Value of Water in Scott River Watershed

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ECO northwest

Background

- Phase 1 Workshop in September to understand types of economic analyses available to help develop the SRRAP
- Key priority to understand the various uses of water within the Watershed (in-stream and out of stream) and their relative values to weigh tradeoffs and identify multi-benefit opportunities
- Phase 2 focuses on establishing baseline understanding of the demand for and value of water from the Scott River in the watershed, to develop future strategies

Phase 2 Goals

- Establish current understanding of how Scott River generates value through various uses of water
- Consider how the various values may change in the future under a Business-As-Usual Scenario
- This analysis is not a comparison of marginal values of water within the Scott Valley. It provides an estimate for total value for use categories but does not analyze the value of an additional unit of water.

Phase 2 Scope

- Baseline Economic Assessment
  - What categories of economic value are supported by the Scott River? How have they changed over time?
  - What is the current value of agriculture in the Scott River Watershed? How has it changed over time?
  - What is the current value of salmon supported by the Scott River? How has it changed over time?
  - What is the current economic output, jobs, income, and tax revenue from agriculture in the Scott River Watershed?
  - What is the current economic output, jobs, income, and tax revenue from habitat restoration activities in the Scott River Watershed?
  - How will the value of these categories change in the future in response to changing environmental and market conditions?

Value of Water from the Scott River

Chinook and Coho Salmon

Instream flows support commercial fishing, recreational fishing, and value for species survival

Irrigated Agriculture

Water diversions and groundwater pumping support crop and livestock production

Water-Based Recreation

Instream flows support recreation activities

Tribal Value

Instream flows support tribal use

Other Values

Instream flows support scenic beauty, public health, and sense of place

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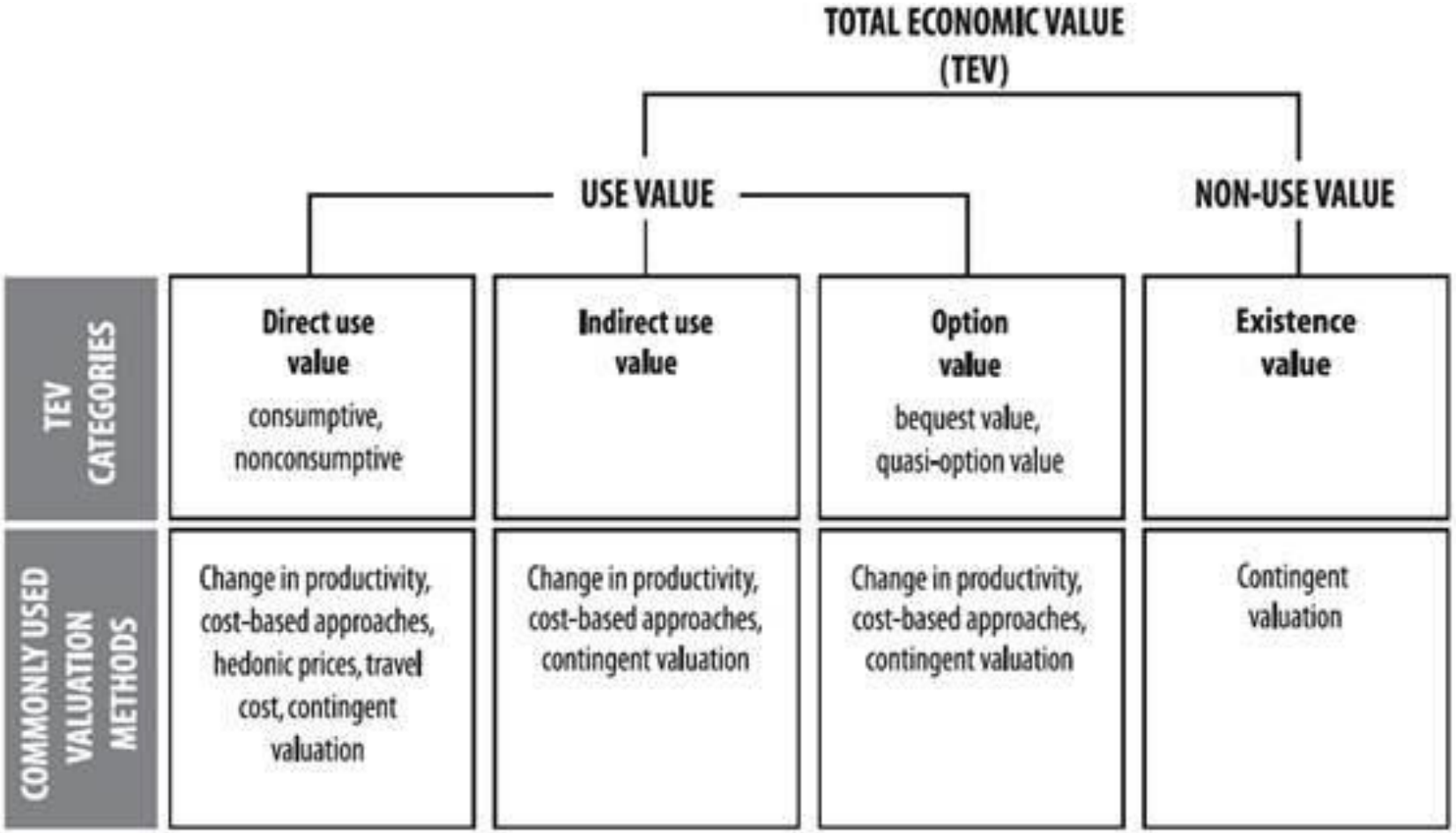
Federal Guidance

- Office of Management and Budget (OMB)
  - Circular A-4 and Circular A-94 (rev. in 2023)
  - Provides guidance for regulatory economic analysis by federal agencies
- Environmental Protection Agency (EPA)
  - Guidelines for Economic Analysis (rev. in 2016)

- Guidance treats market and non-market benefits (and costs) distinctly

Different benefits, different methods



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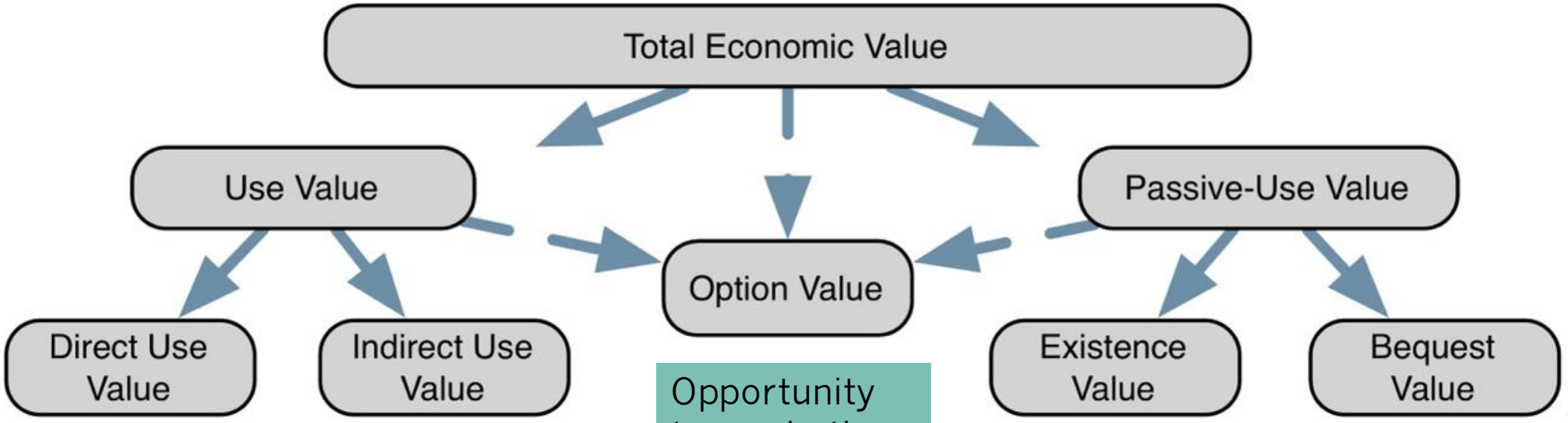
Types of Economic Value



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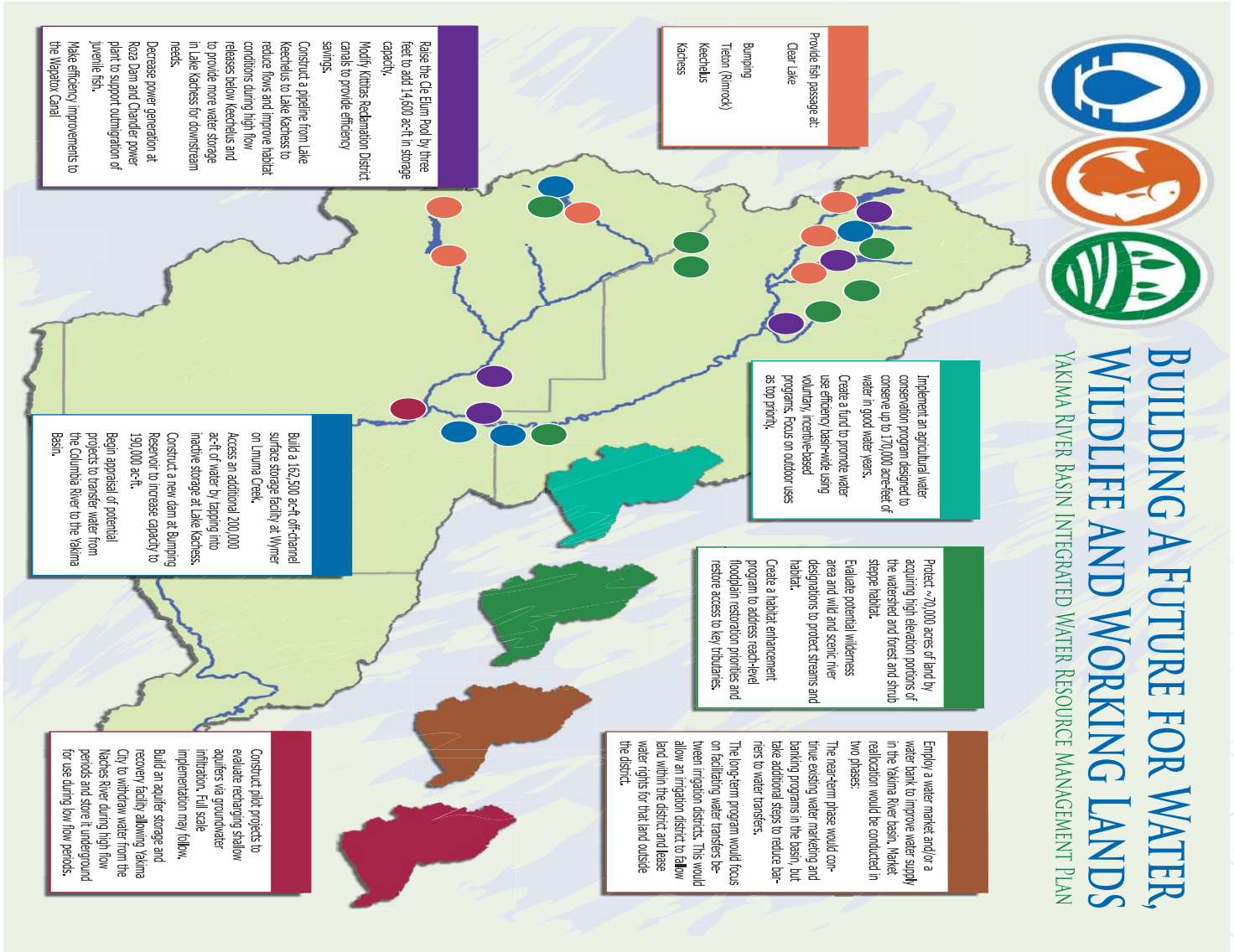
Yakima Basin Integrated Plan

- Securing water resources for irrigation districts required finding multiple benefits with fish, habitat, recreation, and tribal objectives.



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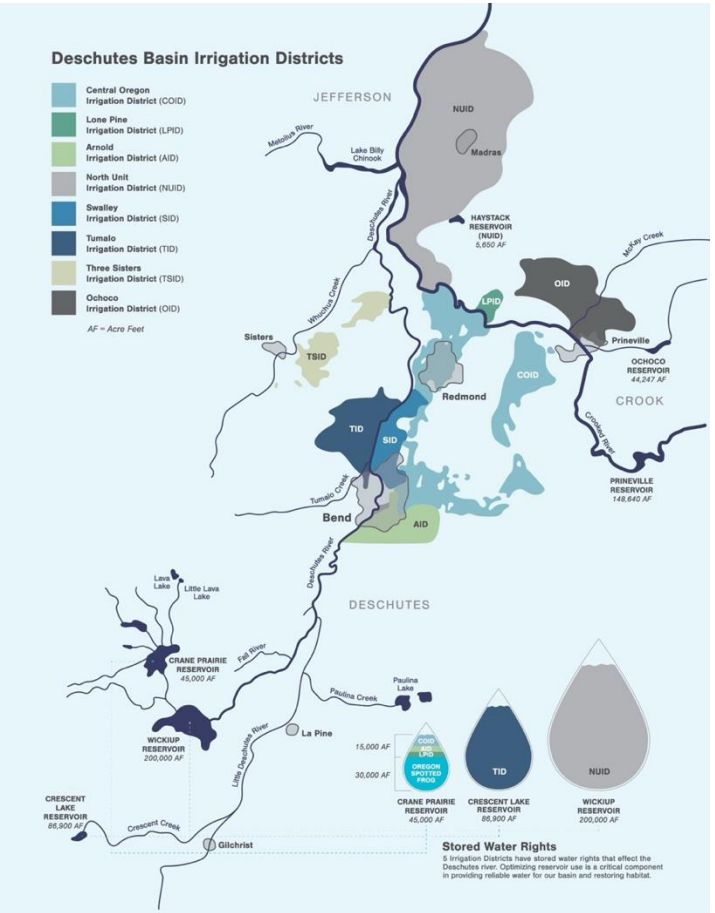
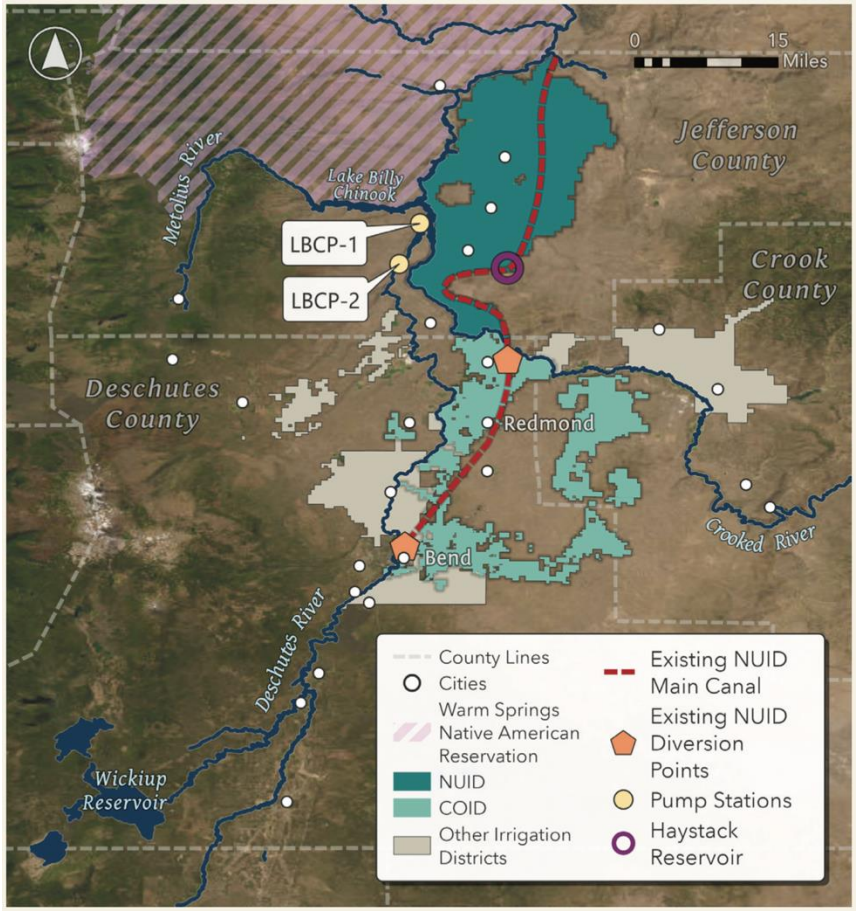
Deschutes Basin NUID Water Project





- Project will require multiple benefits to move forward: environmental (fish), cultural (tribe), recreational

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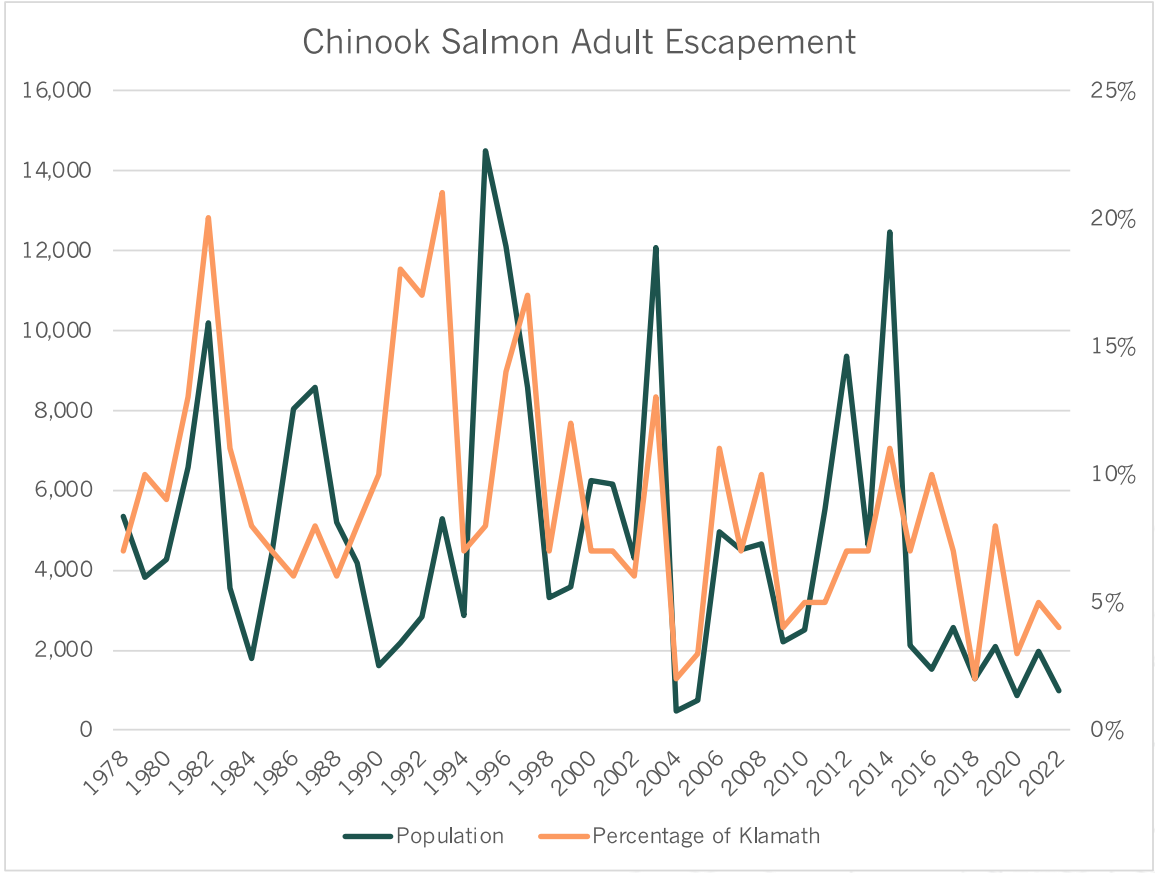
Chinook Salmon in the Scott River

- Scott river population declining at faster rate than Klamath Basin population
- Chinook Salmon abundance in steady decline since 2014
- Averages 9% of Klamath Escapement



Source: CDFW 2022

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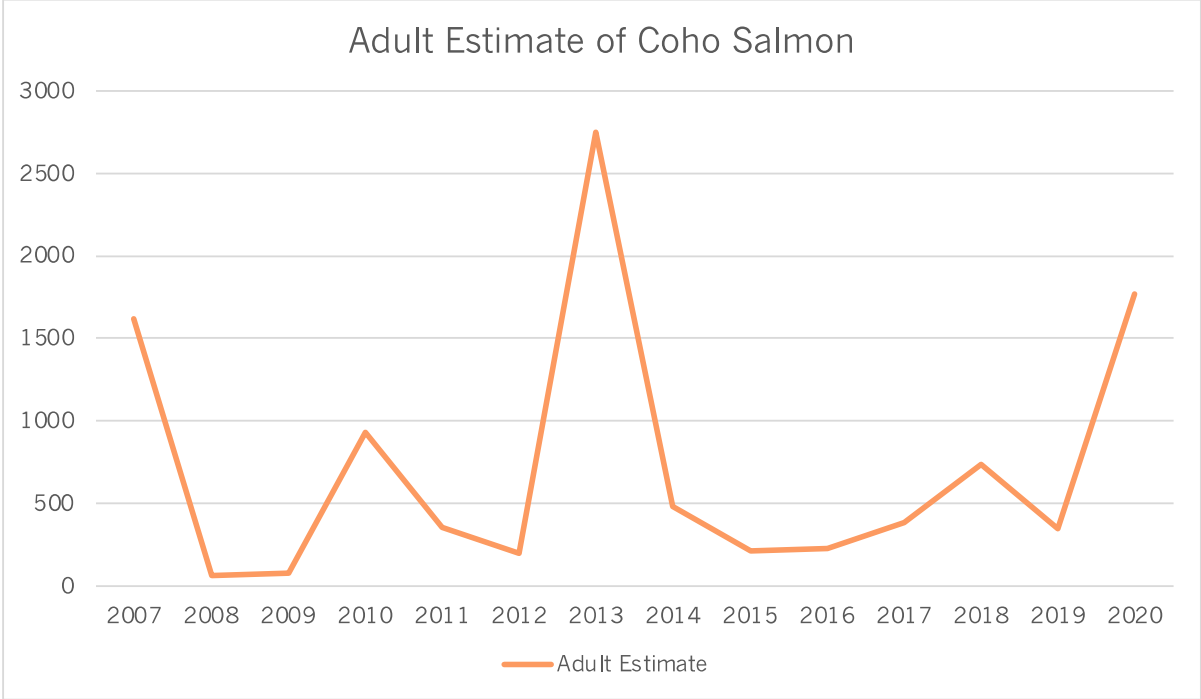
Coho Salmon in the Scott River

- SONCC Coho population listed
- An average of 703 fish since 2007 video operations for salmon escapement
- Based on most recent data available from the 2022 study by CDFW



Source: CDFW 2022

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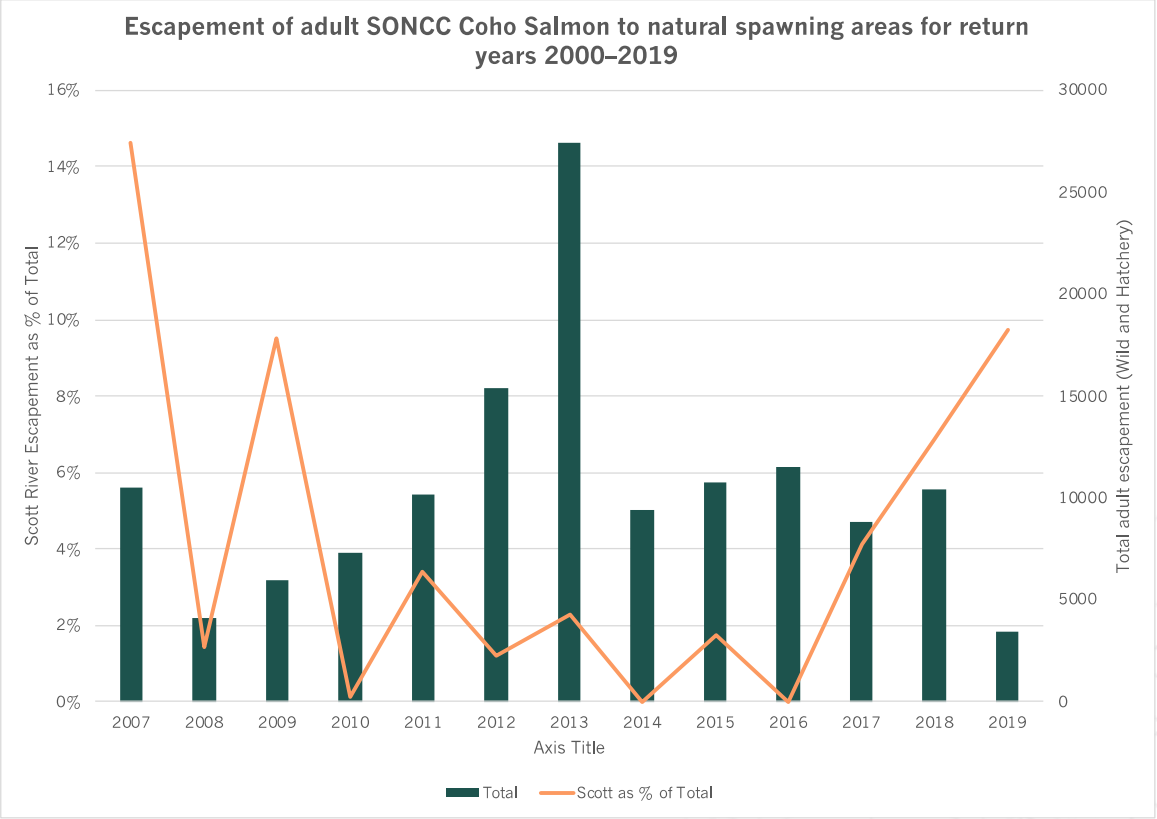
Coho Salmon in the Scott River

- Between 2007 and 2019, adult wild SONCC coho escapement in Scott averaged 4% of the overall SONCC escapement
- Scott population is a core population and must be at low risk of extinction for overall SONCC recovery



Source: PFMC 2021

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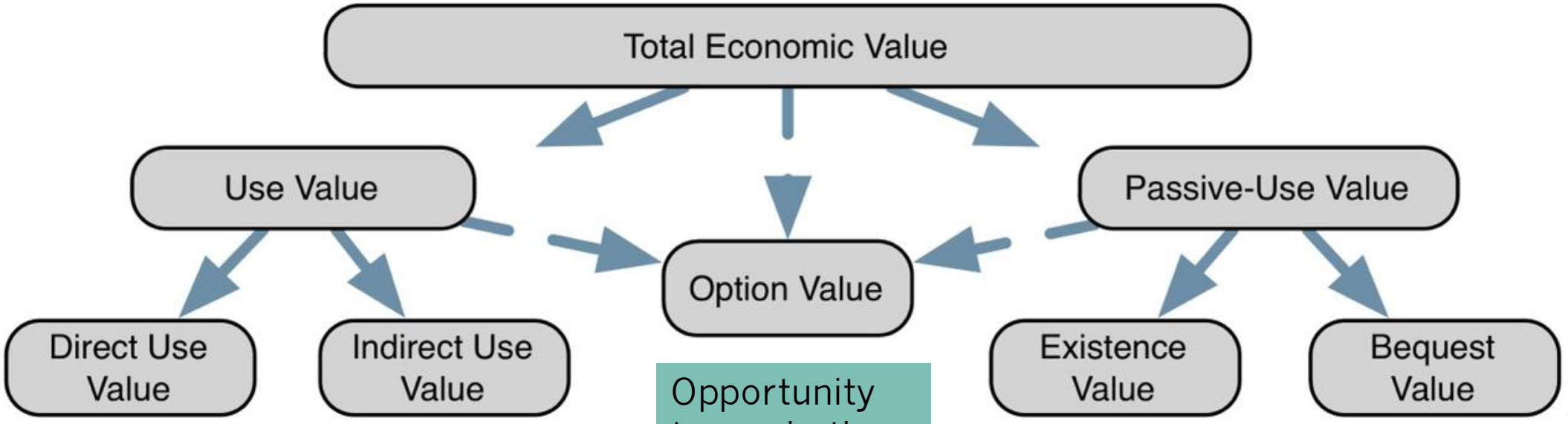
Types of Salmon Value



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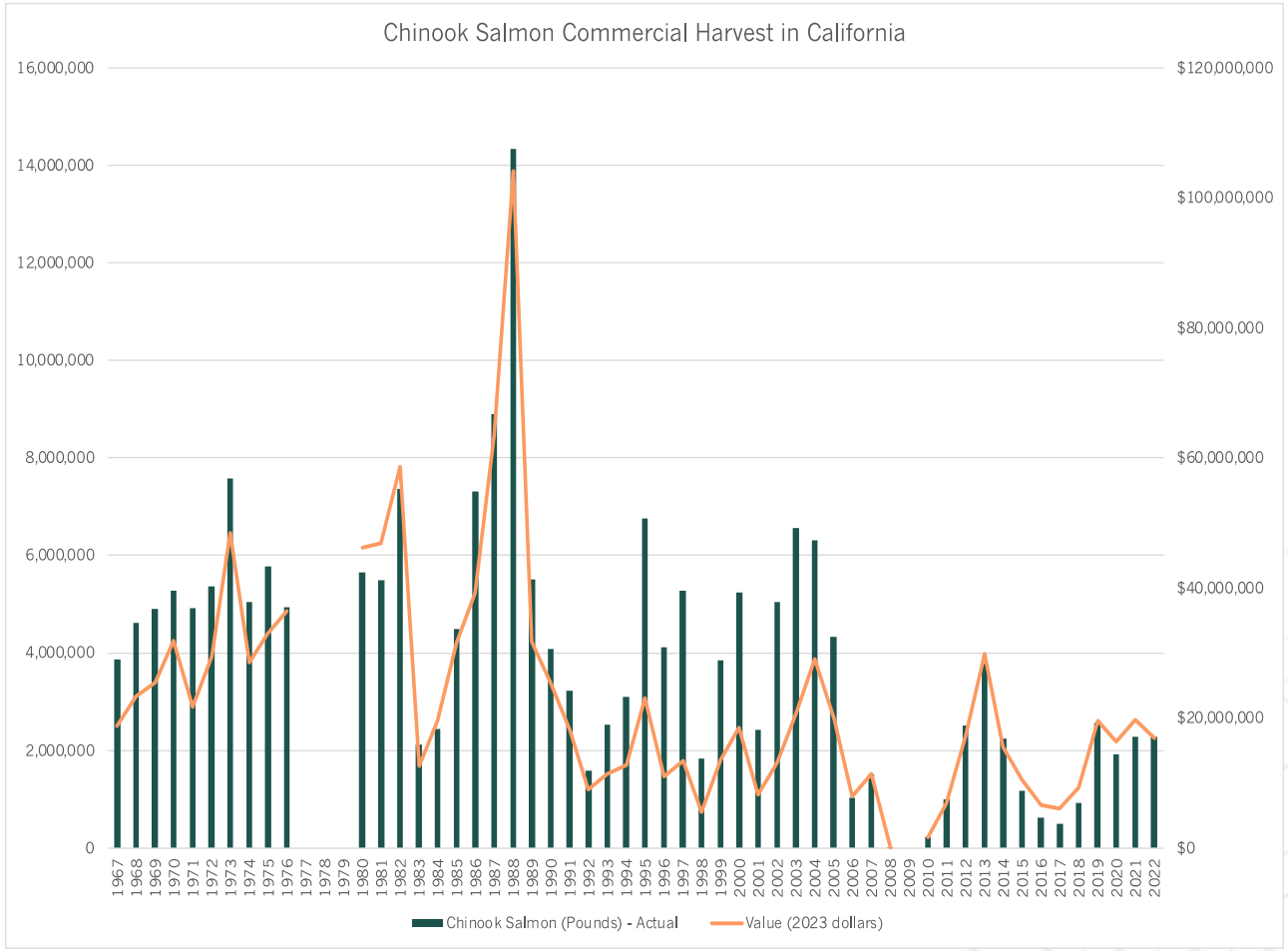
Commercial Fishing of Chinook Salmon

- Ocean commercial harvest averaged 4 million lbs annually between 1967 and 2022
- In 2008 and 2009, fisheries collapsed.
- Majority of harvest is Sacramento Chinook



Source: CDFW Data

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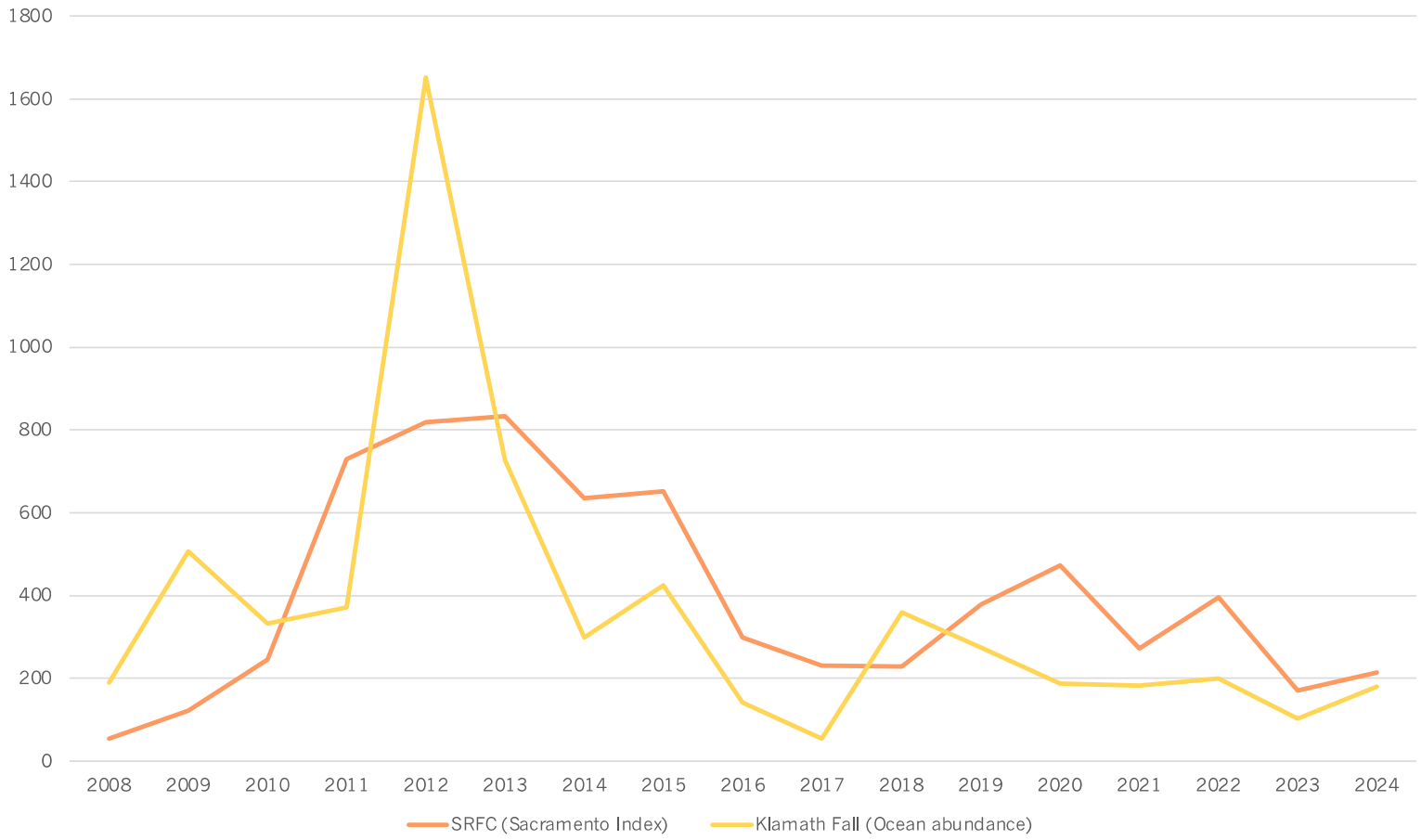
Commercial Fishing of Chinook Salmon

Klamath Fall Run Chinook Salmon have made up 19 to 81 percent of the stock in a given year, an average of 45 percent.



Source: PFMC Pre-season reports

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Commercial Fishing of Chinook Salmon

- **While we cannot accurately estimate the commercial value of Scott River's Chinook Salmon, we know it is critical to continued commercial fishing in California**
  - Commercial salmon fishing industry is valued at $1.4 billion in a normal year in California
  - Chinook Salmon in the Scott River contributes a small share to the overall commercial harvest in California
  - Faster decline than Klamath Basin makes it a critical population particularly given the Scott's role in providing spawning and breeding habitat

Recreational Fishing of Chinook Salmon

- **Similarly, while we cannot accurately estimate the recreational value of Scott River's Chinook Salmon, it contributes to downstream recreational fishing**
  - The experience of fishing and the eventual catch both hold value for those fishing.
  - Fishers also contribute to economic activity through their spending on fishing trips e.g. mileage, fishing gear, guided trips etc.

Subsistence Fishing of Chinook Salmon

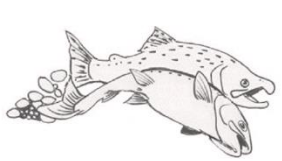
- **Households also rely on the fishing of chinook salmon and other species to supplement their diet**
  - **Public health benefits**
  - **Cultural benefits**
  - **Avoided market costs**

Value of Salmon Recovery

- **People value continued existence of salmon**
- $100s of millions of dollars annually spent on salmon recovery and restoration projects in CA demonstrates value for salmon recovery
- Non-market economic valuation methods for total economic value of salmon widely applied (Klamath, Puget Sound, coastal OR/CA)
- Surveys that estimate a household's Willingness to Pay for every 1000 fish added to the population (OR Coast Coho)
  - Lewis et al. (2022) estimates $0.11 to $0.26 with an average of $0.19 per 1000 fish per household.

Example survey instrument for valuation

- Example of Choice Experiment Card from Lewis et al. (2022).
- Respondents presented with Status Quo and two alternatives.
- Asked to choose which bundle of attributes fit their preferences.



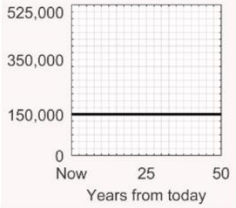
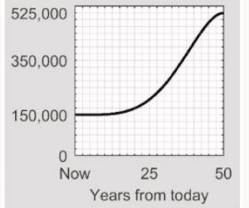
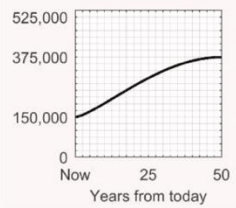
	Results in 50 years		
	Status Quo	**Alternative A**	**Alternative B**
Population Status	**Threatened**	**Recovered**	**Recovered**
Population Size	**150,000 fish**	**525,000 fish**	**375,000 fish**
Population over Time	**No Change** 	**Slow Change** 	**Quick Change** 
Recreational Fishing (# of fish that can be kept)	**Periodically Closed** **5 fish/year**	**Open Every Year** **10 fish/year**	**Open Every Year** **5 fish/year**
Added cost to your household each year for 10 years	**$0**	**$100/year**	**$350/year**
Which alternative do you prefer? *(Choose One)*	◯1 **Status Quo**	◯2 **Alternative A**	◯3 **Alternative B**

Fig. 3. Example choice card question. Attributes are selected from the experimental design in Table 1, and there are 60 unique choice cards.

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Value for Salmon Recovery in the Scott

- **Used multiple definitions of salmon recovery**
- Chinook Salmon
  - Average (2018-2022) = 1,436
  - Average (1978-1983) = 6,033
  - Maximum (1995) = 14,477
- Coho Salmon
  - Average (2016-2020) = 692
  - Maximum (2013) = 2,752
  - Recovery Target (2013) = 6,500

Annual Value for Salmon Recovery in the Scott

	12-County Klamath Area	California
Chinook Salmon		
Change to 1978-1983 levels	$340,000	$11,496,000
Change to maximum levels	$963,000	$32,611,000
Coho Salmon		
Change to maximum levels	$152,000	$5,152,000
Change to recovery target	$429,000	$14,524,000

Irrigated Agriculture

- California Dept. of Water Resources
  - Land Use (e.g., crop production) for 2019-2023
  - Applied water estimates by crop type for Siskiyou County
- County of Siskiyou, Dept. of Agriculture
  - Crop Yields (2018-2022)
  - Crop Prices/Value (2018-2022)
- USDA-NASS
  - Some estimates of crop production and value
- UC Davis
  - Cost and Return Studies for estimates of net returns per acre
    - Scott Valley, Siskiyou County, and Sacramento Valley budgets were used where applicable.

Agricultural Land Use and Value (2019-2023)

Agricultural production in the Scott River Watershed spans approx 31,000 acres with a market value of $30 million annually

Crop	Average Acres	Yield	Units	Value per Unit	Total Value
Pasture	15,828	5.0	AUM/A	$88	$6,953,285
Alfalfa	11,215	5.9	Ton	$264	$17,400,192
Other Hay/Grain	3,274	4.3	Ton	$279	$3,928,538
Wheat	408	3.1	Ton	$245	$313,068
Idle	318	0		$0	$0
Corn, Sorghum, or Sudan	154	165	CWT	$47	$1,201,035
Total	**31,196**				**$29,796,117**

Estimated Annual Net Returns for Scott Valley

Assuming pastures are an input into livestock production, Alfalfa and Pasture are the profitable crops.

Agricultural production generates an estimated annual net returns of approx. $6.5 million

Crop	Average Acres	Net Returns per Acre	Total Net Returns
Pasture	15,828	$76	$1,199,444
Alfalfa	11,215	$499	$5,593,850
Other Hay/Grain	3,274	-$67	-$220,309
Wheat	408	-$223	-$91,035
Idle	318	$0	$0
Corn, Sorghum, or Sudan	154	-$72	-$11,078
Total	**31,196**		**$6,470,871**

Estimated Annual Consumptive Water Use

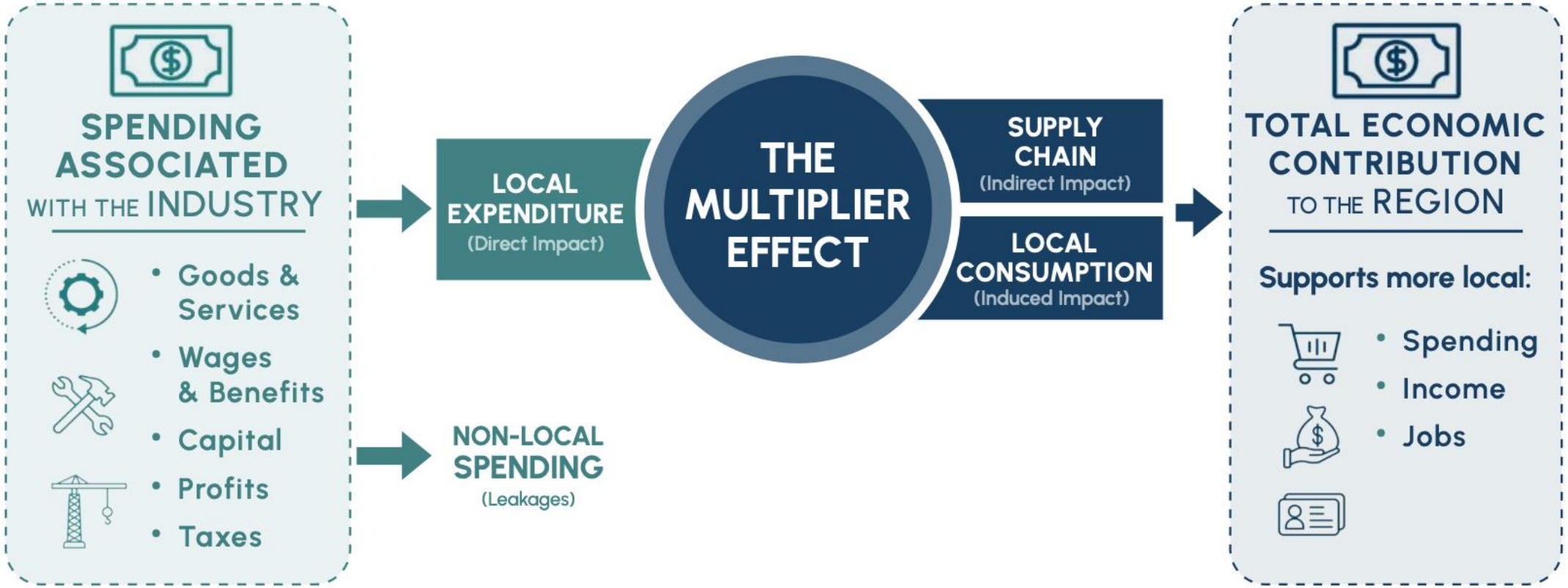
Based on DWR data for Siskiyou County, pasture and Alfalfa are also the most water intensive crops.

Crop production consumes approximately 88 TAF per year.

Crop	Average Acres	Est Water Use AFY	AF/Ac
Pasture	15,828	50,081	3.2
Alfalfa	11,215	29,114	2.6
Other Hay/Grain	3,274	8,262	2.5
Wheat	408	491	1.2
Idle	318	-	0.0
Corn, Sorghum, or Sudan	154	216	1.4
Total	**31,196**	**88,164**	**2.8**

Economic Contributions through IMPLAN

Direct spending on agricultural production supports income and employment in businesses that supply the inputs (indirect) and businesses people spend their wages (induced)



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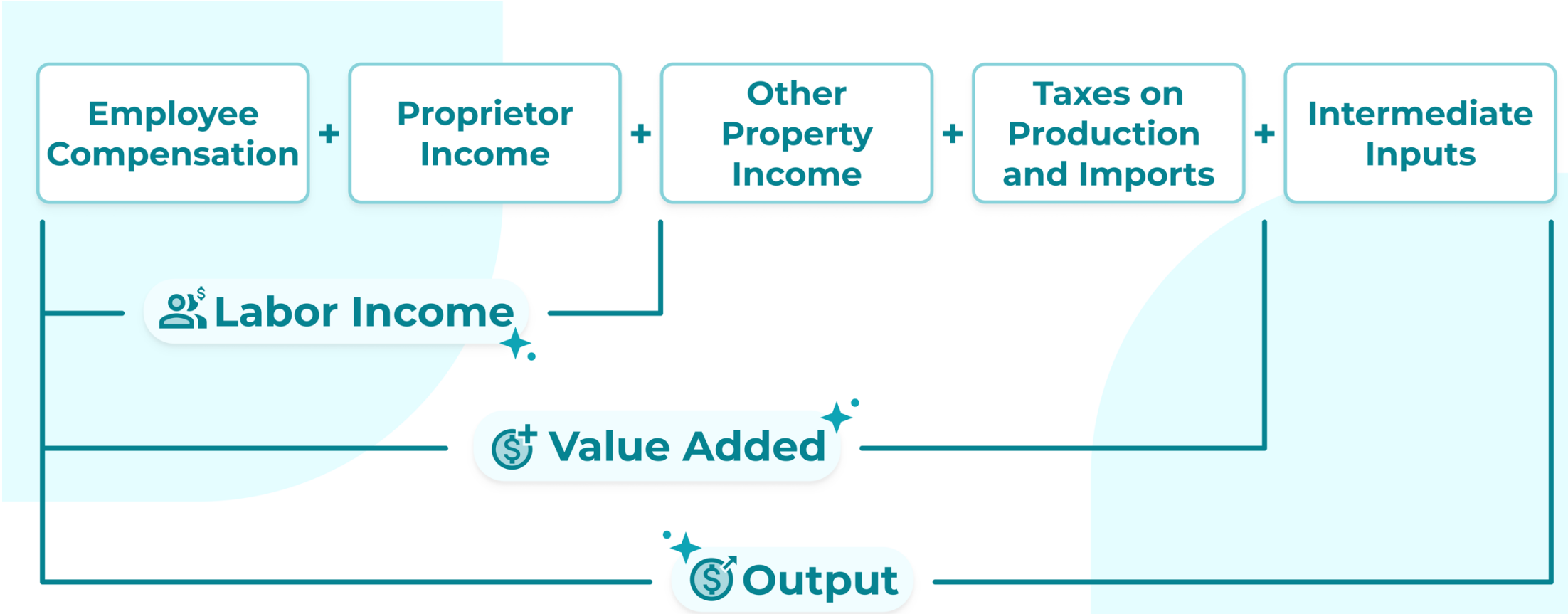
Economic Contributions through IMPLAN

IMPLAN provides estimates of employment, labor income, Value Added, and Output



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Annual Economic Contributions of Agriculture

Agricultural Production in Scott Valley employs approx. 81 people with wages and benefits equaling $9 million, Value Added equaling $15.6 million and total output equaling $30 million

Impact	Employment	Labor Income	Value Added	Output
Direct	81	$9,380,000	$15,600,000	$29,800,000
Indirect	32	$2,410,000	$3,180,000	$5,520,000
Induced	29	$1,300,000	$2,880,000	$4,580,000
Totals	142	$13,090,000	$21,660,000	$39,900,000

Non-Market Agricultural Contributions

- Complementary services for landscape scale ecosystem services
- Pest and weed management, good neighbor policies
- Aesthetics, property value, tourism
- Social capital maintenance
- Others?
- These provide opportunities for collaboration on multi-benefit objectives

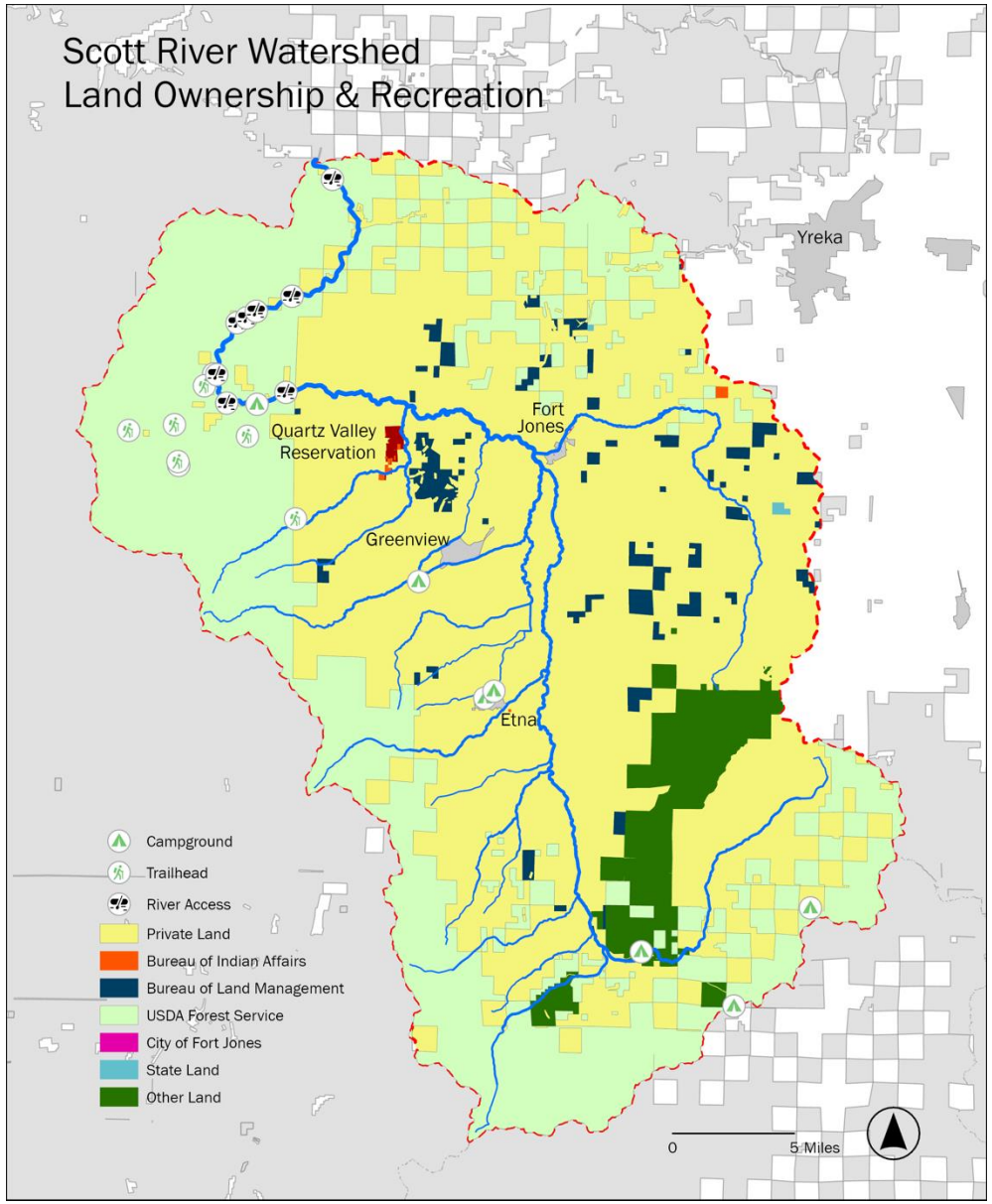
Tribal Value

- Several tribes have resided in the Klamath River Basin since time immemorial.
- Karuk tribe, Quartz Valley Indian Reservation, Shasta Indian Nation, Hoopa Valley, and Yurok tribe among several others
- Scott River is a site for ceremonial practices. Salmon production in the Scott is important for First Salmon ceremonies.
- The water from the river also supports supply of natural resources like native vegetation that are important for tribal sustenance and cultural identity.
- Yurok and Hoopa Valley tribes have a federally-reserved right to 50 percent of the available harvest surplus of Klamath fall-run Chinook salmon
  - Tribal harvest was 2,091 fish in 2023 with 53 salmon recreationally caught in-river.
  - Last commercial sale of salmon from tribal fisheries was in 2019.

Tribal Value

- Water from the Scott River supports the physical and mental health of tribal members
- 86 percent of surveyed Karuk Tribe members reported that their health and well-being are affected by their feelings about the river, and 56 percent believe the river is “not very healthy”.
- Loss of access to Salmon and other resources supported by the Scott River means the dietary needs of tribal members are not met leading to higher incidence of physical and mental effects
  - Incidence of diabetes among the Karuk Tribe increased in the 1970s following the Klamath Dam construction
  - Karuk tribe has a higher rate of diabetes and heart disease than the U.S. Average. A 2016 survey estimate a household incidence rate of 17.95% for Type II Diabetes among the Karuk Tribe.
  - The ADA estimates that diabetes patients incur $12,886 in direct costs associated with the disease. resulting in an estimated $8.6 million in annual diabetes-related healthcare costs for the Karuk Tribe. These do not include in indirect cost due to lost wages and other factors.

Water-related Recreation



- Mostly private land adjacent to the Scott River restricts public access for recreation
- Most public recreation occurs through Klamath National Forest
- Activities on the Scott River:
  - Class 4-5 Rafting and Kayaking during spring
  - Swimming and gold prospecting in summer
  - Fishing in fall
  - Non-motorized boating

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Water-related Recreation

Based on the NVUM Survey of 2018, approximately 202,000 visits were made to Klamath National Forest.

These translate into approximately 300,000 days of recreation by visitors (local and non-local)

Activity	Nonlocal		Local		Total Activity Days
	Day	Overnight	Day	Overnight	
Viewing Natural Features	1,567	23,888	16,926	1,288	43,669
Hiking / Walking	5,702	86,918	61,587	4,687	158,894
Viewing Wildlife	110	1,684	1,193	91	3,079
Developed Camping	714	10,877	3,031	586	15,208
Nature Study	159	2,423	1,717	131	4,430
Non-motorized Water	2,063	31,440	22,278	1,695	57,476
Picnicking	85	1,294	917	70	2,365
Fishing	108	4,202	2,978	227	7,515
Bicycling	128	1,946	1,379	105	3,557
Total	**10,637**	**164,672**	**112,006**	**8,879**	**296,194**

Value of Water-related Recreation

Riverfront recreation on the Klamath National Forest creates value for visitors. Non-motorized water-related recreation and fishing directly generated $8-9 million in value for visitors based on 2018 data.

Activity	Total Activity Days	Consumer Surplus
Viewing Natural Features	43,669	$3,603,636.45
Hiking / Walking	158,894	$17,037,625.65
Viewing Wildlife	3,079	$275,290.19
Developed Camping	15,208	$687,543.00
Nature Study	4,430	$338,184.64
Non-motorized Water	57,476	$7,948,520.49
Picnicking	2,365	$147,630.39
Fishing	7,515	$682,359.74
Bicycling	3,557	$391,747.73
Total	**296,194**	**$31,112,538.28**

Spending on Water-related Recreation

Visitors to Klamath National Forest spent approximately $12 million in 2018 on a variety of recreational activities. Scott River attracts some of this spending to the Valley by providing recreation opportunities.

Activity	Nonlocal Day	Nonlocal Overnight	Local Day	Local Overnight	Total
Viewing Natural Features	$160,000	$4,824,000	$772,000	$186,000	$5,942,000
Hiking / Walking	$18,000	$1,735,000	$314,000	$82,000	$2,149,000
Viewing Wildlife	$3,000	$122,000	$22,000	$6,000	$153,000
Developed Camping	$20,000	$262,000	$452,000	$24,000	$758,000
Nature Study	$10,000	$176,000	$66,000	$10,000	$262,000
Non-motorized Water	$3,000	$52,000	$21,000	$3,000	$79,000
Picnicking	$5,000	$176,000	$32,000	$8,000	$221,000
Fishing	$4,000	$108,000	$18,000	$4,000	$134,000
Bicycling	$76,000	$1,269,000	$505,000	$78,000	$1,928,000
Total	**$297,000**	**$8,725,000**	**$2,203,000**	**$401,000**	**$11,626,000**

Other Scott River Values

- Aesthetic Value
  - Proximity to the river provides scenic beauty to residents and visitors alike.
  - Likely supports higher property values when compared to similar properties further away from the river.
  - Agricultural landscape also has viewshed benefits for those living in and visiting the Scott Valley.
- Physical and Mental Health
  - Maintains air quality through vegetation
  - Provides natural open spaces spaces

Other Scott River Values (cont.)

- Cultural and Heritage Values
  - Supports a sense of identity and connection to place for residents of the Valley
  - Agricultural production provides a sense of purpose and livelihoods to community through generations

Future Scenario

- Agriculture
  - Between 2017 and 2022, the number of farms in the county decreased by 12% and the number of family farms decreased 14% while average farm size increased by 11%. These changes point to increasing farm consolidation and decreasing family farm operations in the county.
  - Climate change is likely to reduce snowpack and increase frequency of droughts in the future. Increased droughts coupled with emergency curtailments increase future uncertainty about water availability for irrigation.
  - Actual impact on agricultural production is uncertain, as decreased supply of certain crops could drive up value of existing ag production by driving up prices.

Future Values

- Salmon
  - Reduced snowpack and increased frequency of droughts will likely reduce instream flows and increase water temperature adversely affecting salmon in the Scott.
  - Further reductions in salmon abundance may push coho salmon within the Scott past possible recovery and lead to more frequent chinook salmon collapse.
  - Collapsed salmon stocks would prevent commercial and recreational fishing within Klamath basin adversely affecting commercial and recreational fishing industries.
  - Changing demographics within the county and surrounding regions may also shift value for salmon recovery. Actual impact on value of salmon is uncertain, as decreased abundance could drive up the marginal value of increasing salmon abundance.

Future Values

- Recreation
  - In California, outdoor recreation contributed 2.1 percent of CA's GDP and demand for outdoor recreation is projected to increase due to the continued increase in population
  - Some research suggests that interest in water-based activities, particularly non-motorized water recreation, will rise to counter extreme heat
  - More frequent droughts and longer dry seasons may shift certain recreational activities away from the Scott Valley.
- Adverse impacts to salmon and river flows will likely adversely impact Tribal values as well building on adverse impacts to other natural resource dependencies

Restoration Economy

- River and salmon habitat restoration in the Scott River Watershed also contributes to economic activity in the form of jobs and labor income particularly for state and federal grants that would otherwise have been received by other regions

Restoration Economy

- Klamath IFRMP estimates costs of Scott River restoration projects

Project Type	Low	Medium	High
Wetland projects	$15,845,000	$38,123,000	$69,530,000
In-stream projects	$11,894,000	$22,708,000	$33,566,000
Upland projects	$7,067,000	$8,323,000	$9,664,000
Other projects	$3,641,000	$8,518,000	$13,384,000
Fish passage projects	$765,000	$2,190,000	$3,757,000
Riparian projects	$510,000	$908,000	$1,113,000
TOTAL	**$39,722,000**	**$80,770,000**	**$131,014,000**

Source: PSMFC 2023

Restoration Economy

- These projects together have the potential to support 852 jobs, $45.6 million in labor income, $69.5 million in Value Added, and $129 million in output in total over the time of spending.

Impact	Employment	Labor Income	Value Added	Output
Direct	547	29,481,050	41,970,286	80,770,000
Indirect	213	11,828,240	17,879,738	32,698,614
Induced	92	4,322,144	9,620,800	15,302,050
TOTAL	**852**	**45,631,434**	**69,470,824**	**128,770,664**

Next Steps

- Refine analysis incorporating feedback
- Build on this baseline assessment to further investigate competing and compatible uses of water and assess relative marginal values
- Search for multi-benefit opportunities and identify beneficiaries for funding strategies
- Benefits are enjoyed at multiple geographic and temporal scales. Non-market benefits provide management and funding challenges

Feedback

- Limit monetary valuation to agricultural production
- Describe aesthetic, cultural, ecological, health, and economic resilience benefits tied to agricultural production
  - What kind of analysis can be used to support this?
- Focus on consumption and not applied water use for agricultural production
- Describe spillover effects of ag production including thresholds for local economy and businesses
  - What kind of analysis can be used to support this?