.1	24.1	25.1	25.0
Sugar Beets	30.6	32.4	N/A	33.2
Sweet Corn	21.3	N/A	22.4	N/A
Wine Grapes	N/A	N/A	25.0	N/A
Winter Grain	21.7	23.4	22.5	25.4

Source: (AgriMet, 2015)

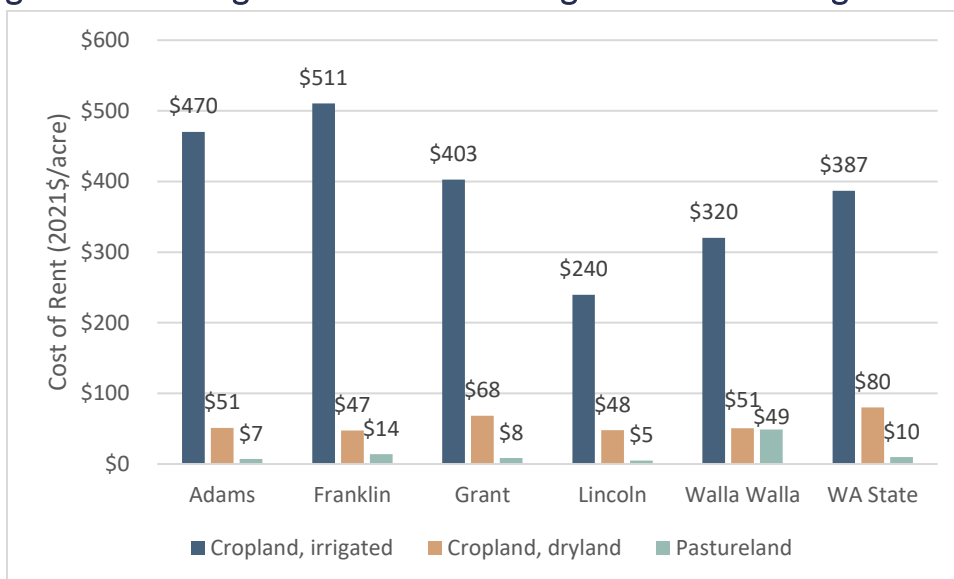
Data from the 2017 Census of Agriculture suggests that very few crops in the study area are grown without irrigation. These primarily-dryland crops include:

- Barley (in Grant, Lincoln, and Walla Walla Counties)
- Canola (Lincoln)
- Chickpeas (Lincoln and Walla Walla)
- Hay (only in Lincoln, elsewhere irrigated)
- Dry peas (only in Walla Walla, elsewhere irrigated)
- Wheat (all six counties) (USDA NASS, 2021).

A majority of the acreage in all other crops (for which there are data available) is irrigated, with all acreage irrigated for most other crops.

Comparing the rental rates for irrigated land to the rental rates for dryland provides a useful indication of the per-acre value of irrigation water. Figure 3-3 below compares rental rates of irrigated cropland, dryland cropland, and pastureland (which is almost completely non-irrigated in the study area according to the 2017 Census of Agriculture). Across the CBP counties, the average rental rate for irrigated cropland is \$389 per acre (2021 dollars), which is nearly identical to the state average of \$387.¹⁶ Rent for dryland cropland averages \$53 per acre, suggesting that access to irrigation generates an additional value of \$336 per acre per year on average. Within the CBP counties, this additional value of irrigation ranges from \$192 in Lincoln County to \$463 in Franklin County, and the primary CBP counties (Adams, Franklin, and Grant) have an average additional value of \$405 per acre. The value of water in the CBP as reflected in land rental rates is 32% higher than the state average (\$307 per acre, estimated based on \$387 for irrigated cropland versus \$80 for dryland cropland), suggesting that the CBP irrigation brings higher-than-average value to agriculture production relative to the state average.

Figure 3-3: Average Rental Rates for Irrigated and Non-Irrigated Land



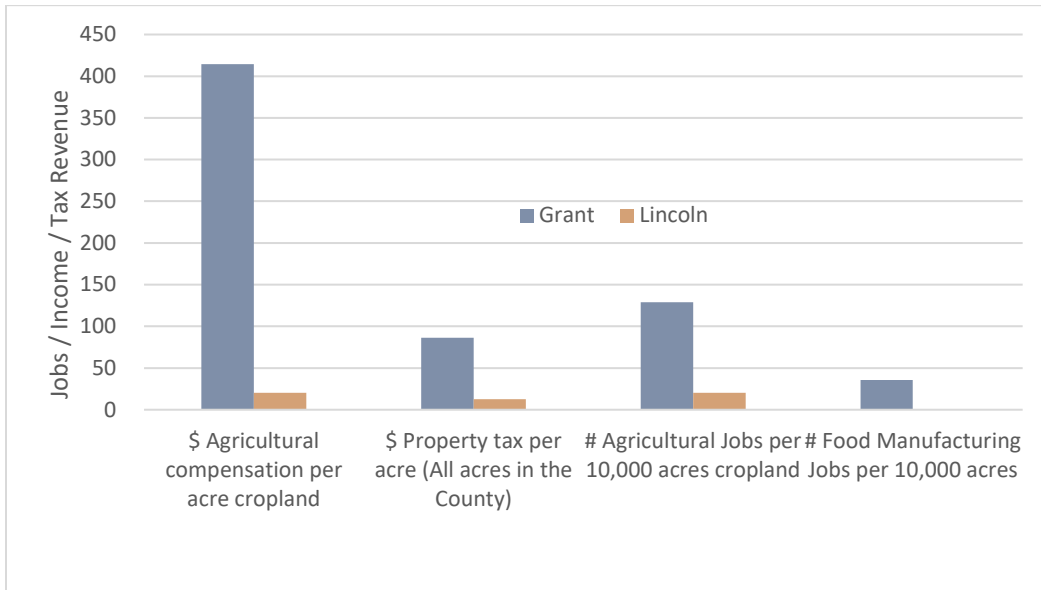
Note: Values represent the average rental rate from 2012-2020, where data was available. Annual values were adjusted to 2021 dollars using the Consumer Price Index prior to averaging.

Source: Highland Economics' analysis of (USDA NASS, 2021)

The economic conditions in Lincoln County compared to Grant County in Figure 3-4 highlight the importance of the CBP to overall economic development in east central Washington. As shown in the figure below, comparing the agricultural economies of Grant and Lincoln counties, agricultural compensation (including to proprietors and farm labors) per acre of farmland is over 20 times higher in Grant County, while property taxes for all acreage in the county (agricultural and otherwise) and the number of farm jobs per acre is approximately six times higher in Grant County. Grant County also has a robust food processing industry that is non-existent in Lincoln County.

¹⁶ Values represent the average rental rate from 2012-2020, where data was available (USDA NASS, 2021). Annual values were adjusted to 2021 dollars using the Consumer Price Index prior to averaging.

Figure 3-4: Agricultural Economy of Grant and Lincoln Counties Compared



3.2 AGRICULTURAL EMPLOYMENT AND INCOME

This section outlines the sources of farm jobs and income in the study area, as well as jobs and income generated by industries that depend on agriculture. Agriculturally-dependent industries include those that sell goods and services to agricultural operations (e.g., fertilizer companies) and those that use agricultural goods in their own products (e.g., frozen food manufacturers).

3.2.1 Farming

Crop and animal production comprises 18% of all private employment in the five-county area (U.S. Bureau of Labor Statistics, 2019). In Grant County, where farm employment is especially high, over one-quarter of all private employment is dedicated to crop and animal production. Table 3-7 breaks down the average annual employment by farming industry, with detail provided for each farming sectors as defined by the North American Industry Classification System (NAICS). In the table below, and many that follow, data for some counties is suppressed (indicated by an ‘S’ in the table); so for regional totals including such counties, we include a ‘+’ after the estimate to indicate that the sum of the available data is the minimum, and that the actual value may be higher due to suppressed values.

Industries, by NAICS name, with highest farming employment include:

- Fruit and tree nut farming (9,516 employees)
- Other crop farming, including hay (1,992 employees)
- Vegetable and melon farming (1,804 employees)
- Cattle ranching and farming (1,364 employees)
- Other crop farming (1,992 employees)
- Greenhouse and nursery production (933 employees)

Table 3-7: Wage and Salary Employment in Farming Industries, 2019

Industry	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Lincoln	Walla Walla	Other CBP Counties, Subtotal	CBP County Total
Total, all industries (private/non-governmental)	7,229	28,281	31,486	66,996	1,523	22,341	23,864	90,860
NAICS 11 Agriculture, forestry, fishing and hunting	2,981	S	S	2,981+	S	S	0+	2,981+
NAICS 111 Crop production	849	3,306	7,612	11,767	196	3,270	3,466	15,233
NAICS 1111 Oilseed and grain farming	160	106	162	428	156	198	354	782
NAICS 1112 Vegetable and melon farming	154	754	896	1,804	S	S	0+	1,804+
NAICS 1113 Fruit and tree nut farming	261	1,506	5,006	6,773		2,743	2,743	9,516
NAICS 1114 Greenhouse and nursery production	85	170	678	933	S	S	0+	933+
NAICS 1119 Other crop farming	189	770	870	1,829	25	138	163	1,992
NAICS 112 Animal production and aquaculture	351	S	525	876+	S	111	111+	987+
NAICS 1121 Cattle ranching and farming	302	480	490	1,272	10	82	92	1,364
NAICS 11211 Beef cattle ranching, farming, and feedlots	41	141	183	365	10	82	92	457
NAICS 11212 Dairy cattle and milk production	260	339	307	906				906
NAICS 1129 Other animal production	S	13	S	13+	S	S	0+	13+
Total Farm Proprietor Employment, All Sectors	487	673	1,136	2,296	1,882	787	2,669	4,965
TOTAL FARM EMPLOYMENT	1,687	4,472	9,273	10,960+	2,088	4,168	6,256	17,216+

Note: "S" indicates the value was suppressed in the original dataset to protect the identity (or identifiable information) of cooperating employers, or to protect sensitive information from another industry or area.

Source: (U.S. Bureau of Labor Statistics, 2019) and Bureau of Economic Analysis, 2021.

The Bureau of Labor Statistics data presented by NAICS code in Table 3-7 only includes wage and salary employment but does not include proprietor employment. Data from the Bureau of Economic Analysis, which does include proprietor employment (but does not provide the level of employment by crop type), indicate that proprietor farm employment is also sizable in the region. Including both wage and

salary and proprietor farm employment, in the three primary CBP counties of Adams, Franklin, and Grant, there are approximately 15,432 people employed in the farm sector.

Table 3-8 shows the total wages by farming industry and county (the estimates do not include profits to farm proprietors but solely show wages paid to employees). Crop and animal farming in the five-county area paid roughly \$548 million in wages in 2019 (this is the sum of NAICS sectors 111 and 112), comprising 14% of all wages from private companies (U.S. Bureau of Labor Statistics, 2019).¹⁷ Over 90% of those wages were related to crop production (as opposed to animal production). Farming industries (by NAICS sector) that paid the largest number of total wages were:

- Fruit and tree nut farming (nearly \$271 million)
- Vegetable and melon farming (nearly \$86 million)
- Other crop farming, including hay (over \$74 million)
- Cattle ranching and farming (over \$63 million)

¹⁷ Dollar values were adjusted to 2021 dollars using the Consumer Price Index. Note that the values in Table 3-8 differ from the data presented in Table 2-8 that showed total compensation by industry; total compensation includes proprietor income as well as wage income.

Table 3-8: Wages in Farming Industries, 2019 (in millions)

Industry	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Lincoln	Walla Walla	Other CBP Counties, Subtotal	CBP County Total
NAICS 11 Agriculture, forestry, fishing and hunting	\$100.12	S	S	\$100.12+	S	S	\$0.00+	\$100.12+
NAICS 111 Crop production	\$33.88	\$118.75	\$232.85	\$385.48	\$6.09	\$110.31	\$116.40	\$501.88
NAICS 1111 Oilseed and grain farming	\$6.35	\$4.12	\$5.53	\$16.00	\$4.64	\$7.10	\$11.74	\$27.74
NAICS 11114 Wheat farming	\$2.52	\$3.83	\$3.18	\$9.53	\$3.58	\$5.50	\$9.08	\$18.61
NAICS 11119 Other grain farming	S	S	\$2.16	\$2.16+	\$1.06	S	\$1.06+	\$3.22+
NAICS 1112 Vegetable and melon farming	\$7.24	\$38.97	\$39.40	\$85.61	S	S	\$0.00+	\$85.61+
NAICS 11121 Vegetable and melon farming	\$7.24	\$38.97	\$39.40	\$85.61	S	S	\$0.00+	\$85.61+
NAICS 1113 Fruit and tree nut farming	\$7.93	\$36.70	\$135.98	\$180.61		\$90.37	\$90.37+	\$270.98+
NAICS 11133 Noncitrus fruit and tree nut farming	\$7.93	\$36.70	\$135.98	\$180.61		\$90.37	\$90.37+	\$270.98+
NAICS 1114 Greenhouse and nursery production	\$5.39	\$6.63	\$23.10	\$35.12	S	S	\$0.00+	\$35.12+
NAICS 11141 Food crops grown under cover	S		\$3.22	\$3.22+	S	S	\$0.00+	\$3.22+
NAICS 11142 Nursery and floriculture production	S	\$6.63	\$19.88	\$26.51+		S	\$0.00+	\$26.51+
NAICS 1119 Other crop farming	\$6.97	\$32.32	\$28.84	\$68.13	\$0.99	\$5.24	\$6.23	\$74.36
NAICS 11194 Hay farming	\$4.14	\$14.11	\$11.00	\$29.25	\$0.23	\$1.90	\$2.13	\$31.38
NAICS 11199 All other crop farming	\$2.82	\$18.22	\$17.84	\$38.88	\$0.75	\$3.34	\$4.09	\$42.97
NAICS 112 Animal production and aquaculture	\$15.95	S	\$24.87	\$40.82+	S	\$5.23	\$5.23+	\$46.05+
NAICS 1121 Cattle ranching and farming	\$14.12	\$21.67	\$23.52	\$59.31	\$0.27	\$3.93	\$4.20	\$63.51
NAICS 11211 Beef cattle ranching, farming, and feedlot	\$1.76	\$6.16	\$9.56	\$17.48	\$0.27	\$3.93	\$4.20	\$21.68
NAICS 11212 Dairy cattle and milk production	\$12.35	\$15.51	\$13.95	\$41.81				\$41.81
NAICS 1129 Other animal production	S	\$0.65	S	\$0.65+	S	S	\$0.00+	\$0.65+
NAICS 11291 Apiculture	S	\$0.65	S	\$0.65+		\$1.30	\$1.30	\$1.95+

Note: "S" indicates the value was suppressed in the original dataset to protect the identity (or identifiable information) of cooperating employers, or to protect sensitive information from another industry or area. All values were adjusted to 2021 dollars using the Consumer Price Index.

Source: (U.S. Bureau of Labor Statistics, 2019)

3.2.2 Agricultural Support and Product Processing

Because agriculture is such a large sector of the economy in the study area, many other agriculture-related industries depend on it. These include businesses that sell agricultural inputs and equipment (such as fertilizer and tractors), offer agriculture-related services (e.g., soil analysis and packing), and create value-added products (e.g., canning and preserving fruits and vegetables). Support activities to agricultural and forestry industries comprise 4% of all private employment in the six-county area; a total of 7,361 employees (U.S. Bureau of Labor Statistics, 2019). Table 3-9 below outlines the employment by industry for the six counties.

Food manufacturing (also referred to as food processing) represents about 5% of private employment (over 9,252 employees) in the study area, most of which are in the fruit and vegetable preserving and specialty (over 6,700 employees) and frozen food manufacturing (over 1,427 employees) industries. Other notable agricultural support industries include:

- Farm supplies merchant wholesalers (over 859 employees)
- Farm and garden equipment merchant wholesalers (over 1,346 employees)
- Grocery and related products wholesalers (over 644 employees)
- Nursery, garden, and farm supply stores (over 315 employees)

Table 3-9: Employment in Agricultural Support and Processing Industries, 2019

Industry	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Benton	Lincoln	Walla Walla	Other CBP Counties, Subtotal	Region Total
Total, all industries (private/non-governmental)	7,229	28,281	31,486	66,996	79,597	1,523	22,341	103,461	170,457
NAICS 115 Agriculture and forestry support activities	1,781	2,503	1,389	5,673	1,445	65	178	1,688	7,361
NAICS 1151 Support activities for crop production	S	S	1,378	1,378+	S	S	164	164+	1,542+
NAICS 11511 Support activities for crop production	S	S	1,378	1,378+	S	S	164	164+	1,542+
NAICS 311 Food manufacturing	1,003	2,959	2,036	5,998	1,480	S	1,774	3,254+	9,252+
NAICS 3111 Animal food manufacturing	S	S	100	100+	S		S	0+	100+
NAICS 31111 Animal food manufacturing	S	S	100	100+	S		S	0+	100+
NAICS 3114 Fruit and vegetable preserving and specialty	964	2,593	1,790	5,347	1,359		S	1,359+	6,706+
NAICS 31141 Frozen food manufacturing	S	S	1,427	1,427+	S		S	0+	1,427+
NAICS 31142 Fruit and vegetable canning and drying	S	S	363	363+	S		S	0+	363+
NAICS 42382 Farm and garden equip. merchant wholesalers	88	261	239	588	713	S	45	758+	1,346+
NAICS 4244 Grocery and related product wholesalers	S	274	229	503+	56		85	141+	644+
NAICS 42448 Fruit and vegetable merchant wholesalers	S	S	164	164+	284		S	284+	448+
NAICS 4245 Farm product raw material merch. whls.	S	S	81	81+	S	S	114	114+	195+
NAICS 42451 Grain and field bean merchant wholesalers	S	S	63	63+		S	S	0+	63+
NAICS 42491 Farm supplies merchant wholesalers	S	370	429	799+		S	60	60+	859+
NAICS 44422 Nursery, garden, and farm supply stores	S	132	119	251+	64		S	64+	315+
NAICS 44523 Fruit and vegetable markets	S	S	7	7+	S		S	0+	7+
NAICS 3253 Agricultural chemical manufacturing		11	S	11+	S			0+	11+
NAICS 32531 Fertilizer manufacturing		11	S	11+	S			0+	11+

Note: "S" indicates the value was suppressed in the original dataset to protect the identity (or identifiable information) of cooperating employers, or to protect sensitive information from another industry or area.

Source: (U.S. Bureau of Labor Statistics, 2019)

Businesses in the six county study area that support agricultural and forestry production paid approximately \$243 million in wages in 2019, 75% of which occurred in Adams, Franklin, and Grant Counties (U.S. Bureau of Labor Statistics, 2019).¹⁷ Large wage-paying industries that supply agriculture include farm and garden equipment merchant wholesalers (over \$47 million) and farm supplies merchant wholesalers (over \$62 million).¹⁷ Food manufacturing wages totaled over \$475 million, with Franklin and Grant Counties generating half of that value (see Table 3-10).¹⁷ Based on the available data, most of these wages come from the fruit and vegetable preserving and specialty industry (over \$352 million) and the frozen food manufacturing industry (over \$78 million).¹⁷

Table 3-10: Wages in Support and Processing Industries, 2019 (in millions)

Industry	Adams	Franklin	Grant	Primary CBP Counties, Subtotal	Benton	Lincoln	Walla Walla	Other CBP Counties, Subtotal	Region Total
Total, all industries (private/non-governmental)	\$290	\$1,213	\$1,310	\$2,813	\$4,619	\$59	\$1,000	\$5,678	\$8,491
NAICS 115 Agriculture and forestry support activities	\$50.30	\$75.94	\$56.08	\$182.32	\$51.66	\$3.31	\$6.02	\$60.99	\$243.31
NAICS 1151 Support activities for crop production	S	S	\$55.81	\$55.81+	S	S	\$5.50	\$5.50+	\$61.31+
NAICS 11511 Support activities for crop production	S	S	\$55.81	\$55.81+	S	S	\$5.50	\$5.50+	\$61.31+
NAICS 311 Food manufacturing	\$57.95	\$135.80	\$108.36	\$302.11	\$87.94	S	\$85.31	\$173.25+	\$475.36+
NAICS 3111 Animal food manufacturing	S	S	\$4.58	\$4.58+	S		S	\$0.00+	\$4.58+
NAICS 31111 Animal food manufacturing	S	S	\$4.58	\$4.58+	S		S	\$0.00+	\$4.58+
NAICS 3114 Fruit and vegetable preserving and specialty	\$56.04	\$117.69	\$96.10	\$269.83	\$82.21		S	\$82.21+	\$352.04+
NAICS 31141 Frozen food manufacturing	S	S	\$77.71	\$77.71+	S		S	\$0.00+	\$77.71+
NAICS 31142 Fruit and vegetable canning and drying	S	S	\$18.39	\$18.39+	S		S	\$0.00+	\$18.39+
NAICS 42382 Farm and garden equip. merchant whls.	\$6.44	\$19.68	\$15.81	\$41.93	\$3.01	S	\$2.63	\$5.64+	\$47.57+
NAICS 4244 Grocery and related product wholesalers	S	\$10.90	\$7.20	\$18.10+	\$17.85		\$3.85	\$21.70+	\$39.80+
NAICS 42448 Fruit and vegetable merchant wholesalers	S	S	\$3.71	\$3.71+	S		S	\$0.00+	\$3.71+
NAICS 4245 Farm product raw material wholesale	S	S	\$3.21	\$3.21+	S	S	\$8.93	\$8.93+	\$12.14+
NAICS 42451 Grain and field bean merchant wholesalers	S	S	\$2.95	\$2.95+		S	S	\$0.00+	\$2.95+
NAICS 42491 Farm supplies merchant wholesalers	S	\$27.35	\$25.90	\$53.25+	\$5.27	S	\$3.90	\$9.17+	\$62.42+
NAICS 44422 Nursery, garden, and farm supply	S	\$7.11	\$7.70	\$14.81+	S		S	\$0.00+	\$14.81+
NAICS 44523 Fruit and vegetable markets	S	S	\$0.08	\$0.08+	S		S	\$0.00+	\$0.08+
NAICS 3253 Agricultural chemical manufacturing		\$0.48	S	\$0.48+	S			\$0.00+	\$0.48+
NAICS 32531 Fertilizer manufacturing		\$0.48	S	\$0.48+	S			\$0.00+	\$0.48+

Note: "S" indicates the value was suppressed in the original dataset to protect the identity (or identifiable information) of cooperating employers, or to protect sensitive information from another industry or area. All values were adjusted to 2021 dollars using the Consumer Price Index.

Source: (U.S. Bureau of Labor Statistics, 2019)

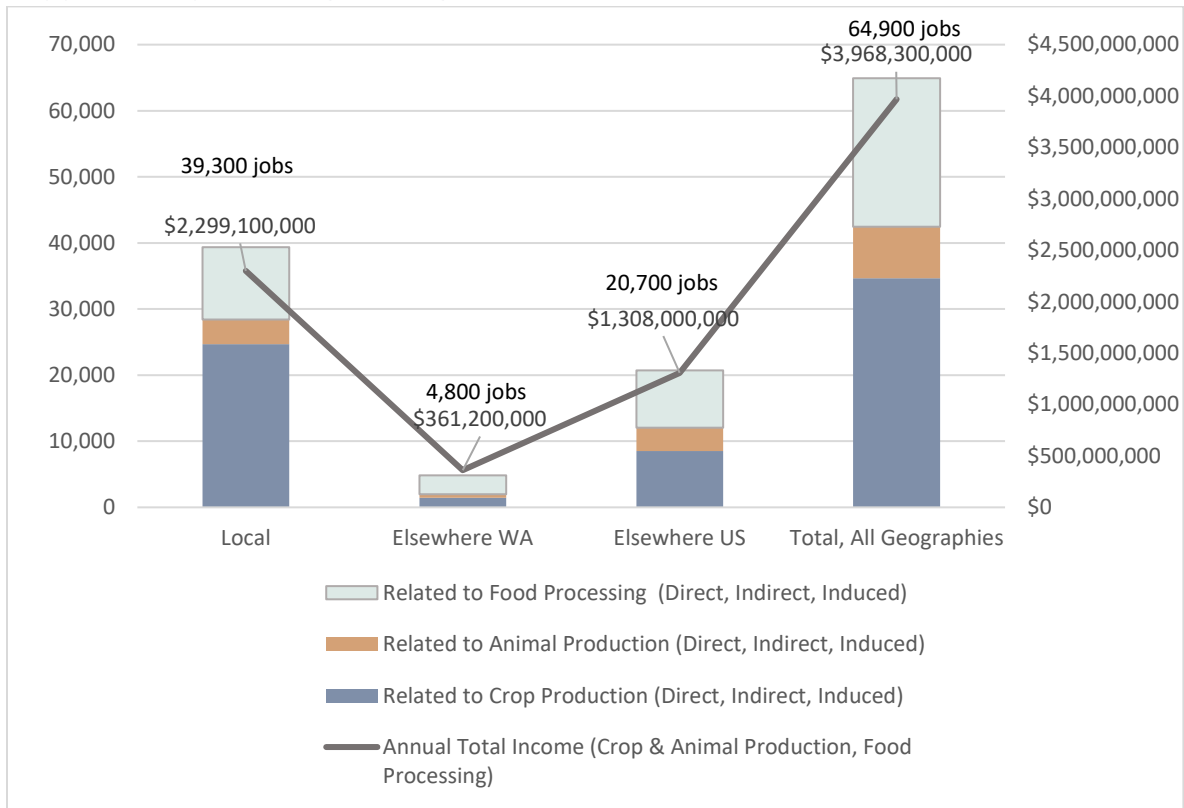
4 ECONOMIC CONTRIBUTION OF THE CBP AGRICULTURAL ECONOMY

This section describes the methods used to estimate the economic impacts of the CBP and details the results of that analysis. CBP crop production supports economic activity throughout the local region, as well as throughout the rest of Washington State and the nation. The total economic contribution of the CBP includes: 1) the direct effects on farms of agricultural jobs and income supported by irrigated crop production, 2) the indirect effects in other sectors of jobs and income supported by farms purchasing inputs such as seed, fertilizer, and farm equipment necessary for crop production, and 3) the induced effects in other sectors such as real estate and health care resulting from the spending of employee wages. There are also additional economic effects of the CBP: CBP crop production is a vital input and makes possible substantial local animal production and food processing, and CBP irrigation infrastructure provides water-based recreation opportunities that support a thriving local recreation economy (discussed in Section 5).

The total economic contribution (direct, indirect, and induced) of each these types of effects from agricultural production is summarized in Figure 4-1 below.¹⁸ **In the local region, the CBP agricultural production (not including recreation effects of the CBP) supports an estimated 39,300 jobs (full and part-time jobs) and \$2.3 billion in income (including total employee compensation and proprietor income) annually.** Elsewhere in Washington State, an estimated 4,800 jobs and \$361 million in income are supported annually, while elsewhere in the nation, 20,700 jobs and \$1.3 billion in income may be supported annually (estimation of effects elsewhere in the nation is less certain). Note that in the absence of the CBP, economic activity would fall by less than this amount as many people directly or indirectly employed in CBP-related activities would engage in other economic activities.

¹⁸ Note that Figure 4-1 includes only agricultural production-related economic contribution while the similar Figure ES-4 also includes recreation-related economic contribution so has slightly higher estimates.

Figure 4-1: Total Employment and Annual Labor Income (Direct, Indirect, Induced) Supported by CBP Irrigated Agriculture



4.1 METHODOLOGY & DATA SOURCES

This section outlines the data sources and methods to estimate the total economic contribution of production on CBP-irrigated lands. **Economic contribution is measured in terms of employment (full and part-time jobs) and labor income (employee compensation and proprietor income) directly or indirectly supported by CBP crop production.**

The analysis first estimated the direct jobs, income, and employment from crop production. Using regional economic models, the analysis then estimated the “backward-linked”, secondary “ripple” effects on sectors that provide inputs to agriculture (indirect effects), as well as the ripple effects of farm employees (and other linked sector employees) spending wages and spurring economic activity at retail, service sector, and other businesses (induced effects). Finally, the analysis also estimated the total

TYPES OF ECONOMIC EFFECTS

Direct: Farm jobs and income related to irrigated crop production.

Indirect: Jobs and income at businesses supplying inputs, such as fertilizer, machinery, seeds to the CBP-irrigated farms.

Induced: Jobs and income at businesses such as retail stores and service providers supported by the spending of CBP-related income.

Forward-Linked: Jobs and income in industries reliant on CBP crop production, such as animal production and food processing, and reliant on CBP infrastructure, such as water-based recreation.

economic effects (direct, indirect, and induced) of ‘forward-linked’ animal production and food processing production that is reliant on CBP production as key inputs. **Total effects in economic impact analysis are equal to the sum of direct, indirect, and induced effects of both backward linked and forward linked sectors.**

To estimate the indirect and induced “ripple” effects of CBP economic activity, this analysis used IMPLAN, a regional economic model that simulates the economic relationships between industries in terms of input and output, jobs, and taxes (IMPLAN, 2021). The study region is six counties: Adams, Franklin, Grant, Walla Walla, Lincoln, and Benton counties. Adams, Franklin, and Grant have the vast majority of CBP-irrigated acreage. Walla Walla has some CBP irrigated acreage; agricultural land in Lincoln is authorized by Congress to receive CBP irrigation water (although the project has not been completed to reach lands in Lincoln), and Benton is closely tied with the economy of the other counties as the regional hub of the tri-cities of Kennewick, Pasco and Richland spans both Benton and Franklin counties. The economic impacts of the CBP influence the economies of these immediately surrounding

counties, particularly Benton County, due to food processing and winery operations that are reliant on local crop production.

The economic impact analysis for Washington State and for the local six-county region was done using a multiple-region input output, or MRIO, methodology. In this method, the IMPLAN model estimates not only the economic impacts of inter-industry spending and ripple effects within the study area, but also models the purchase of inputs from Washington State that are used in the six-county study area to produce the crops, animals, and food products analyzed.

It is not feasible to use IMPLAN software to conduct MRIO analysis to estimate the economic linkages and the inputs purchased from elsewhere in the Nation to support CBP economic activity. As such the analysis could only approximate the purchases from elsewhere in the Nation that support CBP crop/animal production and related food processing and the associated total economic contribution. Specifically, the analysis used a separate, national-level economic model to estimate the average total economic contribution throughout the nation that would be expected to result from the level of crop, animal, and food processing output associated with the CBP. At the national level there is a higher level of total economic contribution than estimated to occur in just Washington State as goods and services can be sourced from throughout the entire nation, and not just from Washington State (i.e., if most farm equipment is not manufactured in Washington State, then the economic effect on the manufacturing sector of CBP farms purchasing farm equipment will not be captured by the MRIO analysis for the 6-county region and Washington State). The national model captured the higher level of economic contribution that results from a greater geographic area providing a larger portion of the economic inputs required to support this level of crop/animal production and food processing. As such, the economic effects estimated in this analysis for the rest of the nation are based on the difference between the national model estimates and the MRIO model estimates for the six-county region and the State of Washington. While this is the only available way to estimate the impacts of the CBP that are experienced at the national level, there is less certainty in the accuracy of the estimates than at the local and state level, as the national level model provides average economic contribution estimates for production that occurs anywhere in the United States as a whole.

4.1.1 Data Sources

The key data sources for the economic impact analysis of agricultural production are as follows:

- Farm-Level Employment. Data on crop and animal farm employment, including workers and proprietors, were gathered at the County level from the Bureau of Economic Analysis. Direct crop employment effects of the CBP were based on the proportion of CBP irrigated acreage relative to total county acreage (e.g., if 80% of the irrigated acreage in a given county is in the CBP, we assumed 80% of the county farm employment was reliant on the CBP)¹⁹, while direct animal employment effects of the CBP were based on the proportion of total county milk production and cattle production reliant on CBP crop production.
- CBP Irrigated Acreage by Crop. These data was provided by the three irrigation districts in the CBP. ECBID and QCBID provided data on the annual acres under production by crop from 2010 to 2020 (East Columbia Basin Irrigation District, 2021; Quincy-Columbia Basin Irrigation District, 2021). SCBID provided similar data for the years 2008, 2009, 2010, 2015, and 2021 (South Columbia Basin Irrigation District, 2021). In total, the districts' data included the production acreage for 121 crops.
- Value per Acre by Crop. To estimate the production value per acre of each crop grown, the analysis used yield and farmgate price²⁰ data from the USDA National Agricultural Statistical Service (NASS) database Quickstats (USDA NASS, 2021).

¹⁹ With this assumption, we assume that the irrigated crop production in the CBP requires approximately the same labor per acre as other irrigated lands in each county.

²⁰ Farmgate prices are the prices growers receive for their agricultural products.

- Dairy Production Value in CBP. To estimate the annual milk production value in CBP counties, the analysis relied on 2020 data gathered by the US Department of Agriculture under the Pacific Northwest Federal Milk Marketing Order (US Department of Agriculture, 2021). The analysis also relied on data from the Washington Department of Agriculture on the location of dairy facilities in the CBP region, which indicates that all dairies in Grant, Adams, and Franklin Counties are located within the CBP boundaries (Washington State Department of Agriculture, 2021). As such, the analysis assumes all milk production in Adams, Franklin, and Grant counties is reliant on CBP irrigated agricultural production.
- Beef Cattle Value in CBP Counties. To estimate the value of beef cattle, the analysis used US Department of Agriculture National Agricultural Statistics Service (NASS) data on the total sales of cattle (including calves) in Adams, Grant, and Franklin counties in the years 2002, 2007, 2012, and 2017. To estimate the value of beef cattle reliant on CBP production, the analysis used NASS data on the total hay acreage of production in Adams, Grant, and Franklin counties coupled with data from the districts on crop acreage to estimate the total proportion of hay acreage in the three-county area that is irrigated by the CBP. The analysis assumes that the proportion of livestock value in the three counties that is supported by the CBP is equivalent to the proportion of hay acreage in the three counties that is grown in the CBP: approximately 75%.²¹ To the extent that hay and other forage crops in the CBP supports livestock production elsewhere in the three-county region, the analysis will underestimate the total local livestock value supported by the CBP.
- Food Manufacturing or Processing Value. To estimate the value of local food processing that is reliant on CBP crop production, the analysis uses data from Bureau of Economic Analysis and Bureau of Labor Statistics on the size of the regional food processing industry; data from the IMPLAN model on the reliance of each local food processing industry sector on key crops grown in the CBP (i.e., the proportion and amount of crop inputs sourced locally); data from NASS on the proportion of vegetable acreage grown in Adams, Franklin, and Grant counties that is for processing; and wine industry publications regarding wine grape acreage and wineries.

4.2 CBP CROP PRODUCTION VALUE AND CBP-SUPPORTED ANIMAL & PROCESSING VALUES

To estimate the annual production value from CBP-supported crops, the analysis started with the acreage data provided by the irrigation districts. For each of the 121 crops in the dataset, the analysis used average annual acres under production for the years of data available. For about half of the crops in the districts' data, NASS statistics had yield and farmgate price data. For the other half of crops (mostly small acreage specialty crops) that did not have price and yield data, the analysis assigned values for a similar crop that had available yield and price data. For example, prices and yields for leaf lettuce (for which there was data) were used to approximate the per acre value of endive kale (which had no available yield and price data). In cases where similar crops have a lower production value per acre than the actual crop, it would lead to an underestimate of CBP impacts; in cases where the production value was higher, it would lead to an overestimate of CBP impacts. However, care was taken to assign the most relevant substitute crops based on available price and yield data, and the resulting overall

²¹ Note that much of the hay grown in the three-county area is exported; the analysis assumes that hay from the CBP and from non-CBP acreage in the three-county area are equally likely to be used locally to support animal production or be exported.

estimated production value is considered a good approximation for the actual value produced on CBP-irrigated agricultural lands.

The availability of price and yield data varied by crop and geography. For some crops, yield data existed at the county level. For other crops, yield data were only available at the state or national level. For all crops, price data were only available at the state or national levels. For each crop, data at the most proximate geographic level was used in order to match the local conditions as closely as possible (i.e., county data was prioritized first, then state, and national only when others were not available). When county-level yield data were available for districts that straddle multiple counties, a weighted average was taken of the county yields according to the approximate percentage of the district that lies within each county. ECBID was weighted 55/45 between Adams and Grant Counties. SCBID was weighted 80/20 between Franklin and Grant Counties. QCBID was based on Grant County alone. Once the most relevant yield and price were determined, the analysis multiplied the average annual acres dedicated to each crop by its corresponding yield and price to estimate the total production value for each crop. Each crop was assigned to a general crop category to match the categories used in IMPLAN software. The total production value of each crop category is shown in Figure 4-2 and Table 4-1 below.

Figure 4-2: CBP Crop Production Value (By IMPLAN crop category)

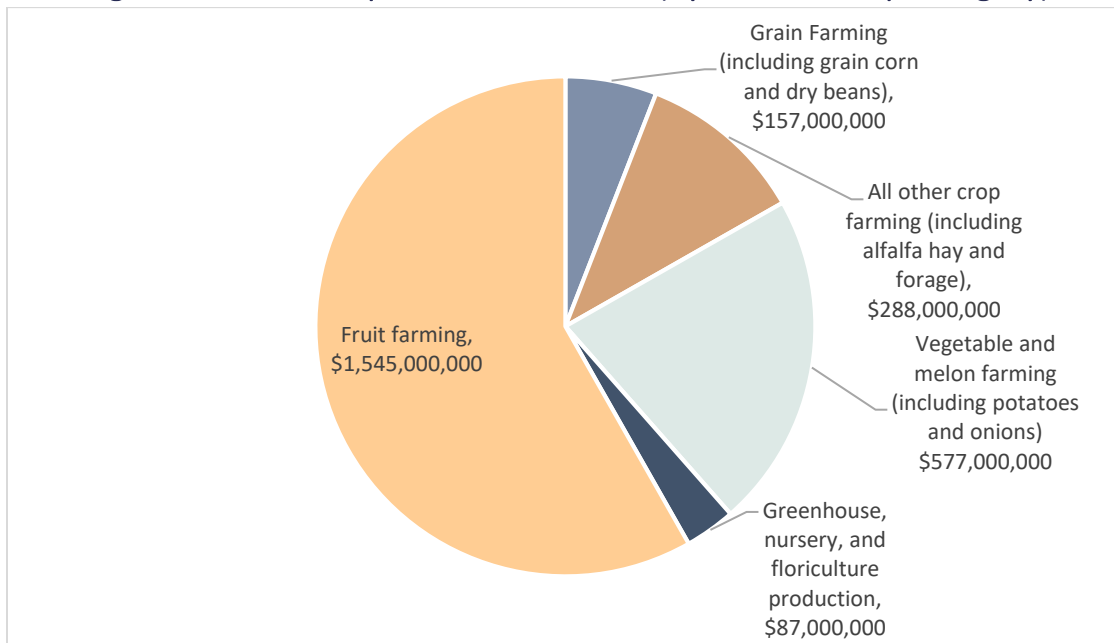


Table 4-1: Estimated Annual CBP Crop Production Value by IMPLAN crop category

Crop Type (by IMPLAN Crop Category)	CBP Annual Average Production Value
Oilseed farming	\$300,000
Grain farming (including grain corn and dry beans)	\$156,900,000
Vegetable and melon farming (including potatoes)	\$577,300,000
Fruit farming	\$1,545,400,000
Greenhouse, nursery, and floriculture production	\$86,700,000
Sugar beet farming	\$1,600,000
All other crop farming (including alfalfa hay and forage)	\$288,400,000
Total	\$2,656,500,000

CBP irrigation water not only supports crop production, but also supports a local livestock industry dependent on those crops for feed. The study area supports a thriving dairy and cattle industry. As noted above, to estimate the value of dairy milk production supported by CBP crops, this analysis used data from the US Department of Agriculture under the Pacific Northwest Federal Milk Marketing Order (US Department of Agriculture, 2021) and data from the Washington Department of Agriculture on the location of dairy facilities in the CBP region. In total, the 39 dairies in Adams, Franklin, and Grant Counties (there are no dairies reported in Walla Walla County), all of which are located within CBP boundaries, produced 1,720,783,000 pounds of milk in 2021. NASS data for 2010 to 2020 indicates that during this time the price of milk (expressed in 2021 dollars) averaged \$0.21 per pound. As such, the total value of milk produced in the CBP, and supported by CBP crop production, is estimated at approximately \$358,800,000 annually. Dairies may source feed from other areas, but many components of dairy feed, such as silage, are heavy and are expensive to transport. As such, dairies typically grow some of their own feed or source it locally. Based on the location of all dairies in Adams, Franklin, and Grant counties within CBP boundaries, this study assumes that all dairy production (100%) in these three counties is reliant on and supported by feed crops from the CBP.

To estimate the value of local cattle production that is supported by feed crops grown in the CBP, the analysis assumes that the proportion of cattle sold in the three primary CBP counties (Adams, Franklin, and Grant) that is reliant on CBP production is equal to the proportion of total hay acreage in the three counties that is grown in CBP-irrigated areas. Accordingly, the analysis calculates the average annual cattle (including calves) sales in each of the three counties using the data available in the years 2002, 2007, 2012, and 2017 (\$416.9 million), and the average annual acres dedicated to hay production for the data available from 2014 to 2020 (259,359 acres) (USDA NASS, 2021).²² By calculating the percent of the total three-county hay acres that are grown on CBP-irrigated lands (approximately 75%), and applying this percent to the annual value of cattle (including calves) in the three-county area, the analysis estimates the value of three-county cattle sales supported by CBP irrigation. These values are shown in Table 4-2 under “Beef cattle ranching & farming.”

²² The annual production value in each year was adjusted for inflation to 2021 dollars using the Consumer Price Index prior to averaging.

Table 4-2: Estimated Annual CBP-Supported Animal Production Value

Crop Type	Total 3 County Value	Approximate % of 3-County Value	Estimated CBP-Supported Annual Average Production Value
Beef cattle ranching & farming	\$416,900,000	75%	\$312,300,000
Dairy cattle and milk production	\$358,800,000	100%	\$358,800,000
Total	\$775,700,000	87%	\$671,100,000

Regarding food and animal processing, this analysis relied on data from a variety of sources to estimate the processing values that are heavily reliant on the local CBP crop and animal production. The sectors that are most reliant are listed in Table 4-3; these are the sectors in which a large share of the total final product value is a crop or animal input that is produced in the CBP. Note that the total local food processing sector includes many sectors not highlighted in Table 4-3, but these are the primary sectors that are heavily reliant on locally produced crops and animals. Data that was used to estimate the values presented in Table 4-3 include:

- US Census of Agriculture data for 2012 and 2017 indicate that 80% of the vegetable acreage²³ harvested in Adams, Franklin, and Grant Counties is for processing (146,300 acres out of 181,700 acres). Further the three primary CBP counties of Adams, Franklin, and Grant account for approximately 60% of the processing vegetable acreage in the overall six-county region.
- US census of Agriculture data for 2012 and 2017 indicate that for fruit acreage (excluding grapes), approximately 70% of six county region sales are from acreage in the three-county region.
- For grape acreage, US census of Agriculture data for 2012 and 2017 indicate approximately 33% of the six-county acreage is located in the three primary CBP counties.
- For wine grapes, a 2018 report published by Washington Wine presented data on wineries and wine production by County as well as wine grape acreage by county that was useful in estimating the proportion of six-county winery production that is supported by the CBP. As of 2018 there were 944 wineries in the State of Washington, of which 30 were in Adams, Franklin, and Grant counties, and 292 of which were in the six-county study area. The wineries in the six-county study area produced 67% of the total wine production in the State of Washington (13,081,450 cases out of 19,424,190 cases statewide), approximately equivalent to the proportion of statewide wine grape acreage grown in the six-county region of 66%. These data highlight the importance of wine grape production in the CBP and other regions of the study area, and the use of CBP wine grapes by wineries in the broader six-county region (as there are few wineries in the three counties where the vast majority of CBP acreage is located). As the CBP has 31% of the vineyard acreages in the six-county region (12,250 acres out of 39,200 acres), this analysis assumes that it supports 30% of the six-county winery output value.
- IMPLAN data on the total crop and animal demand by each food manufacturing or processing sector, and the proportion of local inputs used in these sectors.

²³ Nearly three-quarters of the vegetable acreage is in potatoes, dry onions, and sweet corn.

Table 4-3: Estimated Food Processing/Manufacturing Value Reliant on CBP Crop Production

IMPLAN Sector	Processing Sectors	Local Production Value (6 County Area)	% of Total Local (Six County) Production Value	6-County Production Value Supported by CBP
77	Frozen fruits, juices and vegetables manufacturing	\$2,473,383,000	65%	\$1,607,700,000
82	Cheese manufacturing	\$103,141,000	50%	\$51,600,000
89	Animal, except poultry, slaughtering	\$428,227,000	30%	\$128,500,000
107	Wineries	\$699,314,000	30%	\$209,800,000

4.3 TOTAL ECONOMIC CONTRIBUTION ESTIMATES

The figures below highlight the total employment and local income supported by: crop production, animal production (dairy and beef cattle), and food processing (including crop and animal processing). For each of these three components or pathways of economic impact, the direct impacts are presented (represented by the orange bars) separately from the indirect/induced impacts (grey bars) in order to show the level of employment and income in the directly affected crop (or animal production or food processing sectors) versus the level of employment and income estimated in linked, supporting sectors. The total economic impact, which is the sum of direct and indirect/induced, is also presented for each component (represented by the dark blue bars).

Results are presented for three geographic areas: the local six-county area, elsewhere in Washington, and elsewhere in the nation. As shown in Figures 4-3 and 4-4, total employment supported in the CBP local region is estimated at approximately 39,300 jobs and \$2.3 billion in income. As highlighted in these figures and in Figure 4-9, approximately 60% of these local impacts are the direct, indirect, and induced effects of crop production. Elsewhere in Washington (as shown in Figures 4-5 and 4-6), total effects are estimated at 4,800 jobs and \$361.2 million in income, of which approximately 60% are related to supporting food-processing activities in the local area that are associated with the CBP. Elsewhere in the nation (as shown in Figures 4-7 and 4-8), total effects are estimated at 20,700 jobs and \$1.3 billion in income, of which approximately 40% are related to supporting CBP crop production and another 40% are related to supporting CBP food processing.

Figure 4-3 Local Employment Supported by the CBP

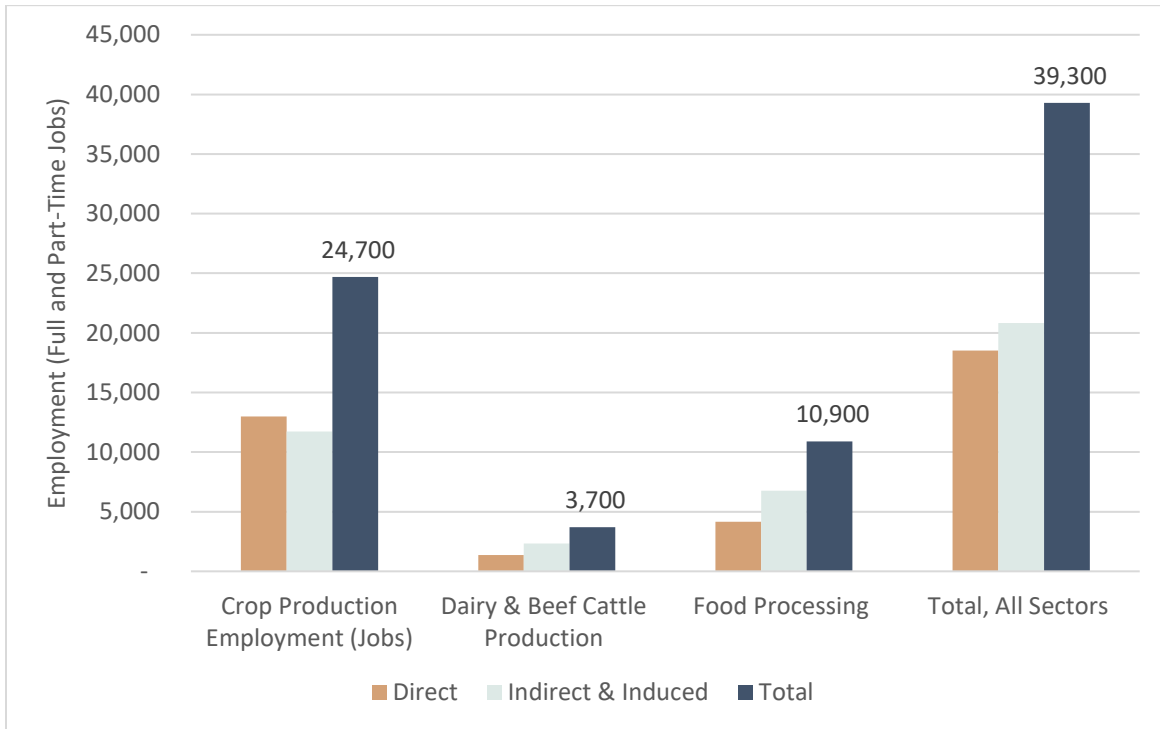


Figure 4-4 Local Income Supported by the CBP

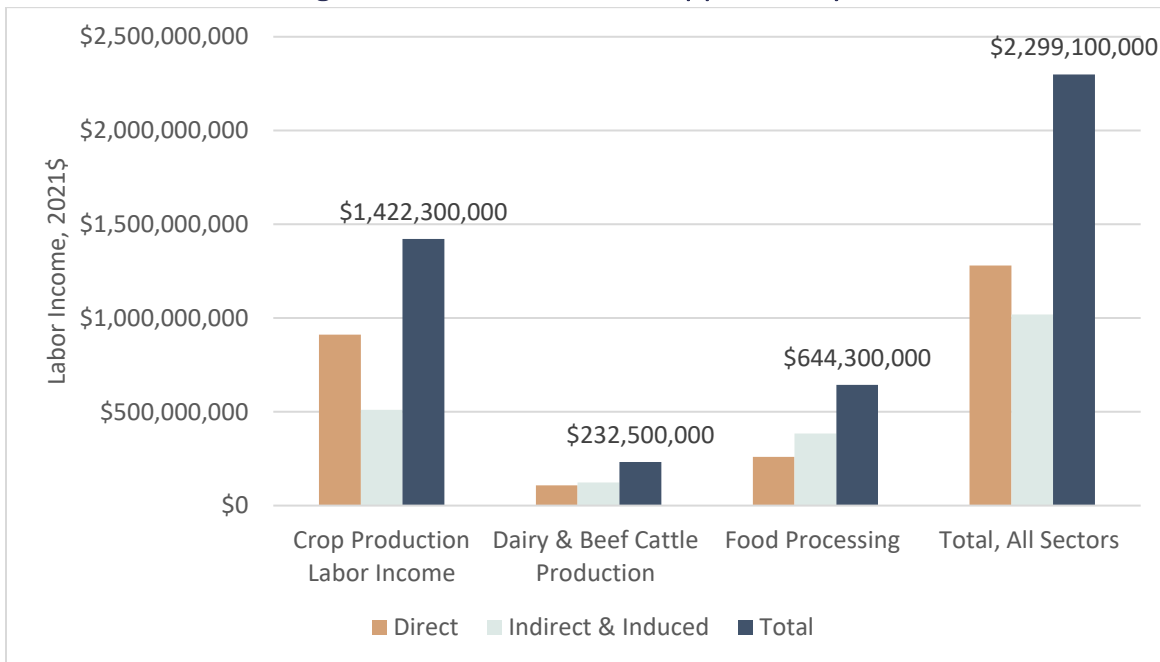


Figure 4-5 Elsewhere in Washington, Employment Supported by the CBP

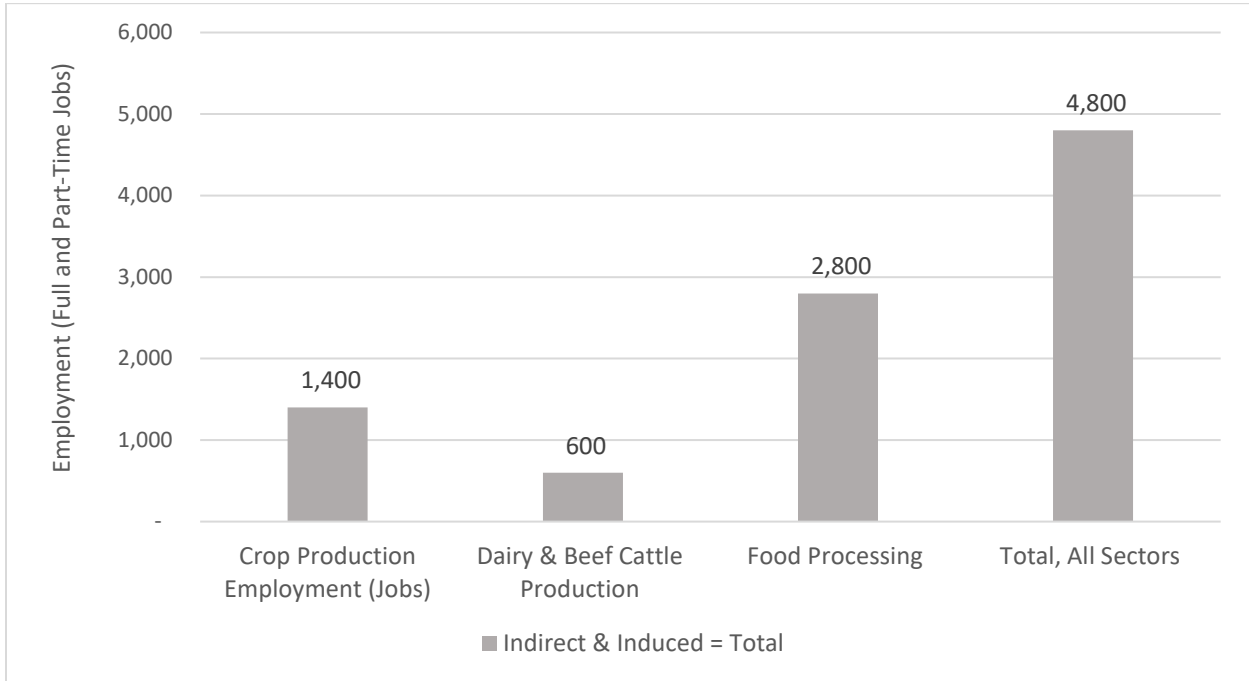


Figure 4-6 Elsewhere in Washington, Income Supported by the CBP

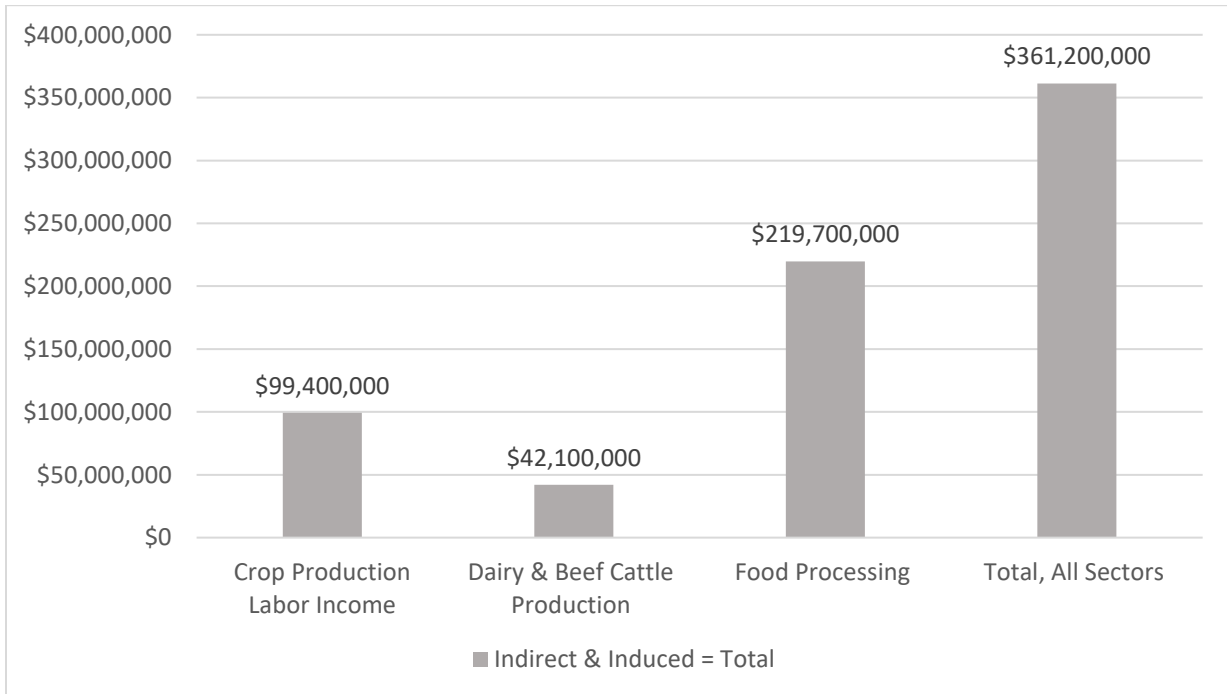


Figure 4-7 Elsewhere in Nation, Employment Supported by the CBP

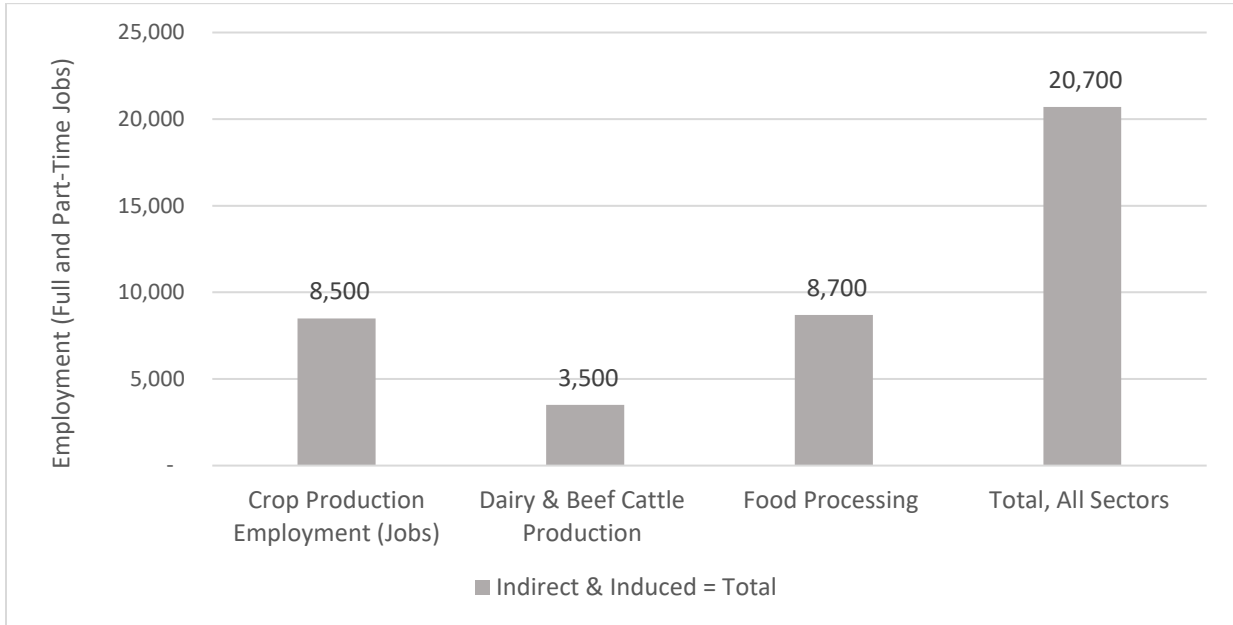


Figure 4-8 Elsewhere in Nation, Income Supported by the CBP

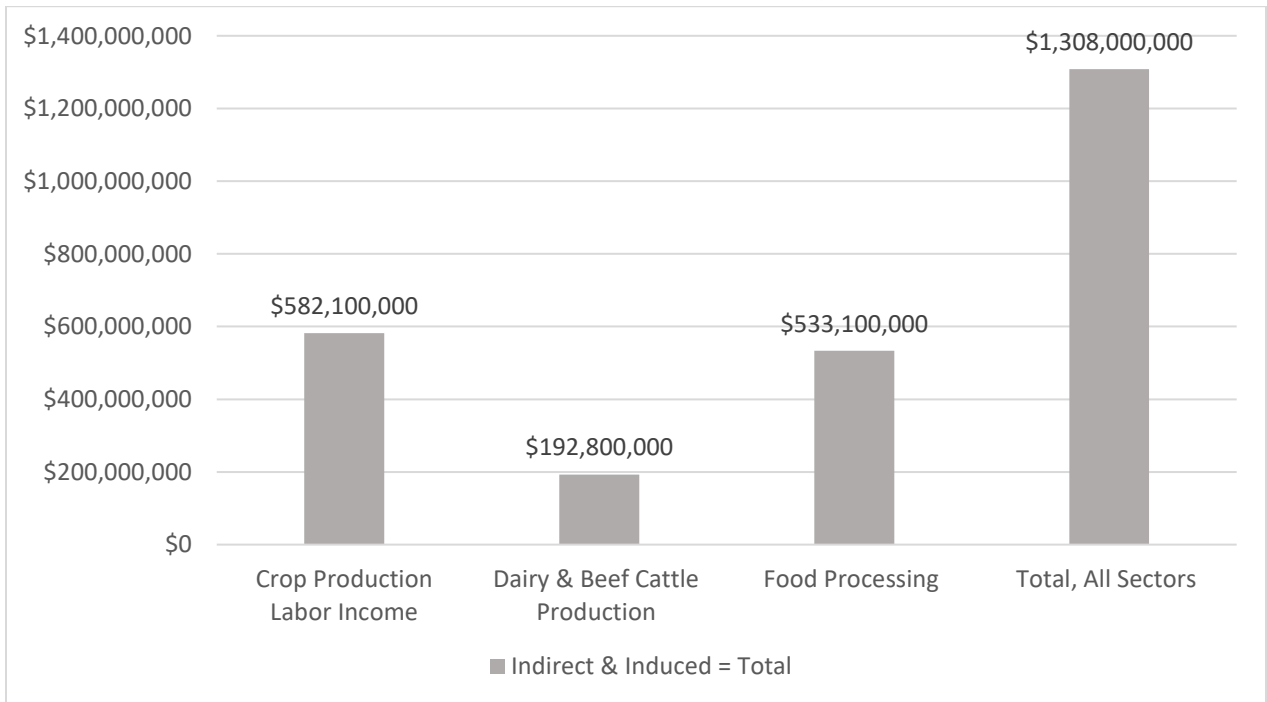
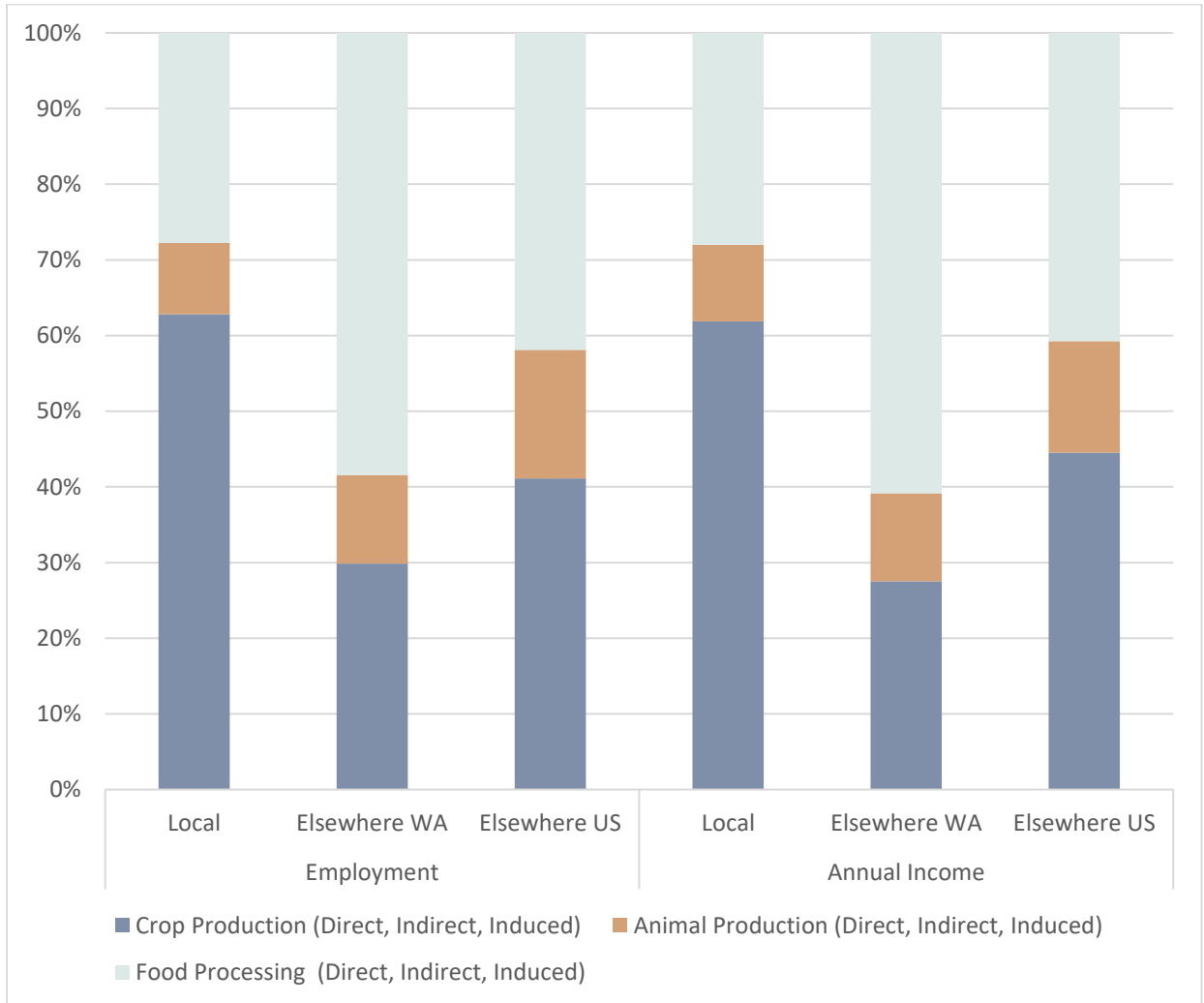


Figure 4-9 Source of Economic Effects: Crop Production, Animal Production vs. Food Processing



5 ECONOMIC CONTRIBUTION OF CBP-RELATED RECREATION

Irrigation-related infrastructure created as part of the Columbia Basin Project (CBP) creates significant opportunities for recreation. The reservoirs intended for irrigation water storage can also be used for water-based recreation, including: hunting, fishing, boating, swimming, camping, and wildlife viewing. According to Washington Department of Fish and Wildlife, Grant County is Washington's top producer of ducks and geese. In 2019 for example, 50,874 ducks and 16,718 geese were harvested in Grant County while 9,634 ducks and 3,016 geese were harvested in Adams County (Washington Department of Fish and Wildlife, 2021).

Key components of CBP infrastructure such as Banks Lake and Potholes Reservoir support water-dependent recreation at Potholes State Park, Steamboat Rock State Park, Columbia National Wildlife Refuge, and Scootenev Reservoir. In addition to these recreation destinations, public boat launches, municipal parks, concessioner resorts, and private hunting lands throughout the CBP region offer recreational opportunities that are made possible because of CBP water and CBP irrigation facilities.

5.1 METHODOLOGY

The economic impact of recreation is based on the total number of visitors and their level of expenditures in the region. This study uses publicly available data on visitation where available and estimates visitation where data are not available. Visitor spending by recreators can vary greatly, largely determined by whether the recreator is from the local area (non-locals tend to spend more), whether the recreator is an overnight visitor or a day trip recreator (overnight visitors tend to spend more), and the type of recreation activity (some activities, such as boating, tend to have higher expenditures per trip). As such, visitation is analyzed to estimate the proportion of recreators who are local (come from within 50 miles) and the proportion who stay overnight at the destination or are on a day trip. Visitor expenditures by recreation type are taken from an Oregon study of outdoor recreation (Dean Runyan, 2009).

A range of values is presented for the total visitation and the total economic activity supported by CBP-related recreation as there is uncertainty in the level of visitation (given that many sites do not have publicly available visitation data or were not able to provide visitation estimates). This analysis focuses on expenditures and the associated economic activity supported by recreational visits to recreation sites with waterbodies created or supported by CBP infrastructure. The enjoyment and value to recreators themselves of these recreational opportunities (known in economics as recreation consumer surplus) is not evaluated as part of this study.

For recreational impacts, the analysis uses visitation estimates and spending profiles to estimate the total spending by visitors to CBP-supported recreational areas and then uses an IMPLAN model of the six-county study area to estimate the total economic impacts (direct, indirect, and induced) of this recreation expenditures. The same methodology is used to estimate the indirect and induced impacts elsewhere in Washington and elsewhere in the United States (as described in Section 4.1).

5.2 ESTIMATES OF RECREATION VISITATION IN THE CBP

Recreation visitation in the region occurs at sites managed by federal, state, municipal, and private concessioner entities. Data are available for visitation at state parks and the federally-managed Columbia National Wildlife Refuge; less data are available for other sites.²⁴ In total, using all available data sources, we estimate that there are approximately 1.1 million to 1.6 million recreation visits in the region supported by CBP infrastructure (not including Lake Roosevelt, which is not included as the infrastructure at Lake Roosevelt is not exclusively used for irrigation²⁵).

5.2.1 State Parks & Columbia National Wildlife Refuge

There are three public recreation sites supported by CBP water for which there are visitation data available: Columbia National Wildlife Refuge, Steamboat Rock State Park, and Potholes State Park. Visitation to these recreation areas are presented in Table 5-1.²⁶ There is significant fluctuation in annual visitation, partly due to disruptions such as fires and water quality issues, as well as the recent pandemic (Felton, 2021). However, on average over the last ten years, the three sites have hosted roughly 674,000 visitors annually, of which approximately 560,000 are estimated to be day use visitors. Because expenditures vary by whether a visitor is an overnight or day use visitor (with overnight visitors spending more) and whether a visitor is local or non-local (non-locals generally spend more), this analysis attempts to differentiate between these types of visitors. An average of 80% of visitors at Potholes SP and 89% of visitors at Steamboat Rock SP are day use visitors to the park. All visitation at Columbia National Wildlife Refuge is day use. Based on other studies of recreation participation in the region and elsewhere in Washington State, we estimate that just over half of visitors to these state parks (55%²⁷) are residents of the local area.

²⁴ While data are available from Washington Department of Fish and Wildlife for hunting and fishing, they are not available by site to determine the dependence on CBP irrigation-related infrastructure, so this analysis focused on visitation data available from sites with known dependence on CBP irrigation infrastructure.

²⁵ We focus on the CBP irrigation infrastructure that is necessary solely for agricultural production and do not include Lake Roosevelt, which is formed by Grand Coulee Dam. In addition to serving agriculture, Grand Coulee Dam is the largest hydropower facility in the United States, generating more than 21 billion kilowatt-hours of electricity each year (US Bureau of Reclamation, 2021).

²⁶ Visitation figures to the Columbia National Wildlife Refuge are only available for 2011 (Carver & Caudill, 2013) and are adjusted over time based on the average rate of visitation growth at Steamboat Rock SP and Potholes SP between 2011 and 2020.

²⁷ This figure is averaged from studies on recreation participation in Washington State (Dean Runyan, 2002) (Schundler, Mojica, & Briceno, 2015) (Carver & Caudill, 2013)

Table 5-1: Average Annual Total Visitation to Major Recreational Sites in the CBP

State Park	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Average
Potholes SP	156,993	162,183	108,540	173,354	99,209	240,485	206,547	158,140	159,482	130,772	159,571
Steamboat Rock SP	314,529	409,295	456,391	436,071	571,527	535,720	427,927	455,130	442,972	474,699	452,426
Columbia NWR	51,874	53,942	56,093	58,330	60,655	63,074	65,589	68,204	70,923	73,751	62,244
Total	523,396	625,420	621,024	667,755	731,391	839,279	700,063	681,474	673,377	679,222	674,240

Note: Recreation at Columbia NWR is extrapolated based on visitation at Potholes SP and Steamboat Rock SP.

Source: (Carver & Caudill, 2013) (Washington State Parks, Accessed 2021) (Thrasher, 2021)

Visitor spending can also vary by recreational activity. Visitors to these three parks participate in fishing, hunting, camping, hiking, boating, and other outdoor activities. Though hunting is not allowed on state park lands, hunters at the parks are able to hunt on the reservoirs. Data are available from 2011 for Columbia National Wildlife Refuge regarding the type of recreation participated in by visitors (Carver & Caudill, 2013): 4% were hunters, 19% were anglers, and 77% were other recreational users (including non-hunting/fishing boating and swimming). Assuming the same breakdown of recreation participation by activity at the state parks, we estimate that the three sites annually host an average of approximately 27,000 hunters, 128,000 anglers, and 509,000 other recreators.²⁸

5.2.1.1 Washington Department of Fish and Wildlife

Washington Department of Fish and Wildlife maintains roughly 50 boat launches across the Columbia Basin, with recreational access to CBP infrastructure of varying sizes and improvement level (Eidson, 2021). For example, WDFW has six water access points at Banks Lake and nine water access points at Potholes Reservoir as well as access at Scooteney Reservoir. These WDFW sites receive year-round use, though summer is the busiest season (Eidson, 2021). Total use data is not collected at WDFW sites, though WDFW has collected car counts at area sites, which can be used to extrapolate total visitation. Roughly 350,000 day-use vehicles and 27,000 overnight vehicles access CBP infrastructure through WDFW managed locations annually (Finger, 2021)²⁹. In order to convert estimates of vehicles to estimates of visitors, the number of visitors per vehicle (vehicle occupancy) is needed. According to a 2009 study of recreation in Washington State, average travel party size in Washington for hunting, fishing, and wildlife watching recreational trips ranges from 2.3 recreators per party to 3.7 recreators per party (Dean Runyan, 2009). Since party size may be larger than vehicle occupancy if parties travel in multiple vehicles, we conservatively assume a vehicle occupancy range of 1 to 2 recreators per vehicle. In total this suggests between 377,000 and 750,000 annual person-visits to WDFW sites supported by CBP infrastructure.

Similar to other regional outdoor recreation destinations, visitors to WDFW sites participate in fishing, hunting, camping, hiking, boating, and other outdoor activities (Finger, 2021). Visitor participation by type of activity is not recorded at WDFW sites so participation rates are assumed to follow that of Columbia National Wildlife Refuge as presented in (Carver & Caudill, 2013). Assuming the same breakdown of recreation participation by activity at WDFW sites, we estimate that WDFW sites annually host approximately 16,000 to 31,000 hunters, 73,000 to 145,000 anglers, and between 289,000 and 574,000 other recreators.³⁰

5.2.1.2 Other Recreation Locations

CBP infrastructure also supports recreation at concessioner resorts and municipal parks particularly in Coulee City and Moses Lake. Mar Don Resort on Potholes Reservoir has an active boat ramp and overnight use. Municipal parks in Coulee City and Moses Lake maintain boat ramps, campgrounds and other facilities that attract recreators to the area. Visitation data requested from these other recreation locations generated no response or inconclusive data. Visitation to these other recreation locations is

²⁸ Figures may not sum due to rounding

²⁹ Data was collected at inconsistent intervals and varying sites over multiple years and is not statistically sound. Data is used here to provide a rough estimate of visitation.

³⁰ Figures may not sum due to rounding

estimated as 10% of total visitation to Potholes State Park, Steamboat Rock State Park, Columbia National Wildlife Reserve, and Washington Department of Fish and Wildlife operated sites³¹. In total, this visitation is estimated between 104,000 to 141,000 visitors annually, with visitors engaged in water-dependent activities at the same rate as estimated at Columbia National Wildlife Refuge.

Additionally, there is extensive hunting that occurs on private lands, including on private hunting leases that is supported by the CBP irrigation water and infrastructure. Irrigation infrastructure provides water while grain and forage crop fields in the region provide feed that supports waterfowl and other species. Visitation on these private lands that is supported by CBP infrastructure and cropping was not available.

5.2.1.3 Total Estimated Recreation Visitation

In order to understand the magnitude of recreational visitation to CBP infrastructure, annual visitation is summed at Potholes State Park, Steamboat Rock State Park, Columbia NWR, Columbia Basin WDFW sites, municipal parks and concessioner resorts. In total, there is an estimated combined 1.1 to 1.6 million annual visits to these locations. Of these recreational visit estimates, between 1 million and 1.4 million visits are day trips with the remainder overnight trips.

To provide context and to evaluate whether these estimates are reasonable, we reviewed the existing tourism studies for the region. In 2014, an estimated 1.5 million overnight person trips occurred in Grant County with an additional 217,000 overnight person trips in Adams County (Dean Runyan, 2015); our estimate of approximately 150,000 overnight person trips indicates CBP-related recreation may support approximately 9% of the overnight tourism visitation in the region. The numbers from this general tourism study covers all visitation and not just recreation-based tourism, in the context of this other study, our estimates of CBP-related tourism appear reasonable.

5.2.2 Recreation Expenditures in the CBP

Recreators generate economic activity through expenditures on transportation, food, lodging and other categories. To estimate the economic impact of CBP-related recreation, we combine the above estimates of recreation visitation with estimates of per visit expenditures. Recreator expenditures are estimated in a variety of studies. For this analysis, we rely on expenditures by visitors estimated at Washington state Parks (Schundler, Mojica, & Briceno, 2015), which is supported by other expenditure data collected within the region (Carver & Caudill, 2013). As noted above, we differentiate expenditures by day user versus overnight user and by local versus non-local visitor as overnight visitors spend more on average than day users, and non-locals typically spend more than locals. We estimate the per visit expenditure for these different types of recreation visitors as shown in Table 5-2. As this study aims to estimate the total economic contribution of recreation associated with the CBP, we include local recreation activity. Without the recreation opportunities provided by the CBP, local recreators may still spend their recreation dollars in the local area, but at different locations or on other recreational or entertainment activities. On the other hand, local recreators may choose to travel to other regions and spend their recreation dollars in other regions if opportunities are not available in their local area. As such, while non-resident recreator spending likely represents additional spending in the region, local recreator spending may or may not represent additional spending in the region.

³¹ Derived from personal communication with (Eidson, 2021).

Table 5-2: Recreator Trip-Related Expenditures per Person Visit, 2021 dollars

Type of Recreator	Average Expenditure	
	Low	High
Activity: General Recreation		
Local Day	\$6.85	\$23.32
Non-Local Day	\$43.35	\$157.62
Local Overnight	\$16.35	\$55.69
Non-Local Overnight	\$61.86	\$224.88
Activity: Hunting		
Local Day	\$31.34	\$45.88
Non-Local Day	\$84.36	\$102.73
Local Overnight	\$66.70	\$97.62
Non-Local Overnight	\$182.49	\$263.21
Activity: Fishing		
Local Day	\$15.13	\$30.26
Non-Local Day	\$37.33	\$74.66
Local Overnight	\$32.20	\$64.39
Non-Local Overnight	\$80.75	\$161.50

Source: Adapted from (Carver & Caudill, 2013) and (Schundler, Mojica, & Briceno, 2015)

Based on the total 1.1 to 1.6 million visitors to recreation sites supported by CBP water and the range of estimated expenditures presented in Table 5-2, we estimate total recreation expenditures supported by CBP infrastructure of between \$31.6 million and \$129.2 million annually (see Table 5-3). Based on the Dean Runyan 2015 study of all tourism spending in Washington state referenced above, our range estimate represents between 9% and 38% of all estimated visitor spending in Grant and Adams Counties, the two counties where CBP-supported recreation facilities are primarily located. However, a different study estimated spending associated with outdoor recreation in Washington State of \$445 million in these two counties in 2019, including spending by visitors and locals. Based on this estimate of recreation-related spending, our estimate for the spending associated with CBP infrastructure represents approximately 7% to 29% of outdoor recreation-related spending in the two-county area. Based on the context provided by these two studies, we expect that the mid-point estimate of our analysis, or approximately \$80 million, is a reasonable estimate to use as the basis for the economic contribution of recreation associated CBP facilities. Table 5-3 summarizes the apportionment of this recreation expenditure by sector; this apportionment is based on a 2009 study of recreation visitor spending in Washington State (Dean Runyan, 2009).

Table 5-3: Total Annual Estimated Recreation Expenditures, 2020 Dollars

Expenditure Type	Low	High	Mid
Accommodations	\$6,200,000	\$26,900,000	\$16,550,000
Food & beverages	\$6,900,000	\$29,600,000	\$18,250,000
Food stores	\$7,000,000	\$27,700,000	\$17,350,000
Ground transportation	\$5,500,000	\$21,800,000	\$13,650,000
Retail	\$3,300,000	\$13,000,000	\$8,150,000
Outfitter/guide/charter fees	\$1,200,000	\$3,900,000	\$2,550,000
Other	\$1,500,000	\$6,300,000	\$3,900,000
TOTAL	\$31,600,000	\$129,200,000	\$80,400,000

Source: Highland Economics analysis using data on proportion recreational expenditure from (Dean Runyan, 2009).

5.3 ECONOMIC IMPACT OF CBP-RELATED RECREATION SPENDING

Figures 5-1 and 5-2 summarize the approximate economic contribution of recreation supported by CBP-facilities. As shown in the figures below, the total economic activity associated with CBP-supported recreational infrastructure in the local region is 750 jobs and \$26.7 million in income, 40 jobs and \$3.2 million elsewhere in Washington, and 210 jobs and \$13.9 million in income elsewhere in the United States. In total, approximately \$80 million in estimated recreation-related spending at CBP-related facilities supports approximately 1,000 jobs and \$43.9 million annually in income across the United States.

This economic contribution includes spending by local recreators; this spending by locals might occur even in the absence of the CBP facilities as local recreators in that case might still spend their recreational dollars in the local area. However, as noted above, to the extent that local recreators would instead recreate and spend their dollars elsewhere, the CBP recreation opportunities help to retain in the region these recreational expenditures by locals. Expenditures by non-locals at CBP-related facilities likely generate additional spending and economic activity that would not otherwise occur in the region in the absence of the CBP facilities.

Figure 5-1 Total Employment Supported by CBP-Supported Recreation Facilities

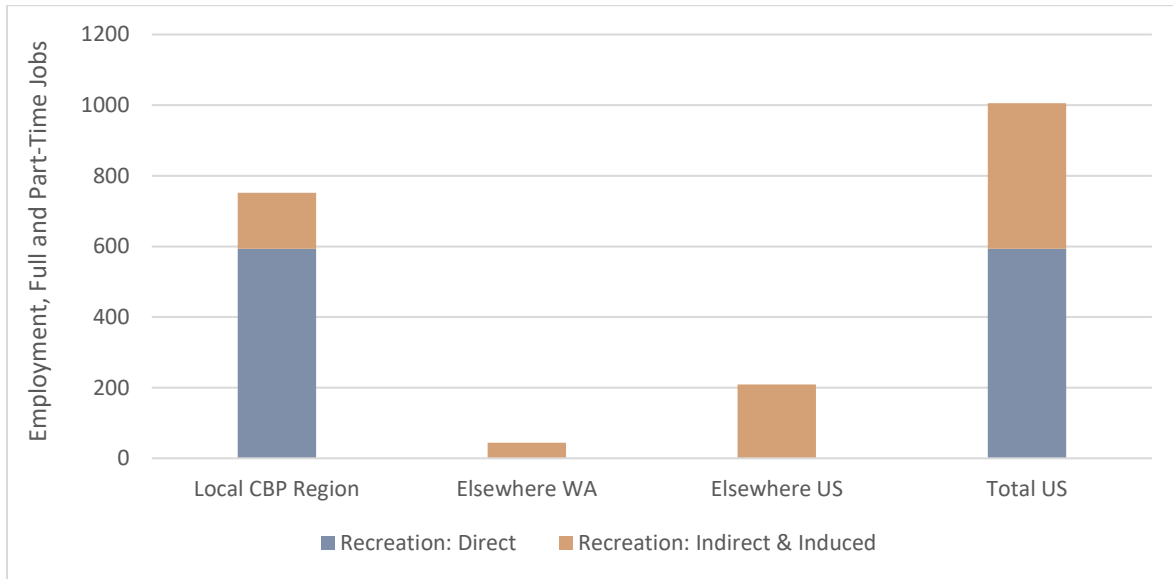
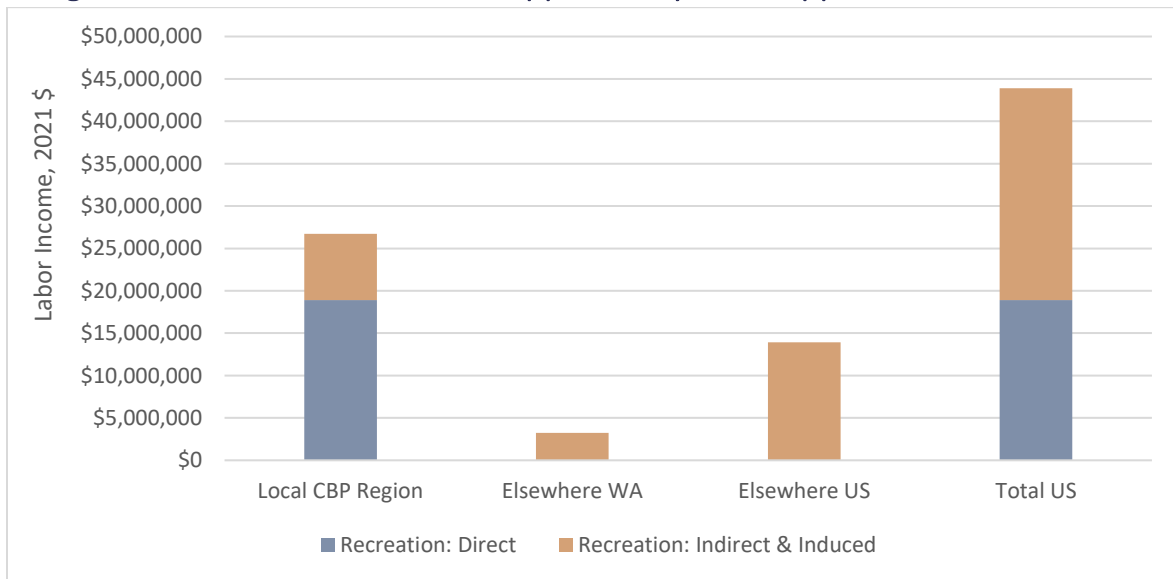


Figure 5-2 Total Labor Income Supported by CBP-Supported Recreation Facilities



6 FISCAL CONTRIBUTION OF CBP-SUPPORTED AGRICULTURE & RECREATION

This section presents the estimated tax revenues supported by the CBP, related to both agriculture and recreation. The fiscal analysis is based on the economic analysis: the total economic activity estimated in the preceding sections generates tax revenues in the form of property tax, sales tax, income tax, social insurance, and other taxes; the fiscal analysis presented here is conducted using the IMPLAN model described in Section 4.1. Figure 6-1 summarizes the tax revenues associated with each component of economic activity analyzed in this study. As highlighted in the Figure 6-2, the tax revenues at the federal government-level comprise 68% of the total revenues, although tax revenues at the local level are larger as a percent of total revenues. In total, across all governments, tax revenues are estimated at \$1.29 billion.

Figure 6-1 Estimated Total Tax Revenues Supported by the CBP by Source

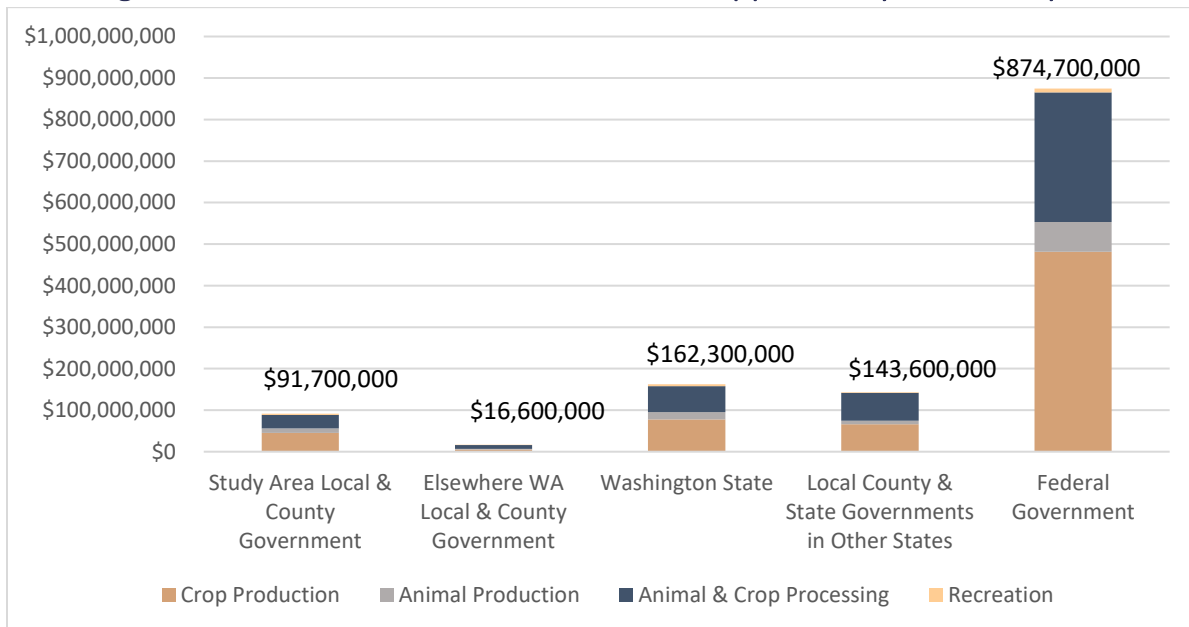
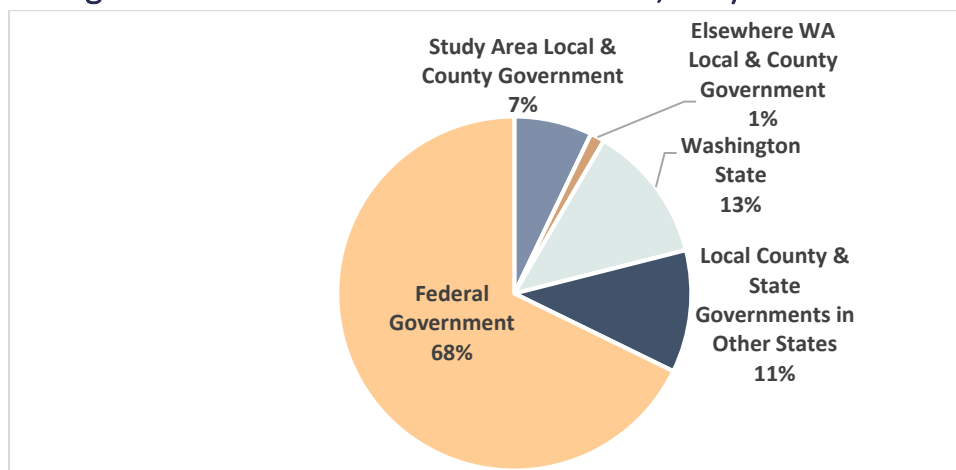


Figure 6-2 Estimated Total Tax Revenues, % by Jurisdiction



7 OTHER BENEFITS OF THE CBP

There are other social benefits of the CBP. In particular, the CBP provides economic opportunity to rural and minority populations, particularly Hispanic populations. The CBP infrastructure provides water-based recreational opportunities, which both support the local recreation economy and provide social and recreational enjoyment for locals and non-locals. Finally, review of the publicly available financial data for the CBP indicates that the level of agricultural profit it has enabled through time far exceeds the Project's cost.

7.1 ECONOMIC OPPORTUNITY FOR RURAL AREAS & MINORITY POPULATIONS

This study estimates that approximately 40,100 jobs are supported in the CBP local region, primarily in the counties of Franklin, Grant, and Adams. This represents over one-third of the employment (approximately 105,000 jobs according to the Bureau of Economic Analysis) in these three counties. Based on Census data, there are approximately 216,400 people living in these three counties; if, proportionate with employment, one-third of the population is supported directly or indirectly by the CBP, this would represent over 70,000 people in the region living in a household wholly or partially supported by the CBP. Said differently, **the farming, food processing, and recreation-related employment made possible by the CBP likely provide rural economic opportunity for approximately 70,000 people in the study area.**

Approximately 50% of the population of Franklin, Grant, and Adams counties is Hispanic, while for the State as a whole only 14% of the population is Hispanic. **The jobs and people economically supported by the CBP are thus likely disproportionately minority populations.** This study estimates that approximately 14,400 farm jobs are created by CBP-irrigated agriculture, and agricultural farmworkers are overwhelmingly Hispanic. Data from the 2017-2018 National Agricultural Worker Survey for the Northwest region (an eight-state region including Washington) indicates that 78% of agricultural workers in this region are foreign-born (primarily from Mexico). CBP agriculture can provide opportunities for immigrants to take the first step in achieving greater economic security for themselves and their families.

7.2 RECREATION BENEFITS

As discussed in Section 5, this study estimates that there are approximately **1.1 million to 1.6 million recreation visits annually in the region supported by CBP infrastructure (not including Lake Roosevelt³²), highlighting the importance of these facilities for providing value and enjoyment to locals and non-locals alike.** Recreational opportunities are an important aspect of quality of life. Based on numerous studies of the value of recreation for hunting, fishing, boating, and general recreation, the net value (benefits to the recreator less costs of recreation) of a recreator day for these activities can be higher than \$100 per day. A review of recreational studies of the net value to recreators of various

³² We focus on the CBP irrigation infrastructure that is necessary solely for agricultural production and do not include Lake Roosevelt, which is formed by Grand Coulee Dam. In addition to serving agriculture, Grand Coulee Dam is the largest hydropower facility in the United States, generating more than 21 billion kilowatt-hours of electricity each year (US Bureau of Reclamation, 2021).

recreational opportunities conducted for the Forest Service found that for the Pacific Northwest region, the value from diverse studies conducted from 1958 to 2015 had found net values to recreators for these activities averages around \$75 per day (Rosenberger, White, Kline, & Cvitanovich, 2017). However, the U.S. Army Corps of Engineers uses much lower values per recreator day, in the range of \$4 to \$12 per day for general recreation. This study uses a reasonable estimate of the net value per recreator day of \$30. Applying this to the over one million annual recreation visits supported by the CBP infrastructure indicates **over \$30 million in annual value to recreators is provided at water-based recreation areas created by CBP facilities.**

7.3 AGRICULTURAL GROSS PRODUCTION & PROFITS THROUGH TIME

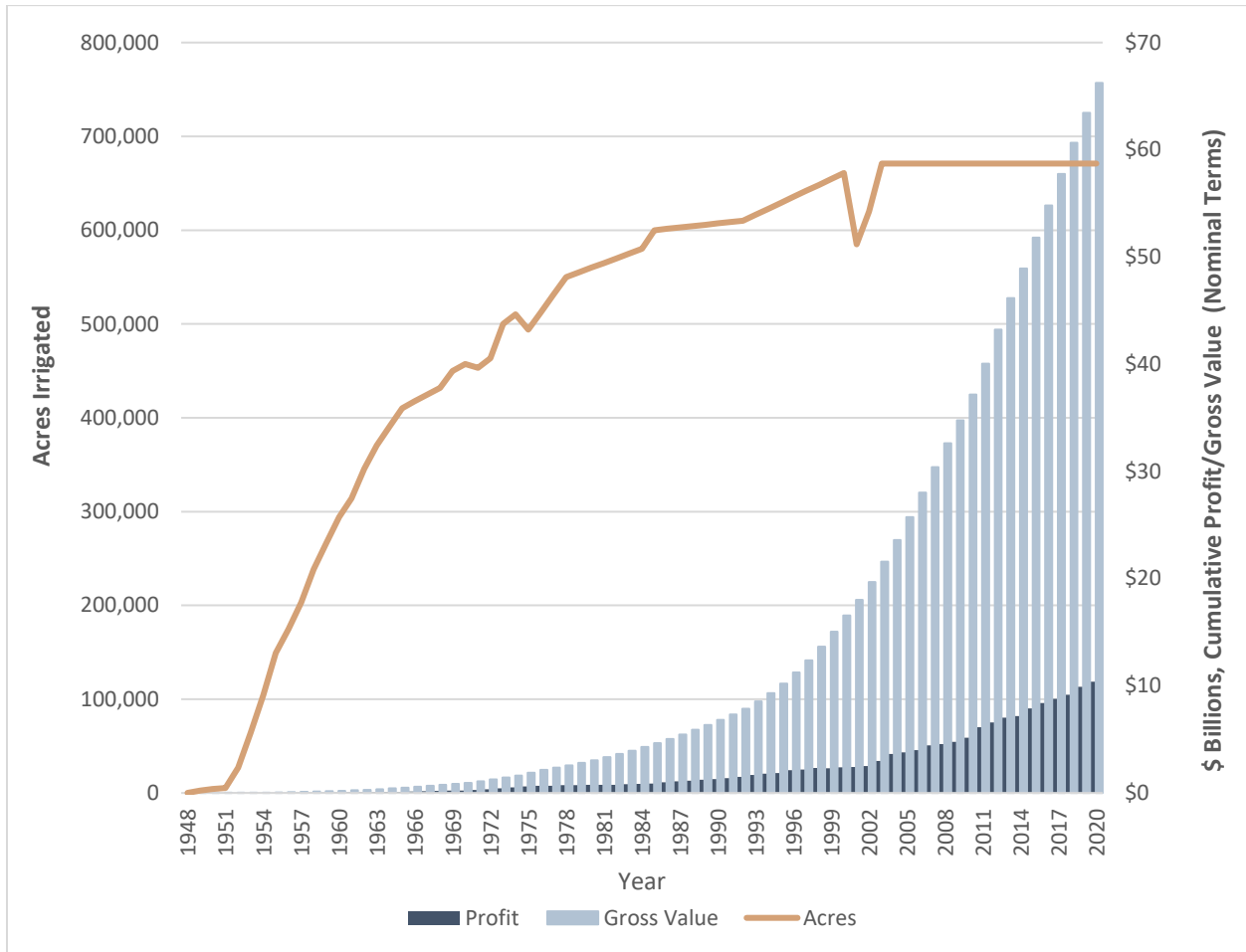
Previous annual reports prepared by the Bureau of Reclamation provide estimates of both acreage irrigated and total gross value of crops produced in the CBP.³³ Using data presented in a select number of these available reports³⁴ as well as a 2020 study of water supply and use in the CBP that includes acreage estimates through time (U.S. Bureau of Reclamation, 2020), **we estimate the cumulative gross revenue of crops produced by CBP's irrigated acreage at \$66.7 billion from 1948 through 2020 (this amounts to approximately \$108.8 billion in 2020 dollar values)**³⁵. Economic Research Service (ERS) maintains estimates of farm profitability as a percentage of gross revenue as part of their Farm Income and Wealth Statistics for Washington State producers (USDA ERS 2021). Based on this dataset, and adjusting for just crop production (i.e., not including animal production), from 1948 to 2020 annual profit accounted for between -2% (loss of 2%) to 47% of gross revenue to the operator, with an average of nearly 21% annually. Assuming 21% of gross revenue is profit, **we estimate that the CBP has generated \$10.4 billion in cumulative profit from 1948 to 2020 (this amounts to approximately \$18.1 billion in 2020-dollar values).**

³³ For example, see United States Department of Interior, Bureau of Reclamation, Summary Statistics, Water, Land and Related Data reports from the 1950's to mid-1990's (Denver: US Government Printing Office).

³⁴ Specifically, data was available for 1950, 1955, 1960, 1965, 1972, 1975, 1978, 1984, 1985, and 1992.

³⁵ Nominal values were converted to 2020 dollar values through the Producer Price Index, annual value (USDA NASS 1948-2020).

Figure 7-1 CBP Irrigated Acreage & Cumulative Farm Sales and Profit through Time



Source: Highland Economics analysis of Bureau of Reclamation reports and USDA Economic Research Service data.

7.4 FOOD SECURITY

The CBP provides irrigation water for crops and associated animal production valued at an estimated \$3.328 billion annually.³⁶ On average, American farmers in 2019 received approximately 14 cents of every dollar spent on food purchased by consumers (Economic Research Service, USDA, 2021). Converting the \$3.328 billion value of farmgate food production value to the retail value of food, and assuming CBP farmers receive on average 14% of the retail value of food, the CBP produces roughly \$23.8 billion of food sold in grocery stores or other establishments. In 2020, Americans spent a total of \$876.8 billion for food to be consumed at home (i.e., purchased at supermarkets and other retailers) (Economic Research Service, USDA, 2021). **These data suggest that the CBP thus produces the equivalent of approximately 2.7% of all American food grocery store purchases, representing approximately the food purchases of 8.9 million Americans** (based on a US population of 328.2 million people). While in reality much of the production from the CBP is currently exported, these figures

³⁶ This includes \$2.66 value of crop production and \$671 million in animal production.

highlight the magnitude of the food produced in the CBP and the number of people that can be supported by this food production.

The importance of the CBP is likely to only grow in the future as drought, warmer temperatures, and severe weather events threaten agricultural production in other key agricultural production regions. In Washington State, overall vulnerability of agricultural production to a changing climate is expected to be low in areas such as the CBP where irrigation water supplies are available (Snover, Mauger, Whitely Binder, Krosby, & Tohver, 2013). This is not the case for many other regions in the world. For example, California is a key American agricultural production area (particularly for vegetables, fruits, and nuts) facing numerous challenges related to water scarcity, water quality, and rising temperatures. In 2015 and 2016 for example, roughly 1 million acres of California's 27 million acres of cropland were fallowed due to water shortages (Xides, Kehmeier, & Kerr, 2016). In addition to water shortages, sea level rise related to climate change threatens some areas of California agricultural production. Due to the low elevation of the Central Valley, the region is especially sensitive to sea levels rising, which is expected to cause an increase in salinity in the San Joaquin Delta (Hanak, et al., 2019). In total, The San Joaquin valley is expected to fallow roughly 200,000 acres annually due to climate change (Hanak, et al., 2019).

Climate change is impacting crop yields as well. In lower-latitude regions, crop yields including that of corn and wheat have already been negatively impacted by climate change, while crop yields of corn, wheat and sugar beets in higher-latitude regions have been positively impacted by climate change (IPCC, Accessed 2021). While yield impacts vary by crop and location, overall across the globe, one study led by researchers at Cornell University estimates that total agricultural output is 21% lower than it would have been without climate change (Ortiz-Bobea, Ault, Carillo, Chambers, & Lobell, 2021).

Agricultural production in the Columbia Basin Project is expected to be resilient to climate change. The region is expected to face warmer and slightly wetter conditions due to climate change. These changes are expected to lead to an earlier and wetter start to the growing season and a reduction in the irrigation season for most crops (WA DOE, 2016). However, the Washington Department of Ecology forecasts an increase in annual water supplies across the Basin, and increased temperatures could lead to a lengthening of the growing season on the Columbia Basin (WA DOE, 2016). Changes in agricultural production in the region as a response to climate change include the potential to increase double cropping as crops mature earlier in the season and a change in crop mix (WA DOE, 2016). **Based on the relatively low climate-related risks to agricultural production in the Columbia River Basin, researchers at the Agriculture Climate Network are already studying how future reduced agricultural production in California could be offset by increased vegetable production in the Columbia River Basin** (Maureira, 2020).

With an abundance of water forecasted and a lengthening of the growing season, the Columbia Basin region is particularly well suited to face climate change especially when compared to many other agricultural producing regions. Due to the anticipated decrease in agricultural production in other parts of the nation and world due to rising temperatures and water shortages associated with climate change, the potential additional output produced by the CBP under climate change highlights the likely growing importance of CBP food production in the future.

8 BIBLIOGRAPHY

- Adams County Assessor's Office. (2021). *Adams County 2021 Tax Levies*. Adams County Assessor's Office. Retrieved from <https://www.co.adams.wa.us/2021%20Tax%20Levy%20Information.pdf>
- AgriMet. (2015). *Evapotranspiration Totals and Averages*. Retrieved November 2021, from <https://www.usbr.gov/pn/agrimet/ETtotals.html>
- BestPlaces. (n.d.). *Climate in Adams County, Franklin County, Grant County, Lincoln County, and Walla Walla County*. Retrieved from https://www.bestplaces.net/climate/county/washington/walla_walla
- Carver, E., & Caudill, J. (2013, October). *Banking on Nature*. Retrieved from US Fish and Wildlife: <https://www.fws.gov/refuges/about/refugereports/pdfs/BankingOnNature2013.pdf>
- Dean Runyan. (2009). *Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon 2008 State and County Expenditure Estimates*. Retrieved from Dean Runyan: [https://www.dfw.state.or.us/agency/docs/report_5_6_09--final%20\(2\).pdf](https://www.dfw.state.or.us/agency/docs/report_5_6_09--final%20(2).pdf)
- Dean Runyan. (2015). *WASHINGTON STATE COUNTY TRAVEL IMPACTS & VISITOR VOLUME 1991-2014P*. Retrieved from Dean Runyway: <http://www.lakechelan.com/wp-content/uploads/2018/01/WAColmp14pRev.pdf>
- Dehghan, Z., Fathian, F., & Eslamian, S. (2009). *Climate change impact on agriculture and irrigation network*. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/61052809/Climate_Change-Resilient_Agriculture-EBOOK_220191028-6358-14m1xx6-with-cover-page-v2.pdf?Expires=1639173737&Signature=SBouQdQ2~gYapy3sreTLL5lmlOdxA8JmVmCVz~eEo~eZD978nvsTVLpVivQf~RLUx2ZDlaFJ3t74z5zdt6EKeZGqf
- East Columbia Basin Irrigation District. (2021). *Crop Reports, 2010-2020*. East Columbia Basin Irrigation District.
- Economic Research Service, USDA. (2021, March 17). *Documentation Food Dollar Series*. Retrieved from Economic Research Service, USDA: <https://www.ers.usda.gov/data-products/food-dollar-series/documentation/#marketing>
- Economic Research Service, USDA. (2021, November 8). *Food Prices and Spending*. Retrieved from Economic Research Service, USDA: <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-prices-and-spending/>
- Eidson, C. (2021, 10 12). Columbia Basin Wildlife Manager for WA Dept of Fish and Wildlife. (T. Wirkkala, Interviewer)
- ERS. (Accessed 2021). *Food Expenditure Series*. Retrieved from <https://www.ers.usda.gov/data-products/food-expenditure-series/food-expenditure-series/#Current%20Food%20Expenditure%20Series>
- ERS. (Accessed 2021). *Price Spreads from Farm to Consumer*. Retrieved from <https://www.ers.usda.gov/data-products/price-spreads-from-farm-to-consumer/>

- Finger, R. (2021, 10 15). Lands Operational Manager. (T. Wirkkala, Interviewer)
- Franklin County Assessor's Office. (2021). *2020 Assessments for 2021 Tax Collection*. Franklin County Assessor's Office. Retrieved from <http://www.co.franklin.wa.us/assessor/myuploads/file/taxbooklets/levybook20for21.pdf>
- Grant County Assessor's Office. (2021). *Grant County Levy Year 2021 for Tax Year 2021 Information*. Grant County Assessor's Office. Retrieved from <https://www.grantcountywa.gov/ArchiveCenter/ViewFile/Item/513>
- Hanak, E., Escriva-Bou, A., Gray, B., Green, S., Harter, T., Jezdimirovic, J., . . . Seavy, N. (2019). *Water and the Future of the San Joaquin Valley*. Retrieved from <https://www.ppic.org/wp-content/uploads/water-and-the-future-of-the-san-joaquin-valley-february-2019.pdf>
- IMPLAN. (2021). IMPLAN software. Retrieved from <https://www.implan.com/>
- IPCC. (Accessed 2021). *Special Report on Climate Change and Land: Food Security*. Retrieved from <https://www.ipcc.ch/srccl/chapter/chapter-5/>
- JBS International. (2021). *Findings from the National Agricultural Workers Survey (NAWS) 2017-2018: A Demographic and Employment Profile of United States Farmworkers*. U.S. Department of Labor. Retrieved from <https://www.dol.gov/sites/dolgov/files/ETA/naws/pdfs/NAWS%20Research%20Report%202014.pdf>
- Lincoln County Assessor's Office. (2021). *Lincoln County 2021 Consolidated Levy Rates by Tax Code Area*. Lincoln County Assessor's Office. Retrieved from <https://www.co.lincoln.wa.us/assessor/wp-content/uploads/sites/8/2021/02/20210115-2021-Levy-Rates.pdf>
- Maureira, F. (2020, February 6). *Exploring Whether Washington State Could Become the New California in Vegetable Production*. Retrieved from Agriculture Climate Network: <https://www.agclimate.net/2020/02/06/exploring-whether-washington-state-could-become-the-new-california-in-vegetable-production/>
- Mount, Jeffrey, & et al. (2018). *Managing Drought in a Changing Climate Four Essential Reforms*. Retrieved from <https://www.ppic.org/wp-content/uploads/managing-drought-in-a-changing-climate-four-essential-reforms-september-2018.pdf>
- MRSC. (2020, July 1). *Local sales tax rates & components – effective July 1, 2020*. Retrieved from Tax and Population Data: <https://mrsc.org/Home/Explore-Topics/Finance/Economic-and-Population-Data/Population-Property-and-Sales-Tax-Archive.aspx>
- NASA. (2021). *Global Climate Change Impact on Crops Expected Within 10 Years, NASA Study Finds*. Retrieved from <https://climate.nasa.gov/news/3124/global-climate-change-impact-on-crops-expected-within-10-years-nasa-study-finds/>
- Ortiz-Bobea, A., Ault, T., Carillo, C., Chambers, D. G., & Lobell, D. (2021). *Anthropogenic climate change has slowed global agricultural productivity growth*. Retrieved from <https://www.nature.com/articles/s41558-021-01000-1>

- Quincy-Columbia Basin Irrigation District. (2021). *Crop Reports, 2010-2020*. Quincy-Columbia Basin Irrigation District.
- Rosenberger, R. S., White, E. M., Kline, J. D., & Cvitanovich, C. (2017). *Recreation Economic Values for Estimating Outdoor Economic Benefits from the National Forest System*. Portland: US Forest Service.
- Schundler, G., Mojica, J., & Briceno, T. (2015). *Economic Analysis of Outdoor Recreation at Washington's State Parks*. Retrieved from Earth Economics:
<https://parks.state.wa.us/DocumentCenter/View/5910/State-Parks-Economic-Analysis---Earth-Economics-9-9-15-PDF?bidId=>
- Snover, A., Mauger, G., Whitely Binder, L., Krosby, M., & Tohver, I. (2013). *Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers. State of Knowledge Report prepared for the Washington State Department of Ecology*. Retrieved from University of Washington Climate Impact Group: <https://cig.uw.edu/wp-content/uploads/sites/2/2020/12/snoveretalsok2013sec11.pdf>
- South Columbia Basin Irrigation District. (2021). *SCBID Crop Data 08 09 10 15 and SCBID 2021 crop data*. South Columbia Basin Irrigation District.
- Sover, A., Mauger, G., Whitely Binder, L., Krosby, M., & Tohver, I. (2013). *Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers SECTION 11 How Will Climate Change Affect Agriculture in Washington?* Retrieved from <https://cig.uw.edu/wp-content/uploads/sites/2/2020/12/snoveretalsok2013sec11.pdf>
- State of Washington Office of Financial Management. (2018). *2017 Projections - County Growth Management Population Projections by Age and Sex: 2010-40*. State of Washington. Retrieved from
https://ofm.wa.gov/sites/default/files/public/dataresearch/pop/GMA/projections17/GMA_2017_county_pop_projections.pdf
- U.S. Bureau of Economic Analysis. (2020, November 17). Compensation of Employees by NAICS Industry (CAINC6N & SAINC6N). Retrieved from <https://apps.bea.gov/iTable/index.cfm>
- U.S. Bureau of Economic Analysis. (2020, November 17). Total Full-Time and Part-Time Employment by NAICS Industry (CAEMP25N & SAEMP25N).
- U.S. Bureau of Labor Statistics. (2019). Quarterly Census of Employment and Wages. Retrieved from <https://www.bls.gov/cew/downloadable-data-files.htm>
- U.S. Bureau of Labor Statistics. (2021). *Consumer Price Index for All Urban Consumers*. U.S. Bureau of Labor Statistics. Retrieved from <https://www.bls.gov/cpi/>
- U.S. Bureau of Labor Statistics. (2021). Local Area Unemployment Statistics. Retrieved from <https://www.bls.gov/lau/>
- U.S. Bureau of Reclamation. (2020, November 16). *Columbia Basin Project*. Retrieved from <https://www.usbr.gov/pn/grandcoulee/cbp/index.html>

- U.S. Census Bureau. (2010). 2010 DEC Summary File 1, Table P1. Retrieved from <https://data.census.gov/cedsci/>
- U.S. Census Bureau. (2019). *2019 American Community Survey 5-year Estimates, Poverty Status in the Past 12 Months (Table S1701)*. U.S. Census Bureau. Retrieved from <https://data.census.gov/cedsci/>
- U.S. Census Bureau. (2019). ACS 5-year Estimates Subject Tables, Income in the Past 12 Months (in 2019 Inflation-Adjusted Dollars). Retrieved from www.data.census.gov
- U.S. Census Bureau. (2020). 2020 DEC Redistricting Data (PL 94-171), Tables P1 & P2. Retrieved from <https://data.census.gov/cedsci/>
- US Census Bureau. (2021). *Table HH-4 Households by Size 1960 to Present*. Retrieved from Historical Households Tables: <https://www.census.gov/data/tables/time-series/demo/families/households.html>
- US Department of Agriculture. (2021). *Compilation of Statistical Material Pacific Northwest Federal Milk Marketing Order*. Seattle: USDA Agricultural Marketing Service.
- USDA NASS. (2017). *2017 Census of Agriculture, Table 45*. USDA. Retrieved from https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Washington/st53_2_0045_0045.pdf
- USDA NASS. (2019). *2017 Census of Agriculture, Washington State and County Data, Volume 1, Geographic Area Series, Part 47*. USDA. Retrieved from https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Washington/wav1.pdf
- USDA NASS. (2021). *Quickstats*. Retrieved from <https://quickstats.nass.usda.gov/>
- WA Department of Revenue. (2021). *Local Retail Sales, 2016-2020*. Retrieved from Retail sales for cities and counties: <https://dor.wa.gov/about/statistics-reports/retail-sales-cities-and-counties>
- WA DOE. (2016). *Columbia River Basin Long-Term Water Supply and Demand Forecast*. Retrieved from <https://apps.ecology.wa.gov/publications/documents/1612001.pdf>
- WA Office of Financial Management. (2019). *State Expenditures and Revenues by County: Fiscal Year 2016*. WA Office of Financial Management. Retrieved from https://ofm.wa.gov/sites/default/files/public/dataresearch/fiscal/county_expenditures_revenues.pdf
- Walla Walla County Assessor's Office. (2021). *Walla Walla County 2021 Assessment Guide*. Walla Walla County Assessor's Office. Retrieved from https://www.co.walla-walla.wa.us/document_center/assessor/2021LevyGuide.pdf
- Washington Department of Revenue. (2021). *Local retail sales, Taxable Retail Sales by County, Calendar Years 2016-2020*. Washington Department of Revenue. Retrieved from <https://dor.wa.gov/about/statistics-reports/retail-sales-cities-and-counties>

Washington Office of Financial Management. (2019). *State Expenditures and Revenues by County: Fiscal Year 2016*. Washington Office of Financial Management. Retrieved from https://ofm.wa.gov/sites/default/files/public/dataresearch/fiscal/county_expenditures_revenues.pdf

Washington State Department of Agriculture. (2021). *Washington Dairies Open Data*. Retrieved from <https://www.arcgis.com/apps/webappviewer/index.html?id=187a52c48d8047f3b699206c8ae54d38>

Xides, A., Kehmeier, E., & Kerr, A. (2016). *Drought Impacts on California Crops*. Retrieved from https://caclimatehub.ucdavis.edu/wp-content/uploads/sites/320/2016/03/factsheet3_crops.pdf