Economic Impact of the Klamath Settlement Agreements

With a Focus on the Impact of Restoration and Construction Activity on the Economies of Del Norte, Humboldt, Klamath, and Siskiyou Counties

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Executive Summary

Introduction

In this study we estimate the economic impacts of actions proposed for the Klamath River and its tributaries. These actions—potential removal four hydroelectric dams extensive restoration, monitoring, and reintroduction activities, and measures to stabilize agriculture—are included in the Klamath Settlement Agreements (KSA's). The relevant settlement documents include the Klamath Hydroelectric Settlement Agreement (KHSA) and the Klamath Basin Restoration Agreement (KBRA). The approach is a conservative one, particularly with regard to the local impacts of construction, as it is assumed that no local firms receive contracts, and much of the labor is drawn from outside of the immediate area. The focus of this study is on the local economic impact of restoration and construction activity connected to the KSA's. In depth analysis of the effects on agriculture may be the focus of future studies.

Summary and Conclusions

Were the actions called for in the settlement documents to occur, they would have significant positive impacts on the economies of Del Norte, Humboldt, Klamath, and Siskiyou Counties. In this study we estimate those impacts, incorporating two methodological improvements over previous efforts. First, a gravity model is used to allocate the economic impacts of hydroelectric dam removal and other construction projects to the affected counties within the four-county study area, and to Jackson County, Oregon, outside of the area. Second, the IMPLAN input-output model is used to generate county-specific multipliers for each of the counties in the study area. The multipliers are used to calculate the total effects on business revenues, income, and employment that result from direct project expenditures.

Economic impacts on each of the counties in the study area are summarized below under separate headings and in the summary table that follows. The counties are listed in order of the size of the impacts on total business revenues. The projects included in the KHSA and KBRA would have the greatest near-term impact on Klamath and Siskiyou Counties. In the long-term Klamath, Siskiyou, and Modoc Counties would receive additional economic benefits through stabilization of agricultural production, and an increase in the value of agricultural output in the basin. The KBRA offers a combination of stabilized irrigation water deliveries, improvements in the efficiency of the delivery system, and temporary compensation for irrigation reductions in drought years that would have significant positive impacts on the basin agricultural economy of Klamath, Siskiyou, and Modoc Counties. Potential water rights settlement in the Off Project area through the KBRA would appear to minimize the risks to irrigated agriculture in the area, and provide compensation for proposed water use reductions. Agricultural impacts are discussed briefly in this report, and are intended to be explored in depth in subsequent studies. Finally, stabilization of water supply to the refuges is also likely to increase visitation, bringing additional visitors and spending to those same counties.

Humboldt and Del Norte Counties would experience smaller near-term impacts, as no construction and a relatively small percentage of other projects contained in the KHSA and KBRA are located within the counties. However, in the long-term, the counties would see a measurable increase in economic activity

from fishery improvements. Assuming that projects increase salmon populations by 100 percent, commercial and recreational fishing would bring another $2.24 million in annual income (78 percent of the total impact) to the two counties. The potential increase in commercial, tribal, and recreational fishing activity would support an additional 21 full- and part-time jobs (not including direct tribal fishing employment) and increase annual business revenues by $1.45 million.

Klamath County

Over the eleven years of construction, restoration, monitoring, and reintroduction, Klamath County would see an average annual increase in business revenues of $40.04 million. Income to the affected businesses and their employees would increase by $29.15 million and the projects would sustain an average of 707 full- and part-time jobs.

Siskiyou County

Siskiyou County would experience significant, although smaller impacts, with the increase in business revenues averaging $20.68 million over the eleven years of KHSA and KBRA projects. Siskiyou County income would be higher by $16.58 million on an annual basis, and average employment would increase by 298 full- and part-time jobs.

Humboldt County

Over the ten-year period of restoration, monitoring, and reintroduction, Humboldt County would see business revenues increase by an average of $4.93 million annually. The enhanced economic activity would raise county income by $3.61 million, and create an average of 98 additional full- and part-time jobs.

Del Norte County

Del Norte County would see an average annual increase in business revenues of $4.36 million, an increase in income to businesses and their employees of $3.42 million, and 69 full- and part-time jobs.

Summary of County Economic Impacts

	Average Annual Impacts		
County	Business Revenues (2007$)	Income (2007$)	Full- and Part-Time Jobs
Klamath	$40.04 million	$29.15 million	707
Siskiyou	$20.68 million	$16.58 million	298
Humboldt	$4.93 million	$3.61 million	98
Del Norte	$4.36 million	$3.42 million	69

Project Scope

The scope of the study is limited to the major categories of benefits, defined in terms of the impact of construction, restoration, monitoring, and reintroduction activities associated with the KHSA and KBRA on Del Norte, Humboldt, Klamath, and Siskiyou Counties. In addition, the economic impacts of expected improvements in the salmon fishery are assessed. The potential benefits to agriculture and the refuges from stabilization of water supplies are discussed, but not quantified. Not all benefits are

included, and the cost and risk issues are not addressed. Impact estimates are provided for each of the counties for the years 2012 through 2022.

Methodology and Sources

The costs of removing the four hydroelectric dams are from studies by the Federal Energy Regulatory Commission and G&G Associates. The economic impact of improved fisheries is estimated from various sources and is calculated from the additional catch and the associated increase in local expenditures. The economic impacts of actions included in the KHSA and KBRA are estimated for the individual counties of Del Norte, Humboldt, Klamath, and Siskiyou, while fishery impacts are estimated for the four-county region only. All direct expenditures are entered into the IMPLAN input-output model in order to estimate total impacts on business revenues, income, and employment.

Structure of the Study

Individual county economic impacts are calculated in two stages and in two separate sections. Direct expenditure (business revenue) impacts are presented in the direct impacts section. The assumptions and data used to derive these impacts are under methodology. The direct economic impacts are then entered into the IMPLAN input-output model to estimate the total economic impact (local economic benefit) and these totals are included in the results section.

Introduction

Purpose

The primary purpose of this study is to estimate the economic benefits of the expenditures undertaken in connection with restoration of the Klamath River and its tributaries, and the economic impact of the expected improvements in the freshwater and ocean fisheries. The funding amounts for the actions included within the Klamath Basin Restoration Agreement (KBRA) are from the February 18, 2010 document.[1] The value of more stable water deliveries to agricultural users and refuges is also discussed, but the potential impacts are not quantified in this study.

General Approach

Hydroelectric dam removal costs, not included in the KBRA, are from studies by the Federal Energy Regulatory Commission and G&G Associates. The economic impact of improved fisheries is estimated from various sources and is calculated from the additional catch and the associated increase in local expenditures. The economic impacts of removal of the four hydroelectric dams, other construction projects including alternative energy facilities, and the restoration, monitoring, and reintroduction activities included in the KBRA are estimated for the individual counties of Del Norte, Humboldt, Klamath, and Siskiyou. Fishery impacts are estimated for the four-county region only.

Scope

The scope of the study is limited to the major categories of benefits, defined in terms of the impact of construction, restoration, monitoring, and reintroduction activities associated with the KBRA and KHSA on the counties most likely to be affected. The economic impacts of the expected improvement in the Chinook salmon fishery are also included, but due to uncertainty regarding the timing of the improvement, they are not a part of the annual benefits estimates.[2] Not all benefits are included, and the cost and risk issues are not addressed.

Potential Benefits Not Assessed

There are certain categories of expenditures in the KHSA and KBRA that are not included in the analysis of economic impacts to the counties within the four-county study area. The benefit analysis excludes expenditures for studies, coordination, and planning, including those in the KHSA designated for the years prior to 2012. In these cases a large percentage of the work may be done by outside firms or within government offices outside of the four-county study area (for example, the Portland office of the USFWS). While this probably leads to understatement of the local impact; there is no reliable way to determine the local component of these expenditures.

No quantitative analysis of the potential impacts on agriculture is included. There was insufficient data available at the time this study was prepared to properly assess the total impacts from changes in water

[1] *Klamath Basin Restoration Agreement for the sustainability of Public Trust Resources and Affected Communities*, February 18, 2010

[2] Restoration activities funded under the KBRA are likely to have positive impacts on populations of Coho salmon, Steelhead, and other species supported by the Klamath River system. However, since Chinook salmon fishing forms the bulk of the freshwater and ocean catch, the analysis is limited to that species.

deliveries to the On- and Off-Project areas, the construction and operation of new renewable energy facilities, and other factors that may affect agricultural production in the basin.

The benefit calculations also exclude both non-use values and use-values, since a significant portion of the benefits are likely to accrue to non-residents. For example, various studies have estimated the value of salmon caught by recreational anglers. Based on contingent valuation and travel cost studies, the estimated value per salmon caught ranges from a few hundred to nine hundred dollars.[3] However, the approach here is to estimate the economic impact that increased catch and angler effort will have on the affected counties, and that is measured by the spending those additional visitors bring to the county. That spending impact is considerably less than the value to those anglers, ranging from $56 to $156 for ocean recreational (the difference depends on whether it from a private boat or a charter), and $64 for freshwater recreational fishing.

Potential benefits to down steam water users from improved water quality, and the positive impact on property values, are also excluded from the analysis. Recreational benefits including possible improvements in the white water rafting experience are not assessed. These types of benefits fit into the category of use value, the analysis of which is not within the project scope. In short, this is an economic impact analysis and its scope is limited to the assessment of the effect of the KSA's on business revenues, income, and employment in the affected counties.

Geographical Scope

Impact estimates are provided for each of the counties within the four-county region. It is not reasonable to assume that the full impact of construction activity would occur within the region, as some of the firms and employees doing the work are likely to come from outside of the immediate area. The stated intent in the KHSA and KBRA is to use local labor and contractors, and local contractors have some competitive advantage as they are not burdened with per diem costs for out of area workers. However, a lack of capacity in local firms, and a limited supply of employees with the skills required for the projects, would inevitably lead to some contract work going outside of the region.[4]

Time Frame

For the most part, the analysis covers only the years 2012 through 2021 included in the KBRA. There are three exceptions. First, the earliest hydroelectric dam removal could occur is 2019 or 2020, so those impacts are assigned to the four-year period beginning in 2019. Second, the impact of KHSA and KBRA activities are not likely to have a significant impact on salmon and steelhead populations until well after 2022. Sediment loading that might occur if the hydroelectric dams are removed may even temporarily reduce river and ocean fishery quality and catch. Therefore, the fishery benefits are quantified, but are not assigned to a particular year Third, placing a floor on agricultural water deliveries for the Klamath Project, and potentially increasing certainty of water delivery for the Off-Project area will be

[3] See ECONorthwest, *Economic Value of Rogue River Salmon*, January 2009, Table 7.

[4] The gravity model employed here uses Medford and Jackson County, Oregon as a proxy for the use workers from outside of the region. It is probable that there would still be some local impact from outside contractors, although no estimate is provided here. The local impact would take the form of local spending for lodging and meals, as well as some local input purchases.

implemented as part of the agreement, but the beginning date for these provisions cannot be well defined.

Structure of the Study

Individual county economic impacts are calculated in two stages and in two separate sections. Direct expenditure (business revenue) impacts are presented in the direct impacts section. The assumptions and data used to derive these impacts are presented in the following section under methodology. The direct economic impacts are then entered into the IMPLAN input-output model to estimate the total economic impact (local economic benefit) and these totals are included in the results section. The measures of economic impact or benefit are presented in terms of total business revenues, income (the sum of labor compensation, proprietor income, property income, and indirect business taxes), and employment.

Methodology

IMPLAN Input-Output Analysis

In order to determine the total impact on county and regional income and employment, direct expenditures are entered into the appropriate sector of the IMPLAN model for the respective counties. IMPLAN is an input-output model that separates the economy into 440 industrial sectors, classifying each according to the primary product or service it provides.[5] The transaction matrix is the model that estimates impacts. It contains the purchases and sales that occur among the various sectors. Column entries are the purchases made by a particular sector from all other sectors included in the model. Row elements are the industry destinations of the sector's sales. An input-output model permits assessment of the total impact of an initial change in income or expenditures.

The total impact is the sum of the direct, indirect, and induced impacts. Indirect impacts are the result of purchases (by the sectors directly affected) from local industries supplying inputs. Induced effects are due to the spending of additional income earned through the enhanced business activity generated by the direct impacts. The model output includes estimated impacts on output, income, employment, and state and local revenues.

Construction

The proposed new hatchery; fish passage and pump screening; salmon collection, production, and acclimation facilities; canal and dike re-engineering; alternative energy facilities, and hydroelectric dam removal are all designated as construction activities. Since many, if not all of the firms engaged in the construction work are likely to come from outside of the immediate area; the estimated impacts are limited to those directly connected to labor compensation. Indirect impacts are zero and induced impacts are limited to the local spending component of labor income. This approach significantly reduces the estimated local impacts, but provides a more realistic assessment of their magnitude.

[5] See http://www.implan.com/about.html for a list of state and federal government agencies, academic institutions, and private organizations using IMPLAN for impact assessment.

Restoration, Monitoring, and Reintroduction

In the case of restoration, monitoring, and reintroduction it is more likely that these activities would be administered at the local level. They would probably be housed in the local USFWS offices in Arcata, Yreka, and Klamath Falls, the CDFG office in Eureka or Yreka, or directly administered by the tribes receiving the funding. Therefore the full amounts of the direct expenditures for these activities are assumed to occur within the local economy. While the programs are likely to be administered by public agencies or tribal entities, the bulk of the work would be done under contract by private firms and their employees.

Refinements to the Methodology of a Previous Study

County –Specific Multipliers

A study completed in 2006 by Ecotrust estimated the economic impact of removal of the four hydroelectric dams on the Klamath River. In estimating the total impacts, the study employed statewide multipliers which significantly overstate the county and regional impacts.[6] In this study we use the individual county-level multipliers generated by the IMPLAN model.

Allocation of Economic Impacts is Based on a Gravity Model

In the Ecotrust study no attempt was made to allocate the impacts to counties other than Siskiyou County. In this study a gravity model is used to apportion direct construction expenditures to counties within the four-county region and to Jackson County, Oregon, outside of the region.

Study Scope

Economic impacts estimated in the Ecotrust study were limited to the expenditures directly associated with dam removal and did not include other expenditures contained in the KBRA. In this study the scope is broadened to include the economic impacts of other construction project spending, expenditures for restoration, monitoring, and reintroduction, and the economic development funds potentially available to Siskiyou County.

Gravity Model

A gravity model is a method of quantifying the interaction between the economies of two regions. In a gravity model the influence of locale A on another is directly proportional to the weight or "gravity' of A and inversely proportional to the square of the distance between them.[7] In this study a gravity model is employed to estimate the movement of labor resources to the various construction projects that are components of the KBRA. Construction labor resources are assumed to originate in Siskiyou, Klamath, and Jackson Counties. The centers are assumed to be the respective population centers of Yreka,

[6] S. Kruse and A. Sholtz, *Preliminary Economic Assessment of Dam Removal: The Klamath River*, Ecotrust, January 31, 2006

[7] For a formulation of the gravity model see http://people.hofstra.edu/geotrans/eng/ch5en/meth5en/threebasicmodels.html

Klamath Falls, and Medford. Personal income for 2007 is used as the weights, providing a proxy for the size of the local labor market.

Mileage is calculated for separate construction project locales—each of the Klamath River hydroelectric dams that may be removed, the new hatchery near Fall Creek, the various projects on the Williamson, Wood, and Sprague Rivers, and the projects in the vicinity of Klamath Lake. In the case of the latter two, mileage differences indicate that nearly 100 percent of the labor would be drawn from Klamath Falls. Most of the labor for the hatchery near Fall Creek (87.6 percent) is projected to come from Yreka, with 8.5 percent from Klamath Falls, and the remainder from outside of the region in Medford. The labor shares for the four hydroelectric dam removal projects are included in Table 1. It is estimated that roughly one-half of all labor would come from Medford, Oregon, and therefore a significant portion of the impact of hydroelectric dam removal would be outside of the four-county region.

Table 1: Origin of Labor Inputs for the Four Klamath River Hydroelectric dam Removal Projects

Project	Yreka	Klamath Falls	Medford
Copco 1&2	30.2%	18.4%	51.5%
Iron Gate	30.7%	9.6%	59.7%
J.C. Boyle	14.6%	49.7%	35.8%

Direct Impacts

Construction Impacts

Included in Table 2 are a number of projects in the Klamath Basin and at Keno Reservoir. Klamath Basin projects involve wetlands, canal and dike construction. Keno Reservoir projects are for fish passage and pump screening. Other projects planned for Klamath County include irrigation efficiency improvements and alternative energy projects, as well as collection, production, and acclimation facilities that are part of the salmon reintroduction plan. Construction projects planned for Klamath River tributaries, including the Williamson, Wood, and Sprague Rivers, are also included in the Klamath County totals. Siskiyou County construction projects in Table 2 are limited to the county's estimated shares of the hatchery near Fall Creek and the four hydroelectric dam removal projects.

Hydroelectric dam removal expenditures are based on estimates provided by FERC and G&G Associates, and are presented here as the average of the two estimates, or $60.9 million in 2007 dollars.[8] This is a conservative estimate in that the KHSA calls for up to $450 million for dam removal, including sediment management and other post-removal costs. The expenditures are allocated to Siskiyou, Klamath and Jackson Counties according to the gravity model results presented in Table 1, and the local amounts are entered into the construction totals for Siskiyou and Klamath Counties for 2019 through 2022.

[8] G&G Associates, *Klamath River Dam Removal Investigation*, July 2003 and for the Federal Energy Regulatory Commission estimates see http://act.americanrivers.org/site/DocServer/FERC_Estimate_of_Dam_Removal_Costs.pdf?docID=8547

Table 2 contains the estimated 2007 dollar construction expenditures by county and by year. The amounts allocated to Siskiyou and Klamath Counties are based on the results of the gravity model, where the percentages depend on the distances between the project sites and the population centers in Yreka and Klamath Falls. The eleven-year totals for Klamath and Siskiyou Counties are $107.1 million and $21.4 million, respectively.

The estimates do not include any costs of sediment removal, nor do they include the cost of reservoir and dam site restoration following removal. Although it is assumed that river hydrology is sufficient for removal of sediment, one study estimated the cost of restoration for reservoir lands at $35 million and the costs of sediment management at $175 million.[9] If these expenditures were to occur, and in the amounts projected, that would add considerably to the positive economic impact on Siskiyou and Klamath Counties. Of course most of this impact would occur in the years following hydroelectric dam removal, an activity assumed to be complete in 2022.

Table 2: Total Construction Spending by County and by Year (thousands of 2007 dollars)

Year	Klamath	Siskiyou	4-County Region
2012	$500	$0	$500
2013	$3,866	$292	$4,158
2014	$27,056	$125	$27,181
2015	$13,448	$125	$13,573
2016	$10,438	$125	$10,563
2017	$5,936	$125	$6,061
2018	$1,461	$4,161	$5,622
2019	$17,567	$1,913	$19,480
2020	$19,219	$2,732	$21,951
2021	$4,719	$2,732	$7,451
2022	$2,842	$9,115	$11,957
Totals	$107,053	$21,445	$128,498

Restoration, Monitoring, and Reintroduction

The county totals for restoration expenditures do not include those specified in the KBRA as studies, coordination, or planning. Restoration projects include restoration of main stem and tributary riparian corridors, wetlands, and public and private uplands, but exclude the re-engineering projects defined as primarily construction activities. Reintroduction expenditures are for operation of the collection, production, and acclimation facilities; transport; and monitoring and evaluation. The expenditures for building the collection, acclimation, and reintroduction facilities and the new hatchery are categorized as construction and are not included in the Table 3 totals. Those expenditures specifically classified as monitoring include various measures to assess water quality, the populations and health of several fish

[9] B. Swann, C. Park, and D. Auslan, *The Klamath Dam Removal: A Review of the Costs, Financing and Risks of This Landmark Restoration Program, No Date,* http://ussdams.com/proceedings/1185-1194.pdf

species, steam flows, and weather. Table 3 includes the direct expenditures for restoration, monitoring, and reintroduction, allocated to the counties in which they are most likely to occur.

Table 3 includes the direct impacts specified in terms of expenditures. As shown in the results section of this report, one impact of these direct expenditures is a significant number of jobs created and sustained throughout the extended period in which restoration, monitoring, and reintroduction activities occur. Although the contracting for many of these activities is likely to be done by public agencies, the majority of the work will be done by private businesses and their employees. For example, Plumas County contractors and workers have considerable experience with the type of work associated with upland restoration. In Red Clover Valley streams have cut deep into their beds (Indian, Red Clover, and Poco Creeks) to the point where they do not support riparian vegetation. In this case much of the damage was the result of a combination of timber harvesting, overgrazing, and using streams for livestock watering. The solution has been to backfill the streams with rock in order to raise water levels, add soil and replant riparian vegetation, fence off the streams to avoid further damage from cattle grazing, and dig wells to provide an alternative source of water for livestock. All of these jobs are private and involve skills possessed by businesses and workers in all of the counties within the four-county area that is the focus of this study.

Table 3: Expenditures for Restoration, Monitoring, and Reintroduction by County and by Year (thousands of 2007 dollars)

Year	Del Norte	Humboldt	Klamath	Siskiyou	4-County Region
2012	$500	$250	$3,868	$6,168	$10,785
2013	$1,750	$1,250	$16,475	$14,294	$33,769
2014	$2,250	$1,750	$24,470	$24,071	$52,540
2015	$3,000	$2,500	$28,770	$16,731	$51,000
2016	$3,595	$3,095	$27,010	$17,331	$51,030
2017	$5,000	$4,500	$34,151	$17,471	$61,121
2018	$5,000	$4,500	$33,101	$36,291	$78,891
2019	$5,250	$4,750	$38,009	$14,529	$62,538
2020	$5,250	$4,750	$47,649	$14,179	$71,828
2021	$4,250	$3,750	$27,709	$11,984	$47,693
Totals	$35,845	$31,095	$281,209	$173,046	$521,195

Funding amounts for tribal fisheries management and conservation projects are also included in the annual county totals. This is necessary since county-level data is used in the IMPLAN model. The expenditures are allocated to the county or counties in which tribal lands are located. Expenditures for the various projects are allocated to the respective counties based on project location, or where the location is only specified in general terms (e.g. Lower Klamath River and Tributaries), to a county roughly on the basis of the proportion of river miles or drainage in that county.

Other Expenditures: $20 Million Development Fund for Siskiyou County

Item 96 in the KBRA is a $20 million dollar payment to be made in 2018 to Siskiyou County for economic development. While entered as a line item in the KBRA, this funding is not certain as it depends on the issuance of a bond by the State of California. The actual impact of that potential payment could also differ significantly depending on how it is utilized by the county. The smallest impact would result from using the money to augment the county budget, while the largest would arise from the use of the fund to leverage private money in order to assist startups or expand existing local small businesses. With particular targeting of the funding, the consequence of that spending might be to permit local firms to secure a larger percentage of the various actions funded under the KHSA and KBRA, increasing the positive economic impact on Siskiyou County. The range of possibilities and the economic impact of the various options are quantified in the results section.

Agricultural Output

Further quantitative and qualitative analysis is needed to ascertain the impacts and avoided risks of the KSAs on agricultural economies in the Klamath Reclamation Project and Off Project area. It is anticipated that subsequent analyses will address these issues as their primary scope. The following provides brief, qualitative analyses of the KSA's provisions pertinent to agricultural economic activity.

KBRA and On Project Agricultural Water Diversions

The KBRA provides a degree of stability to agricultural output and income not present over the last few decades. The agreement establishes additional storage in, and inflows to Upper Klamath Lake, and a floor for On Project agricultural water deliveries of 330,000 acre feet, increasing to 340,000 acre feet with possible construction of additional storage in the future. It provides for temporary water leasing from willing sellers when serious drought conditions require additional reductions in deliveries, and caps maximum deliveries at 385,000 acre feet. The KBRA also includes a number of projects which should reduce losses in portions of the delivery system, increasing the net amount of diverted water available for irrigation. Renewable energy projects and energy efficiency improvements would reduce pumping costs. The measures protecting the productivity of the river's important salmon fishery also benefit agriculture to the degree that they decrease the probability of unpredictable variations in irrigation. It is probable that, in the absence of the KSA measures designed to improve aquatic habitat, the stressed fishery would trigger future reductions in agricultural diversions below historical averages.

Statistical Analysis: Inflows and On Project Agricultural Diversions

Historically (1961-2008) there has been an inverse relationship between inflows to Upper Klamath Lake (UKL) and agricultural diversions.[10] The implication is that, on average, diversions have been at their highest in years where Klamath River flows are at their lowest. Covariance between total UKL inflows and total agricultural diversions is a negative 4,610.[11] Comparing irrigation season diversions (April through September) with inflows to UKL also shows a negative relationship, with covariance of negative 1,806.

[10] MBK Engineering, *Historical Upper Klamath Lake Net Inflow and Klamath Project Diversion Data*, September 29, 2010

[11] Negative covariance implies that as one variable increase in value, the other decreases.

What the KSA's accomplish is to change the sign of that relationship, with increased flows permitting increased diversions, providing a more consistent supply of water for the fishery. Using the KBRA formula for allowable agricultural diversions, the relationship, between irrigation season diversions and April through September inflows to UKL, turns from negative to positive. The covariance changes from a negative 1,806 to a positive 3,672.

The relationship between total historical UKL inflows and irrigation season diversions becomes even more strongly positive. A regression analysis with total UKL inflows as the independent variable, and allowable agricultural diversions specified in the KBRA as the dependent variable, shows a positive and significant relationship, with a t-value of 10.92 and an adjusted R-squared of 0.716.[12] The implication is that relationship is statistically significant at the 99 percent confidence interval and variation in UKL inflows will explain 71.6 percent of the variation in future agricultural diversions.

Clearly the KBRA alters the historical relationship between UKL inflows and agricultural water diversions in a manner that is likely to improve the health of the Klamath River fishery. In fact, when combined with restoration of riparian and upland habitat and possible removal of the four hydroelectric dams, the maintenance of agricultural diversion at historical levels is entirely consistent with increased populations of salmon and other aquatic species.

KBRA and Off Project Agricultural Water Diversions

For the Off Project area, largely defined as areas of agricultural production in Klamath County outside the boundaries of the Reclamation Project, the KBRA offers the potential settlement of existing water rights disputes between Off Project irrigation interests and the Klamath Tribes and US Government (fisheries and tribal trust interests). This program, to be developed under the auspices and budget of the KBRA, is called the Off Project Water Settlement (OPWAS). If successful, the OPWAS would provide a predictable amount of irrigation water to Off Project agriculture. This is in contrast to the complete uncertainty of surface irrigation water availability inherent in the ongoing Klamath Basin Adjudication process in Oregon. It is expected that the OPWAS would, in the short term, reduce Off Project agricultural revenues and jobs since the OPWAS must, by terms of the KBRA, produce 30,000 acre feet of increased annual flow from Off Project tributaries to Upper Klamath Lake. This would be accomplished through reductions in use by willing sellers who would receive compensation through the KBRA. However, in the absence of the settlements, there is the potential for significantly greater losses of irrigation water through adjudication. The OPWAS may offer significant protections for the Off Project agricultural economy, and regardless of the impact of the OPWAS on the quantity of surface irrigation water available, the program could provide significant operational certainty for area water users.

Chinook Salmon Catch

Analysis of fishery impacts is limited to the hypothesized effect of the KBRA and hydroelectric dam removal on populations and harvest of Chinook salmon. Other species of interest and subject to

[12] A t-value in excess of two indicates a relationship that is statistically significant, while a high R-squared implies that the specified independent variable (UKL inflows) explains a large percentage of the variation in the dependent variable (irrigation season agricultural diversions).

monitoring on the Klamath River, its tributaries, and estuary are the shortnose sucker (Lost River), lamprey and green sturgeon. Steelhead and Coho salmon species are also likely to benefit from improvements in the aquatic environment. However, from the point of view of economic impacts, the Chinook salmon is by far the species of greatest interest.

Salmon harvest is composed of four elements: freshwater recreational, tribal, ocean recreational, and ocean commercial. Ocean recreational is further divided into harvest by private vessel and by charter vessel. The focus of the analysis is on the entire four-county region.

Average Harvest: 1986-2003

For the years 1986-2003 the California ocean salmon harvest averaged 518,557 adult fish, with only 1.43 percent of that harvest, occurring within the Klamath Management Zone (KMZ). That does not imply that the Klamath River contributed only that percentage of the fish to the ocean harvest, but rather it is that area from which it is likely that the vessels responsible for the ocean catch would use Eureka, Trinidad, or Crescent City as their home port.[13] Of the average KMZ ocean catch of 11,430 fish, 7,398 were caught commercially, and 4,032 were caught by recreational anglers. [14] The ocean recreational catch for 1986-2003 was the result of 4,856 ocean fishing trips, with 3,895 using private vessels and the remaining 961 via charter vessels.

The annual harvest of freshwater salmon on the Klamath River and its tributaries averaged 33,475 fish for the years 1986 through 2003. That harvest included tribal catch of 25,127 fish and a freshwater recreational catch of 8,348 fish.[15] Each salmon caught by a recreational freshwater angler required an average of 3.45 fishing trips.[16]

Direct Expenditure Impacts of Improvements in the Klamath River Fishery

There is no way to predict with any precision the impact of removal of the Klamath River hydroelectric dams and the associated restoration, monitoring, and reintroduction actions that are part of the KHSA and KBRA. For the purposes of the economic impact of enhancement of the Klamath River fishery, it is reasonable to assume that populations will double. With that doubling of salmon populations, it is also reasonable to assume that the same ocean and freshwater catch shares will be maintained and that the catch for each of the four fishing categories will double as well.

[13] The Klamath Management Zone actually extends from Blue Lake north of Eureka, California to near Port Orford, Oregon. Vessels using the port at Eureka are probably catching some salmon south of the KMZ, while some of the fish in the northern reaches of the KMZ may be harvested by vessels using ports in southern Oregon. Thus, using the KMZ harvest as a proxy for the impact on ports in Del Norte and Humboldt Counties is an approximation.

[14] Pacific Fishery Management Council, *Assessment of Factors Affecting Natural Area Escapement Shortfall of Klamath River Fall Chinook Salmon in 2004-06*, March 2008

[15] Pacific Fishery Management Council, *Assessment of Factors Affecting Natural Area Escapement Shortfall of Klamath River Fall Chinook Salmon in 2004-06*, March 2008

[16] California Department of Fish and Game, Creel Survey Data for the Sacramento River System for 1999 and the assumption of five hours per fishing trip.

Spending per fishing trip varies by type of fishing activity. For ocean charter average trip-related expenditures are $155.95, while for ocean fishing using a private vessel, they average $55.78.[17] For freshwater anglers trip-related expenditures average $63.80. All expenditure estimates are in 2007 dollars.

The economic impact of commercial salmon fishing and the tribal harvest is estimated based on the ex-vessel value of salmon. The reasoning for the commercial catch is obvious, but in the case of the tribal harvest the rationale for this approach is not. There are several studies that examine non-use values of the tribal harvest, and all of them assign a very high value per fish caught. But, in keeping with the economic impact approach in this study, the value of the fish is assumed to be its commercial value, and in the case of the tribal take, it is considered an increase in income. This approach does not consider the cultural impacts of the tribal subsistence fishery, but rather it measures the purely economic impact of the additional tribal harvest. The ex-vessel value used in this economic impact analysis is $62.74.[18]

Table 4 summarizes the annual expenditure impacts by fishing category. The calculated amounts are equal to the product of the change in number of annual trips (or annual catch for the tribal and ocean commercial categories) and the trip-related expenditures per trip (or the value per fish for the tribal and ocean commercial categories). The largest contribution to the increase in direct expenditures is the incremental tribal harvest, contributing an additional $1.6 million to the local economy. Next in economic importance is the freshwater recreational fishery ($0.53 million) followed by the ocean commercial ($0.47 million), and ocean recreational ($0.37 million). These amounts are entered as direct expenditures into the appropriate sectors of the IMPLAN input-output model.

Table 4: Annual Direct Expenditure Impact on the Four-County Region of Increased Fishing Activity: Klamath River and Tributaries, and the Klamath Management Zone

Category	100 Percent Increase in Annual Catch	Increase in Annual Trips	Expenditures per Trip or Value per Fish Harvested	Direct Annual Impact of a 100 Percent Increase in Salmon Catch
River Recreational	8,348		$63.80	$532,571
Ocean Recreational	4,032			$367,145
Private Vessel		3,895	$55.78	$217,277
Charter		961	$155.95	$149,869
Tribal	25,127		$63.80	$1,603,103
Ocean Commercial	7,398		$63.80	$471,999
Total				$2,974,818

[17] U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, *2006 National survey of Fishing, Hunting, and Wildlife-Associated Recreation* and Staff Summary, *Oregon's 2006 Angler Preference Survey of Annually Licensed Resident Anglers*, July 2007

[18] ECONorthwest, *Economic Value of Rogue River Salmon*, January 2009

Allocation to Individual Counties in the Four-County Region

It is impossible to allocate the projected increase in direct expenditures to individual counties. In the case of the ocean fishery, it is divided between Humboldt and Del Norte Counties. In 2004, 70 percent of the fishing activity in Del Norte and Humboldt Counties occurred in Del Norte. That percentage increased to 76 percent in 2006, yet nearly 100 percent of the fish processing industry was located in Humboldt County. A large portion of the tribal fishery is in Humboldt and Del Norte Counties, while at least 50 percent of the freshwater recreational catch is there as well. Future improvements connected to hydroelectric dam removal and the KBRA may shift a larger percentage of the freshwater effort to the mid and upper Klamath and its tributaries, and thus to Siskiyou and Klamath Counties. However, since the freshwater recreational catch is only 18 percent of the total, even a large upstream shift in angler destinations would have little impact on the distribution of direct expenditures by county. Because of the uncertain apportionment among the affected counties, the economic impacts of fishery improvements, presented in the results section, are calculated for the four-county region only.

Refuges

Wetlands based National Wildlife Refuges (NWR's) in the Klamath Basin include the Upper and Lower Klamath; Tule Lake; Clear Lake, and Klamath Marsh. In a 2004 study, the local economic impact of the Lower Klamath NWR was estimated from visitation data collected at the site. The 2004 total visitor count was 204,563. The primary purposes of the visits ranged from the use of nature trails, observation platforms, and other wildlife observation to the hunting of migratory birds and small game. The impact of visitor spending on local business revenues was estimated at $3.20 million, including $1.12 million in local labor income. In addition, it was estimated that visitor spending generated by refuge visitation supports 43 jobs.[19]

The KHSA and KBRA should improve the quality of the refuge experience, and perhaps increase average visitation, by increasing the reliability of water deliveries to the refuges. However, in order to provide an estimate of the value of the quality change it is necessary to correlate water abundance in the refuge system with visitation to all refuges in the system. The source cited for the Lower Klamath NWR contains no estimates for the other basin refuges and provides a single observation for the year 2004. Additional study is needed to determine the impacts of the KSA's water allocation to the refuges, and the local impact of potential increases in visitation.

Economic Impact Results

Del Norte

Restoration, Monitoring, and Reintroduction

The listing of KBRA projects in Appendix C of the agreement does not include any projects within Del Norte County that explicitly involve construction activity. Projects within the county are limited to restoration on the Lower Klamath, including funding for projects administered by the Yurok and Karuk

[19] Caudill, J. and E. Henderson, *Banking on Nature 2004: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation*, Division of Economics, U.S. Fish and Wildlife Service, September 2005

Tribes. Additional county benefits resulting from an expected improvement in the freshwater and ocean fisheries are included in the fishery section of the report.

Table 5: Impacts of KBRA Restoration, Monitoring, and Reintroduction Activity on Del Norte County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Employment: Full- and Part-Time Jobs
2012	$351,967	$228,839	1
2013	$1,753,479	$1,308,734	21
2014	$2,453,175	$1,876,105	34
2015	$3,502,719	$2,727,161	53
2016	$4,335,357	$3,402,332	68
2017	$6,301,502	$4,996,643	103
2018	$6,301,502	$4,996,643	103
2019	$6,651,350	$5,280,328	110
2020	$6,651,350	$5,280,328	110
2021	$5,251,959	$4,145,587	84
Annual Average	$4,355,436	$3,424,270	69

Economic activity peaks in 2019-2020 with an increase in local business revenues of $6.65 million, $5.28 million in additional income, and 110 full- and part-time jobs. The average economic impact is $4.36 million $3.42 million and 69 jobs for Del Norte County business revenues, income, and employment, respectively. The annual economic impacts of restoration, monitoring, and reintroduction activities on the Del Norte County economy are listed in Table 5 for the years 2012 through 2021.

Humboldt

Restoration, Monitoring, and Reintroduction

As in the case of Del Norte County, the listing of KBRA projects in the agreement does not include any projects within Humboldt County that explicitly involve construction activity. Projects within the county are limited to restoration and monitoring on the Lower Klamath, including funding for projects administered by the Yurok Tribe. In addition, there are local benefits arising from the expected improvement in the fishery. Seventy-eight percent of those benefits (not included in Table 6), discussed in the fishery section of this report, likely accrue to Del Norte and Humboldt Counties. The economic impact of KBRA projects is significant over the ten-year, 2012-2021 period proposed in the agreement. Economic activity peaks in 2019-20 with an increase in local business revenues of $7.51 million, $5.55 million in additional income, and 154 full- and part-time jobs. The average economic impact is $4.93 million, $3.61 million, and 98 jobs for Humboldt County business revenues, income, and employment, respectively. The annual economic impacts of restoration, monitoring, and reintroduction activities on the Humboldt County economy are listed in Table 6 for the years 2012 through 2021.

Table 6: Impacts of KBRA Restoration, Monitoring, and Reintroduction Activity on Humboldt County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Employment: Full- and Part-Time Jobs
2012	$419,746	$260,278	4
2013	$2,016,654	$1,408,654	34
2014	$2,801,428	$2,000,719	51
2015	$3,978,588	$2,888,816	77
2016	$4,912,470	$3,593,373	97
2017	$7,117,684	$5,257,074	145
2018	$7,117,684	$5,257,074	145
2019	$7,510,071	$5,553,107	154
2020	$7,510,071	$5,553,107	154
2021	$5,940,523	$4,368,977	120
Annual Average	$4,932,492	$3,614,118	98

Klamath

Construction

Table 7: Impacts of KBRA Construction (Including Renewable Energy Facilities) and Hydroelectric Dam Removal on Klamath County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Employment: Full- and Part-Time Jobs
2012	$104,562	$61,202	5
2013	$808,530	$473,244	42
2014	$5,658,097	$3,311,766	291
2015	$2,812,333	$1,646,099	145
2016	$2,182,869	$1,277,665	112
2017	$1,241,391	$726,604	64
2018	$305,568	$178,853	16
2019	$3,673,687	$2,150,262	189
2020	$4,019,161	$2,352,473	207
2021	$986,858	$577,622	51
2022	$594,331	$347,871	31

The impact of construction activity on the Klamath County Economy is significant, particularly in 2014 when much of the construction around Klamath Lake and at Keno Dam; on the alternative energy facilities and energy efficiency improvements (2014-2017): and on the collection, production, and acclimation facilities are scheduled. Activity reaches a second peak beginning in 2019 with the initial work on hydroelectric dam removal. For the entire 2012 through 2022 period county business revenues

are increased by an average of $2.04 million, while county income and employment are increased by $1.19 million and 105 jobs, respectively. The annual economic impacts of construction activity on the Klamath County economy are listed in Table 7 for the years 2012 through 2022.

Restoration, Monitoring, and Reintroduction

Table 8: Impacts of KBRA Restoration, Monitoring, and Reintroduction Activity on Klamath County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Employment: Full- and Part-Time Jobs
2012	$5,912,963	$3,821,170	42
2013	$24,692,007	$17,666,608	342
2014	$36,520,900	$26,667,220	559
2015	$42,739,630	$31,410,125	674
2016	$40,197,052	$29,256,344	606
2017	$50,697,261	$37,480,225	821
2018	$49,154,201	$36,268,560	789
2019	$56,388,900	$41,873,313	932
2020	$70,537,871	$53,047,334	1,231
2021	$41,234,423	$30,037,241	624

The economic impact of KBRA projects other than construction is significant over the ten-year 2012-2021 period proposed in the agreement. Economic activity peaks in 2019 with an increase in local business revenues of $70.54 million, $53.05 million in additional income, and 1,231 full- and part-time jobs.[20] The average economic impact over the entire 2012-2021 period is $41.81 million, $30.75 million, and 662 jobs for Klamath County business revenues, income, and employment, respectively. The annual economic impacts of restoration, monitoring, and reintroduction activities on the Klamath County economy are listed in Table 8 for the years 2012 through 2021.

Total Eleven-Year Economic Impacts

The total economic impacts on Klamath County by year are included in Table 9. The totals include the impacts from construction, restoration, monitoring, and reintroduction. The average annual increase in county business revenues is $40.04 million, while county income and employment are increased by $29.15 million and 707 jobs, respectively.

[20] The analysis does not imply that all of the economic benefits of this activity go to those presently living within the county. However, since the level of employment is consistently above 600 jobs from 2015 forward, it is unlikely that these workers would live outside of the county.

Table 9: Total Economic Impact of KBRA Construction, Restoration, Monitoring, and Reintroduction on Klamath County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Employment: Full- and Part-Time Jobs
2012	$6,017,525	$3,882,372	47
2013	$25,500,537	$18,139,853	384
2014	$42,178,997	$29,978,986	850
2015	$45,551,962	$33,056,224	819
2016	$42,379,920	$30,534,009	718
2017	$51,938,652	$38,206,829	885
2018	$49,459,769	$36,447,413	805
2019	$60,062,587	$44,023,575	1,121
2020	$74,557,032	$55,399,807	1,438
2021	$42,221,281	$30,614,864	675
2022	$594,331	$347,871	31
Annual Average	$40,042,054	$29,148,346	707

Siskiyou

Construction

The impact of construction activity on the Siskiyou County Economy is relatively small, except during the construction for the hatchery near Fall Creek in 2018, and throughout the process of hydroelectric dam removal; assumed to occur in the 2019-2022 period. Since the distribution of employment during hydroelectric dam removal cannot be determined with any precision, it is appropriate to express the economic impacts as annual averages for the 2018-2022 peak construction period. During those years county business revenues are increased by an average of $507 thousand, while county income and employment are increased by $4.28 million and 64 jobs, respectively. The reason the impact on total business revenues is so small relative to the change in income is that it is assumed that construction is managed by outside firms, and the impact on county income is limited to wages paid to local workers. The small increase in business revenues is the local component of spending by those workers, an impact limited by the tendency of Siskiyou County residents to spend outside of the county. The annual economic impacts of construction activity on the Siskiyou County economy are listed in Table 10 for the years 2012 through 2022.

Table 10: Impacts of KBRA Construction and Hydroelectric dam Removal on Siskiyou County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Employment: Full- and Part-Time Jobs
2012	$0	$0	0
2013	$35,775	$302,353	4
2014	$15,363	$129,839	2
2015	$15,363	$129,839	2
2016	$15,363	$129,839	2
2017	$15,363	$129,839	2
2018	$510,305	$4,312,846	64
2019	$234,671	$1,983,319	29
2020	$335,116	$2,832,232	42
2021	$335,116	$2,832,232	42
2022	$1,117,938	$9,448,256	140

Restoration, Monitoring, and Reintroduction

The economic impact of KBRA projects other than construction is significant and distributed over the ten-year 2012-2021 period proposed in the agreement. Economic activity peaks in 2014 with an increase in local business revenues of $31.18 million, $24.26 million in additional income, and 522 full- and part-time jobs. The average economic impact is $19.94 million, $14.96 million, and 281 jobs for Siskiyou County business revenues, income, and employment, respectively. The annual economic impacts of restoration, monitoring, and reintroduction activities on the Siskiyou County economy are listed in Table 11 for the years 2012 through 2021.

Table 11: Impacts of KBRA Restoration, Monitoring, and Reintroduction Activity on Siskiyou County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Full- and Part-Time Employment
2012	$7,974,174	$6,283,384	141
2013	$18,578,210	$14,159,203	282
2014	$31,184,179	$24,264,519	522
2015	$21,792,685	$16,379,632	309
2016	$22,576,543	$16,957,503	319
2017	$22,770,105	$17,048,350	316
2018	$21,254,694	$15,803,885	285
2019	$18,995,178	$13,935,077	236
2020	$18,545,691	$13,565,956	227
2021	$15,726,769	$11,251,041	168

Economic Development Fund

The local economic impact of the $20 million development fund, potentially granted to Siskiyou County in 2018, depends on how that fund is utilized by the county. The minimum impact would result from the use of the fund to extend or maintain county services. Were it used instead to assist in the funding of business start ups or expansion of existing businesses, it would have a much larger impact and over a longer period. The public money could be used to leverage private funds. For example, redevelopment projects in California leverage an average of seven dollars of private investment for each dollar of state funds expended on the program.[21] Assuming an investment of $150,000 per job created and a seven-year depreciation rate for invested capital, the $20 million public fund would generate total investment in the county of $140 million and as many as 933 jobs for the useful life of the capital.[22]

Table 12 in the total impacts section uses the minimum potential economic impact by assuming that the $20 million economic development fund is used to extend or maintain county services. It is further assumed that the expenditures from that fund are spread over the five years from 2018 through 2022. That increase in county spending would increase county businesses revenues by $5.08 million annually, increase county income by $2.1 million, and sustain 28 jobs in the local economy. This impact is added to the totals from construction, restoration, monitoring, and reintroduction presented in Table 12.

Total Eleven-Year Economic Impacts

Table 12: Total Economic Impact KBRA Construction, Restoration, Monitoring, Reintroduction, and the County Economic Development Fund on Siskiyou County Business Revenues, Income, and Employment

Year	Total Business Revenues (Output)	Total Value Added (Income)	Total Employment: Full- and Part-Time Jobs
2012	$7,974,174	$6,283,384	141
2013	$18,613,985	$14,461,556	287
2014	$31,199,542	$24,394,359	524
2015	$21,808,048	$16,509,471	311
2016	$22,591,905	$17,087,342	321
2017	$22,785,468	$17,178,189	318
2018	$26,847,808	$22,216,314	376
2019	$24,312,657	$18,017,978	293
2020	$23,963,616	$18,497,770	296
2021	$21,144,694	$16,182,855	237
2022	$6,200,746	$11,547,838	168
Annual Average	$20,676,604	$16,579,732	298

[21] Gallo, D. and Koehler, G., *The Economic Impact of Fiscal 2006-07 Redevelopment Agency Activities on the California Economy*, Time Structures, Inc, July 30, 2009

[22] Hasan, R., Mitra, D., and Sundaram, A., The Determinants of Capital Intensity in Manufacturing: The Role of Factor Endowments and Factor Market Imperfections, August 16, 2010

The total economic impacts on Siskiyou County by year are included in Table 12. The totals include the impacts from construction; restoration, monitoring, and reintroduction; and the expenditure of the $20 million economic development fund on county public services over a five-year period. The average annual increase in county business revenues is $20.68 million, while county income and employment are increased by $16.58 million and 298 jobs, respectively.

Top Five Industry Sectors Affected

The significance of the economic impacts discussed under the county headings can also be classified according to the private industry sectors receiving the largest share of business revenues. There is some bias in this list in that the analytical approach does not include expenditures by visiting workers, consultants, and project managers who are likely to spend some time near the project areas. Thus, lodging and food services impacts are probably understated to a significant degree. Subject to this limitation, the five top industry sectors affected, aggregated by two-digit NAICs Code and ranked by the impact on total business revenues, are listed in Table 13 for each of the four counties included in the study area. The amounts are listed as annual average business revenues for a 10-year period in Del Norte and Humboldt Counties and an eleven-year period for Klamath and Siskiyou Counties.

Table 13: Top Five Industry Sectors (by two-digit NAICs code) for Four Counties Directly Affected by KBRA Projects (in 2007 dollars)

	Del Norte		Humboldt		Klamath		Siskiyou	
Two- Digit NAICs	Rank	Average Annual Business Revenues	Rank	Average Annual Business Revenues	Rank	Average Annual Business Revenues	Rank	Average Annual Business Revenues
Agriculture, Forestry, Hunting, and Fishing	1	$2,307,665	1	$3,253,771	1	$16,124,424	1	$8,592,031
Construction	na	na	na	na	2	$9,568,414	3	$2,197,459
Arts, Entertainment, and Recreation	2	$1,260,373	2	$612,158	3	$8,605,943	2	$5,453,755
Healthcare and Social Assistance	4	$321,142	4	$361,516	5	$2,743,261	5	na
Real Estate, Rental, and Leasing	3	$336,891	3	$482,164	4	$2,997,954		$1,402,536
Retail Trade	5	$133,930	na	na	na	na	na	na
Finance and Insurance	na	na	5	$220,409	na	na	na	na
Government	na	na	na	na	na	na	4	$2,047,154

The sector most impacted in each of the counties is agriculture. This is primarily due to the classification of the restoration activity within the agricultural and forestry services sector of the IMPLAN model. The construction sector is an important beneficiary of hydroelectric dam removal and other construction

activities in Klamath and Siskiyou Counties. Monitoring is included under management of conservation areas, and that six-digit NAICs sector is included within the arts, entertainment, and recreation sector within the IMPLAN sector configuration. That sector is ranked second or third in terms of the impact on business revenues in all four counties. The remaining sectors classified in the top five for one or more counties are healthcare and social assistance; real estate rental and leasing; finance and insurance; healthcare and social assistance; and government. The government sector appears in the top five sectors in Siskiyou County only, and that is because the $20 million development fund was entered into the state and local government enterprises sector of the IMPLAN model.

Economic Impact of Increased Salmon Catch

The Klamath salmon fishery has four components: ocean commercial, ocean recreational, freshwater recreational, and tribal. If the fishery improvements increase salmon populations by the 100 percent assumed in this study, and that leads to the same percentage increase in the catch for all components, then salmon fishing would bring another $2.88 million in annual income to the four-county region. Roughly 78 percent of the income benefit, or $2.24 million, would accrue to businesses and residents in Del Norte and Humboldt Counties. The increase in commercial, tribal, and recreational fishing activity would support an additional 26 full- and part-time jobs and increase annual business revenues by $1.86 million, with 21 of those jobs and $1.45 million in income going to Del Norte and Humboldt Counties. The sectors receiving the largest share of the additional annual business revenues include: agriculture, forestry, hunting, and fishing, $617,000; accommodations and food services, $199,000; healthcare and social assistance, $192,000; real estate, rental, and leasing, $186,000; and retail trade, $162,000.

Conclusions

Removal of the four Klamath River hydroelectric dams and the restoration, monitoring, and reintroduction activities preceding the removal would have significant economic impacts on the economies of Del Norte, Humboldt, Klamath, and Siskiyou. Del Norte and Humboldt Counties would see the smallest impact as the county is the location of no major construction and a relatively small percentage of other projects contained in the Klamath Basin Restoration Agreement (KBRA). However, these two counties would be the beneficiaries of 78 percent of the additional spending that would result from the improvement in the ocean and freshwater salmon fishery. In the near term—over the next ten or eleven years—the majority of the additional business revenues and jobs would accrue to businesses and their employees in Klamath and Siskiyou Counties.

Over the ten years covered by the KBRA, Del Norte County would see an average annual increase in business revenues of $4.36 million, an increase income to businesses and their employees of $3.42 million, and 69 full- and part-time jobs. Humboldt County would experience slightly larger impacts, with business revenues increasing by an average of $4.93 million annually, income higher by $3.61 million, and an average of 98 additional full- and part-time jobs over the 10-year fishery and habitat restoration period. If the fishery improvements increase salmon populations by the 100 percent assumed in this study, commercial and recreational fishing would bring another $2.24 million in annual income (78 percent of the total impact) to the two counties. The increase in commercial, tribal, and recreational

fishing activity would support an additional 21 full- and part-time jobs and increase annual business revenues by $1.45 million

Hydroelectric dam removal and the associated projects included in the KBRA would have the greatest near-term impact on Klamath and Siskiyou Counties. Over the eleven years of construction, restoration, monitoring, and reintroduction, Klamath County would see an average annual increase in business revenues of $40.04 million. Income to the affected businesses and their employees would increase by $29.15 million and the increase in employment would average 707 full- and part-time jobs. Siskiyou County would experience significant, although smaller impacts, with the increase in business revenues averaging $20.68 million over the eleven years of KBRA projects and hydroelectric dam removal. Siskiyou County income would be higher by $16.58 million on an annual basis, and average employment would increase by 298 full- and part-time jobs. In the long-term the area counties would likely receive additional economic benefits through stabilization of agricultural production, although rigorous quantitative analysis has yet to be conducted. The KBRA offers a combination of stabilized irrigation water deliveries, improvements in the efficiency of the delivery system, and temporary compensation for irrigation reductions in drought years that would be expected to have significant positive impacts on the basin agricultural economy of Klamath, Siskiyou, and Modoc Counties.

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