

**THE ECONOMIC IMPACT ON GLENN COUNTY OF  
PUBLIC LAND ACQUISITION AND HABITAT  
RESTORATION ACTIVITIES IN THE  
SACRAMENTO RIVER CONSERVATION AREA**

**U.S. Fish and Wildlife Service Contract Number 11332-9-G018**

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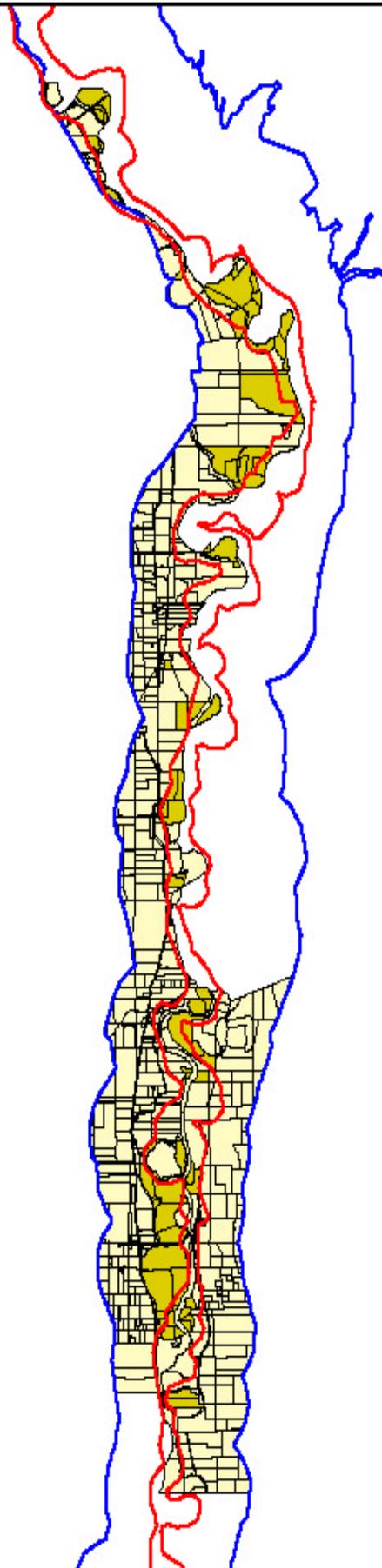
Glenn County  
Land Ownership  
in the  
Sacramento River  
Conservation Area

-  Inner-River Zone
-  Sacramento River Conservation Area
- Ownership
  -  Private
  -  Public

1 0 1 2 3 4 Miles



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Geographical Information Center  
May 2001



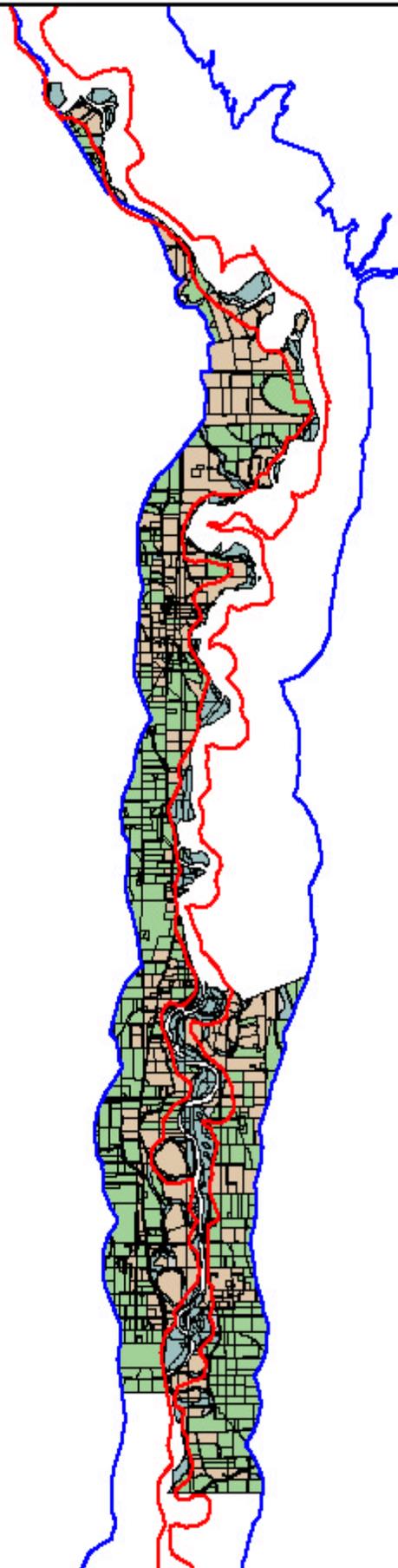
Glenn County  
Land Use  
in the  
Sacramento River  
Conservation Area

-  Inner-River Zone
-  Sacramento River Conservation Area
- Land Use
  -  Idle
  -  Native/Riparian
  -  Orchard
  -  Other Agriculture
  -  Urban

1 0 1 2 3 4 Miles



Prepared by:  
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## EXECUTIVE SUMMARY

### **Purpose and Scope of the Study**

The project includes an analysis of the economic impacts on Glenn County resulting from the preservation and restoration of riparian habitat within the Sacramento River Conservation Area (SRCA) and the Inner river Zone (IRZ). The potential adverse impacts on the county economy include reduced county income and employment. The primary purpose of the study is to determine the extent of those impacts.

The expansion of riparian habitat will also provide benefits to county residents. Local benefits assessed in this report include environmental, savings on public facilities, the value of water freed up for other uses, compensation for flood damage to private lands, and the economic activity generated by habitat restoration. Environmental benefits are projected for enhanced fishing and wildlife watching activities, and, for the amenity value for households classified as nonusers of recreation resources.

### **Geographical Scope of the Study**

The study area includes the 38,514 acres (including 1,616 acres of water surface) within Glenn County and the SRCA. It borders the Sacramento River from north of the Hamilton City Bridge (river mile 199.5) and the Colusa County line north of Princeton (river mile 164) and includes portions of the “Red Bluff Diversion Dam to Chico landing” and “Chico Landing to Colusa” Ecological Management Units. The study area is separated into the Inner River Zone Guideline and the portion of the SRCA outside of the Inner River Zone Guideline.

### **Agricultural Land Use within the SRCA**

There are 38,514 acres in the SRCA within Glenn County and, according to data provided for 1994, 80 percent or 30,776 acres are in various agricultural uses. Deciduous orchards (primarily prunes, almonds, and walnuts) cover 13,349 acres or 43 percent of the land in agricultural use. Rice was produced on 4787 acres, while grain and hay (3106 acres), corn (1929 acres), sugar beets (1655 acres), safflower (1238 acres), dry beans (1162 acres), and various field crops (1120 acres) were the other main agricultural land uses (GIS 2000). Of the 9,560 acres in the IRZ, 36 percent or 3,476 acres is in agricultural use. Deciduous orchards (2,745 acres) constitute 79 percent of the agricultural uses in this area.

### **Methodology**

The economic impact of removing lands from agricultural production is estimated using the IMPLAN model. IMPLAN is an input-output model (I-O) that separates the economy into 458 industrial sectors, classifying each according to the primary product or service it provides. The mechanism through which the model estimates impacts is the transaction matrix, which contains the purchases and sales that occur among the various sectors. The column entries are the purchases made by a particular sector from all other sectors included in the model. The row elements are the industry destinations of the sector's sales. The I-O model permits assessment of the total impact of an initial change in output for a basic industry, in this case agriculture.

Removing land from agricultural use has direct impacts on production and employment, and, secondary consequences for those sectors dependent upon activity in the farming sector. The impact on sectors related to agriculture is called the indirect effect and it is measured as the reduction in output or employment for all sectors buying from or selling to the agricultural sector. As income declines in agriculture and allied sectors, local consumer spending is also affected, leading to additional impacts on local business sales, output, and employment. These are the induced effects. The total impact is the sum of the direct, indirect, and induced effects.

### **Data Sources**

The direct impacts on output are estimated from the number of acres removed from agricultural use and the average value of output per acre. Projections of acres withdrawn from agricultural production are based on various scenarios for the ultimate composition of the SRCA and the rate of transformation from present uses. For purposes of the base case estimates we use the county averages for agricultural production per acre for all crops produced in the SRCA with the exception of orchard productivity within the Inner River Zone (IRZ). For orchard production on land subject to frequent flooding, assumed to be limited to those properties within the IRZ, we assume production is 70 percent of the county average.

### **The Base Case**

The impact analysis that follows is based on the consensus view of the most likely configuration for the Sacramento River Conservation Area (SRCA) and the Inner River Zone (IRZ) contained within. Critical to establishing the effect on the Glenn County economy is the mix of remaining agricultural uses and restored riparian habitat.

All of the land currently in public ownership in the IRZ will be preserved in or restored to riparian habitat. In addition, it is assumed that all remaining native vegetation and riparian habitat will be preserved through acquisition or the use of conservation easements. The totals within the IRZ are 4,613 acres (including 9 acres of barren or wasteland). Of that amount, 2,059 acres are in public ownership (GIS 2000), leaving 2,554 acres to be encumbered by acquisition or conservation easements. Publicly owned agricultural lands within the IRZ total 808 acres and it is assumed that all of his land will be removed from production. The majority opinion of those interviewed was that 80 percent of the IRZ would be removed from agricultural production, leaving an additional 1,061 acres of agricultural land for acquisition and conversion to riparian or native vegetation.

It is also assumed that all of the lands currently in public ownership in the portion of the SRCA outside of the IRZ will be preserved in or restored to riparian habitat or other native vegetation. Of the 2,821 acres in this category, 541 acres are in riparian or native vegetation, while 2,272 acres are in various agricultural uses. It is assumed that, with one exception, no additional land acquisitions take place in the portion of the SRCA outside of the IRZ. The exception is for those parcels acquired in the IRZ that extend beyond the IRZ boundaries where, in one-half of those cases, the entire parcel will be acquired and

converted to riparian or native vegetation. In addition, a modified base case is analyzed assuming removal from agricultural use of 25 percent of the parcel overlap. This sensitivity analysis is to indicate the impact on the Glenn County economy of a change in public acquisition procedures that leads to more frequent splitting of parcels at the IRZ boundary.

### **Impacts on the Glenn County Economy- The Base Case**

For the base case assumptions the annual output loss for Glenn County is \$9,254,549. Output losses in the agricultural sector are \$7,869,180 or 85.0 percent of the total. Other sectors experiencing significant output reductions are trade (\$386,732 or 4.2 percent of the loss); finance, insurance, and real estate (\$345,685 or 3.7 percent of the loss); and services (\$260,140 or 2.8 percent of the loss). Annual employment losses in the county total 104.5 jobs. Employment losses in agriculture are 83.7 jobs or 80.0 percent of the total. Other sectors showing significant job reductions are trade (8.8 or 8.4 percent of the loss) and services (5.8 or 5.6 percent of the loss).

### **Methodology for Benefits Estimation**

Environmental benefits accrue to local residents through two pathways. First, an improvement in environmental quality increases the value to local residents of those activities that depend on the quality of the environment. Fishing is more highly valued when more fish are caught per unit of effort. Wildlife watching is more rewarding and thus greater value is placed on the activity in a diverse environment with more viewable wildlife. For those residents who do not engage in recreational activities on the Sacramento River, there are non-user benefits deriving from the existence of enhanced biodiversity and other factors contributing to amenity value. Second, nonresident users derive value from the use of higher quality local resources. While these benefits are not received directly by residents, the increased spending by visitors generates additional local economic activity.

For nonresident participants the value to Glenn County is derived from the travel expenditures of visitors. The local value of an improvement in resource quality is due to the impact on nonresident participants' willingness to travel to the county. More frequent trips mean additional spending in the county. The value to Glenn County of increased nonresident use is the product of trip related expenditures per visit and the increase in the number of trips resulting from the improvement in recreational resource quality. The total value to Glenn County residents of an improvement in local resource quality is then the sum of resident benefits and the impact of additional local spending by visitors.

### **Estimated Recreational Benefits Accruing to Glenn County Residents**

- Fishing- Benefits are estimated using three different methodologies derived from an extensive literature review. For the base year resident benefits range from \$1,369,046 to \$2,107,499. The impact of additional spending by visiting anglers is \$157,778.
- Wildlife Watching- The projected base-year value for wildlife watching by Glenn County residents in the Sacramento River National wildlife Refuge is \$11,880.

- Visitor spending in association with this activity is expected to generate an increase in Glenn County output of \$162,998.
- Hunting- It is assumed that there will be no additional hunting activity in the SRCA.
  - Non-user Benefits- Benefits from habitat restoration also accrue to residents who do not engage in recreational resource use. The environmental economics literature categorizes non-user benefits as existence, bequest, altruistic, option, and ecological services values. The base-year estimates for this benefit category range from \$225,960 to \$334,955.

### **Total Benefits**

Total base-year benefits to the Glenn County economy and its residents range from \$1,689,822 to \$2,428,275.

### **Future Value of Recreational Benefits**

Recreational benefits increase at a rate that is a function of the rate of growth in per capita real income, the rate of inflation, and the rate of population growth. Resident benefits are projected using forecasted growth rates for Glenn County's population and income, while visitor expenditures are forecasted based on rates of population and income growth for the state. Resident benefits are expected to increase at a 3.67 percent annual rate in constant dollars. Visitor expenditures are projected to increase at a somewhat slower rate of 3.15 percent annually.

### **Non-Recreational Benefits Excluded from the Benefit Totals**

The benefit totals used in the cost-benefit section of this study do not include estimates for savings on public facilities, compensation for flood damages, or the value of water freed up by conversion of agricultural land to habitat. Each of these benefits were considered, however, for various reasons we considered it inappropriate to include the derived values.

### **Non-Recreational Benefits Included in the Benefit Totals: Expenditures for Habitat Restoration**

For the base case there are 5,553 acres currently in agricultural production (as of 1994) that are targeted for conversion to riparian habitat. Active restoration is assumed to occur on 60 percent of those lands, or 3,332 acres. In discussions with those involved in restoration activities it was determined that the per acre cost is \$4,500 with 30 percent of the direct output effects occurring in Glenn County. The direct impact on Glenn County output totals \$4,497,978 for all restoration activities assumed for the base case. For the life of the habitat restoration projects Glenn County output and employment are increased by \$5,736,561 and 209.5 jobs, respectively. Since the output and employment effects are one-time impacts the annual impact on the Glenn County economy depends on the rate at which habitat restoration activity takes place. Assuming a twenty-year restoration schedule, Glenn County output is increased by \$286,828 annually, while 10.5 jobs are created.

### **Comparison of Costs and Benefits**

In this section we analyze three cases: the base case, a modified base case, and one that minimizes the adverse impacts on the Glenn County economy. In the first two cases we construct a scenario that includes completion of land acquisition and habitat restoration within 20 years and compare projected costs and benefits over a longer 35-year period. Since some of the reductions in agricultural production and habitat restoration projects were initiated between 1995 and 2000, the starting point for the 35-year period is 1995. The value of agricultural production is assumed constant in real terms over the 35 years of the cost-benefit comparison. Benefits assessed are limited to those associated with increased recreational and aesthetic values, and, the increased economic activity that results from habitat restoration expenditures.

The third case assessed incorporates the same assumptions except it is assumed that habitat restoration outside the Inner River Zone (IRZ) is limited to one-half of the agricultural lands currently under public ownership. Additional habitat preservation is restricted to lands currently in riparian or other native vegetation. Where additional parcels are acquired in the IRZ only that portion within the boundaries of the IRZ is restored to natural habitat. The remaining agricultural land uses are preserved either through leasing or sale to private owners. Land acquisition and restoration within the IRZ are assumed to conform to the base case where 80 percent of the land is preserved in, or restored to riparian habitat. In addition it is assumed that the extent of habitat restoration is sufficient to achieve the CVPIA goal of doubling populations of anadromous fish species, to provide enough habitat to attract the number of wildlife watching participants projected in the benefits section, and to generate the nonuser benefits also included in that section.

### **Impact on the Glenn County Economy- Base Case**

For all 35 years of the scenario there is a net cost imposed on Glenn County. However, the annual net cost is not uniform. The net cost rises through the first ten years, reaching an initial peak in 2005 at \$4,803,174 decreasing to \$2,480,884 (for the median benefits estimate) the following year. This discontinuity is the result of assuming no benefits for the first ten years while 50 percent of the agricultural production is eliminated over the same period. The only offset to the cost imposed by reduced agricultural production in the first ten years of the program is the local expenditure component of habitat restoration activities. In 2006 the large decrease in net cost to the county is because the full value of the benefits is added in at that point. Net costs reach a second peak in 2015 at \$5,427,932. At that point all targeted lands have been removed from agricultural use and restored to riparian or other native habitat. For each year after 2015 the net costs decline due to the increasing real value of the recreational and nonuser benefits. However, for the final year of the scenario (2030) the net cost to Glenn County is still \$2,752,715.

Losses in county personal income are somewhat smaller than the output losses. The decrease in personal income due to changes in agricultural land use peaks in 2014 at \$5,100,555. Comparing decreases in value added (approximately equal to personal income) with recreational and nonuser benefits leads to the conclusion that, for the

median benefits estimates, the net benefits are a positive \$39,528 in the 30<sup>th</sup> year, increasing to a positive \$1,041,337 in the 35<sup>th</sup> year.

### **Impact on the Glenn County economy- Modified Base Case**

For all 35 years of the scenario there is a net cost imposed on Glenn County. However, as for the base case, the annual net cost is not uniform. The net cost rises through the first ten years, reaching an initial peak in 2005 at \$4,270,411 and then decreases to \$1,896,376 the following year. In 2006 the large decrease in net cost to the county is because \$2,785,017 in recreational benefits is added in at that point. Net costs reach a second peak in 2015 at \$4,393,012. At that point all targeted lands have been removed from agricultural use and restored to riparian or other native habitat. For each year subsequent year the net costs decline due to the increasing real value of the recreational and nonuser benefits. However, for the final year of the scenario (2030) the net cost to Glenn County is still \$1,717,796.

### **Impact on the Glenn County Economy- Impact Minimization Case**

The definition of minimum impact is that the present value of net benefits over the 35-year projection is approximately zero. This case represents very closely the maximum extent of habitat restoration that is consistent with no significant impact on the Glenn County economy. As in the base case there is a significant difference in the annual impacts. For the median benefits estimates the net annual loss peaks in 2005 at \$1,692,542. In 2006 the benefits begin to accrue and the impact becomes a positive \$929,198. Through the year 2025 the net benefits are the product of two partially compensating factors. As additional land is converted from agricultural uses to habitat the costs to the county increase. But with rising income and population the value of recreational uses, and thus benefits increase as well. Net benefits reach a minimum of \$424,158 in the year 2020 increasing in each subsequent year. Beginning in 2024 when no further reductions in agricultural output occur, net benefits begin to rise rapidly since the only remaining factor is increasing recreational and nonuser benefits driven by growth in income and population. Net benefits reach a maximum of \$1,603,521 in the final year of the scenario (but continue to grow in subsequent years).

### **Comparison of the Three Cases**

The three cases presented in this section represent a range of possible outcomes. Assigning the title of “base case” does not imply that the projected impacts are the most likely. What the base case does represent is the impact assuming a continuation of past public land acquisition patterns and the median benefits estimates. Of course, actual benefits may be higher or lower. In part that is a function of the management plan established for the use of the restored habitat and the willingness of agencies to provide the facilities necessary to achieve the full recreational potential of the acquired public lands. Also, past patterns of public land acquisition may not be indicative of future patterns. A number of individuals providing advice on various aspects of this study indicated that there was clear movement away from land acquisitions outside the IRZ and an increased desire to clip parcels at the IRZ boundary. From that perspective the modified base case might be more accurately described as the most likely outcome. The purpose of providing the impact minimization case was simply to illustrate the maximum

extent of restoration consistent with avoiding any adverse impact on the Glenn County economy without implying anything about the reasonableness of the underlying assumptions.

### **Generalization to Other Counties and to the Regional Economy**

One of the purposes of completing this study was to provide a basis for estimating impacts on other affected counties and the broader region. There is much in this case study that can be used to gauge the magnitude of the impacts in the remaining counties affected by habitat preservation and restoration in the SRCA. However, some caution is appropriate when using the study results for this purpose. First, there are important structural differences between the Glenn County economy and the other affected counties. Glenn County has a comparatively small population, low population density, and a high degree of dependence on agriculture. The small population reduces the economic benefits associated with the increase in recreational activities. The relative importance of agriculture also increases the significance of the adverse impact resulting from reduced farming activity. It can be concluded that the net benefits are more likely to be positive in a county with a large population relative to the amount of agricultural production affected. But, the agricultural impact estimates provide a reasonable indication on a per acre basis of the influences on local output and employment that can be expected in other affected counties.

Significant differences can be expected in the county-level and regional impacts of habitat preservation and restoration. Estimates of both costs and benefits will be larger for the broader region. The impacts of reduced agricultural production will be larger because the indirect and induced effects across county boundaries will be included. Generally impact multipliers are larger for more broadly defined regions. Benefit estimates will also be larger for habitat restoration activities and increased recreational opportunities. It is likely that close to 100 percent of the direct impact of restoration investment will be felt in the regional economy, while a much smaller percentage will occur in the particular county where the restoration occurs. Estimated recreational benefits are higher when they accrue to local residents. The local benefits of visitor use of recreational resources include only trip related expenses, which are roughly one-third of the total willingness to pay of residents. By defining the local region more broadly, a larger percentage of the use value of the enhanced environment accrues to local residents, thus generating greater measured benefits to the local economy.

## **INTRODUCTION**

### **Purpose and Scope of the Study**

The project includes an analysis of the economic impacts on Glenn County resulting from the preservation and restoration of riparian habitat within the Sacramento River Conservation Area (SRCA) and the Inner river Zone (IRZ). The potential adverse impacts on the county economy include reduced county income and employment. The primary purpose of the study is to determine the extent of those impacts.

The expansion of riparian habitat will also provide benefits to county residents. Local benefits assessed in this report include environmental, savings on public facilities, the value of water freed up for other uses, compensation for flood damage to private lands, and the economic activity generated by habitat restoration. Environmental benefits are projected for enhanced fishing and wildlife watching activities, and, for the amenity value for households classified as nonusers of recreation resources. A detailed discussion of the methodology and results for the benefit estimates is contained in the third section of the report.

### **Senate Bill 1086**

Senate Bill 1086 was passed by the legislature and signed into law in 1986. Its purpose was to establish a management plan for the Sacramento River and its tributaries “that would protect, restore, and enhance both fisheries and riparian habitat” (SRCA 2000). The broad goals of the SB1086 program are described in the Sacramento River Conservation Area Handbook.

The overall goals of the SB1086 program are to preserve remaining riparian habitat and reestablish a continuous riparian ecosystem along the Sacramento River between Redding and Chico, and reestablish riparian vegetation along the river from Chico to Verona. Riparian habitat is actually a diverse mosaic of habitat types, which is part of the bigger picture that includes the entire river system and the humans within it (SRAC 2000).

Habitat preservation and restoration are to be constrained by certain guiding principles. Among the principles are those that most closely pertain to the subject of this study. They include an ecosystem approach sustainable by natural processes, the use of the least damaging bank protection methods, maintenance of a limited meander, consistency with flood control and bank protection programs, and voluntary participation by private landowners. In addition, local concerns are to be given full consideration. “No county or local government should lose revenue by virtue of an increase in public land” (SRAC 2000).

The goals of the SB1086 program are to be achieved with a combination of land acquisition, conservation easements, and set-aside agreements. Land acquisition has been the predominant vehicle for habitat preservation. Approximately 6,800 acres or 13 percent of the land in the SRCA between Red Bluff and Chico Landing and 7,200 acres

or 10 percent of the land in the SRCA between Chico Landing and Colusa has been acquired by public agencies. Conservation easements are legally binding restrictions on the use of the land that the landowner accepts in exchange for payment. They may prohibit or restrict some activities deemed inconsistent with preservation of habitat or resident species. Conservation easements have seen limited use within the SRCA, but may become a more important method for preservation in the future. They could potentially reduce the cost of achieving the SB1086 goals and have less impact on agriculture compared to outright acquisition. Set-aside agreements are designed for the portion of private land holdings less suited for agricultural production. They allow the landowner continued ownership and provide a payment for a limited period of time for eligible lands committed to riparian habitat. No set-aside agreements have been concluded as yet in conjunction with the SB1086 program (SRAC 2000).

### **Geographical Scope of the Study**

The study area includes the 38,513 acres (including 1,616 acres of water surface) within Glenn County and the SRCA. It borders the Sacramento River from north of the Hamilton City Bridge (river mile 199.5) and the Colusa County line north of Princeton (river mile 164) and includes portions of the “Red Bluff Diversion Dam to Chico landing” and “Chico Landing to Colusa” Ecological Management Units.

The study area is separated into the Inner River Zone Guideline and the portion of the SRCA outside of the Inner River Zone Guideline. The Inner River Zone (IRZ) includes all locations of the river channel between 1896 and 1991 (the 100-year meander belt) plus the 50-year projection of channel movements. Projections have been completed for the Red Bluff Diversion Dam to Chico Landing river reach but not for the Chico Landing to Colusa segment of the river. Therefore below river mile 193 the IRZ and the 100-year meander belt are identical. The SRCA is broader than the riparian corridor and includes “potential riparian habitat and valley oak woodland” (SRAC 2000). For the Red Bluff Diversion Dam to Chico Landing portion of the river, the SRCA is approximately two miles wide and includes “all areas within geologic control, within the 100-year floodline, and stands of valley oak woodland that are contiguous with this area” (SRAC 2000). The SRCA for the Chico Landing to Colusa portion of the river “includes all areas between the setback levees of the Sacramento River Flood Control Project and a one-mile transition zone outside of the levees where soils are suitable for riparian species or valley oak woodland” (SRAC 2000).

River Reach H, between river miles 198.5 and 193 (Chico Landing), is characterized by significant bank erosion with a meander width ranging from 1300 to 6600 feet. Most of this area is inundated by a 2.5-year flood and therefore habitat restoration using natural processes is appropriate. Between river miles 174 and 194 there are three low points in the private levee system on the east side of the river. The M&T, 3B’s, and Goose Lake Flood Relief Structures feed water outside of the main river channel where it collects in the Butte Sink and is diverted into the Sutter Bypass. While this section of the river is described as particularly “sinuous” and “dynamic”, meander has been limited by installation of bank protection by the U.S. Army Corps of Engineers. Below river mile 174 the river is contained within the setback levees of the Sacramento River Flood

Control Project. On the west side of the river in Glenn County the levees begin near the town of Ord and are built along the Modesto Formation, a geologic feature that is responsible for the gradual formation of natural levees beginning as far north as Hamilton City. Along this stretch of the river floodwaters are released to the Sutter Bypass through a system of weirs. Most of the area between the setback levees is inundated by a 2-year flood event and virtually all is flooded every 4 years thus making natural restoration of riparian vegetation possible (SRAC 2000).

### **The Glenn County Economy**

Glenn County is a rural county with agriculture as the primary industry. In 1998 27 percent of county employment was in agriculture or agricultural services. Other sectors contributing significantly to 1998 county employment were government (18%), services (15%), retail trade (13%), and manufacturing (10%). Between 1990 and 2000 county population increased at a 0.99 percent annual rate from 24,600 to 27,100. Employment decreased from 10,900 in 1990 to 9,600 in 1999 (Employment Development Department definition) for an annual rate of change of -1.48 percent. Personal income increased at a 1.54 percent (in 1998\$) annual rate between 1990 and 1998, reaching \$442 million in 1998 (Gallo 2000).

Forecasts of future economic growth in the county vary considerably by source. Three organizations offer county level economic forecasts of economic and demographic growth, while the California Department of Finance (DOF) provides population projections only. Complete economic and demographic forecasts are published by Woods and Poole (W&P), the Center for Economic Development (CED), and the Center for the Continuing Study of the California Economy (CCSCE). The following summary of forecast results is an excerpt from an unpublished paper prepared for a forecast conference sponsored by the CED and scheduled for presentation in January 2001 (Gallo 2000).

- **Summary-** There is little agreement among forecasters concerning the future economic and demographic performance of Glenn County. The projections range from pessimistic (CED and W&P) to optimistic (CCSCE). CCSCE expects population and personal income growth rates for Glenn County to exceed those of Butte and Tehama Counties. W&P and the CED rank Glenn County last in terms of population, employment, and personal income growth.
- **Population-** For 1998 through 2005, W&P projects negative population growth for Glenn County. At the other end of the forecast spectrum, DOF projects county population growth at an annual rate of 3.11%. The CED and CCSCE projections fall in between the two extremes. There is somewhat less disagreement regarding the 2005-2010 period but the forecast spread for the annual percentage change in population is still relatively wide at 0.14% (CED) to 2.69% (DOF). The highest population estimate for 2010 exceeds the lowest by 41%. Table 1 contains a summary of the numerical estimates.

**Table 1**  
**Summary of Population Projections and Forecasted Annual**  
**Rates of Growth for Glenn County**

<b>Source</b>	<b>2005</b>	<b>2010</b>	<b>1998-2005</b>	<b>2005-2010</b>
<b>W&amp;P</b>	27,060	27,630	-0.29%	0.43%
<b>CED</b>	27,700	27,900	0.45%	0.14%
<b>CCSCE</b>	30,400	34,200	1.39%	2.38%
<b>DOF</b>	34,280	39,055	3.11%	2.69%

- **Employment-** Employment projections offered by W&P and the CED are uniformly pessimistic with some disagreement over the distribution of growth between the 1998/1999-2005 and 2005-2010 periods. W&P sees almost all of the employment growth occurring before 2005, while the CED forecasts slower, but significant growth after 2005. The numerical forecasts are summarized in Table 2. There is also some disagreement concerning the industry level employment projections, although much of the difference can be explained by the differences in the 1997 (W&P) and 1998 (CED) Department of Commerce employment projections. In the CED forecast the majority of the employment growth is expected in the agricultural sector with construction a distant second. W&P forecasts that only manufacturing and construction will contribute significantly to job growth, while the county will experience some employment losses in agriculture and retail trade.

**Table 2**  
**Summary of Employment (EDD) Projections and Forecasted**  
**Annual rates of Growth for Glenn County**

<b>Source</b>	<b>2005</b>	<b>2010</b>	<b>1998-2005</b>	<b>2005-2010</b>
<b>W&amp;P</b>	9733	9739	0.23%	0.01%
<b>CED</b>	9400	9500	0.46%	0.21%
<b>CCSCE</b>	N/A	N/A	N/A	N/A

- **Personal Income-** W&P and the CED forecast similar rates of growth for Glenn County personal income between 2005 and 2010 but the W&P forecast is higher for income growth to 2005. The CCSCE forecast is far higher than the others for both periods and projects Glenn County income growth rates much greater than those of the state or Butte and Tehama Counties. The various numerical estimates for personal income and forecasted growth rates are contained in Table 3.

**Table 3**  
**Summary of Personal Income Projections (millions of 1998\$)**  
**and Forecasted Annual Real Rates of Growth for Glenn County**

<b>Source (Base Year)</b>	<b>2005</b>	<b>2010</b>	<b>BY*-2005</b>	<b>2005-2010</b>
<b>W&amp;P (1997)</b>	537.26	586.94	1.65%	1.79%
<b>CED (1998)</b>	483.83	529.80	1.30%	1.83%
<b>CCSCE (1997)</b>	626.80	722.60	3.63%	4.27%

\*BY is the base year for the respective forecast.

County level personal income data and forecasts are widely available. However, the projected impacts of reduced agricultural activity presented in the next section are in terms of output, not personal income. Glenn County output for 1997 was \$1,071,000,415. That figure includes the total value of all goods and services produced including the cost of inputs. Value added for 1997 is much lower at \$503,810,000 and is the sum of earnings by industry, dividends, interest, rent, and indirect business taxes. Personal income is calculated as value added plus transfer payments minus personal contributions for social insurance. Glenn County personal income in 1997 was \$467,412,000 or 43.64 percent of county output for that year. Therefore, if the output effects delineated in the following sections are to be compared with overall county economic activity they must be compared to county output, not personal income. An approximation of forecasted output can be obtained (for purposes of making such comparisons) by dividing forecasted personal income by 0.4364.

**The Glenn County Agricultural Sector**

The value of Glenn County's agricultural production increased from \$218,895,000 in 1998 to \$251,810,00 in 1999. Rice production was the leading crop with a 1999 value of \$90,241,000, an increase of \$20,367,000 or 29 percent over the 1998 value. Other crops contributing significantly to the value of Glenn County's agricultural output include dairy products, almonds, prunes, cattle and calves, alfalfa hay, corn, walnuts, sunflower seed, and olives. Table 4 contains the top ten agricultural products in Glenn County for the years 1998 and 1999, ranked by 1999 crop value (Glenn 1999).

**Table 4**  
**Glenn County's Leading Agricultural Products**

<b>Crop</b>	<b>Value in 1999</b>	<b>Value in 1998</b>
<b>Rice</b>	\$90,241,000	\$69,874,000
<b>Dairy Products</b>	\$41,744,000	\$45,977,000
<b>Almonds</b>	\$18,558,000	\$24,342,000
<b>Prunes</b>	\$14,711,000	\$6,655,000
<b>Cattle &amp; Calves</b>	\$12,002,000	\$11,308,000
<b>Hay, Alfalfa</b>	\$7,972,000	\$6,411,000
<b>Corn</b>	\$7,333,000	\$7,204,000
<b>Walnuts</b>	\$6,570,000	\$6,288,000
<b>Sunflower Seed</b>	\$4,861,000	\$4,039,000
<b>Olives</b>	\$4,578,000	\$4,189,000

In the 10 years between 1987 and 1997 personal income in the agricultural sector increased by 29.50 percent from \$60,534,000 to \$78,398,000 (CED 2000) The annual rate of increase of 2.62 percent exceeded the rate of growth in county personal income. From 1994 to 1999 the value of Glenn County agricultural production grew at an annual rate of 0.57 percent, leading to a 2.89 percent increase for the 5-year period. Excluding production of livestock and poultry, the value of crops produced declined by 0.36 percent over that period from \$208,710,000 in 1994 to \$207,958,000 in 1999 (Glenn County 1999).

**Agricultural Land Use within the SRCA**

There are 38,514 acres in the SRCA within Glenn County and, according to data provided for 1994, 80 percent or 30,776 acres are in various agricultural uses. Deciduous orchards (primarily prunes, almonds, and walnuts) cover 13,349 acres or 43 percent of the land in agricultural use. Rice was produced on 4787 acres, while grain and hay (3106 acres), corn (1929 acres), sugar beets (1655 acres), safflower (1238 acres), dry beans (1162 acres), and various field crops (1120 acres) were the other main agricultural land uses (GIS 2000). The Inner River Zone (IRZ) encompasses any area where the main river channel was located between 1896 and 1991 and to where it is projected to migrate over the next 50 years (defined for the Red Bluff to Chico Landing portion of the river, but not for the segment between Chico Landing and Colusa). Of the 9,560 acres in the IRZ, 36 percent or 3,476 acres is in agricultural use. Deciduous orchards (2,745 acres) constitute 79 percent of the agricultural uses in this area. Table 5 summarizes the agricultural land uses within the SRCA, the IRZ, and the portion of the SRCA outside of the IRZ.

**Table 5  
Important Agricultural Land Uses within the SRCA**

Crop Type	Acres in 1994		
	SRCA	IRZ	SRCA minus the IRZ
<b>Deciduous</b>	14,349	2,745	10,605
<b>Rice</b>	4,787	27	4,760
<b>Grain and Hay</b>	3,106	165	2,941
<b>Corn</b>	1,929	81	1,920
<b>Sugar Beets</b>	1,655	8	1,647
<b>Safflower</b>	1,238	89	1,149
<b>Dry Beans</b>	1,162	126	1,036
<b>Field Crops</b>	1,120	117	1,003
<b>Pasture</b>	653	38	615
<b>Sunflower</b>	373	48	325
<b>Total</b>	30,372	3,444	26,001

**Table 6  
Deciduous Orchard Crops within the SRCA**

Crop Type	Acres in 1994		
	SRCA	IRZ	SRCA minus the IRZ
Almonds	3,769	431	3,338
Prunes	4,260	910	3,350
Walnuts	6,314	1404	4,910
Other	3	00	3
<b>Total</b>	13,346	2,745	11,601

**Productivity of Glenn County Agricultural Lands**

The average value of output per acre is calculated for all major crops produced in Glenn County with the exception of seed crops. The entries in Table 7 are the average value in 1997 dollars of fruit and nut crops, field crops, and vegetable crops. The values are obtained by multiplying the price per unit (in 1997 dollars) times production per acre for each of the years (1987 through 1999) and then taking the average for the 11 years of observations. The production and price data for each year are from the “Annual Crop and Livestock Report” released by the Glenn County Department of Agriculture for that year (Glenn County 1999).

**Table 7  
The Average Value of Production per Acre for the Major  
Crops Produced in Glenn County (in 1997\$)**

Crop	Average Value of Output per Acre
<b>Field Crops</b>	
Barley	\$666
Beans	\$557
Hay, Alfalfa	\$692
Hay, Other	\$186
Pasture, Irrigated	\$138
Range	\$7
Rice	\$980
Silage	\$642
Grain Sorghum	\$254
Sugar Beets	\$1016
Wheat	\$288
<b>Fruit and Nut Crops</b>	
Almonds	\$1530
Citrus	\$2478
Olives	\$2050
Prunes	\$2339
Walnuts	\$1483
Misc. Fruits and Nuts	\$1541

**Productivity of Agricultural Lands within the SRCA**

Data provided by The Nature Conservancy (TNC) on orchard lands on properties within the IRZ indicate that orchards in close proximity to the river are less productive than the county average. The parcels in the sample include lands purchased by TNC but leased for commercial farming and lands appraised for future acquisition by TNC. Table 8 is a summary of acreage and production for walnuts in the IRZ. Additional data were provided for almonds and prunes, but the sample was too small (three orchards) to be representative of productivity in the area. The value of walnut production in the orchards contained in the sample was 70 percent of the county average

The impact of flooding on the productivity of field and vegetable crops is likely to be less significant. For any given soil class, proximity to the river may reduce crop production primarily by delaying planting in severe flood years. There were no data available to measure this impact and thus field and vegetable crop productivity in the IRZ is assumed to be equal to the county average.

**Table 8  
Productivity of Walnut Orchards in the Inner  
River Zone (IRZ)(1994-1999)**

<b>Year/number of Orchards</b>	<b>Acr es in Sa mpl e</b>	<b>Total Income</b>	<b>Income/Acre</b>	<b>% of Glenn County Average</b>
1994/6	1220.0	\$732,776	\$600.64	30.96%
1995/3	435.5	\$434,567	\$997.86	77.05%
1996/5	1145.0	\$1,309,298	\$1143.49	87.76%
1997/5	1145.0	\$1,513,205	\$1321.58	68.55%
1998/7	1401.9	\$971,100	\$692.70	68.65%
1999/3	946.4	\$753,553	\$796.23	86.93%
			<b>Average</b>	<b>69.98%</b>

An internal memo provided by TNC delineates production in “prime orchards” that are in Glenn County and within the Sacramento River National Wildlife Refuge (SRNWR). The value of production for those orchards averaged \$868 per acre for 1998 and 1999 (TNC 2000). That is 83 percent of the per acre value of walnut production and 66 percent of the per acre value of prune production in Glenn County for those years (Glenn County 1999). The TNC memo also discusses the reasons that agricultural production per acre for land near the river (in this case lands already under public ownership) is likely to be below the county average.

Ninety percent (90%) of public lands along the Sacramento River flood at least every other year (are within the 2.5 year flood). Thirty-seven percent (37%) of the land in conservation ownership is soil unsuited for most agricultural crops

“possessing extreme limitations for most crop types” (capability class III or higher, Glenn County Soil Survey). Seventy-five percent (75%) of conservation land on the river is within geologic control; these are actively meandering areas of the river that experience high rates of erosion, deposition, and result in highly stratified and diverse soil types. (TNC 2000)

Data from the Geographical Information System (GIS) indicate that average soil quality within the IRZ is significantly lower than for the SRCA as a whole. Only 7.4 percent of the land within the meander belt has class I soil, while 45.8 percent of the acreage inside the SRCA but outside of the IRZ is class I soil. Land with low quality soil, class III or above, is 29.2 percent of the acreage within the IRZ, while only 15.9 percent of the land outside of the IRZ, but inside of the SRCA. Table 9 contains the acreage for class I, class II, and class III-VIII soils for the SRCA, the IRZ, and for the portion of the SRCA outside of the IRZ. Approximately 1674 acres within the SRCA (1562 within the IRZ) are excluded from the totals because no soil class codes were attached to the parcels in the GIS database.

**Table 9**  
**Soil Classes within the SRCA and the IRZ**

Soil Class	Acres/Percent of Classified Acreage		
	SRCA	IRZ	SRCA- IRZ
<b>I</b>	12,399/ 38.3%	473/ 7.4%	11,926/ 45.8%
<b>II</b>	13,959/ 43.1%	4052/ 63.4%	9,907/ 38.0%
<b>III- VIII</b>	6018/ 18.6%	1867/ 29.2%	4,151/ 15.9%

We could locate no research delineating the relative productivity of orchards planted on class I and class II soils. When orchards are planted on class II soils adjustments are possible that will allow production levels similar to what can be achieved on class I soils. Closer tree spacing, a choice of different rootstocks, low volume irrigation, and soil modification prior to planting are among the potential changes in cultivation practices (Krueger 2000). While these adjustments are possible that does not imply that all orchards planted on class II soils actually incorporate optimum practices. In addition, the differences in orchard productivity indicated by the data sample provided by TNC may be due primarily to flooding frequency, not soil type.

## **THE COST TO GLENN COUNTY'S ECONOMY OF PRESERVATION AND RESTORATION OF RIPARIAN HABITAT ON AGRICULTURAL LANDS WITHIN THE SRCA**

### **Methodology and Assumptions**

#### **➤ The Input-Output Model**

The economic impact of removing lands from agricultural production is estimated using the IMPLAN model. IMPLAN is an input-output model (I-O) that separates the economy into 528 industrial sectors, classifying each according to the primary product or service it provides (see [http://www.mig-inc.com/about\\_us/clients.htm](http://www.mig-inc.com/about_us/clients.htm) for a list of state and federal government agencies, academic institutions, and private organizations using IMPLAN for impact assessment). The mechanism through which the model estimates impacts is the transaction matrix, which contains the purchases and sales that occur among the various sectors. The column entries are the purchases made by a particular sector from all other sectors included in the model. The row elements are the industry destinations of the sector's sales. The I-O model permits assessment of the total impact of an initial change in output for a basic industry, in this case agriculture.

Removing land from agricultural use has direct impacts on production and employment, and, secondary consequences for those sectors dependent upon activity in the farming sector. The impact on sectors related to agriculture is called the indirect effect and it is measured as the reduction in output or employment for all sectors selling to the agricultural sector. As income declines in agriculture and allied sectors, local consumer spending is also affected, leading to additional impacts on local business sales, output, and employment. These are the induced effects. The total impact is the sum of the direct, indirect, and induced effects.

Often the results of an I-O model are expressed in the form of a multiplier. The output multiplier is equal to the ratio of the direct, indirect, and induced impacts on output to the direct impact. IMPLAN generates Modified Type II multipliers that are somewhat larger since they include the effect of transfer payments in the induced impacts. Direct, indirect, and induced employment impacts are calculated as the change in employment for each one million-dollar change in the output of a particular sector. Employment multipliers are then calculated in the same manner as the output multiplier, as the ratio of the total change (direct, indirect, and induced) in employment to the direct change. Output and employment multipliers are determined by the interrelationships specified in the transactions matrix. The magnitude of the derived multipliers also depends on the degree of self-sufficiency for the local region. Generally, the smaller the scale of the local economy, the smaller the output and employment multipliers. That is because for a small economy so many local needs are met through purchases from outside. Even for broadly defined regions, the value of output multipliers rarely approaches two. In the case of small economies that are not geographically isolated, output multipliers of less than 1.5 are to be expected.

### ➤ **Data Sources and Assumptions**

The direct impacts on output are estimated from the number of acres removed from agricultural use and the average value of output per acre. Projections of acres withdrawn from agricultural production are based on various scenarios for the ultimate composition of the SRCA and the rate of transformation from present uses. The estimated impact of past conversion of agricultural lands to riparian habitat is derived from a comparison of land uses prior to public acquisition and current uses (1994). Information on current land uses for publicly owned parcels was supplied by the Geographical Information Center (GIC) at CSU, Chico, while the office of the Glenn County Assessor provided detailed information on previous land uses under private ownership.

Estimates of output per acre for various crops produced on the affected agricultural lands were obtained from two sources. The “Annual Crop and Livestock Reports” from the Glenn County Department of Agriculture were used to establish the average value (1987-1999) of output per acre for agricultural products produced in the county. Second, The Nature Conservancy (TNC) provided output data for orchard lands within the SRCA. The value of production for walnut orchards was 70 percent of the Glenn County average (Table 8, TNC 2000a). The averages for almonds (59 percent) and prunes (52 percent) were considerably lower, but the small sample size limits the usefulness of the data. All of the orchards included in the sample were on parcels that border the Sacramento River.

For purposes of the base case estimates we use the county averages for agricultural production per acre for all crops produced in the SRCA with the exception of orchard productivity within the Inner River Zone (IRZ). For orchard production on land subject to frequent flooding, assumed to be limited to those properties within the IRZ, we assume production is 70 percent of the county average.

### **Economic Losses Due to Past Land Acquisitions and Habitat Restoration on Glenn County Agricultural Lands**

#### ➤ **The Economic Impact of Past Land Acquisitions within the SRCA**

There were no significant changes in land use on the publicly owned lands in the SRCA by 1994 when the latest GIS data were collected. This conclusion is based on data provided by the Glenn County Assessor on land use for the parcels purchased in the SRCA by various public agencies but prior to acquisition. The pattern of land use under private ownership was then compared to that available from the 1994 GIS data. By 1994 the average parcel (for 30 parcels) had been under public ownership for 4.66 years. Over that period the amount of land in agricultural use actually increased slightly from 672 acres to 698 acres (possibly due to measurement error). The data also indicate an increase in orchard acreage from 448 acres to 575 acres. It is reasonable to conclude that the measured changes are the result of data imperfections and that through the year 1994 habitat restoration in the SRCA had no measurable impact on the Glenn County economy.

➤ **The Economic Impact of Past Land Acquisitions in the Butte Sink**

The area in Glenn County along Butte Creek is not a part of the SRCA nor is it within the defined scope of this study. However, we included the following assessment for two reasons. First, a number of individuals in Glenn County expressed an interest in the impact of public land acquisitions in this area of the county. Second, we had much of the needed information by parcel from a study of the impacts of public land purchases on Glenn County property tax revenues (Adams and Gallo 1999). The Glenn County Assessor provided the remaining data on prior land uses for those parcels.

By 1994 23 parcels had been acquired by public agencies in the Butte Creek Area of Glenn County for a total of 4,082 acres. Prior to public acquisition 3,249 acres were in various agricultural uses, primarily rice (3,099 acres). The 1994 GIS data indicate a significant decrease in rice acreage to 1,543 acres. The decrease (1706 acres) was roughly equal to the amount of land classified as idle in the 1994 GIS data (1,636 acres). The difference (70 acres) is measurement error or it represents rice land converted from rice production to other agricultural uses. We assume that had the land remained in private ownership the 1,636 acres of idle land would have remained in rice production. Based on that assumption and a \$980 per acre value for rice production, the direct loss to Glenn County output is \$1,602,927. Including the indirect and induced impacts results in a computed annual loss to the Glenn County economy of \$1,991,247. The detailed impacts on output by sector are contained in Table 1a.

**Table 1a**  
**Direct, Indirect, Induced, and Total Impacts on Glenn County Output**  
**Due to Elimination of 1,636 Acres of Rice Production**  
**In the Butte Creek Area (By Sector in 1997\$)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	1,602,927	56,455	2,713	1,662,095
<b>28</b>	<b>Mining</b>	0	3	0	4
<b>48</b>	<b>Construction</b>	0	22,033	2,284	24,317
<b>58</b>	<b>Manufacturing</b>	0	3,708	3,439	7,148
<b>433</b>	<b>TCPU*</b>	0	35,439	5,159	40,598
<b>447</b>	<b>Trade</b>	0	41,868	32,060	73,928
<b>456</b>	<b>FIRE**</b>	0	89,933	29,074	119,007
<b>463</b>	<b>Services</b>	0	20,057	25,290	45,347
<b>510</b>	<b>Government</b>	0	14,031	4,237	18,268
<b>516</b>	<b>Other</b>	0	0	535	535
<b>30001</b>	<b>Institutions</b>	0	0	0	0
<b>Total</b>		1,602,927	283,528	104,792	1,991,247

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

➤ **The Economic Impact of Future Land Acquisitions and Conversion to Riparian Habitat within the SRCA**

In this section the contribution to the Glenn County economy is estimated for agricultural production in the Inner River Zone (IRZ) and the portion of the Sacramento River Conservation Area (SRCA) outside of the IRZ. These estimates are not indicative of the likely scale of habitat restoration, but rather the estimates form the basis for the subsequent presentation of possible scenarios. The assumed percentage of each area to be converted from agricultural use to riparian habitat is used to scale the estimates presented in this section.

The economic impact of public land acquisition and conversion to riparian habitat is the direct loss of agricultural output and employment plus the indirect and induced effects that stem from the initial output and employment change. The direct impact for each affected area- the SRCA, the IRZ, and the portion of the SRCA outside of the IRZ- is estimated as the acres of crop production of each crop type multiplied by the average value per acre for that crop. The indirect and induced effects are estimated using the IMPLAN model. For each crop the output loss is allocated to the appropriate IMPLAN sector. The model then generates the indirect and induced impacts for a given amount of direct output or employment loss.

Table 2a includes the contribution to Glenn County output of agricultural production within the IRZ. Output effects are listed by crop. The value of each crop is assumed to be equal to the county average for the 1988-1999 period converted to 1997 dollars (the IMPLAN base year). Average production per acre is computed by multiplying yield per acre for each crop (for each year) by the unit price for each crop (for the same year in 1997 dollars). The average is then the average dollar (1997) revenue per acre. The purpose of using this approach is that often in years where crop yields are down (due to adverse weather conditions, e.g.) there is an offsetting increase in the unit price. Averaging the price times quantity is preferable to taking the product of average yield and average price in that it captures the offsetting movements in price and per acre yield. The only exception to the assumption of yields equaling the county average is for almond, prune, and walnut production. As discussed above, the output of the deciduous orchard crops within the IRZ is assumed to equal 70 percent of the county average. The output effects are listed on a per acre basis and the total for the IRZ.

The totals are further subdivided into direct impacts (acres affected times the output per acre) and the sum of direct, indirect, and induced effects (total). Table 3a and 4a present the output and employment impacts by sector for the aggregated 10-sector IMPLAN model. Additional detail is provided in the disaggregated (528 sectors) IMPLAN matrices included in Appendix A.

**Table 2a**  
**Annual Direct and Total Impact on Glenn County Output from**  
**Agricultural Production in the Inner River Zone (in 1997\$)**

		<b>Change in Output (1997\$)</b>	
<b>Crop /IMPLAN Sector</b>	<b>Acres</b>	<b>Per Acre</b>	<b>Direct Impacts**</b>
<b>Food Grains/11</b>			<b>\$46,974</b>
Rice	26.85	\$980	\$26,313
Wheat	71.74	\$288	\$20,661
<b>Feed Grains/12</b>			<b>\$115,735</b>
Corn	81.35	\$557	\$45,318
<b>Field Crops</b>	117.46	\$600	\$70,417
Sudan	0.00	\$642	\$0
<b>Hay/13</b>			<b>\$69,893</b>
Pasture	38.12	\$138	\$5,261
Alfalfa	93.40	\$692	\$64,633
<b>Fruit/16</b>			<b>\$1,490,385</b>
Prunes	910.27	\$2339(X0.7)	\$1,490,385
<b>Tree Nuts/17</b>			<b>\$1,919,137</b>
Almonds	430.75	\$1530(X0.7)	\$461,333
Walnuts	1404.30	\$1483(X0.7)	\$1,457,804
<b>Vegetables/18</b>			<b>\$83,956</b>
Dry Beans	126.06	\$666	\$83,956
<b>Sugar/19</b>			<b>\$7,833</b>
Sugar Beets	7.70	\$1016	\$7,833
<b>Oil/21</b>			<b>\$49,361</b>
Safflower	89.22	\$249	\$22,216
Sunflower	47.95	\$566	\$27,145
<b>Total Impacts**</b>			<b>\$4,962,699</b>
Direct			<b>\$3,783,274</b>
Indirect			<b>\$749,493</b>
Induced			<b>\$429,931</b>
<b>Total Acres</b>	3445.17		
<b>Total Impact/Acre</b>	1440.48		

\*Sector totals in bold print.

\*\* The total impact is the sum of the direct, indirect and induced impacts and includes all output effects of reduced agricultural production.

**Table 3a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Output from Agricultural Production in the IRZ (By Sector in 1997\$)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	3,783,274	454,182	11,158	4,248,613
<b>28</b>	<b>Mining</b>	0	3	2	5
<b>48</b>	<b>Construction</b>	0	22,271	9,319	31,590
<b>58</b>	<b>Manufacturing</b>	0	13,094	14,236	27,330
<b>433</b>	<b>TCPU*</b>	0	68,808	21,204	90,012
<b>447</b>	<b>Trade</b>	0	75,844	131,871	207,715
<b>456</b>	<b>FIRE**</b>	0	65,407	118,764	184,171
<b>463</b>	<b>Services</b>	0	38,388	103,737	142,126
<b>510</b>	<b>Government</b>	0	11,497	17,448	28,945
<b>516</b>	<b>Other</b>	0	0	2,192	2,192
<b>30001</b>	<b>Institutions</b>	0	0	0	0
<b>Total</b>		3,783,274	749,493	429,931	4,962,699

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 4a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Employment from Agricultural Production in the IRZ (By Sector)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	27.5	16.6	0.1	44.3
<b>28</b>	<b>Mining</b>	0.0	0.0	0.0	0.0
<b>48</b>	<b>Construction</b>	0.0	0.4	0.1	0.5
<b>58</b>	<b>Manufacturing</b>	0.0	0.2	0.1	0.2
<b>433</b>	<b>TCPU*</b>	0.0	0.6	0.2	0.8
<b>447</b>	<b>Trade</b>	0.0	1.1	3.7	4.8
<b>456</b>	<b>FIRE**</b>	0.0	0.6	0.5	1.1
<b>463</b>	<b>Services</b>	0.0	0.8	2.3	3.1
<b>510</b>	<b>Government</b>	0.0	0.1	0.2	0.4
<b>516</b>	<b>Other</b>	0.0	0.0	0.3	0.3
<b>30001</b>	<b>Institutions</b>	0.0	0.0	0.0	0.0
<b>Total</b>		27.5	20.4	7.5	55.5

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

The direct contribution of agricultural production in the IRZ to Glenn County output totals \$3,783,274. In addition, agriculture in the IRZ generates \$749,493 in indirect effects (through the impact on suppliers of inputs) and \$429,931 in induced effects (through the expenditure of personal income) for a total impact of \$4,962,699. Agricultural activity in the IRZ directly supports 27.5 jobs and is responsible for 20.4 indirect and 7.5 induced jobs.

The impact on Glenn County output is felt primarily in the agricultural sector. Of the \$4,962,699 in output attributable to agricultural production in the IRZ, \$4,248,613, or 85 percent is in the agricultural sector. Other sectors experiencing significant impacts are trade (\$207,715); finance, insurance, and real estate (\$184,171); services (\$142,126); and transportation, communications, and public utilities (\$90,012).

The impact on Glenn County employment is also primarily in the agricultural sector. Of the 55.5 jobs generated by agriculture in the IRZ, 44.3, or 80 percent is in that sector. Employment impacts on other sectors are relatively small. In only three sectors are one or more jobs attributable to agriculture in the IRZ. Employment in trade; services; and finance, insurance, and real estate is increased by 4.8, 3.1 and 1.1, respectively.

The estimated impact of agricultural production in the Inner River Zone (IRZ) on Glenn County output and employment is based on the crop patterns observed in 1994 and included in the Geographic Information System (GIS) database. It is likely that changes in relative prices and other economic and non-economic factors have led to changes in the mix of crops. However, these changes, particularly when they involve the substitution of one annual crop for another, will have a minimal impact on the estimates. The only exception is where the gross revenue per acre for a specific crop differs substantially from the average. For example, with the exception of rice, sugar beets generate significantly higher gross revenue per acre than other annual crops. But, with the closure of the local sugar processing plant it is unlikely that there is significant acreage in sugar beets as was the case in 1994 (1,643 acres in the SRCA). While this is not a factor affecting the estimates for the IRZ (only 7.7 acres were planted in sugar beets in the IRZ in 1994), it may impart an upward bias to the estimates for the remainder of the SRCA.

Table 5a includes the projected impacts on Glenn County output of agricultural production in the portion of the SRCA outside of the IRZ. Output effects are listed by crop. The value of each crop is assumed to be equal to the county average for the 1988-1999 period converted to 1997 dollars (the IMPLAN base year). The totals are further subdivided into direct impacts (acres affected times the output per acre) and the sum of direct, indirect, and induced effects (total). Table 6a and 7a present the output and employment impacts by sector for the aggregated 10-sector IMPLAN model. Additional detail is provided in the disaggregated (456 sector) IMPLAN matrices included in Appendix A.

**Table 5a**  
**Annual Direct and Total Impact on Glenn County Output**  
**from Agricultural Production in the Portion of**  
**the SRCA Outside of the IRZ (in 1997\$)**

Crop /IMPLAN Sector	Acres	Change in Output (1997\$)	
		Per Acre	Direct Impacts**
<b>Food Grains/11</b>			<b>\$5,063,464</b>
Rice	4759.90	\$980	\$4,664,702
Wheat	1384.59	\$288	\$398,762
<b>Feed Grains/12</b>			<b>\$1,638,818</b>
Corn	1841.93	\$557	\$1,025,899
<b>Field Crops</b>	1001.94	\$600	\$600,663
Sudan	19.09	\$642	\$12,256
<b>Hay/13</b>			<b>\$1,145,882</b>
Pasture	613.57	\$138	\$84,673
Alfalfa	1533.54	\$692	\$1,061,210
<b>Fruit/16</b>			<b>\$7,834,831</b>
Prunes	3349.65	\$2339	\$7,834,831
<b>Tree Nuts/17</b>			<b>\$12,394,664</b>
Almonds	3337.94	\$1530	\$5,107,048
Pistachios	3.00	\$1920	\$5,760
Walnuts	4910.22	\$1483	\$7,281,856
<b>Vegetables/18</b>			<b>\$690,202</b>
Dry Beans	1036.34	\$666	\$690,202
<b>Sugar/19</b>			<b>\$1,669,644</b>
Sugar Beets	1643.35	\$1016	\$1,669,644
<b>Oil/21</b>			<b>\$464,015</b>
Safflower	1124.19	\$249	\$279,923
Sunflower	325.25	\$566	\$184,092
<b>Totals**</b>			<b>\$39,892,618</b>
Direct			<b>\$30,901,520</b>
Indirect			<b>\$5,818,354</b>
Induced			<b>\$3,172,743</b>
<b>Total Acres</b>	26884.50		
<b>Total Impact/Acre</b>	1483.85		

\* Sector totals in bold print.

\*\*The total impact is the sum of the direct, indirect and induced impacts and includes all output effects of reduced agricultural production.

**Table 6a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Output from Agricultural Land Production in the Portion**  
**of the SRCA outside the IRZ (By sector in 1997\$)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	30,901,520	3,077,738	82,297	34,061,556
<b>28</b>	<b>Mining</b>	0	34	11	45
<b>48</b>	<b>Construction</b>	0	228,337	68,853	297,190
<b>58</b>	<b>Manufacturing</b>	0	96,826	104,865	201,691
<b>433</b>	<b>TCPU*</b>	0	579,097	156,417	735,515
<b>447</b>	<b>Trade</b>	0	619,958	972,634	1,592,592
<b>456</b>	<b>FIRE**</b>	0	764,433	877,245	1,642,678
<b>463</b>	<b>Services</b>	0	323,760	765,575	1,089,335
<b>510</b>	<b>Government</b>	0	127,169	128,662	255,832
<b>516</b>	<b>Other</b>	0	0	16,184	16,184
<b>30001</b>	<b>Institutions</b>	0	0	0	0
<b>Total</b>		30,901,520	5,818,354	3,172,743	39,892,618

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 7a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Employment from Agricultural Land Production in the**  
**Portion of the SRCA outside the IRZ (By Sector)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	263.5	112.2	0.9	376.6
<b>28</b>	<b>Mining</b>	0.0	0.0	0.0	0.0
<b>48</b>	<b>Construction</b>	0.0	3.7	1.0	4.7
<b>58</b>	<b>Manufacturing</b>	0.0	1.2	0.5	1.7
<b>433</b>	<b>TCPU*</b>	0.0	5.2	1.3	6.5
<b>447</b>	<b>Trade</b>	0.0	9.4	27.0	36.4
<b>456</b>	<b>FIRE**</b>	0.0	6.1	3.9	10.1
<b>463</b>	<b>Services</b>	0.0	6.8	16.9	23.7
<b>510</b>	<b>Government</b>	0.0	1.4	1.7	3.2
<b>516</b>	<b>Other</b>	0.0	0.0	2.3	2.3
<b>30001</b>	<b>Institutions</b>	0.0	0.0	0.0	0.0
<b>Total</b>		263.5	145.9	55.6	465.1

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

The direct contribution to Glenn County output of agricultural production in the portion of the SRCA outside of the IRZ is \$30,901,520. In addition, that production generates \$5,818,354 in indirect effects (through the impact on suppliers of inputs) and \$3,172,743

in induced effects (through the expenditure of personal income) for a total impact of \$39,892,618. Agricultural activity on those parcels directly supports 263.5 jobs and is responsible for 145.9 indirect and 55.6 induced jobs.

The impact on Glenn County output is felt primarily in the agricultural sector. Of the \$39,892,618 in output attributable to agricultural production in that part of the SRCA, \$34,061,556, or 85 percent is in the agricultural sector. Other sectors experiencing significant impacts are trade (\$1,592,592); finance, insurance, and real estate (\$1,642,678); services (\$1,089,335); and transportation, communications, and public utilities (\$735,515).

The impact on Glenn County employment is also primarily in the agricultural sector. Of the 465.1 jobs generated by agriculture in the portion of the SRCA outside the IRZ, 376.6, or 81 percent is in that sector. Employment impacts on other sectors are relatively small. In only three sectors are ten or more jobs attributable to agriculture in the area. Employment in trade; services; and finance, insurance, and real estate is increased by 36.4, 23.7 and 10.1, respectively.

➤ **Description of the Base Case- The Most likely Scenario**

The impact analysis that follows is based on the consensus view of the most likely configuration for the Sacramento River Conservation Area (SRCA) and the Inner River Zone (IRZ) contained within. Critical to establishing the effect on the Glenn County economy is the mix of remaining agricultural uses and restored riparian habitat. Also of importance is where limitations are placed on agricultural land use. Conversion of land in high value crops, orchards in particular, will have a greater impact on Glenn County output and employment.

In order to determine the most likely scenario we consulted with a number of individuals and groups having an interest in the process. We elicited their opinions through a series of telephone interviews during the week of November 20, 2000. The following base case is, in part, derived from the opinions expressed in those interviews.

1. All of the land currently in public ownership in the IRZ will be preserved in or restored to riparian habitat. In addition, it is assumed that all remaining native vegetation and riparian habitat will be preserved through acquisition or the use of conservation easements. The totals within the IRZ are 4,613 acres (including 9 acres of barren or wasteland). Of that amount, 2,059 acres are in public ownership (GIS 2000), leaving 2,554 acres to be encumbered by acquisition or conservation easements. Publicly owned agricultural lands within the IRZ total 808 acres and it is assumed that all of his land will be removed from production. The majority opinion of those interviewed was that 80 percent of the IRZ would be removed from agricultural production, leaving an additional 1,061 acres of agricultural land for acquisition and conversion to riparian or native vegetation. We believe this is a reasonable assumption given funding limitations, authorization of only 5,000 to 6,000 additional acres to be added to the Sacramento River National Wildlife Refuge (SRNWR) between Red Bluff Diversion Dam and Colusa, and the voluntary nature of participation by private landowners. However, since some of the

interviewees expressed the view that all of the IRZ would eventually be added, either through authorization of additional purchases under the SRNWR or through other state or federal programs, we consider in the sensitivity analysis section the impact of removing the remaining agricultural production from the IRZ.

2. It is assumed that all of the lands currently in public ownership in the portion of the SRCA outside of the IRZ will be preserved in or restored to riparian habitat or other native vegetation. Of the 2,821 acres in this category, 541 acres are in riparian or native vegetation, while 2,272 acres are in various agricultural uses.

3. It is assumed that, with one exception, no additional land acquisitions take place in the portion of the SRCA outside of the IRZ. The exception is for those parcels acquired in the IRZ that extend beyond the IRZ boundaries. It is assumed that in one-half of those cases the entire parcel will be acquired and converted to riparian or native vegetation. This is consistent with the past pattern of public land acquisitions. The GIS data used in constructing the study shows that for each acre of public land acquisition within the IRZ 1.0163 acres were purchased in the portion of the SRCA outside of the IRZ. Since an additional 3615 acres of land must be acquired within the IRZ to meet the 80 percent public ownership assumption, past acquisition patterns would imply an additional 3674 acres would be purchased outside of the IRZ, or 49.33 percent of the parcel overlap. For the remaining acquisitions within the IRZ it is assumed that the parcels will be split at the IRZ boundary with the portion outside of the IRZ remaining in agricultural production. The impact of the acreage loss is computed based on the average production per acre for all parcels that straddle the IRZ boundary.

### **Estimated Impacts on Glenn County Output and Employment: Base Case**

#### **1. Impact of Reduced Agricultural Production in the IRZ**

Table 8a and 9a contain the estimated impacts on Glenn County output and employment, respectively, due to the elimination of agricultural production on 808 acres of publicly owned lands within the IRZ. Total output losses, including indirect and induced impacts, are \$1,027,717, while employment losses total 11.5 jobs. Most of the output losses, or 86 percent, occur in agriculture and total \$880,492 for that sector. Employment losses in agriculture are 9.2 jobs, or 80 percent of the total job losses.

Under the base case scenario an additional 1,061 acres of agricultural land will be acquired and removed from production. Table 10a and 11a contain the estimated impact of eliminating all remaining agricultural land uses (2637 acres) from the privately held lands in the IRZ. The 1,061 acres used in the base case constitute 40.235 percent of that total. Therefore, public acquisition and conversion to habitat of an additional 1,061 acres in the IRZ, currently held privately and in agricultural use, will reduce Glenn County output by \$1,180,890. There will also be a loss of 17.7 additional jobs in the county.

The resulting impact on the Glenn County economy of the base case actions in the IRZ is a reduction in output of \$2,610,957 and a reduction in employment of 29.2 jobs. The totals are calculated by summing the respective output and employment impacts of removal from agricultural production of the 808 acres of publicly held lands and 1061 acres of privately held lands in the IRZ that are currently (as of 1994) in agricultural use.

**Table 8a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Output from Elimination of all Agricultural Land Use on 808 acres**  
**of Publicly Held Lands in the IRZ (By Sector in 1997\$)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	790,198	87,886	2,408	880,492
<b>28</b>	<b>Mining</b>	0	1	0	1
<b>48</b>	<b>Construction</b>	0	3,560	2,013	5,573
<b>58</b>	<b>Manufacturing</b>	0	2,681	3,071	5,752
<b>433</b>	<b>TCPU*</b>	0	13,487	4,576	18,063
<b>447</b>	<b>Trade</b>	0	13,522	28,459	41,981
<b>456</b>	<b>FIRE**</b>	0	13,278	25,645	38,923
<b>463</b>	<b>Services</b>	0	7,991	22,392	30,384
<b>510</b>	<b>Government</b>	0	2,311	3,765	6,076
<b>516</b>	<b>Other</b>	0	0	473	473
<b>30001</b>	<b>Institutions</b>	0	0	0	0
<b>Total</b>		790,198	144,716	92,803	1,027,717

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 9a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Employment from Elimination of all Agricultural Land Use on 808 acres**  
**of Publicly Held Lands in the IRZ (By Sector)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	5.9	3.2	0.0	9.2
<b>28</b>	<b>Mining</b>	0.0	0.0	0.0	0.0
<b>48</b>	<b>Construction</b>	0.0	0.1	0.0	0.1
<b>58</b>	<b>Manufacturing</b>	0.0	0.0	0.0	0.0
<b>433</b>	<b>TCPU*</b>	0.0	0.1	0.0	0.2
<b>447</b>	<b>Trade</b>	0.0	0.2	0.8	1.0
<b>456</b>	<b>FIRE**</b>	0.0	0.1	0.1	0.2
<b>463</b>	<b>Services</b>	0.0	0.2	0.5	0.7
<b>510</b>	<b>Government</b>	0.0	0.1	0.1	0.1
<b>516</b>	<b>Other</b>	0.0	0.1	0.1	0.1
<b>30001</b>	<b>Institutions</b>	0.0	0.0	0.0	0.0
<b>Total</b>		5.9	4.0	1.6	11.5

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 10a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Output from Elimination of Agricultural Land Use on 2637 acres**  
**of Privately Held Lands in the IRZ (By Sector in 1997\$)**

I-O #	Industry	Direct	Indirect	Induced	Total
1	Agriculture	2,993,076	366,296	8,750	3,368,121
28	Mining	0	3	1	4
48	Construction	0	18,711	7,307	26,018
58	Manufacturing	0	10,413	11,165	21,578
433	TCPU*	0	55,321	16,628	71,948
447	Trade	0	62,322	103,412	165,734
456	FIRE**	0	52,129	93,120	145,249
463	Services	0	30,397	81,345	111,742
510	Government	0	9,186	13,683	22,869
516	Other	0	0	1,719	1,719
30001	Institutions	0	0	0	0
<b>Total</b>		2,993,076	604,777	337,129	3,934,982

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 11a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Employment from Elimination of Agricultural Land Use on 2637 acres**  
**of Privately Held Lands in the IRZ (By Sector)**

I-O #	Industry	Direct	Indirect	Induced	Total
1	Agriculture	21.6	13.6	0.1	35.1
28	Mining	0.0	0.0	0.0	0.0
48	Construction	0.0	0.3	0.1	0.5
58	Manufacturing	0.0	0.1	0.0	0.2
433	TCPU*	0.0	0.5	0.1	0.6
447	Trade	0.0	0.9	2.9	3.8
456	FIRE**	0.0	0.5	0.4	0.9
463	Services	0.0	0.6	1.8	2.4
510	Government	0.0	0.1	0.2	0.3
516	Other	0.0	0.0	0.2	0.2
30001	Institutions	0.0	0.0	0.0	0.0
<b>Total</b>		21.4	16.5	5.9	44.0

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

## **2. The Impact on the Glenn County Economy of Eliminating Agricultural Production from all Publicly Held Lands in the Portion of the SRCA outside of the IRZ**

There are currently 2,272 acres of publicly held land in agricultural use in the portion of the SRCA outside of the IRZ. The conversion from agricultural uses to riparian or native vegetation will reduce Glenn County output by \$4,572,793 and reduce county

employment by 52.1 jobs. Table 12a and 13a include the impacts on Glenn County sectors in terms of output and employment losses, respectively.

**Table 12a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Output from Elimination of Agricultural Production on 2272 acres of Public Lands**  
**in the Portion of the SRCA outside of the IRZ (By Sector in 1997\$)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	3,464,294	439,776	9,843	3,913,913
<b>28</b>	<b>Mining</b>	0	4	1	5
<b>48</b>	<b>Construction</b>	0	24,900	8,215	33,116
<b>58</b>	<b>Manufacturing</b>	0	12,107	12,565	24,672
<b>433</b>	<b>TCPU*</b>	0	66,648	18,704	85,352
<b>447</b>	<b>Trade</b>	0	79,465	116,331	195,796
<b>456</b>	<b>FIRE**</b>	0	60,794	104,706	165,500
<b>463</b>	<b>Services</b>	0	34,878	91,491	126,369
<b>510</b>	<b>Government</b>	0	10,744	15,394	26,137
<b>516</b>	<b>Other</b>	0	0	1,933	1,933
<b>30001</b>	<b>Institutions</b>	0	0	0	0
<b>Total</b>		3,464,294	729,315	379,183	4,572,793

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 13a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Employment from Elimination of Agricultural Production on 2272 acres**  
**of Public Lands in the Portion of the SRCA outside of the IRZ (By Sector)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	25.7	16.0	0.1	41.8
<b>28</b>	<b>Mining</b>	0.0	0.0	0.0	0.0
<b>48</b>	<b>Construction</b>	0.0	0.4	0.1	0.5
<b>58</b>	<b>Manufacturing</b>	0.0	0.2	0.1	0.2
<b>433</b>	<b>TCPU*</b>	0.0	0.6	0.2	0.8
<b>447</b>	<b>Trade</b>	0.0	1.2	3.2	4.4
<b>456</b>	<b>FIRE**</b>	0.0	0.5	0.5	1.0
<b>463</b>	<b>Services</b>	0.0	0.7	2.0	2.8
<b>510</b>	<b>Government</b>	0.0	0.1	0.2	0.3
<b>516</b>	<b>Other</b>	0.0	0.0	0.3	0.3
<b>30001</b>	<b>Institutions</b>	0.0	0.0	0.0	0.0
<b>Total</b>		25.7	19.7	6.6	52.1

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**3. The Impact on the Glenn County Economy of Eliminating Agricultural Production on 50 Percent of the Parcel Segments outside of the IRZ that are Purchased in Association with Acquisitions within the IRZ**

Table 14a and 15a contain the respective impacts on Glenn County output and employment of eliminating agricultural output on the portion of those parcels that are outside of the IRZ but extend into the IRZ. If each parcel acquired inside of the IRZ is not split at the boundary there is the possibility that agricultural production will be eliminated on the entire parcel. The overlap consists of 7,010 acres of land currently in agricultural use. In the base case it is assumed that 1,061 acres or 40.325 percent of the remaining privately held lands in agricultural use within the IRZ are to be acquired and converted to habitat. It is also assumed that 50 percent of the acquisitions will be limited to the portions of those parcels that fall within the IRZ, leaving the remainder in agricultural use. There is also an implicit assumption that purchase of riparian habitat within the IRZ does not involve the acquisition of additional agricultural lands outside of the IRZ boundary. Table 14a and 15a contain the impacts on Glenn County output and employment, respectively, of removing the entire 7,010 acres from agricultural production. For the base case we include 50 percent of 40.325 percent, or 20.1175 percent of the totals as losses to county output and employment. This component of the loss to county output is \$2,168,928, while these acquisitions add 26.9 jobs to the employment loss totals.

**Table 14a  
Annual Direct, Indirect, Induced, and Total Impacts on Glenn County Output from Elimination of Agricultural Production on 7010 Acres of Private Lands in the Portion of the SRCA outside of the IRZ (By Sector in 1997\$)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Total</b>
<b>1</b>	<b>Agriculture</b>	7,961,480	812,525	22,380	8,796,384
<b>28</b>	<b>Mining</b>	0	7	3	11
<b>48</b>	<b>Construction</b>	0	48,640	18,721	67,361
<b>58</b>	<b>Manufacturing</b>	0	25,560	28,520	54,080
<b>433</b>	<b>TCPU*</b>	0	142,574	42,535	185,109
<b>447</b>	<b>Trade</b>	0	144,458	264,497	408,955
<b>456</b>	<b>FIRE**</b>	0	173,158	238,528	411,686
<b>463</b>	<b>Services</b>	0	82,256	208,179	290,436
<b>510</b>	<b>Government</b>	0	29,110	34,989	64,099
<b>516</b>	<b>Other</b>	0	0	4,401	4401
<b>30001</b>	<b>Institutions</b>	0	0	0	0
<b>Total</b>		7,961,480	1,458,289	862,753	10,282,521

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 15a**  
**Annual Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Employment from Elimination of Agricultural Production on 7010 Acres**  
**of Private Lands in the Portion of the SRCA outside of the IRZ (By Sector)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Tota l</b>
<b>1</b>	<b>Agriculture</b>	62.3	29.8	0.2	92.3
<b>28</b>	<b>Mining</b>	0.0	0.0	0.0	0.0
<b>48</b>	<b>Construction</b>	0.0	0.8	0.3	1.1
<b>58</b>	<b>Manufacturing</b>	0.0	0.3	0.1	0.5
<b>433</b>	<b>TCPU*</b>	0.0	1.3	0.4	1.6
<b>447</b>	<b>Trade</b>	0.0	2.2	7.4	9.5
<b>456</b>	<b>FIRE**</b>	0.0	1.4	1.1	2.5
<b>463</b>	<b>Services</b>	0.0	1.7	4.6	6.3
<b>510</b>	<b>Government</b>	0.0	0.3	0.5	0.8
<b>516</b>	<b>Other</b>	0.0	0.0	0.6	0.6
<b>30001</b>	<b>Institutions</b>	0.0	0.0	0.0	0.0
<b>Total</b>		62.3	37.9	15.1	115.3

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

➤ **Summary of the Impacts on the Glenn County Economy: Base Case**

Table 16a contains the impacts on Glenn County output and employment for the three elements of the base case. The entries include the effects of removing agricultural land uses on 80 percent of the lands in the IRZ; on all publicly owned (as of 1994) lands in the portion of the SRCA outside of the IRZ; and on 50 percent of the parcels acquired within the IRZ that overlap outside the IRZ boundary.

**Table 16a**  
**Annual Losses of Output and Employment for Glenn County**  
**for the Base Case Assumptions**

<b>Parcel Categories by IRZ and SRCA minus IRZ</b>	<b>Annual Impacts (Losses)</b>	
	<b>Output (1997\$)</b>	<b>Employment</b>
<b>IRZ (80%)</b>	\$2,611,916	29.2
<b>SRCA minus IRZ (Public)</b>	\$4,572,793	52.1
<b>SRCA minus IRZ (Overlap, 50%)</b>	\$2,069,839	23.2
<b>Total Impact</b>	\$9,254,549	104.5

For the base case assumptions the annual output loss for Glenn County is \$9,254,549. Output losses in the agricultural sector are \$7,869,180 or 85.0 percent of the total. Other sectors experiencing significant output reductions are trade (\$386,732 or 4.2 percent of the loss); finance, insurance, and real estate (\$345,685 or 3.7 percent of the loss); and services (\$260,140 or 2.8 percent of the loss). Annual employment losses in the county total 104.5 jobs. Employment losses in agriculture are 83.7 jobs or 80.0 percent of the

total. Other sectors showing significant job reductions are trade (8.8 or 8.4 percent of the loss) and services (5.8 or 5.6 percent of the loss).

**Deviations from the Base Case: Sensitivity Analysis**

In this section we consider two additional possibilities: elimination of the remaining agricultural land uses in the IRZ (but not including the parcel overlap beyond the IRZ boundary) and a reduction to 25 percent (from 50 percent) of the parcels overlapping the IRZ boundary converted to riparian or native habitat. The second change is to accommodate the changes in procedures of the involved government agencies regarding land acquisitions. The view was expressed by several employees of DWR, DFG and USFWS that wherever possible the agencies intend to deviate from past land acquisition processes in order to reduce the amount of land acquired outside of the IRZ. The change involves splitting parcels purchased inside the IRZ at the boundary, leaving the portion outside the IRZ in private agricultural production.

There are currently 2,637 acres of agricultural land use on private lands in the IRZ. Conversion of 1,061 acres to habitat is included in the base case, leaving an additional 1,576 acres (59.76 percent) to be included in this assessment. Removing the remaining acreage from agricultural production would reduce Glenn County output by a further \$2,351,742 and eliminate another 26.3 jobs in the county (Table 10a and 11a).

A change in acquisition procedures that reduced by 50 percent (from 50 to 25 percent) the loss of agricultural production outside of the IRZ (associated with acquisitions inside the IRZ) reduces county output and job losses by \$1,034,293 and 11.6 jobs, respectively. Table 17a summarizes the output and employment impacts for the base case and the two deviations from the base case assessed in this section.

**Table 17a  
Annual Output and Employment Impacts: The Base Case and Two Variations**

<b>Case</b>	<b>Output Loss</b>	<b>Employment Loss</b>
<b>Base Case</b>	\$9,252,336	104.5
<b>Base Case + Remaining IRZ</b>	\$11,604,078	116.1
<b>Base Case – 25% of parcel Overlap</b>	\$8,218,043	92.9

## **INTRODUCTION TO LOCAL BENEFITS ASSESSMENT**

Habitat restoration and/or rehabilitation goals are to be achieved through the cooperation of federal, state, and local government agencies in conjunction with private individuals and organizations. Increases in populations of fish and other wildlife, as well as diverse plant communities are indicators of enhanced biodiversity and ecosystem health. The goals include a doubling of anadromous fish populations (CVPIA) and the creation of sustainable populations of threatened species. In CALFED's Strategic Plan for Ecosystem Restoration the expressed goal is, "to restore or mimic ecological processes and to increase and improve aquatic and terrestrial habitats to support stable, self-sustaining populations of diverse and valuable species" (CALFED 1999). The USFWS also advocates an ecosystem approach as a "critically important tool in promoting the conservation of biological diversity and an environmentally sustainable level of development" (USFWS 2000). The ecosystem approach as envisioned by the USFWS "means protecting or restoring the function, structure, and species composition of an ecosystem while providing for its sustainable socioeconomic use" (USFWS 1997).

In order to achieve the CVPIA goal of a doubling of populations of anadromous fish species, the ecosystem approach implies a combination of actions. The purpose of the actions is to "improve survival rates by reducing or eliminating entrainment of juveniles at diversions", and to enhance "the opportunity for adult fish to reach their spawning habitats in a timely manner" (DFG 2000). The program involves a range of actions including alteration of seasonal water flows, restoration of riparian habitat along the Sacramento River, and improving spawning conditions in streams in the Sacramento River watershed. Projects "include removing artificial barriers to migration, installing or upgrading fish ladders, expanding or improving the quality of spawning grounds, rearing habitat and riparian habitat, and acquiring permanent easements in floodplains and riparian corridors" (DFG 2000). The creation of the Sacramento River Conservation Area (SRCA) under SB1086 is part of the process essential for achieving the CVPIA goals for anadromous fish species and to improve environmental conditions for other varieties of fish and wildlife.

The socioeconomic costs imposed by the various projects are likely to vary considerably by county. For Glenn County the primary economic impact is due to the conversion of land in the SRCA from current agricultural uses to either other agricultural uses generating less revenue or to restored riparian habitat. The benefits to the county can be separated into five categories: environmental, savings on public facilities, the value of water freed up for other uses, compensation for flood damage to private lands, and the value of economic activity generated by habitat restoration. In the following sections we consider the value of those benefits to the residents of Glenn County. Environmental benefits assessed include the impact of ecosystem enhancement projects on the value of fishing and wildlife watching activities, and, on the amenity value to local residents (non-user benefits). We also considered the impact on the value of hunting activity, but lacking any indication that restored riparian habitat would be made accessible to hunters,

we assumed that program actions provide no significant benefits to residents engaged in that activity.

### **Methodology for Benefits Estimation**

Environmental benefits accrue to local residents through two pathways. First, an improvement in environmental quality increases the value to local residents of those activities that depend on the quality of the environment. Fishing is more highly valued when more fish are caught per unit of effort. Wildlife watching is more rewarding and thus greater value is placed on the activity in a diverse environment with more viewable wildlife. For those residents who do not engage in recreational activities on the Sacramento River, there are non-user benefits deriving from the existence of enhanced biodiversity and other factors contributing to amenity value. Second, nonresident users derive value from the use of higher quality local resources. While these benefits are not received directly by residents, the increased spending by visitors generates additional local economic activity.

Resident benefits resulting from an increase in the quality of the local environment are measured as the increase in the willingness to pay for affected recreational activities. The value placed on those activities is the sum of what residents spend to participate plus what additional amount they are willing to pay. This added amount, called consumer surplus, is not actually paid, but rather is the net benefit of the activity to the participant. The value of a quality improvement is a function of the increase in willingness to pay per unit of use and the increased rate of use by participants. Specifically, the value is equal to the gross willingness to pay for use of the higher quality recreational resource times the use rate following the quality improvement, minus the pre-improvement willingness to pay times the pre-improvement use rate. For example, if an angler uses the river 14 days per year and is willing to pay \$100 per day for that use, the initial value of the fishery resource is \$1,400 per year for that angler. Assume that following an improvement in fishery quality the same angler uses the river 16 days annually and values each day of use at \$120. The annual benefits to the angler of the change in resource quality are then equal to \$1,920 (16 days x \$120/day) minus \$1,400, or \$520.

For nonresident participants the value to Glenn County is derived from the travel expenditures of visitors. The local value of an improvement in resource quality is due to the impact on nonresident participants' willingness to travel to the county. More frequent trips mean additional spending in the county. The value to Glenn County of increased nonresident use is the product of trip related expenditures per visit and the increase in the number of trips resulting from the improvement in recreational resource quality. The total value to Glenn County residents of an improvement in local resource quality is then the sum of resident benefits and the impact of additional local spending by visitors.

## **The Economic Value of Fishery Resources**

### **➤ Defining a Change in Quality**

The goal of the Central Valley Improvement Act (CVPIA) is to “at least double natural production of anadromous fish in California’s Central Valley streams”. This is to be achieved through enhanced water flows, reduced entrainment of juvenile fish at diversions, improved access to spawning habitats, and restoration of riparian habitat. Specifically, Section 3406(b)(1) of the CVPIA states that the goal of the Anadromous Fish Restoration Program (AFRP) is to,

develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991 (USFWS 1997).

Targeted species include chinook salmon, steelhead, striped bass, American shad, and white and green sturgeon.

The California Department of Fish and Game’s (DFG) annual Sacramento River creel census summarizes angler effort in terms of species sought. The results for 1998 are derived from a sample obtained during the April 1 to December 31, 1998 period. The river reach most closely corresponding to our study area is the portion of the Sacramento River between Colusa and Red Bluff. The DFG surveyed sport anglers on the river, collecting its sample over 131 days and estimating a total of 351,472 angler hours for the year. The great majority of angler effort was focused on two species. 50.8 percent and 42.7 percent of angler hours were spent seeking chinook salmon and striped bass respectively. Only 2.3 percent of the hours were devoted to fishing for American shad and sturgeon were the target species 1.3 percent of the time. Less than one percent of the angler hours were spent fishing for catfish, rainbow trout and steelhead (DFG 2000a).

Therefore, for 1998 in excess of 97 percent of angler effort was focused on species targeted under the AFRP. For purposes of this study it is assumed that the AFRP target is met for the year 2005 and beyond, and, that populations of all species sought by sport anglers are twice the average for the 1967- 1991 period. For striped bass the target is 2.5 million legal size fish and for chinook salmon the aggregate target for the four annual runs is 443,000 adult fish (USFWS 1997).

For the 1992-1998 period average salmon runs on the Sacramento River were 116,956 fish annually. Achieving the CVPIA target implies a 279 percent increase in salmon abundance. Striped bass populations were estimated through a tagging program for 1992-1994 and 1996. The average annual population of legal size fish for those years was 700,250 (DFG 1995, DFG 2000a). The target of 2.5 million striped bass implies a 257 percent increase over populations of recent years.

We could find only a single study linking fish abundance with the catch rate. In the majority of studies attempting to measure the value of changes in the quality of sport fishing resources, the unit of quality is the per day or per trip catch rate. The one study addressing the link between abundance and catch rate was for salmon fishing at various ports along the California coast. The authors found that for a ten percent increase in fish populations, catch per trip increased by more than ten percent. In addition, they found that a ten percent increase in abundance increased angler use by between 1.3 and 6.9 percent (Andrews and Wilen 1988). Those relationships were not apparent in the population and catch rate data for salmon and striped bass on the Sacramento River. However, there are only five years for which fish population, catch, and angler use data coincide, thus making valid statistical testing impossible.

Andrews and Wilen point out that abundance in the ocean salmon fishery is well publicized. For ports where the majority of anglers are local and thus are able to respond to known changes in fishing conditions, angler use and catch rate are particularly responsive to variations in salmon populations. As populations of anadromous fish in the Sacramento River increase and that fact becomes well known to anglers, it is likely that a strong relationship between fish abundance and angler participation and catch rate will emerge.

➤ **Measuring the Local Benefits of a change in Fishery Resource Quality**

There are two sources of potential local benefits resulting from an improvement in local fishery resources. First, local citizens receive benefits in the form of greater satisfaction derived from sport fishing activities. Second, the local economy may benefit from the influx of visiting anglers attracted by improved fishing conditions. Additional visitors generate increased spending in the local economy.

There are a number of studies that attempt to measure the value of fishery resources. Using LOGIT functions, travel cost analysis, contingent valuation or other methodologies they estimate the value of a fishing day or some other unit of fishery resources. Summaries of the results of several studies are included in Table 1b.

There are a number of problems associated with applying the results of these studies to the estimation of local benefits from improvement in Sacramento River fishery resources. The main difficulty is that the studies are site-specific. Estimates can vary considerably depending on proximity to population centers, species of fish sought, availability of substitute sites, and other factors. The use of the results of a study based on one set of site-specific parameter values to estimate the economic value of fishery resources in an area where parameter values differ substantially can result in significant errors in the estimates. In addition, these studies are measuring the value of an existing fishery resource not the benefits of a change in quality. They are useful for measuring quality changes only if it can be assumed that the incremental value of an improvement in quality is equal to the average per unit value of the existing resource.

**Table 1b**  
**Value of Fishery Resources**

				<b>Value (1998 dollars)</b>	
<b>Study</b>	<b>Date/ Location</b>	<b>Species/ Type</b>	<b>Unit</b>	<b>Net*</b>	<b>Gross**</b>
Charboneau and Hay 1978	1975/U.S.	Trout and Salmon	Per Day	\$75.75	
Creel and Loomis 1992	1989/San Joaquin Valley, California	Fishing	Per Participant Annually		\$165.69 – \$180.16
Englin and Lambert 1995	1989/ Eastern Lakes	Trout	Per trip	\$106.17- \$128.49	\$133.01- \$155.33
Daubert and Young 1975	1978/Colorado	Trout	Per Day		\$29.18 – \$75.88
Gorden, Chapman and Bjornn 1972	1970/Idaho	Salmon	Per Day	\$96.60 – \$142.80	
Gum and Martin 1975	1973/Arizona 1973/Arizona	Cold Water Warm Water	Per Trip Per Trip		\$184.03 \$168.57
Huppert 1989	1985 - ` 86/ California	Salmon and Striped Bass/ Saltwater	Per Day	\$89.23 – \$440.21	
Layman, Boyce and Criddle 1996	1992/Alaska	Chinook Salmon	Per Day	\$17.35 – \$42.66	
Russell and Vaughn 1982	1975/U.S. 1975/U.S. 1975/U.S.	Trout Bass Catfish	Per Day Per Day Per Day	\$33.63 \$29.39 \$21.21	\$73.02 \$64.84 \$48.48
Vaughn and Russell 1982	1979/U.S.  1979/U.S.  1975/U.S. 1975/U.S.	Trout  Catfish  Trout Catfish	Per Day  Per Day  Per Day Per Day	\$24.61 – \$43.76 \$15.72 – \$28.02	\$35.02 – \$54.08 \$23.84 – \$35.99 \$63.63 \$45.45

\* Net Value is the total willingness to pay for the fishery resource minus the cost of the use.

\*\*Gross Value is the total willingness to pay for the fishery resource.

In order to measure the benefits to resident anglers of an increase in quality, it is necessary to estimate the increase in the value of a fishing day and the induced increase in fishing days per year. The local economic contribution by non-resident anglers is estimated as the product of increased visits annually and the impact of local expenditures per visit. There are few existing studies attempting to estimate the parameters needed for establishing the value of quality changes, and, as discussed above, the results are the product of site-specific characteristics and do not necessarily provide accurate estimates where the site characteristics differ. Table 2b includes the results of a number of studies addressing the impact of quality changes. In the individual studies quality is measured as changes in the catch rate, fish populations, fishable river miles, or water quality. For most of the studies, the value of the quality change is measured in dollars per day of fishing activity. In addition, Table 3b contains the results of several studies that focus on the impact of a change in the quality of sport fishing resources on participation by anglers. The results contained in this table are the increase in sport fishing participation in response to an increase in quality, generally defined as an increase in fish caught per fishing day.

**Table 2b**  
**Value of Changes in Quality of Fishery Resources**

<b>Study</b>	<b>Date/ Location</b>	<b>Species/Type</b>	<b>Quality Unit</b>	<b>Value in 1998 Dollars</b>
Faber 1996	1986/ Louisiana	Freshwater	50% decrease in catch rate 75% decrease in catch rate	(\$15.20) per user per year (\$22.59) per user per year
Huppert 1989	1985–86/ California	Salmon, Striped Bass / Saltwater	100% increase in catch rate	\$73.17 per day
Layman, Boyce, and Criddle 1996	1992/ Alaska	Chinook Salmon	100% increase in fish population	\$143.12 per user per year
Phaneuf 1999	1989/ Great Lakes	Rainbow Trout  Salmon	20% increase in catch rate  50% decrease in catch rate	\$8.28 mean willingness to pay per angler per year (\$141.89) mean willingness to pay per angle per year
Sutherland 1982	1979/ Pacific Northwest	Freshwater	Increase in fishable river miles	\$2,155.20 per river mile per year
Taylor and Douglas 1998	1993 – 94/ Trinity River, California	Salmon and Steelhead	\$40% increase in catch rate	\$23.40 - \$57.11 increase in consumer surplus per day.

**Table 3b**  
**Sportfishing Participation in Response to Change in Quality**

<b>Study</b>	<b>Date/ Location</b>	<b>Species/ Type</b>	<b>Quality Unit</b>	<b>Change in Participation</b>
Andrews and Wilen 1988	1976 – 78/ California	Salmon/ Ocean	10% increase in abundance	1.3% - 6.9% increase in annual trips 12.8% - 19.52% increase in catch Greater than 10% increase in catch per trip
Bergstrom et al.1990	1985 – 86/ Louisiana	Freshwater	0.5 additional fish caught per day	48% increase in participation rate
Huppert 1989	1985 – 86/ California	Salmon and Striped Bass/ Saltwater	100% increase in the catch rate	9.8% - 12.4% increase in annual trips per angler
USFWS 1999	1996/ California	Trout	50% increase in water quality	4.6% increase in trout fishing participation by anglers

➤ **The Value of the Sacramento River Fishery to Glenn County Anglers**

According to the Bureau of the Census the population of Glenn County was 26,234 in 1998 and 18,660 county residents were 16 years of age or over. Eleven percent of California's population aged 16 and over engages in sport fishing and the average angler fishes 14.27 days annually (USFWS 96). Therefore Glenn County residents spend a portion of 29,290 days per year ( $18,660 \times 0.11 \times 14.27$ ) fishing. A Survey conducted by the California Department of Fish and Game (DFG) during the 1991-1994 period determined that an average fishing day was 3.27 hours. There was some variation depending on the species sought. A fishing day for striped bass averaged 3.30 hours and for chinook salmon it was 4.28 hours (DFG 1995).

The *National Survey of Fishing, Hunting, and Wildlife- Associated Recreation* (USFWS 1996) provides estimates of daily expenditures by anglers. Expenditures per fishing day for California residents are \$93.56 in 1998 dollars. This is total expenditures which includes both equipment and trip related expenses. The total value of a fishing day to an angler is this amount plus the consumer surplus. The results included in Table 1b show that estimates of consumer surplus (the net value column) can vary considerably depending on location, type of fish sought, and methodology used. For the purposes of this study we use a value of \$20 per day, a relatively conservative figure given the range of estimates. This approach implies that anglers value fishing on the Sacramento River at \$113.56 per day, rounded to \$114 per day for purposes of the benefit calculations performed below.

Fishing days on the Sacramento River by Glenn County residents can be estimated as the total annual fishing days of 29,290 multiplied by the percentage of local fishing done on the Sacramento River. From a survey of local fishing supply and guide businesses we obtained an estimate of 50 to 60 percent. Using this method and the 55 percent average from the survey, adult Glenn County residents spend 16,110 days fishing on the Sacramento River worth \$1,836,483 annually.

The sample data for the current creel survey indicate that 14.7 percent of the fishing days on river reach 5 are by Glenn County residents. If residents fished for 16,110 days annually, that would constitute 34.9 percent of the 1998 fishing days for river reaches 5 and 6. That percentage is not reasonable given the small population of the county relative to those of other counties bordering the river. The following calculations are based on the conservative assumption that Glenn County residents account for 14.7 percent and 0 percent of the fishing days in river reaches 5 and 6, respectively.

➤ **Benefits to Glenn County Residents of Achieving the CVPIA Anadromous Fish Population Goals**

• **Method 1- Constant Value per Fish Caught**

One method commonly used to value a change in quality is based on the assumption that the value per fish caught is constant for all catch rates. While arguably flawed due to the implication that fishing activity is valued for the catch alone, it does provide a benchmark against which the results using other methods can be compared.

The fish population targets for the CVPIA imply an increase in salmon populations of 279 percent over the 1992-1998 average and a 257 percent increase in striped bass populations over the average for the years 1992-1994 and 1996. There is only partial overlap between these averaging years and the years for which creel survey data were collected. We assume that the percentage increases in fish populations are the same (279 percent and 257 percent for salmon and striped bass, respectively) when applied to the weighted average of the catch for the 1991-1994 and 1998 years. Using this approach implies that reaching the CVPIA targets will result in an increase in the annual catch of 19,491 for salmon and 13,122 for striped bass for the Colusa to Red Bluff Diversion Dam portion of the Sacramento River.

**Table 4b**  
**Daily Catch Rates for Salmon and Striped Bass:**  
**Colusa to Red Bluff Diversion Dam**

Species	Catch*	Fishing Hours	Catch/Hour	Catch/Day**
Salmon	34930	661564	0.0528	0.226
Striped Bass	25530	250537	0.1019	0.337

\*Annual catch and fishing hours are from DFG creel surveys for 1991-1994 and 1998.

\*\* Based on 4.28 hours for a salmon fishing day and 3.3 hours for a day of striped bass fishing (DFG 1995)

Using a weighted average of the 1991-1994 and 1998 catch rates yields daily catch rates of 0.226 for salmon and 0.337 for striped bass (Table 4b). Assuming that the value of a fishing day is \$114, catching a single fish of legal size is worth \$504 (\$114/0.226) and \$338 (\$114/0.337) for salmon and striped bass, respectively. Multiplying these values per fish by the increase in catch for each species yields a benefit of \$9,823,464 for salmon and \$4,435,236 for striped bass for a total of \$14,258,700. This represents the annual value, to all anglers using the portion of the Sacramento River between Colusa and Red Bluff Diversion Dam, of the increase in fish populations resulting from achieving the CVPIA goals. The benefits to Glenn County residents are calculated from the days of

fishing by Glenn County residents on the Colusa to Hamilton City portion of the river as a percentage of the total (14.7%) and the proportion of the Colusa to Red Bluff (river reaches 5 and 6) that is between Colusa and Hamilton City (56 percent). Therefore 56 percent times 14.7 percent of the benefits, or \$1,173,776 accrue directly to Glenn County residents annually.

- **Method 2- Based on Huppert's Estimated Value for a Change in the Catch Rate**

Huppert (1989) estimated that a 100 percent increase in the daily catch rate for salmon and striped bass off the central California coast was worth \$73.17 (1998 dollars) in 1985-86. Assuming the values increase proportionately with the percentage increase in catch, a 279 percent increase in the Sacramento River salmon catch is valued at \$204 per day. Using the same method, a 257 percent increase in the striped bass catch is worth \$188 per day to anglers.

Average annual fishing days on the Sacramento River between Colusa and Red Bluff are 30,914 and 15,184 for salmon and striped bass, respectively. Using Huppert's estimates for the change in the value of a fishing day yields an increase in the annual value of salmon fishing of \$6,306,456 and an increase in the annual value of striped bass fishing of \$2,854,592. For this method the total benefits of a change in fishery resource quality is \$9,161,048, 8.2 percent (56%x14.7%), or \$754,137 of which accrues directly to adult Glenn County resident anglers.

- **Method 3- Based on the Value of an Increase in the Catch Rate for Salmon and Steelhead on the Trinity River (Taylor and Douglas 1998)**

Using the contingent valuation method based on survey data collected during 1993-1994, Taylor and Douglas determined that a 40 percent increase in the catch rate for salmon and steelhead was worth between \$23.40 and \$57.11 per day to anglers using the Trinity River (Table 2b). Taking the midpoint of \$40.26 per day, and extrapolating to a 268 percent increase (the average of 279 percent for salmon and 257 percent for striped bass) yields a value of \$270 per day for achieving the CVPIA fish population goals on the Sacramento River. For the 46098 fishing days on the river between Colusa and Red Bluff the value of the increased catch rate is \$12,446,460, 8.2 percent (56%x14.7%), or \$1,024,593 of which accrues directly to adult anglers residing in Glenn County.

**Table 5b**  
**Summary of Estimated Values for Changes in the Salmon and Striped Bass Catch on the Sacramento River Between Colusa and The Red Bluff Diversion Dam**

Method/Basis	Annual Value
1/ Constant Value per Fish Caught	\$14,258,700
2/ Huppert 1989	\$9,161,048
3/ Taylor and Douglas 1998	\$12,446,460

➤ **Comparison of Methods 1- 3**

Each of the three methods of valuation is subject to some criticism. The first method assumes that each fish landed by an angler has the same value, independent of the number caught. While the estimates obtained using the second method are based on values for salmon and striped bass, the value for a change in the catch rate is for ocean fishing. The third method is based on estimated values for a change in river populations of salmon and steelhead, but the survey data were collected for the Trinity River and the value estimates were for a 40 percent change in fish populations. The 268 percent increase in Sacramento River anadromous fish populations is 6.7 times the change used in the Trinity River study and the estimates are based on the assumption that benefits to Sacramento River anglers are 6.7 times those obtained in the Trinity River survey.

Despite the methodological shortcomings of the three valuations presented here, it is our opinion that they are the best estimates available. However, the estimated benefits are not inclusive of all factors since they do not account for variation in angler effort. The enhanced catch rate raises the value of a fishing day, but also induces anglers to engage in sport fishing activity for more days per year. The following section examines angler response to quality changes and the implications for valuing the Sacramento River fishery resource.

➤ **The Benefits to Glenn County of Increased Resident and Non Resident Sport Fishing Use of the Sacramento River**

An increase in the catch rate for salmon and striped bass will have a positive impact on angler use of the Sacramento River fishery resource. Table 3b includes a number of estimates of angler response to quality changes. The Table 6b entries are based on the responsiveness estimates from Table 3b but are for a 268 percent increase in the daily catch (the average of 279 percent for salmon and 257 percent for striped bass. The estimates range from a low of 26.3 percent to a high of 185 percent.

**Table 6b**  
**Increase in Angler Use of a 268 Percent Increase**  
**In the Catch Rate**

<b>Study</b>	<b>Percent Increase in Angler Use</b>
Andrews and Wilen 1988	34.8% to 185.0%
Bergstrom, et al 1990	60.5 % (Salmon)*
	83.5 % (Striped Bass)*
Huppert 1989	26.3% to 33.2 %

\* Calculated using an increase in the daily catch rate of 297% for salmon and 257% for striped bass.

The high degree of variability in the estimates is explained by differences in accessibility and availability of information. In the Andrews and Wilen study, angler effort was more responsive to increases in the catch rate where use included a greater proportion of local anglers. The same conclusion is reached when anglers reside near the fishery utilized, presumably receiving timely information regarding fishing conditions and being able to respond to quality changes. The lower percentage response for some ports was due to use by anglers traveling significant distances and whose use is thus more likely constrained by employment obligations. The mix of residents and nonresidents also explains the relatively low response rates in the Huppert (1989) study. In that study nonresident anglers traveling significant distances constituted a large share of the sample.

For the case of changes in Sacramento River use due to catch rate changes, it is likely that angler response is towards the high end of the estimates, particularly for resident anglers. For purposes of this study a 50 percent increase in angler use is assumed, a conservative figure given the range of estimates. Table 7b summarizes the benefits to adult Glenn County anglers based on the three methods presented in Table 5b.

**Table 7b**  
**The Annual Value to Glenn County Resident Anglers of Achieving the CVPIA**  
**Targets for Anadromous Fish Species**

<b>Method</b>	<b>Value (constant use)</b>	<b>Value (50% increase in use)</b>
1	\$1,173,776	\$1,760,664
2	\$754,137	\$1,131,206
3	\$1,024,593	\$1,536,890

Nonresident anglers also receive benefits from the use of an improved Sacramento River fishery. However, the benefits to nonresidents are not benefits to Glenn County. The local benefits are due to the expenditures in the county by visitors and are significantly less than the value to visiting anglers. Most equipment purchases are likely to take place in the angler's county of residence. Trip related expenditures for visiting anglers are \$39.40 per day (USFWS 1996).

The sample data from the creel survey allowed us to identify the origin of the anglers using river reach 5. It was determined that 14.7 percent were Glenn County residents. Another

45.6 percent were residents of towns east of the river between Marysville and Red Bluff and who are more likely to access the river from the Butte County side. The remaining 39.6 percent were visitors likely to approach the river using the I-5 corridor, therefore passing through Glenn or Colusa Counties (DFG 2000b). Sixty-three percent of the western bank of river reach 5 is in Glenn County. The annual use by visiting anglers accessing the river (river reach 5) through Glenn County is 6440 (46098X0.56X0.396X0.63) days. A 50 percent increase in use implies an increase of 3220 visitor days annually.

The daily trip related expenditures for visiting anglers are detailed in Table 8b. They are assigned to the appropriate IMPLAN sector for the purpose of estimating the indirect and induced impacts on county output. The \$126,868 in spending due to the additional 3220 annual visitor days will generate a total increase in county output of \$157,778.

**Table 8b**  
**Daily Trip Related Expenditures by Visiting Anglers**

Category	Amount	IMPLAN Sector
Food	\$9.67	454
Lodging	\$3.27	463
Transportation	\$8.84	451
Boat Related	\$14.45	488
Other	\$3.16	455
Total Trip Related	\$39.40	

### **The Economic Value of Wildlife Watching**

In the *National Survey of Fishing, Hunting and Wildlife-Associated Recreation* (USFWS 1996) nonresidential wildlife watching is defined as those activities involving “trips or outings at least one mile from home for the primary purpose of observing, photographing, or feeding wildlife” (USFWS 1996). According to the survey, ten percent of California’s population aged 16 and over engages in nonresidential wildlife watching for an average of 8.2 days per year in their state of residence. Daily expenditures including trip and equipment costs average \$101.27 in 1998 dollars.

Assuming Glenn County resident interest in wildlife watching is represented by the state average, 2623 adult county residents engage in that activity for a total of 21509 days annually, spending \$2,178,216 each year. The value of wildlife watching is then the amount spent plus the consumer surplus. The only estimate we could locate for consumer surplus associated with wildlife viewing was based on a 1988 survey of refuge visitors engaged in bird watching in the San Joaquin Valley (Cooper and Loomis 1991). They estimated that for then current conditions visitors were willing to pay \$154.32 annually (in excess of trip costs) for three trips per year. Dividing by 8.2 days per participant annually results in an estimate of \$18.82 (1998 dollars) for daily consumer surplus or \$404,789 annually for Glenn County residents. The total value is the sum of annual expenditures and annual consumer surplus, or \$2,583,004 per year in 1998 dollars. Alternatively, equating value per trip with value per day results in a calculated daily consumer surplus of \$51.44 and annual benefits to adult Glenn County residents of \$3,284,639.

### ➤ **Wildlife Watching on the Sacramento River**

There are a number of avian species found in the riparian cottonwood and willow thickets along the Sacramento River and other valley streams. The Western Yellow-Billed Cuckoo, Western Least Bittern, Least Bell's Vireo, California Yellow Warbler, and the wood duck are the species of particular concern affected by the availability of riparian habitat (CALFED 1999). Additional avian species can be observed in the area including various species of waterfowl, raptors, and songbirds. Mammals commonly seen near the river include opossum, beaver, muskrat, skunks, and a variety of rodents. Less common, but likely to be of interest to wildlife watchers include ringtail, fox, river otter, mink, and spotted skunk. There are also a number of reptile and amphibian species indigenous to the area. Those species frequently observed include the Western pond turtle, Western yellow-bellied racer, common garter snake, American bullfrog, and Western fence lizard. Among the species seen less frequently are the king snake, gopher snake, Western aquatic garter snake, and pacific tree frog.

In spite of the variety of species residing along the Sacramento River for at least a portion of the year, there is no concrete evidence that it is an important wildlife viewing area. Conversations with the individuals in the DFG involved with collection of data for the creel surveys indicate that there are very few boats on the river other than those whose operators were involved in fishing activity. Since riparian habitat along the Sacramento River is inaccessible in most areas except by boat, it is reasonable to assume that the DFG information implies little wildlife viewing (as the primary purpose of the visit) is taking place on the river. A 1980 survey of recreational use of the Sacramento River listed the major activities on various sections of the river. The activities were listed according to the percentage of recreation days spent and included fishing, swimming/beach use, picnicking, canoeing, rafting/tubing, camping, relaxing, and pleasure boating/water skiing. For the Hamilton City Bridge to Meridian Bridge section of the river, activities were listed involving as little as three percent of the recreation days (DWR 1982). However, a wildlife watching category was not mentioned, presumably because that was not the primary purpose of a significant number of recreation users. We also contacted local members of the National Audubon Society and were unable to verify the existence of a significant amount of wildlife viewing along the Sacramento River. There are a few individuals and groups conducting wildlife viewing trips on the river, primarily on spring and summer weekends, but at this time they involve fewer than 1000 visitor days annually. The departure locations for these trips are Scotty's Landing and Woodson Bridge and thus these visitors have little or no economic impact on Glenn County. Apparently due to the proximity to a number of wildlife refuges, most local wildlife viewing activity takes place outside of the river's riparian corridor.

While the preceding discussion does not imply that wildlife viewing is unimportant to recreational river users, it does imply that it was not the primary purpose of their visit. It enhances the value of other activities through improving aesthetic aspects of river recreation. That effect is likely to be captured in the estimates of quality changes for the other activities. For example, the significant increase in the value of the fishery resource when the catch rate is increased is probably, in part, the product of general environmental quality changes associated with the increase in fish populations. The fishing experience is

enriched by the broader effects of habitat restoration, not simply because there are more fish to catch.

➤ **Valuation of Wildlife Watching on the Sacramento River Using Visitor Data from Existing Area Refuges**

The six national wildlife refuges included in the Sacramento National Wildlife Refuge Complex cover approximately 24,000 acres of grassland, marshes, ponds, seasonal wetlands, and riparian habitat bordering the Sacramento River. Visitation numbers for existing refuges may be indicative of the wildlife viewing potential of a restored river floodplain. The plan for habitat restoration includes a 100-yard corridor along the river linking larger “blocks of riparian habitat, typically greater than 50 acres” (CALFED 1999). The restored habitat is likely to support a mix of plant communities, and, avian, mammalian, reptilian, and amphibian species as varied as those contained in the present refuge system. Assuming an equivalent degree of accessibility (an issue not as yet resolved), future wildlife watching activity can be represented by current refuge visitor data. However, since there is likely to be some substitutability among various wildlife watching areas, the results obtained using this approach can be best interpreted as the maximum value of wildlife viewing activity for residents in the restored riparian habitat. Substitution of one viewing area for another is less of a factor for nonresident visitors. The overall increase in availability of wildlife viewing opportunities is likely to draw additional visitors, not simply induce a shift from one area to another.

We tabulated visitor data from the Sacramento Wildlife Refuge near Willows in Glenn County. The data were separated into three visitor categories: Glenn County residents, visitors from communities on the eastern side of the river between Red Bluff and Marysville, and other out of county visitors. This classification differs from the local designation used for data collection by the refuges. For their purposes local is defined as any visitor who resides in the Sacramento Valley between Redding and Sacramento. However, in order estimate wildlife viewing benefits to Glenn County residents we needed to classify those refuge users as a separate category. For wildlife habitat along the Sacramento River it is reasonable to assume that visitors would access the river from the Glenn County side if they traveled along Interstate 5. That would include all nonresident visitors except those from the eastern valley and foothill communities between Marysville and Red Bluff.

Vehicle occupants entering the Refuge register in the guest book indicating their home address and the number of passengers. The Visitor count is based on the total number of passengers. However, for purposes of estimating the value of wildlife watching activities we need to know the number of visitors 16 years of age and over. That is because the data for visitor expenditures provided by the *National Survey of Hunting, Fishing, and Wildlife-Associated Recreation* (USFWS 1996) are for participants 16 years of age or older. We assumed no more than two adult occupants per vehicle. Using this approach we determined that adult county residents used the Refuge 99 days annually. Adult visitors likely to access the Refuge using Interstate 5 (and therefore through Glenn County) are estimated to spend 2,867 days per year at the facility.

➤ **The Value of Changes in Quality**

Non-consumptive wildlife recreation has received little attention in the literature despite the fact that participation exceeds that of hunting and it is nearly as popular as freshwater fishing. We could locate only two studies that addressed the impact of quality changes on the value of wildlife viewing. Both studies were based on data collected during 1988-89 for visitors to San Joaquin Valley sites. In a 1992 study Creel and Loomis estimated fishing and wildlife viewing values for an improvement in water quality. For the two models used the estimated benefits were between \$28.93 and \$30.36 (1998 dollars) per wildlife watching participant annually. In a 1991 study Cooper and Loomis provided estimates for the value of a quality change, defining quality in terms of the number of birds observed per visit. They determined that a 50 percent increase in bird populations was worth \$31.74 per participant annually, while a 100 percent increase had an annual value of \$38.64. The annual values estimated in these studies were based on three wildlife viewing trips per year. Assuming the value per day is equivalent to the value per trip yields a daily value for quality improvements ranging from \$9.65 to \$12.87 in 1998 dollars.

A 1982 study of general recreation along the Sacramento River found that the presence of anadromous fish species increased the value of a day's use for all visitors. The survey compared the value hypothetically with no viewable anadromous species and with the same species visible. The presence of visible fish increased the value of a recreation day by \$20.27 in 1998 dollars (Meyer Resources 1985).

The estimates of the value of a change in quality are indicative of the additional benefits received by existing participants in an activity. In the case of wildlife viewing on the Sacramento River our research shows little current activity. Therefore, the value of wildlife viewing to Glenn County is determined as the sum of the value of projected use to local residents and the impact of added local spending by visitors from outside the area.

From the refuge data presented in the preceding section we project 99 days of use annually by Glenn County residents. Using a value per day of \$120 (average daily expenditures plus daily consumer surplus of \$18.73) results in calculated annual benefits to resident wildlife watchers of \$11,880 dollars annually. The refuge data also provide a means for estimating the number of annual visitor days by nonresident wildlife watchers. Projecting that the restored habitat will generate 2,867 visitor days per year and using trip related expenditures of \$44.11 per day implies that visitors traveling to the area for purposes of viewing wildlife will directly inject \$126,463 dollars into the Glenn County economy annually. Including the indirect and induced effects the IMPLAN model projects a total impact on annual Glenn County output of \$162,998. Table 9b contains the direct expenditures by category and IMPLAN sector used to determine the output effects.

**Table 9b**  
**Daily Trip Expenditures by Those Visiting for Purposes of Viewing Wildlife**

Category	Expenditures	IMPLAN Sector
Food	\$20.96	454
Lodging	\$6.73	463
Transportation	\$12.26	451
Other	\$4.17	488

<b>Total</b>	\$44.11	
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### **The Economic Value of Hunting**

In 1996 2.17 percent of California's adult population hunted instate an average of 14.47 days annually. Expenditures including equipment and trip related costs averaged \$119.18 per day in 1998 dollars (USFWS 1996). The state percentages imply that there are 569 hunters in Glenn County who annually spend \$981,260 on that recreational activity. The value of hunting to local participants is the sum of expenditures and consumer surplus. Cooper and Loomis (1993) estimated consumer surplus for waterfowl hunting in the San Joaquin Valley. The values varied according to site and methodology, ranging from \$21.56 to \$36.17 per trip in 1998 dollars. Using the average value of \$28.87 per trip and assuming that for local hunters trips are for one day, consumer surplus for Glenn County hunters is \$237,699 and the total value of hunting activity for adult county residents is \$1,218,959.

#### ➤ **Hunting on the Sacramento River**

Relatively little of the hunting activity in the Sacramento Valley is within the river's riparian corridor. While there is some hunting for waterfowl, dove, pheasant, and other small game, it appears to be a small percentage of resident hunting activity. More importantly, there is a low probability that habitat restoration in the riparian corridor will increase either the daily value or the participation rate. Hunting already occurs on private land, and, absent any plans to make public lands within the SRCA accessible to hunters, frequency of use may decrease with additional public land acquisition. There will be an increase in populations of certain species, yet limited accessibility precludes any significant contribution to the value of hunting activities. While there may be a positive impact on the value of existing and potential duck clubs adjacent to the newly created refuge, this effect is difficult to measure. In addition, it is not clear how much of this possible increase in value constitutes a benefit to local residents or to the local economy. For purposes of this study we assume that no benefits accrue to local hunters, no additional visitors will be attracted by changes in hunting conditions, and local expenditures for hunting activity will be unaffected.

#### **The Economic Value to Non-Users**

Benefits from habitat restoration also accrue to residents who do not engage in recreational resource use. The environmental economics literature categorizes non-user benefits as existence, bequest, altruistic, option, and ecological services values. It is impossible to separate non-user value into its various components, however, there have been attempts to estimate overall non-user valuation of resource quality changes. Two studies provide estimates of the amenity value of wetlands preservation. The 1998 dollar values range from \$287 to \$520 per acre (Whitehead 1994). Using an interest rate of seven percent gives a perpetual annual value per acre of \$20.09 to \$36.40.

In the 1999 Taylor and Douglas study of the value of water flow increases in the Trinity River, the values for a resource quality change were estimated for various categories of recreational users, as well as for households classified as non-users. The value per household for a 40 percent increase in stream flow was estimated as \$48.97 annually for non-users. For non-users willingness to pay increased by 200 percent for the 40 percent

increase in stream flow. The projected benefit increases for non-users were 26.8 percent of the benefits received by all categories of recreational resource users.

In 1998 there were 9,120 households in Glenn County and 75 percent were classified as non-users of recreational resources for hunting, fishing, or wildlife watching (USFWS 1996). The Taylor and Douglas estimates imply non-user benefits of \$334,955 annually. Alternatively, using the average annual amenity value for an acre of wetlands of \$28.25 and assuming 8,000 acres of restored or preserved habitat in the SRCA is located in Glenn County yields an estimate for non-user benefits of \$225,960 per year.

**Summary of Recreational and Non-User Benefits**

Table 10b contains the estimated values for all recreational and non-user benefits to the Glenn County economy and residents. Fishing, wildlife watching, and non-user benefits are included for residents, while output effects are provided for visitor expenditures. Visitors are categorized as anglers or wildlife watchers according to the primary purpose of the visit.

**Table 10b**  
**Summary of Annual Recreational and Non-User Benefits for**  
**Glenn County Residents and the Economy**

Category	Annual Benefits to Glenn County
<b>Resident Benefits</b>	\$1,369,046-\$2,107,499
Fishing	\$1,131,206-\$1,760,664
Hunting	\$0
Wildlife Watching	\$11,880
Non-Users	\$225,960-334,955
<b>Impact of Visitor Spending</b>	\$320,776
Fishing	\$157,778
Wildlife Watching	\$162,998
<b>Total Benefits to Glenn County</b>	\$1,689,822-\$2,428,275

## **The Future Value of Recreational and Other Environmental Benefits**

### **➤ Population Growth and the Future Value of Recreational Activities**

For purposes of projecting future benefits it is assumed that a constant percentage of the population participates in fishing and wildlife watching activities. Between 1980 and 1990 the percentage of the Pacific region population (over the age of six) engaged in fishing activity increased slightly from 25.2 to 25.3 percent. Between 1991 and 1996 there was a one percent decrease in the participation rate for adult anglers. For non-consumptive wildlife activities away from home the participation rate of the Pacific region population aged six and over increased from 13.7 percent to 17.7 percent between 1980 and 1990. But between 1991 and 1996 the percentage of the Pacific region adult population engaged in nonresidential wildlife watching declined from 17 percent to 11 percent (USFWS 1996). There is no clear trend in participation rates for either recreational activity. In addition, assuming any constant rate of increase (decrease) in participation rates will eventually lead to the unreasonable result that 100 percent (0 percent) of the population participates in wildlife associated recreational activities.

### **➤ Income Growth and the Future Value of Recreational Activities**

Generally income effects are not a major concern in recreational demand studies. Price elasticity of demand is the critical variable for determining the value of recreational activities and factors affecting trip cost are the focus. For those studies that do use an income variable it is added as a component of travel costs. A certain percentage of the wage rate is included as the opportunity cost of travel (ordinarily 30 percent of the hourly wage rate per hour of travel time). Recreational demand was found to be relatively insensitive to income for those studies where an explicit income variable was included. In some cases the coefficient of income was negative for certain activities. Russell and Vaughn determined that increases in income were negatively correlated with bass fishing participation (Russell and Vaughn 1982). A contrasting result was obtained in another study for general wetlands based recreation. The authors found that participation in a broad range of recreational activities in the Gulf Coast wetlands of Louisiana was strongly and positively affected by income (Bergstrom, et.al. 1990). But, for most studies income sensitivity of recreational participation, particularly for freshwater fishing activity, was found to be weakly positive or not significantly different from zero (Englin and Lambert 1995, Layman, Boyce, and Criddle 1996, Vaughn and Russell 1982). However, the studies discussed here considered the effect of income on participation rates, not on the value of the activity per participant. The primary implication is that rising income will have no effect on the participation rate, thus reinforcing the assumption of the previous section that, over time, a constant percentage of the population will participate in wildlife associated recreation.,

Between 1965 and 1985 real expenditures per freshwater fishing participant increased by 71.2 percent (USFWS 1996). During that period per capita Real GDP increased by 50.1 percent. The implication is that the real income elasticity of demand for freshwater fishing is equal to 1.42 ( $71.2/50.1$ ) and each one percent increase in real income will induce a 1.42 percent increase in real spending on that activity. Lacking expenditure data specific to wildlife watching we use the same 1.42 elasticity of demand estimate for that activity.

### **➤ Determinants of the Future Value of Recreational Benefits**

Recreational benefits increase at a rate that is a function of the rate of growth in per capita real income, the rate of inflation, and the rate of population growth. Resident benefits are projected using forecasted growth rates for Glenn County's population and income. In order to project growth in visitor expenditures, expected future increases in California's population and income are used. There are a number of forecasts of county and state population growth. The California Department of Finance projects that between 2000 and 2040 the annual rate of population growth for the state at 1.33 percent and for Glenn County at 2.38 percent (DOF 1998). The Center for the Continuing Study of the California Economy (CCSCE) forecasts state population growth through 2010 of 1.54 percent annually and for Glenn County, 2.02 percent per year (CCSCE 2000). Another county level forecast is published by Woods and Poole Economics (W&P). W&P project annual rates of population growth through 2025 for the state and county of 0.93 and 0.42, respectively (W&P 2000). For purposes of estimating future resident benefits and visitor expenditures we assume annual rates of population growth equal to the average of the high and low estimates. For Glenn County the annual rate used is 1.40 percent, while for the state we use a rate equal to 1.24 percent.

Estimates of the annual growth rate in real per capita personal income also vary widely. The Bureau of Economic Analysis (BEA) estimates that California per capita income will grow at a 0.73 percent annual rate through 2045 (USBEA 1995). CCSCE estimates growth at an annual rate of 1.92 percent through 2010, while W&P offer a more moderate forecast of 1.32 percent annual growth in per capita income through 2025. The W&P and CCSCE estimates of annual growth in Glenn County per capita income are 1.32 percent and 1.83 percent, respectively (CCSCE 2000, W&P 2000). Again, taking the average of the projection extremes yields annual growth in per capita income for the state of 1.33 percent and 1.58 percent for Glenn County.

Per capita real benefits for Glenn County residents are projected to rise at an annual rate equal to 1.42 times the rate of increase in county real per capita income, or 2.24 percent per year. Real expenditures per visitor are projected to increase at a rate equal to 1.42 times the growth rate of California real per capita income, or 1.89 percent per year. Accounting for county population growth, and, assuming a constant percentage of the population participates in wildlife associated recreational activities, implies a 3.67 percent annual rate of increase in real (constant dollar) benefits to local residents. Assuming a uniform inflation rate of 2.5 percent implies that nominal or current dollar benefits are projected to increase at a 6.26 percent annual rate. With a constant participation rate, visitor expenditures increase at a rate that depends on the annual percentage change in California's population. The resulting annual rate of increase in visitor expenditures is 3.15 percent in constant dollars, or 5.73 percent in nominal dollars.

**Table 11b**  
**Components of the Rate of Increase in Resident Benefits**  
**And Visitor Expenditures (Constant Dollars)**

(1) Geographic Unit	(2) Annual Growth in per Capita Income	(3) = 1.42 times (2)	(4) Annual Rate of Population Growth	(5)* Annual Rate of Growth in Benefits or Visitor Expenditures
<b>Glenn County</b>	1.58%	2.24%	1.40%	3.67%
<b>California</b>	1.33%	1.89%	1.24%	3.15%

\* Column 5 is approximately equal to the sum of columns (3) and (4), but column (5)=[1+column (3)][1+column (4)]-1

**Non-Recreational Benefits**

➤ **Savings on Public Facilities**

Following completion of public land acquisition in the SRCA Glenn County will potentially benefit from reduced costs of road maintenance. The Glenn County Director of Public Works identified the county roads within the SRCA that are eligible for abandonment. Due to their exposure to periodic flooding these roads tend to have higher than average maintenance costs. The high maintenance costs imply that the state funding, which is allocated based on miles of county roads, is not sufficient to cover the full costs. The savings to the county per mile of road are equal to the difference between county costs and state funding. Multiplying by the number of miles of affected road yields the benefit to Glenn County.

➤ **Reductions in Flood Damage Costs to Residents**

The creation of the SRCA will reestablish the dynamic river processes that cause the periodic destruction and creation of land along the Sacramento River. The continuation of farming on lands adjacent to the river exposes landowners to the risk of economic loss as erosion is the result of the natural meander process. Levees and other bank protection measures limit erosion, but they do not eliminate it entirely. While land destruction in one place is largely offset by land creation in another, the created land and the instability of the dynamic process make this added land unsuitable for permanent agriculture in the foreseeable future.

Additional flood protection benefits are provided through the preservation and restoration of riparian vegetation. A report published in 1978 "identified 38 riparian vegetation sites totaling 4,100 acres that serve a flood control function by contributing to the overall stability of the Sacramento River and its overflow areas between Tisdale Weir and Hamilton City". Vegetation lowers peak flow velocities lessening erosion to riverbanks and levees and reducing sedimentation of downstream facilities (SRCA 2000).

Public land acquisition and preservation of riparian habitat in the SRCA thus provide landowners with compensation for the risk of economic loss due to erosion or a direct

reduction in exposure to flooding. Estimating the value of reduced exposure to flooding is beyond the scope of this report. The benefit estimates in this section are for the implied compensation for potential flood losses accruing to willing sellers through public land acquisition. The benefits afforded landowners are private unless the compensation is paid to local residents. Where local residents are the beneficiaries of the payments, the impact on the local economy is due to the implicit income increase.

Flood loss estimates are based on data for the 1986, 1995, and 1998 flood events. The dollar value of crop losses is derived from projections by the Glenn County Department of Agriculture (GCDA 1986, 1995, 1998). Where production losses were offset by significant commodity price increases and crop value was unchanged or increased for the year, it is assumed that no losses occurred. Since 40 percent of the deciduous orchards are located in the SRCA, 40 percent of the losses in fruit and nut production, as well as losses due to tree damage, are allocated to those lands. Other crop and erosion losses are assumed to occur uniformly over all Glenn County cropland (excluding range land and pasture). While this approach tends to bias the loss estimates in a downward direction, it was necessary due to the availability of data on a countywide basis only. In addition, the data do not contain separate estimates for damage due to flooding and rainfall, thus making it impossible to assign all estimated losses to flood prone lands.

The floods of 1986 caused an estimated \$7.25 million in damage to Glenn County agriculture. The largest impact was on the almond crop with \$3.0 million in production losses and tree damage (GCDA 1986). The change in personal income in agriculture from 1985 to 1986 and 1986 to 1987 is much larger than the estimated damage, indicating that the estimate may be too low. County agricultural income in 1986 was \$17.62 million and \$28.71 million below personal income in agriculture for 1985 and 1987, respectively (CED 2000). Based on historical rainfall patterns a flood event of that magnitude can be expected every 5.45 years (23 to 34 inches of rain annually measured at Willows) (GCDA 1999). Peak flow data from gauges near Hamilton City and Butte City imply that a similar flood event can be expected every five years.

The 1995 floods caused an estimated \$27.75 million in damage to Glenn County crops and land, where \$22.5 million was the estimated value of lost almond trees. Production losses in prune orchards and damage to almond orchards were responsible for \$10.53 million of the \$19.39 million in estimated agricultural losses in the 1998 flood. The average loss in orchards for the 1995 and 1998 flood events was \$16.52 million, while other agricultural losses averaged \$7.01 million. These estimates are consistent with the loss in personal income in agriculture for 1995 (county income by industry is not yet available for 1998 and 1999). In 1995 personal income in agriculture was \$16.55 million and \$26.53 million below the respective levels for 1994 and 1996 (CED 2000). The conditions leading to the 1995 and 1998 flood events can be expected to occur once every thirty years (annual rainfall at Willows of at least 34 inches) (GCDA 1999).

Based on this analysis the expected annual flood loss in deciduous orchards in Glenn County is \$30.73 per acre and other crop losses and land damage average \$6.18 per acre. With a mix of 52.5 percent deciduous orchard and 47.5 percent other, the expected annual flood losses on a per acre basis for landowners in the SRCA is \$22.31 ( $\$6.16 + 0.525 \times \$30.73$ ). Public acquisition of flood prone lands generates an annual benefit of \$22.31 per

acre purchased. Where the previous landowner is a county resident the annual amount is a benefit to Glenn County as well.

An alternative measure of flood losses can be derived from data for agricultural production and personal income for the agricultural sector (Glenn 1999, CED 2000). Using this approach we assume that flood losses are equal to the difference between agricultural production (excluding livestock and livestock products) in the flood year and the average for the preceding and following years. The decrease in agricultural production for 1986 is \$23,165,000, while the average loss for the 1995 and 1998 flood events is \$36,904,000. Based on the assumed probabilities for the two flood events, and, allocating the losses over the 163,993 acres of cropland in Glenn County, yields an estimated annual loss of \$31.60 per acre. If the losses are allocated to only those lands in the FEMA 100-year floodplain (11,622 acres in agriculture within the SRCA), the calculated income reduction is \$445.89 per acre. Per acre losses are likely to be even higher for land exposed to more frequent floods such as properties within the meander zone. For example, virtually all of the land within the setback levees and below river mile 174 is inundated at least one in four years (SRAC 2000).

Other data support the use of the \$31.60 per acre estimate. Between 1997 and 1998 the average value of walnut production in Glenn County decreased by \$919, or 48 percent (Glenn County 1999). For a sample of parcels abutting the Sacramento River production decreased by \$552 per acre, or 46 percent between 1997 and 1998 (TNC 2000a). It might be that most of the output loss is not due to flood damage, but rather the result of untimely rainfall. In that case proximity to the river is not the major determinant of production decreases experienced in flood years.

#### ➤ **Value of Water Freed up Following Habitat Restoration**

Removing land from agricultural use frees up water for other uses within the county or for sale to consumers in other areas of the state. During the habitat restoration process water use is unaffected. After three years the restored habitat is no longer irrigated. At that point the amount of water freed for other uses depends on what agricultural crops were removed. Additional water available is equal to the amount used before conversion to riparian habitat less the amount used by the restored riparian vegetation. For deciduous orchards water use averages 3.5 acre-feet per acre annually. Annual use for improved pasture is 4.5 acre-feet per acre, while alfalfa averages 4.7 acre-feet per acre (DWR 1998). For this portion of the study we assume that all orchards use 3.5 acre-feet per acre while all other crops average 4.5 acre-feet per acre. The value of the water is assumed to be \$32 per acre-foot in 1996 dollars increasing at the average rate of inflation. The assumed value corresponds to the highest or marginal value for a unit of water in the Sacramento Valley region (DWR 1998).

#### **Non-Recreational Benefits Excluded from the Benefit Totals**

The benefit totals used in the cost-benefit section of this study do not include estimates for savings on public facilities, compensation for flood damages, or the value of water freed up. This omission has little impact on the net benefit calculations included in the next section of this report since the dollar amounts are small relative to the recreational benefit estimates. In addition there are some problems in interpreting each of the excluded categories of benefits. In the case of the savings on public facilities, data on maintenance costs for flooded roads were not available. Had the information been available

interpretation would have been ambiguous since the cost of road maintenance is both a dollar cost to the county and a boost to local economic activity. Interpretation of flood losses is also difficult since there is no way to determine whether or not the effect on land productivity is factored into the purchase price when public acquisition occurs. The value of water freed up by removing land from irrigation is excluded, in part because the amount of water saved in converting from agriculture to riparian habitat is unknown.

### **Non-Recreational Benefits Included in the Benefit Totals: Expenditures for Habitat Restoration**

Active restoration of habitat is assumed to occur on 60 percent of the lands converted from agricultural use. That is the current practice, but because of problems with invasive, non-native species, an increase to 75 percent is being considered (Vega 2000). It is assumed that passive restoration is the method of choice on the remaining 40 percent of lands previously in various agricultural uses. For all land currently in riparian or other native vegetation, we assume that no additional expenditures are undertaken in association with preservation or enhancement of existing habitat.

The effect of habitat restoration is different from the other factors included in the benefit estimates. That is because the primary impact is one-time, generated only for the three years during which each restoration project is active. This is in contrast to the estimated recreational and non-user benefits. These benefits are ongoing and accrue to county residents every year following habitat and fishery restoration. The annual impact on Glenn County output and employment due to habitat restoration thus depends on the amount of spending and the time period over which the spending occurs.

For the base case there are 5,553 acres currently in agricultural production (as of 1994) that are targeted for conversion to riparian habitat. Active restoration is assumed to occur on 60 percent of those lands, or 3,332 acres. In discussions with those involved in restoration activities it was determined that the per acre cost is \$4,500 with 30 percent of the direct output effects occurring in Glenn County. The direct impact on Glenn County output totals \$4,497,978 for all restoration activities assumed for the base case. Table 12b and 13b contain the direct, indirect, induced, and total impacts by sector on Glenn County output and employment, respectively.

**Table 12b.**  
**Direct, Indirect, Induced, and Total Impacts on Glenn County Output**  
**from Restoration of Riparian Habitat on 3,332 Acres (By Sector in 1997\$)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Total</b>
<b>1</b>	<b>Agriculture</b>	4,497,978	248,658	16,391	4,763,028
<b>28</b>	<b>Mining</b>	0	9	2	11
<b>48</b>	<b>Construction</b>	0	44,521	13,673	58,194
<b>58</b>	<b>Manufacturing</b>	0	31,117	20,935	52,053
<b>433</b>	<b>TCPU*</b>	0	55,989	31,146	87,135
<b>447</b>	<b>Trade</b>	0	73,410	193,727	267,137
<b>456</b>	<b>FIRE**</b>	0	41,158	174,276	215,434
<b>463</b>	<b>Services</b>	0	101,598	152,329	253,927
<b>510</b>	<b>Government</b>	0	10,787	25,637	36,425
<b>516</b>	<b>Other</b>	0	0	3,218	3,218
<b>30001</b>	<b>Institutions</b>	0	0	0	0
<b>Total</b>		4,497,978	607,248	631,335	5,736,561

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

**Table 13b.**  
**Direct, Indirect, Induced, and Total Impacts on Glenn County**  
**Employment from Restoration of Riparian Habitat on 3,332 Acres (By Sector)**

<b>I-O #</b>	<b>Industry</b>	<b>Dire ct</b>	<b>Indir ect</b>	<b>Indu ced</b>	<b>Total</b>
<b>1</b>	<b>Agriculture</b>	188.4	3.7	0.2	192.3
<b>28</b>	<b>Mining</b>	0	0.0	0.0	0.0
<b>48</b>	<b>Construction</b>	0	0.7	0.2	0.9
<b>58</b>	<b>Manufacturing</b>	0	0.4	0.1	0.5
<b>433</b>	<b>TCPU*</b>	0	0.5	0.3	0.8
<b>447</b>	<b>Trade</b>	0	1.2	5.4	6.6
<b>456</b>	<b>FIRE**</b>	0	0.4	0.8	1.2
<b>463</b>	<b>Services</b>	0	2.7	3.4	6.1
<b>510</b>	<b>Government</b>	0	0.2	0.3	0.6
<b>516</b>	<b>Other</b>	0	0.0	0.5	0.5
<b>30001</b>	<b>Institutions</b>	0	0.0	0.0	0.0
<b>Total</b>		188.4	10.1	11.1	209.5

\* Transportation, communications, and public utilities.

\*\* Finance, insurance, and real estate.

For the life of the habitat restoration projects Glenn County output and employment are increased by \$5,736,561 and 209.5 jobs, respectively. The agricultural sector receives the majority of the stimulus with 83 percent of the additional output (\$4,763,028) and 92 percent of the additional jobs (192.3). The trade (4.7 percent), services (4.4 percent), and finance, insurance and real estate (3.8 percent) sectors also receive a significant share of

the increase in county output. Employment impacts are even more concentrated in agriculture with 92 percent of the jobs created in that sector. Trade (3.2 percent) and services (2.9 percent) are the only other sectors showing significant job gains.

Since the output and employment effects are one-time impacts the annual impact on the Glenn County economy depends on the rate at which habitat restoration activity takes place. In the following section costs and benefits are compared for two scenarios. For the base case it is assumed that restoration occurs over the first twenty years of the project and annual output and employment impacts are one-twentieth of those included in Table 12a and 13a. Over the assumed twenty-year life of habitat restoration activities, Glenn County output is increased by \$286,828 annually, while 10.5 jobs are created. The stimulus to output and employment persists only for the duration of the restoration projects.

## **COMPARISON OF COSTS AND BENEFITS**

## Cases Analyzed

In this section we analyze three cases: the base case, a modified base case, and one that minimizes the adverse impacts on the Glenn County economy. For each of the cases we construct a scenario that includes completion of land acquisition and habitat restoration within 20 years and compares projected costs and benefits over a longer 35-year period. Since some of the reductions in agricultural production and habitat restoration projects were initiated between 1995 and 2000, the starting point for the 35-year period is 1995. The base case and the modified base case use the agricultural production losses from the second section summarized in Table 16a and the benefit estimates from the third section summarized in Table 10b. The value of agricultural production is assumed constant in real terms over the 35 years of the cost-benefit comparison. Benefits assessed are limited to those associated with increased recreational and aesthetic values, and, the increased economic activity that results from habitat restoration expenditures. No estimates for savings on public facility maintenance, compensation for flood damages, and the value of water resources freed up are included. Benefits are assumed to increase with population and income growth. The real rates of growth in recreational benefits and visitor expenditures are included in Table 11b.

The second case incorporates potential changes in public land acquisition procedures that will lessen the adverse impact on agricultural production. This case is discussed in the section on sensitivity analysis on page 26 and involves more frequent separation of acquired parcels at the IRZ boundary, leaving the portion outside of the IRZ in agricultural production. One-half of the overlapping parcels assumed in the base case (which, for the base case, is assumed to be 50 percent of the acreage outside of the IRZ that is linked to parcels located, in part, within the IRZ) are eliminated from the acquisition/restoration process in this case.

The third case assessed incorporates the same assumptions except it is assumed that habitat restoration outside the Inner River Zone (IRZ) is limited to one-half of the agricultural lands currently under public ownership. Additional habitat preservation is restricted to lands currently in riparian or other native vegetation. Where additional parcels are acquired in the IRZ only that portion within the boundaries of the IRZ is restored to natural habitat. The remaining agricultural land uses are preserved either through leasing or sale to private owners. Land acquisition and restoration within the IRZ are assumed to conform to the base case where 80 percent of the land is preserved in, or restored to riparian habitat. In addition it is assumed that the extent of habitat restoration is sufficient to achieve the CVPIA goal of doubling populations of anadromous fish species, to provide enough habitat to attract the number of wildlife watching participants projected in the benefits section, and to generate the nonuser benefits also included in that section.

For the cases analyzed it is assumed that no benefits accrue in the initial ten years of the scenario. While the CVPIA goals regarding populations of anadromous fish species are to be met by 2002, we assume the goals are met in 2005. The wildlife watching and nonuser benefits are also deferred until after the 10<sup>th</sup> year of the scenario. That allows sufficient time to construct a management plan and begin establishing the facilities necessary to attract and service participants in recreational activities. In the interim those benefits are assumed to grow at the rates specified in Table 11b. For the base case habitat restoration is assumed to take place at a uniform rate over the first 20 years with 30 percent of the direct

expenditures allocated to Glenn County. For the impact minimization case we assume that removal of agricultural operations and habitat restoration are stretched over a longer 30-year period.

### **Base Case**

Table 1c contains the results of the base case projections. There are three cases that correspond to the low, median, and high estimates for local benefits. The description of the results contained here focuses on the median estimate case.

For all 35 years of the scenario there is a net cost imposed on Glenn County. However, it can be seen from the entries in Table 1c that the annual net cost is not uniform. The net cost rises through the first ten years, reaching an initial peak in 2005 at \$4,803,174 and then decreases to \$2,480,884 (for the median benefits estimate) the following year. This discontinuity is the result of assuming no benefits for the first ten years while 50 percent of the agricultural production is eliminated over the same period. The only offset to the cost imposed by reduced agricultural production in the first ten years of the program is the local expenditure component of habitat restoration activities. In 2006 the large decrease in net cost to the county is because the full value of the benefits is added in at that point.

Net costs reach a second peak in 2015 at \$5,427,932. At that point all targeted lands have been removed from agricultural use and restored to riparian or other native habitat. For each year after 2015 the net costs decline due to the increasing real value of the recreational and nonuser benefits. However, for the final year of the scenario (2030) the net cost to Glenn County is still \$2,752,715.

### **Modified Base Case**

Table 2c contains the results of the projections for the modified base case. There are three cases that correspond to the low, median, and high estimates for local benefits. The description of the results contained here focuses on the median estimate case.

For all 35 years of the scenario there is a net cost imposed on Glenn County. However, as for the base case, it can be seen from the entries in Table 2c that the annual net cost is not uniform. The net cost rises through the first ten years, reaching an initial peak in 2005 at \$4,270,411 and then decreases to \$1,896,376 the following year. This discontinuity is the result of assuming no benefits for the first ten years while 50 percent of the agricultural production is eliminated over the same period. The only offset to the cost imposed by reduced agricultural production is the local expenditure component of habitat restoration activities. In 2006 the large decrease in net cost to the county is because the full value of the benefits is added in at that point.

Net costs reach a second peak in 2015 at \$4,393,012. At that point all targeted lands have been removed from agricultural use and restored to riparian or other native habitat. For each year after 2015 the net costs decline due to the increasing real value of the recreational and nonuser benefits. However, for the final year of the scenario (2030) the net cost to Glenn County is still \$1,717,796.

### **Impact Minimization Case**

Table 3c contains the projections for the impact minimization case. The definition of minimum impact is that the present value of net benefits over the 35-year projection is approximately zero. For the median benefits case contained in Table 2c the net present value at a real discount rate of 3 percent is a positive \$1,153,606 for the 1995 through 2030 period. For the high benefit estimate the present value of the stream of cost minus benefits is equal to \$12,546,654, while the low benefit estimate yields a negative net present value of \$10,239,442. The important point is that this case represents very closely the maximum extent of habitat restoration that is consistent with a zero impact on the Glenn County economy.

As in the base case there is a significant difference in the annual impacts. For the median benefits estimates the net annual loss peaks in 2005 at \$1,692,542. In 2006 the benefits begin to accrue and the impact becomes a positive \$929,178. Through the year 2025 the net benefits are the product of two partially compensating factors. As additional land is converted from agricultural uses to habitat the costs to the county increase. But with rising income and population the value of recreational uses, and thus benefits increase as well. Net benefits reach a minimum of \$431,955 in the year 2022 increasing in each subsequent year. Beginning in 2024 when no further reductions in agricultural output occur, net benefits begin to rise rapidly since the only remaining factor is increasing recreational and nonuser benefits driven by growth in income and population. Net benefits reach a maximum of \$1,603,521 in the final year of the scenario (but continue to grow in subsequent years).

### **Comparison of the Three Cases**

The three cases presented in this section represent a range of possible outcomes. Assigning the title of “base case” does not imply that the projected impacts are the most likely. What the base case does represent is the impact assuming a continuation of past public land acquisition patterns and the median benefits estimates. Of course, actual benefits may be higher or lower. In part that is a function of the management plan established for the use of the restored habitat and the willingness of agencies to provide the facilities necessary to achieve the full recreational potential of the acquired public lands. Also, past patterns of public land acquisition may not be indicative of future patterns. A number of individuals providing advice on various aspects of this study indicated that there was clear movement away from land acquisitions outside the IRZ and an increased desire to clip parcels at the IRZ boundary. From that perspective the modified base case might be more accurately described as the most likely outcome. The purpose of providing the impact minimization case was simply to illustrate the maximum extent of restoration consistent with avoiding any adverse impact on the Glenn County economy without implying anything about the reasonableness of the underlying assumptions.

### **Comparison of Benefits and Resident Income Losses**

While the impact on the Glenn County economy can be interpreted as the negative change in county output, that change overstates the impact on county residents. Measured output includes the cost of inputs to production that come from outside of the area. The loss of those sales has no direct effect on county residents. Ideally the adverse effects on residents are measured as the uncompensated losses in income due to changes in land use. Since value added and personal income are nearly identical in the case of Glenn County, value added is used as a proxy for income loss. Value added in agriculture within the SRCA is

just over 55 percent of output. Approximately 16 percent of value added is proprietor income, arguably not a loss to the private landowner (see the comments in the peer reviews contained in Appendix C). Since the land sale is voluntary it is reasonable to assume that the money received from the sale to a public entity fully compensates the former owner for any loss of income.

Table 4c compares the benefits and income losses for Glenn County residents for the base case assumptions. All economic losses and gains are calculated in terms of the change in value added (or income to county residents). The impact of reduced agricultural production, habitat restoration, and the expenditures of visiting anglers and wildlife watchers are expressed as changes in county value added. No compensation is assumed for losses in proprietor income, and therefore the income impacts of reduced agricultural production are somewhat overstated. The following description of the contents of Table 4c is based on the median benefits estimate.

Using this approach the net effect on income peaks at a negative \$2,647,407 in 2005. The losses reach a second peak in 2014 at \$1,467,963 and decline throughout the remainder of the 35-year scenario. In 2025 the net benefits become positive and increase to a positive \$1,041,337. The adverse impact on annual agricultural value added reaches a peak of \$5,100,555 in 2014 and remains at that level.

Table 1C

Base case: The Total Benefits less Costs to Glenn County from Agricultural Land Conversion

Year	Agriculture Cumulative Output	Restoration Annual Output	1997 \$ Net Cost	Total Benefits 1997\$			Difference: Benefits less Costs For Benefit Estimates:		
				Low	Median	High	Low	Median	High
1995	-\$462,727	\$286,828	-\$175,899	\$0	\$0	\$0	-\$175,899	-\$175,899	-\$175,899
1996	-\$925,455	\$286,828	-\$638,627	\$0	\$0	\$0	-\$638,627	-\$638,627	-\$638,627
1997	-\$1,388,182	\$286,828	-\$1,101,354	\$0	\$0	\$0	-\$1,101,354	-\$1,101,354	-\$1,101,354
1998	-\$1,850,910	\$286,828	-\$1,564,082	\$0	\$0	\$0	-\$1,564,082	-\$1,564,082	-\$1,564,082
1999	-\$2,313,637	\$286,828	-\$2,026,809	\$0	\$0	\$0	-\$2,026,809	-\$2,026,809	-\$2,026,809
2000	-\$2,776,365	\$286,828	-\$2,489,537	\$0	\$0	\$0	-\$2,489,537	-\$2,489,537	-\$2,489,537
2001	-\$3,239,092	\$286,828	-\$2,952,264	\$0	\$0	\$0	-\$2,952,264	-\$2,952,264	-\$2,952,264
2002	-\$3,701,819	\$286,828	-\$3,414,991	\$0	\$0	\$0	-\$3,414,991	-\$3,414,991	-\$3,414,991
2003	-\$4,164,547	\$286,828	-\$3,877,719	\$0	\$0	\$0	-\$3,877,719	-\$3,877,719	-\$3,877,719
2004	-\$4,627,274	\$286,828	-\$4,340,446	\$0	\$0	\$0	-\$4,340,446	-\$4,340,446	-\$4,340,446
2005	-\$5,090,002	\$286,828	-\$4,803,174	\$0	\$0	\$0	-\$4,803,174	-\$4,803,174	-\$4,803,174
2006	-\$5,552,729	\$286,828	-\$5,265,901	\$2,282,144	\$2,785,017	\$3,287,889	-\$2,983,757	-\$2,480,884	-\$1,978,012
2007	-\$6,015,457	\$286,828	-\$5,728,629	\$2,363,727	\$2,885,055	\$3,406,384	-\$3,364,901	-\$2,843,573	-\$2,322,245
2008	-\$6,478,184	\$286,828	-\$6,191,356	\$2,448,236	\$2,988,697	\$3,529,158	-\$3,743,120	-\$3,202,659	-\$2,662,198
2009	-\$6,940,911	\$286,828	-\$6,654,083	\$2,535,776	\$3,096,072	\$3,656,368	-\$4,118,307	-\$3,558,011	-\$2,997,715
2010	-\$7,403,639	\$286,828	-\$7,116,811	\$2,626,456	\$3,207,315	\$3,788,174	-\$4,490,354	-\$3,909,496	-\$3,328,637
2011	-\$7,866,366	\$286,828	-\$7,579,538	\$2,720,389	\$3,322,566	\$3,924,742	-\$4,859,149	-\$4,256,973	-\$3,654,796
2012	-\$8,329,094	\$286,828	-\$8,042,266	\$2,817,692	\$3,441,968	\$4,066,244	-\$5,224,574	-\$4,600,297	-\$3,976,021
2013	-\$8,791,821	\$286,828	-\$8,504,993	\$2,918,486	\$3,565,673	\$4,212,860	-\$5,586,507	-\$4,939,320	-\$4,292,133
2014	-\$9,254,549	\$286,828	-\$8,967,721	\$3,022,897	\$3,693,836	\$4,364,774	-\$5,944,824	-\$5,273,885	-\$4,602,946
2015	-\$9,254,549	\$0	-\$9,254,549	\$3,131,054	\$3,826,617	\$4,522,179	-\$6,123,494	-\$5,427,932	-\$4,732,370
2016	-\$9,254,549	\$0	-\$9,254,549	\$3,243,094	\$3,964,183	\$4,685,273	-\$6,011,455	-\$5,290,366	-\$4,569,276
2017	-\$9,254,549	\$0	-\$9,254,549	\$3,359,154	\$4,106,708	\$4,854,261	-\$5,895,394	-\$5,147,841	-\$4,400,287
2018	-\$9,254,549	\$0	-\$9,254,549	\$3,479,381	\$4,254,370	\$5,029,359	-\$5,775,167	-\$5,000,179	-\$4,225,190
2019	-\$9,254,549	\$0	-\$9,254,549	\$3,603,924	\$4,407,355	\$5,210,786	-\$5,650,624	-\$4,847,194	-\$4,043,763
2020	-\$9,254,549	\$0	-\$9,254,549	\$3,732,939	\$4,565,855	\$5,398,772	-\$5,521,610	-\$4,688,693	-\$3,855,776
2021	-\$9,254,549	\$0	-\$9,254,549	\$3,866,586	\$4,730,070	\$5,593,555	-\$5,387,963	-\$4,524,478	-\$3,660,993
2022	-\$9,254,549	\$0	-\$9,254,549	\$4,005,032	\$4,900,207	\$5,795,381	-\$5,249,517	-\$4,354,342	-\$3,459,167
2023	-\$9,254,549	\$0	-\$9,254,549	\$4,148,450	\$5,076,478	\$6,004,505	-\$5,106,098	-\$4,178,071	-\$3,250,043
2024	-\$9,254,549	\$0	-\$9,254,549	\$4,297,020	\$5,259,106	\$6,221,192	-\$4,957,529	-\$3,995,443	-\$3,033,357
2025	-\$9,254,549	\$0	-\$9,254,549	\$4,450,926	\$5,448,321	\$6,445,715	-\$4,803,623	-\$3,806,228	-\$2,808,833
2026	-\$9,254,549	\$0	-\$9,254,549	\$4,610,361	\$5,644,360	\$6,678,359	-\$4,644,188	-\$3,610,189	-\$2,576,190
2027	-\$9,254,549	\$0	-\$9,254,549	\$4,775,524	\$5,847,470	\$6,919,417	-\$4,479,025	-\$3,407,078	-\$2,335,131
2028	-\$9,254,549	\$0	-\$9,254,549	\$4,946,621	\$6,057,908	\$7,169,195	-\$4,307,928	-\$3,196,641	-\$2,085,353
2029	-\$9,254,549	\$0	-\$9,254,549	\$5,123,866	\$6,275,938	\$7,428,009	-\$4,130,683	-\$2,978,611	-\$1,826,540
2030	-\$9,254,549	\$0	-\$9,254,549	\$5,307,481	\$6,501,833	\$7,696,186	-\$3,947,068	-\$2,752,715	-\$1,558,363

Table 2C

Modified Base case: The Total Benefits less Costs to Glenn County from Agricultural Land Conversion

Year	Agriculture Cumulative Output	Restoration Annual Output	1997 \$ Net Cost	Total Benefits 1997\$			Difference: Benefits less Costs For Benefit Estimates:		
				Low	Median	High	Low	Median	High
1995	-\$410,981	\$250,385	-\$160,596	\$0	\$0	\$0	-\$160,596	-\$160,596	-\$160,596
1996	-\$821,963	\$250,385	-\$571,578	\$0	\$0	\$0	-\$571,578	-\$571,578	-\$571,578
1997	-\$1,232,944	\$250,385	-\$982,559	\$0	\$0	\$0	-\$982,559	-\$982,559	-\$982,559
1998	-\$1,643,926	\$250,385	-\$1,393,541	\$0	\$0	\$0	-\$1,393,541	-\$1,393,541	-\$1,393,541
1999	-\$2,054,907	\$250,385	-\$1,804,522	\$0	\$0	\$0	-\$1,804,522	-\$1,804,522	-\$1,804,522
2000	-\$2,465,889	\$250,385	-\$2,215,504	\$0	\$0	\$0	-\$2,215,504	-\$2,215,504	-\$2,215,504
2001	-\$2,876,870	\$250,385	-\$2,626,485	\$0	\$0	\$0	-\$2,626,485	-\$2,626,485	-\$2,626,485
2002	-\$3,287,852	\$250,385	-\$3,037,466	\$0	\$0	\$0	-\$3,037,466	-\$3,037,466	-\$3,037,466
2003	-\$3,698,833	\$250,385	-\$3,448,448	\$0	\$0	\$0	-\$3,448,448	-\$3,448,448	-\$3,448,448
2004	-\$4,109,814	\$250,385	-\$3,859,429	\$0	\$0	\$0	-\$3,859,429	-\$3,859,429	-\$3,859,429
2005	-\$4,520,796	\$250,385	-\$4,270,411	\$0	\$0	\$0	-\$4,270,411	-\$4,270,411	-\$4,270,411
2006	-\$4,931,777	\$250,385	-\$4,681,392	\$2,282,144	\$2,785,017	\$3,287,889	-\$2,399,248	-\$1,896,376	-\$1,393,503
2007	-\$5,342,759	\$250,385	-\$5,092,374	\$2,363,727	\$2,885,055	\$3,406,384	-\$2,728,646	-\$2,207,318	-\$1,685,990
2008	-\$5,753,740	\$250,385	-\$5,503,355	\$2,448,236	\$2,988,697	\$3,529,158	-\$3,055,119	-\$2,514,658	-\$1,974,197
2009	-\$6,164,722	\$250,385	-\$5,914,337	\$2,535,776	\$3,096,072	\$3,656,368	-\$3,378,560	-\$2,818,264	-\$2,257,968
2010	-\$6,575,703	\$250,385	-\$6,325,318	\$2,626,456	\$3,207,315	\$3,788,174	-\$3,698,862	-\$3,118,003	-\$2,537,144
2011	-\$6,986,685	\$250,385	-\$6,736,299	\$2,720,389	\$3,322,566	\$3,924,742	-\$4,015,910	-\$3,413,734	-\$2,811,558
2012	-\$7,397,666	\$250,385	-\$7,147,281	\$2,817,692	\$3,441,968	\$4,066,244	-\$4,329,589	-\$3,705,313	-\$3,081,036
2013	-\$7,808,647	\$250,385	-\$7,558,262	\$2,918,486	\$3,565,673	\$4,212,860	-\$4,639,776	-\$3,992,589	-\$3,345,402
2014	-\$8,219,629	\$250,385	-\$7,969,244	\$3,022,897	\$3,693,836	\$4,364,774	-\$4,946,347	-\$4,275,408	-\$3,604,469
2015	-\$8,219,629	\$0	-\$8,219,629	\$3,131,054	\$3,826,617	\$4,522,179	-\$5,088,575	-\$4,393,012	-\$3,697,450
2016	-\$8,219,629	\$0	-\$8,219,629	\$3,243,094	\$3,964,183	\$4,685,273	-\$4,976,535	-\$4,255,446	-\$3,534,356
2017	-\$8,219,629	\$0	-\$8,219,629	\$3,359,154	\$4,106,708	\$4,854,261	-\$4,860,475	-\$4,112,921	-\$3,365,368
2018	-\$8,219,629	\$0	-\$8,219,629	\$3,479,381	\$4,254,370	\$5,029,359	-\$4,740,248	-\$3,965,259	-\$3,190,270
2019	-\$8,219,629	\$0	-\$8,219,629	\$3,603,924	\$4,407,355	\$5,210,786	-\$4,615,705	-\$3,812,274	-\$3,008,843
2020	-\$8,219,629	\$0	-\$8,219,629	\$3,732,939	\$4,565,855	\$5,398,772	-\$4,486,690	-\$3,653,773	-\$2,820,857
2021	-\$8,219,629	\$0	-\$8,219,629	\$3,866,586	\$4,730,070	\$5,593,555	-\$4,353,043	-\$3,489,558	-\$2,626,074
2022	-\$8,219,629	\$0	-\$8,219,629	\$4,005,032	\$4,900,207	\$5,795,381	-\$4,214,597	-\$3,319,422	-\$2,424,248
2023	-\$8,219,629	\$0	-\$8,219,629	\$4,148,450	\$5,076,478	\$6,004,505	-\$4,071,179	-\$3,143,151	-\$2,215,123
2024	-\$8,219,629	\$0	-\$8,219,629	\$4,297,020	\$5,259,106	\$6,221,192	-\$3,922,609	-\$2,960,523	-\$1,998,437
2025	-\$8,219,629	\$0	-\$8,219,629	\$4,450,926	\$5,448,321	\$6,445,715	-\$3,768,703	-\$2,771,308	-\$1,773,914
2026	-\$8,219,629	\$0	-\$8,219,629	\$4,610,361	\$5,644,360	\$6,678,359	-\$3,609,268	-\$2,575,269	-\$1,541,270
2027	-\$8,219,629	\$0	-\$8,219,629	\$4,775,524	\$5,847,470	\$6,919,417	-\$3,444,105	-\$2,372,158	-\$1,300,212
2028	-\$8,219,629	\$0	-\$8,219,629	\$4,946,621	\$6,057,908	\$7,169,195	-\$3,273,008	-\$2,161,721	-\$1,050,434
2029	-\$8,219,629	\$0	-\$8,219,629	\$5,123,866	\$6,275,938	\$7,428,009	-\$3,095,763	-\$1,943,691	-\$791,620
2030	-\$8,219,629	\$0	-\$8,219,629	\$5,307,481	\$6,501,833	\$7,696,186	-\$2,912,148	-\$1,717,796	-\$523,443

**Table 3C**

**Impact Minimization Case: The Total Benefits less Costs to Glenn County from Agricultural Land Conversion**

Year	Agriculture Cumulative Output	Restoration Annual Output	1997 \$ Net Cost	Total Benefits 1997\$			Difference: Benefits less Costs For Benefit Estimates:		
				Low	Median	High	Low	Median	High
1995	-\$163,277	\$103,506	-\$59,771	\$0	\$0	\$0	-\$59,771	-\$59,771	-\$59,771
1996	-\$326,554	\$103,506	-\$223,048	\$0	\$0	\$0	-\$223,048	-\$223,048	-\$223,048
1997	-\$489,831	\$103,506	-\$386,325	\$0	\$0	\$0	-\$386,325	-\$386,325	-\$386,325
1998	-\$653,108	\$103,506	-\$549,602	\$0	\$0	\$0	-\$549,602	-\$549,602	-\$549,602
1999	-\$816,385	\$103,506	-\$712,879	\$0	\$0	\$0	-\$712,879	-\$712,879	-\$712,879
2000	-\$979,663	\$103,506	-\$876,156	\$0	\$0	\$0	-\$876,156	-\$876,156	-\$876,156
2001	-\$1,142,940	\$103,506	-\$1,039,433	\$0	\$0	\$0	-\$1,039,433	-\$1,039,433	-\$1,039,433
2002	-\$1,306,217	\$103,506	-\$1,202,710	\$0	\$0	\$0	-\$1,202,710	-\$1,202,710	-\$1,202,710
2003	-\$1,469,494	\$103,506	-\$1,365,987	\$0	\$0	\$0	-\$1,365,987	-\$1,365,987	-\$1,365,987
2004	-\$1,632,771	\$103,506	-\$1,529,264	\$0	\$0	\$0	-\$1,529,264	-\$1,529,264	-\$1,529,264
2005	-\$1,796,048	\$103,506	-\$1,692,542	\$0	\$0	\$0	-\$1,692,542	-\$1,692,542	-\$1,692,542
2006	-\$1,959,325	\$103,506	-\$1,855,819	\$2,282,144	\$2,785,017	\$3,287,889	\$426,325	\$929,198	\$1,432,071
2007	-\$2,122,602	\$103,506	-\$2,019,096	\$2,363,727	\$2,885,055	\$3,406,384	\$344,632	\$865,960	\$1,387,288
2008	-\$2,285,879	\$103,506	-\$2,182,373	\$2,448,236	\$2,988,697	\$3,529,158	\$265,864	\$806,325	\$1,346,786
2009	-\$2,449,156	\$103,506	-\$2,345,650	\$2,535,776	\$3,096,072	\$3,656,368	\$190,126	\$750,422	\$1,310,718
2010	-\$2,612,433	\$103,506	-\$2,508,927	\$2,626,456	\$3,207,315	\$3,788,174	\$117,529	\$698,388	\$1,279,247
2011	-\$2,775,711	\$103,506	-\$2,672,204	\$2,720,389	\$3,322,566	\$3,924,742	\$48,185	\$650,362	\$1,252,538
2012	-\$2,938,988	\$103,506	-\$2,835,481	\$2,817,692	\$3,441,968	\$4,066,244	-\$17,789	\$606,487	\$1,230,763
2013	-\$3,102,265	\$103,506	-\$2,998,758	\$2,918,486	\$3,565,673	\$4,212,860	-\$80,272	\$566,915	\$1,214,102
2014	-\$3,265,542	\$103,506	-\$3,162,035	\$3,022,897	\$3,693,836	\$4,364,774	-\$139,139	\$531,800	\$1,202,739
2015	-\$3,428,819	\$103,506	-\$3,325,312	\$3,131,054	\$3,826,617	\$4,522,179	-\$194,258	\$501,304	\$1,196,867
2016	-\$3,592,096	\$103,506	-\$3,488,589	\$3,243,094	\$3,964,183	\$4,685,273	-\$245,496	\$475,594	\$1,196,683
2017	-\$3,755,373	\$103,506	-\$3,651,867	\$3,359,154	\$4,106,708	\$4,854,261	-\$292,712	\$454,841	\$1,202,395
2018	-\$3,918,650	\$103,506	-\$3,815,144	\$3,479,381	\$4,254,370	\$5,029,359	-\$335,762	\$439,226	\$1,214,215
2019	-\$4,081,927	\$103,506	-\$3,978,421	\$3,603,924	\$4,407,355	\$5,210,786	-\$374,497	\$428,934	\$1,232,365
2020	-\$4,245,204	\$103,506	-\$4,141,698	\$3,732,939	\$4,565,855	\$5,398,772	-\$408,759	\$424,158	\$1,257,074
2021	-\$4,408,481	\$103,506	-\$4,304,975	\$3,866,586	\$4,730,070	\$5,593,555	-\$438,389	\$425,096	\$1,288,580
2022	-\$4,571,759	\$103,506	-\$4,468,252	\$4,005,032	\$4,900,207	\$5,795,381	-\$463,220	\$431,955	\$1,327,129
2023	-\$4,735,036	\$103,506	-\$4,631,529	\$4,148,450	\$5,076,478	\$6,004,505	-\$483,079	\$444,949	\$1,372,976
2024	-\$4,898,313	\$103,506	-\$4,794,806	\$4,297,020	\$5,259,106	\$6,221,192	-\$497,786	\$464,300	\$1,426,386
2025	-\$4,898,313	\$0	-\$4,898,313	\$4,450,926	\$5,448,321	\$6,445,715	-\$447,387	\$550,008	\$1,547,403
2026	-\$4,898,313	\$0	-\$4,898,313	\$4,610,361	\$5,644,360	\$6,678,359	-\$287,952	\$746,047	\$1,780,046
2027	-\$4,898,313	\$0	-\$4,898,313	\$4,775,524	\$5,847,470	\$6,919,417	-\$122,789	\$949,158	\$2,021,105
2028	-\$4,898,313	\$0	-\$4,898,313	\$4,946,621	\$6,057,908	\$7,169,195	\$48,308	\$1,159,595	\$2,270,883
2029	-\$4,898,313	\$0	-\$4,898,313	\$5,123,866	\$6,275,938	\$7,428,009	\$225,553	\$1,377,625	\$2,529,696
2030	-\$4,898,313	\$0	-\$4,898,313	\$5,307,481	\$6,501,833	\$7,696,186	\$409,168	\$1,603,521	\$2,797,873

**Table 4C**

**The Total Benefits less Costs to Glenn County from Agricultural Land Conversion: Value Added Basis**

Annual Value Added	1997 \$ Net Cost	Total Benefits 1997\$			Difference: Benefits less Costs For Benefit Estimates:		
		Low	Median	High	Low	Median	High
\$157,898	\$97,130	\$0	\$0	\$0	-\$97,130	-\$97,130	-\$97,130
\$157,898	\$352,158	\$0	\$0	\$0	-\$352,158	-\$352,158	-\$352,158
\$157,898	\$607,185	\$0	\$0	\$0	-\$607,185	-\$607,185	-\$607,185
\$157,898	\$862,213	\$0	\$0	\$0	-\$862,213	-\$862,213	-\$862,213
\$157,898	\$1,117,241	\$0	\$0	\$0	-\$1,117,241	-\$1,117,241	-\$1,117,241
\$157,898	\$1,372,269	\$0	\$0	\$0	-\$1,372,269	-\$1,372,269	-\$1,372,269
\$157,898	\$1,627,296	\$0	\$0	\$0	-\$1,627,296	-\$1,627,296	-\$1,627,296
\$157,898	\$1,882,324	\$0	\$0	\$0	-\$1,882,324	-\$1,882,324	-\$1,882,324
\$157,898	\$2,137,352	\$0	\$0	\$0	-\$2,137,352	-\$2,137,352	-\$2,137,352
\$157,898	\$2,392,380	\$0	\$0	\$0	-\$2,392,380	-\$2,392,380	-\$2,392,380
\$157,898	\$2,647,407	\$0	\$0	\$0	-\$2,647,407	-\$2,647,407	-\$2,647,407
\$157,898	\$2,902,435	\$2,111,154	\$2,614,027	\$3,116,900	-\$791,281	-\$288,408	\$214,465
\$157,898	\$3,157,463	\$2,187,351	\$2,708,679	\$3,230,008	-\$970,112	-\$448,783	\$72,545
\$157,898	\$3,412,491	\$2,266,304	\$2,806,765	\$3,347,226	-\$1,146,186	-\$605,725	-\$65,264
\$157,898	\$3,667,518	\$2,348,114	\$2,908,410	\$3,468,705	-\$1,319,405	-\$759,109	-\$198,813
\$157,898	\$3,922,546	\$2,432,882	\$3,013,741	\$3,594,600	-\$1,489,664	-\$908,805	-\$327,946
\$157,898	\$4,177,574	\$2,520,718	\$3,122,894	\$3,725,070	-\$1,656,856	-\$1,054,680	-\$452,504
\$157,898	\$4,432,602	\$2,611,731	\$3,236,007	\$3,860,283	-\$1,820,871	-\$1,196,595	-\$572,318
\$157,898	\$4,687,629	\$2,706,037	\$3,353,224	\$4,000,411	-\$1,981,592	-\$1,334,405	-\$687,218
\$157,898	\$4,942,657	\$2,803,755	\$3,474,694	\$4,145,633	-\$2,138,902	-\$1,467,963	-\$797,024
\$0	\$5,100,555	\$2,905,010	\$3,600,572	\$4,296,135	-\$2,195,545	-\$1,499,983	-\$804,420
\$0	\$5,100,555	\$3,009,929	\$3,731,018	\$4,452,108	-\$2,090,626	-\$1,369,537	-\$648,447
\$0	\$5,100,555	\$3,118,645	\$3,866,198	\$4,613,752	-\$1,981,910	-\$1,234,357	-\$486,803
\$0	\$5,100,555	\$3,231,296	\$4,006,285	\$4,781,273	-\$1,869,259	-\$1,094,270	-\$319,282
\$0	\$5,100,555	\$3,348,024	\$4,151,455	\$4,954,886	-\$1,752,531	-\$949,100	-\$145,669
\$0	\$5,100,555	\$3,468,978	\$4,301,895	\$5,134,811	-\$1,631,577	-\$798,660	\$34,256
\$0	\$5,100,555	\$3,594,310	\$4,457,795	\$5,321,280	-\$1,506,245	-\$642,760	\$220,725
\$0	\$5,100,555	\$3,724,180	\$4,619,354	\$5,514,529	-\$1,376,375	-\$481,201	\$413,974
\$0	\$5,100,555	\$3,858,751	\$4,786,779	\$5,714,806	-\$1,241,804	-\$313,776	\$614,251
\$0	\$5,100,555	\$3,998,195	\$4,960,281	\$5,922,367	-\$1,102,360	-\$140,274	\$821,812
\$0	\$5,100,555	\$4,142,688	\$5,140,083	\$6,137,478	-\$957,867	\$39,528	\$1,036,923
\$0	\$5,100,555	\$4,292,414	\$5,326,413	\$6,360,412	-\$808,141	\$225,858	\$1,259,857
\$0	\$5,100,555	\$4,447,561	\$5,519,508	\$6,591,455	-\$652,994	\$418,953	\$1,490,900
\$0	\$5,100,555	\$4,608,327	\$5,719,615	\$6,830,902	-\$492,228	\$619,060	\$1,730,347
\$0	\$5,100,555	\$4,774,916	\$5,926,988	\$7,079,059	-\$325,639	\$826,433	\$1,978,504
\$0	\$5,100,555	\$4,947,539	\$6,141,892	\$7,336,244	-\$153,016	\$1,041,337	\$2,235,689

### **Areas for Further Research**

The cost-benefit assessment scenarios presented in this section do not include two potentially significant benefits to the Glenn County economy. First, only the local portion of the direct impact of habitat restoration was included. While in a static analysis this a reasonable approach given the scope of the study, it may inaccurately portray the effects of a more extensive habitat restoration process. In the past much of the direct impact of habitat restoration activity in Glenn County has been in other counties. However, an expanded restoration program, as implied by the scenarios included in this section, may provide an incentive to expand the local component. That might include changes such as production of more of the nursery stock locally.

A second possible impact not included in benefits assessment is the effect on the Glenn County economy of local investment of funds received from government land acquisition payments. To the extent that local residents sell their land and invest a portion of the sale proceeds in the county, there is the potential for an increase in county output and employment. For example, if the sale of farmland in the county results in the receipt of funds from outside of the county, and, the money is invested in a way that enhances agricultural productivity, then economic activity in the county will expand. Conversion of land in row crops to orchard will increase county output by the difference in the value of production. Further increases in output and employment will result from the indirect and induced effects. While this impact is potentially quite large and could offset a significant portion of the economic costs to the county, no information was available that would permit an accurate assessment of its extent.

### **Generalization to Other Counties and to the Regional Economy**

One of the purposes of completing this study was to provide a basis for estimating impacts on other affected counties and the broader region. There is much in this case study that can be used to gauge the magnitude of the impacts in the remaining counties affected by habitat preservation and restoration in the SRCA. However, some caution is appropriate when using the study results for this purpose. First, there are important structural differences between the Glenn County economy and the other affected counties. Glenn County has a comparatively small population, low population density, and a high degree of dependence on agriculture. The small population reduces the economic benefits associated with the increase in recreational activities. The relative importance of agriculture also increases the significance of the adverse impact resulting from reduced farming activity. It can be concluded that the net benefits are more likely to be positive in a county with a large population relative to the amount of agricultural production affected. But, the agricultural impact estimates provide a reasonable indication on a per acre basis of the influences on local output and employment that can be expected in other affected counties.

Significant differences can be expected in the county-level and regional impacts of habitat preservation and restoration. Estimates of both costs and benefits will be larger for the broader region. The impacts of reduced agricultural production will be larger because the indirect and induced effects across county boundaries will be included. Generally impact multipliers are larger for more broadly defined regions. Benefit

estimates will also be larger for habitat restoration activities and increased recreational opportunities. It is likely that close to 100 percent of the direct impact of restoration investment will be felt in the regional economy, while a much smaller percentage will occur in the particular county where the restoration occurs. Estimated recreational benefits are higher when they accrue to local residents. The local benefits of visitor use of recreational resources include only trip related expenses, which are roughly one-third of the total willingness to pay of residents. By defining the local region more broadly, a larger percentage of the use value of the enhanced environment accrues to local residents, thus generating greater measured benefits to the local economy.

## **Conclusions**

For the base case the annual impact of agricultural production losses imposes a significant cost on the Glenn County economy, reaching a peak in 2015 and subsequent years of \$9,254,549. While habitat restoration activities offset some of those losses in the early years, after the assumed completion date the production losses are ongoing. Offsets in future years are limited to recreational and nonuser benefits and the estimated net impact is sensitive to the extent of those benefits. Taking the median benefit estimate still leaves a net cost to Glenn County of \$3,806,228 in the 30<sup>th</sup> year and \$2,752,715 in the 35<sup>th</sup> year.

Losses in county personal income are somewhat smaller than the output losses. The decrease in personal income due to changes in agricultural land use peaks in 2014 at \$5,100,555. Comparing decreases in value added (approximately equal to personal income) with recreational and nonuser benefits leads to the conclusion that, for the base case and for the median benefits estimates, the net benefits are a positive \$39,528 in the 30<sup>th</sup> year, increasing to a positive \$1,041,337 in the 35<sup>th</sup> year.

Glenn County personal income is projected to increase at 2.84 percent annual rate (see Table 3 and 11b) through 2010. In 1997 the ratio of county personal income to output was 0.4364. Assuming the income-output ratio and income growth rates are constant throughout the period covered by the scenarios we can calculate the losses as a percentage of county output. For the base case the net dollar losses (1997 dollars) peak in 2005 and again in 2015. The losses in 2005 are \$4,803,174, while Glenn County personal income and output are projected to increase to \$584,779,000 and \$1,340,007,000, respectively. The output loss in 2005 is 0.36 percent of forecasted real output in that year. The net loss of \$5,427,932 in 2015 is 0.31 percent of projected output of \$1,773,096,000 for 2015. For 2030, the last year of the base case scenario, the loss of \$2,752,715 is 0.10 percent of the forecast output level of \$2,698,754,000.

While this study estimates the impact on the Glenn County economy of various land uses in the SRCA, it is clear that the actual impact depends on a number of factors that are the product of state and federal policy. Among the most important are the following:

1. The most important factor in determining the impact on Glenn County output and employment is the extent of conversion of agricultural land uses to habitat restoration. From the perspective of Glenn County the preferred approach would be to sacrifice the minimum amount of agricultural production consistent with

achieving the program goals. That might involve focusing restoration on those soils with lower productivity that cannot profitably support production of high value crops such as fruits and nuts.

2. While the benefits estimates were not linked to specific state or federal policies, it is clear that government decisions have an important impact on the extent of recreational benefits. Achieving the projected fishery benefits is dependent on reaching population goals for anadromous fish species. But, without adequate access, including well-maintained boat ramps, it is unlikely that those benefits will be realized. It is not just a matter of keeping existing facilities in a state of repair, but rather expanding the available facilities. The projected benefits imply more intensive use and adequate capacity is essential for attracting the additional users. The same can be said for facilities for wildlife watching. Availability of trails, observation points, and boat launching facilities will generate the use levels necessary to realize the projected benefits.
3. Local economies will benefit from early availability of recreational opportunities. Accelerated completion of a resource management plan will generate benefits at an earlier date. The results presented in Table 1c and 2c indicate that net costs are reduced or net benefits are increased if recreational benefits begin to accrue before the year 2006. Giving priority to finalizing a management plan and providing the necessary recreational facilities will have a positive impact on the affected local economies.
4. Habitat restoration can have a significant positive impact on the local economy. However, in Glenn County only 30 percent of the direct expenditures contribute to county economic activity. An expanded role for county residents and businesses would provide additional offsets to the agricultural losses in the critical early years of the program. Expanding the local role in habitat restoration activities requires the initiative of private businesses, as well as the governmental and non-profit organizations involved in funding restoration activities.

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## APPENDIX A

**Table A-1. Direct , indirect , induced and total output generated by agriculture in the Inner River Zone of the Sacramento River Conservation Area, Glenn County expressed in 1997\$.**

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		1 Dairy Farm Products	0	2,346	1,999	4,345
		2 Poultry and Eggs	0	0	0	0
		3 Ranch Fed Cattle	0	1,953	202	2,155
		4 Range Fed Cattle	0	1,502	255	1,757
		5 Cattle Feedlots	0	1,730	28	1,758
		6 Sheep- Lambs and Goats	0	251	61	312
		7 Hogs- Pigs and Swine	0	1,027	12	1,040
		8 Other Meat Animal Products	0	12	2	14
		9 Miscellaneous Livestock	0	289	445	735
		10 Cotton	0	259	6	265
		11 Food Grains	46,974	11,933	981	59,888
		12 Feed Grains	115,735	934	91	116,761
		13 Hay and Pasture	69,893	1,718	168	71,780
		14 Grass Seeds	0	176	9	185
		15 Tobacco	0	0	0	0
		16 Fruits	1,490,385	5,434	1,744	1,497,563
		17 Tree Nuts	1,919,137	8,792	1,829	1,929,759
		18 Vegetables	83,956	977	1,381	86,314
		19 Sugar Crops	7,833	865	65	8,764
		20 Miscellaneous Crops	0	0	0	0
		21 Oil Bearing Crops	49,361	785	82	50,229
		22 Forest Products	0	64	7	71
		23 Greenhouse and Nursery Products	0	31,144	760	31,903
		24 Forestry Products	0	0	0	0
		25 Commercial Fishing	0	0	0	0
		26 Agricultural- Forestry- Fishery Service	0	381,932	876	382,809
		27 Landscape and Horticultural Services	0	56	154	211
		28 Iron Ores	0	0	0	0
		29 Copper Ores	0	0	0	0
		30 Lead and Zinc Ores	0	0	0	0
		31 Gold Ores	0	0	0	0
		32 Silver Ores	0	0	0	0
		33 Ferroalloy Ores- Except Vanadium	0	0	0	0
		34 Metal Mining Services	0	0	0	0
		35 Uranium-radium-vanadium Ores	0	0	0	0
		36 Metal Ores- Not Elsewhere Classified	0	0	0	0
		37 Coal Mining	0	0	0	0
		38 Natural Gas & Crude Petroleum	0	0	0	0
		39 Natural Gas Liquids	0	0	0	0
		40 Dimension Stone	0	0	0	0
		41 Sand and Gravel	0	3	2	5
		42 Clay- Ceramic- Refractory Minerals-	0	0	0	0
		43 Potash- Soda- and Borate Minerals	0	0	0	0
		44 Phosphate Rock	0	0	0	0
		45 Chemical- Fertilizer Mineral Mining	0	0	0	0
		46 Nonmetallic Minerals (Except Fuels)	0	0	0	0
		47 Misc. Nonmetallic Minerals- N.E.C.	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		48 New Residential Structures	0	0	0	0
		49 New Industrial and Commercial Build	0	0	0	0
		50 New Utility Structures	0	0	0	0
		51 New Highways and Streets	0	0	0	0
		52 New Farm Structures	0	0	0	0
		53 New Mineral Extraction Facilities	0	0	0	0
		54 New Government Facilities	0	0	0	0
		55 Maintenance and Repair- Residential	0	2,042	5,566	7,608
		56 Maintenance and Repair Other Facilities	0	20,229	3,753	23,983
		57 Maintenance and Repair Oil and Gas	0	0	0	0
		58 Meat Packing Plants	0	0	0	0
		59 Sausages and Other Prepared Meats	0	0	0	0
		60 Poultry Processing	0	0	0	0
		61 Creamery Butter	0	0	0	0
		62 Cheese- Natural and Processed	0	19	4,128	4,147
		63 Condensed and Evaporated Milk	0	7	1,472	1,479
		64 Ice Cream and Frozen Desserts	0	0	0	0
		65 Fluid Milk	0	0	0	0
		66 Canned Specialties	0	0	0	0
		67 Canned Fruits and Vegetables	0	0	0	0
		68 Dehydrated Food Products	0	1	855	856
		69 Pickles- Sauces- and Salad Dressings	0	3	250	253
		70 Frozen Fruits- Juices and Vegetables	0	0	0	0
		71 Frozen Specialties	0	0	0	0
		72 Flour and Other Grain Mill Products	0	0	0	0
		73 Cereal Preparations	0	0	0	0
		74 Rice Milling	0	0	0	0
		75 Blended and Prepared Flour	0	0	0	0
		76 Wet Corn Milling	0	0	0	0
		77 Dog- Cat- and Other Pet Food	0	0	0	0
		78 Prepared Feeds- N.E.C	0	40	53	93
		79 Bread- Cake- and Related Products	0	0	0	0
		80 Cookies and Crackers	0	0	0	0
		81 Sugar	0	0	4	4
		82 Confectionery Products	0	0	0	0
		83 Chocolate and Cocoa Products	0	0	0	0
		84 Chewing Gum	0	0	0	0
		85 Salted and Roasted Nuts & Seeds	0	9	2,494	2,503
		86 Cottonseed Oil Mills	0	0	0	0
		87 Soybean Oil Mills	0	0	0	0
		88 Vegetable Oil Mills- N.E.C	0	0	0	0
		89 Animal and Marine Fats and Oils	0	0	0	0
		90 Shortening and Cooking Oils	0	59	859	918
		91 Malt Beverages	0	0	0	0
		92 Malt	0	0	0	0
		93 Wines- Brandy- and Brandy Spirits	0	0	0	0
		94 Distilled Liquor- Except Brandy	0	0	0	0
		95 Bottled and Canned Soft Drinks & Wa	0	0	0	0
		96 Flavoring Extracts and Syrups- N.E.C	0	0	0	0
		97 Canned and Cured Sea Foods	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		98 Prepared Fresh Or Frozen Fish Or Sea	0	0	0	0
		99 Roasted Coffee	0	0	0	0
		100 Potato Chips & Similar Snacks	0	0	0	0
		101 Manufactured Ice	0	0	0	0
		102 Macaroni and Spaghetti	0	0	0	0
		103 Food Preparations- N.E.C	0	0	0	0
		104 Cigarettes	0	0	0	0
		105 Cigars	0	0	0	0
		106 Chewing and Smoking Tobacco	0	0	0	0
		107 Tobacco Stemming and Redrying	0	0	0	0
		108 Broadwoven Fabric Mills and Finishi	0	0	0	0
		109 Narrow Fabric Mills	0	0	0	0
		110 Womens Hosiery- Except Socks	0	0	0	0
		111 Hosiery- N.E.C	0	0	0	0
		112 Knit Outerwear Mills	0	0	0	0
		113 Knit Underwear Mills	0	0	0	0
		114 Knit Fabric Mills	0	0	0	0
		115 Knitting Mills- N.E.C.	0	0	0	0
		116 Yarn Mills and Finishing Of Textiles-	0	0	0	0
		117 Carpets and Rugs	0	0	0	0
		118 Thread Mills	0	0	0	0
		119 Coated Fabrics- Not Rubberized	0	0	0	0
		120 Tire Cord and Fabric	0	0	0	0
		121 Nonwoven Fabrics	0	0	0	0
		122 Cordage and Twine	0	0	0	0
		123 Textile Goods- N.E.C	0	0	0	0
		124 Apparel Made From Purchased Material	0	0	0	0
		125 Curtains and Draperies	0	0	0	0
		126 Housefurnishings- N.E.C	0	0	0	0
		127 Textile Bags	0	8,189	278	8,467
		128 Canvas Products	0	0	0	0
		129 Pleating and Stitching	0	0	0	0
		130 Automotive and Apparel Trimmings	0	0	0	0
		131 Schiffi Machine Embroideries	0	0	0	0
		132 Fabricated Textile Products- N.E.C.	0	0	0	0
		133 Logging Camps and Logging Contract	0	94	38	132
		134 Sawmills and Planing Mills- General	0	242	106	347
		135 Hardwood Dimension and Flooring Mi	0	0	0	0
		136 Special Product Sawmills- N.E.C	0	0	0	0
		137 Millwork	0	0	0	0
		138 Wood Kitchen Cabinets	0	63	70	132
		139 Veneer and Plywood	0	0	0	0
		140 Structural Wood Members- N.E.C	0	48	34	83
		141 Wood Containers	0	0	0	0
		142 Wood Pallets and Skids	0	0	0	0
		143 Mobile Homes	0	0	0	0
		144 Prefabricated Wood Buildings	0	0	0	0
		145 Wood Preserving	0	0	0	0
		146 Reconstituted Wood Products	0	0	0	0
		147 Wood Products- N.E.C	0	1,019	321	1,340

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		148 Wood Household Furniture	0	0	0	0
		149 Upholstered Household Furniture	0	0	0	0
		150 Metal Household Furniture	0	0	0	0
		151 Mattresses and Bedsprings	0	0	0	0
		152 Wood Tv and Radio Cabinets	0	0	0	0
		153 Household Furniture- N.E.C	0	0	0	0
		154 Wood Office Furniture	0	0	0	0
		155 Metal Office Furniture	0	0	0	0
		156 Public Building Furniture	0	0	0	0
		157 Wood Partitions and Fixtures	0	7	6	14
		158 Metal Partitions and Fixtures	0	0	0	0
		159 Blinds- Shades- and Drapery Hardware	0	0	0	0
		160 Furniture and Fixtures- N.E.C	0	0	0	0
		161 Pulp Mills	0	0	0	0
		162 Paper Mills- Except Building Paper	0	0	0	0
		163 Paperboard Mills	0	0	0	0
		164 Paperboard Containers and Boxes	0	0	0	0
		165 Paper Coated & Laminated Packaging	0	0	0	0
		166 Paper Coated & Laminated N.E.C.	0	0	0	0
		167 Bags- Plastic	0	0	0	0
		168 Bags- Paper	0	0	0	0
		169 Die-cut Paper and Board	0	0	0	0
		170 Sanitary Paper Products	0	0	0	0
		171 Envelopes	0	0	0	0
		172 Stationery Products	0	0	0	0
		173 Converted Paper Products- N.E.C	0	0	0	0
		174 Newspapers	0	168	343	510
		175 Periodicals	0	0	0	0
		176 Book Publishing	0	0	0	0
		177 Book Printing	0	0	0	0
		178 Miscellaneous Publishing	0	0	0	0
		179 Commercial Printing	0	190	239	429
		180 Manifold Business Forms	0	0	0	0
		181 Greeting Card Publishing	0	0	0	0
		182 Blankbooks and Looseleaf Binder	0	0	0	0
		183 Bookbinding & Related	0	0	0	0
		184 Typesetting	0	0	0	0
		185 Plate Making	0	0	0	0
		186 Alkalies & Chlorine	0	0	0	0
		187 Industrial Gases	0	0	0	0
		188 Inorganic Pigments	0	0	0	0
		189 Inorganic Chemicals Nec.	0	0	0	0
		190 Cyclic Crudes- Interm. & Indus. Org	0	0	0	0
		191 Plastics Materials and Resins	0	0	0	0
		192 Synthetic Rubber	0	0	0	0
		193 Cellulosic Man-made Fibers	0	0	0	0
		194 Organic Fibers- Noncellulosic	0	0	0	0
		195 Drugs	0	0	0	0
		196 Soap and Other Detergents	0	0	0	0
		197 Polishes and Sanitation Goods	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		198 Surface Active Agents	0	0	0	0
		199 Toilet Preparations	0	0	0	0
		200 Paints and Allied Products	0	0	0	0
		201 Gum and Wood Chemicals	0	0	0	0
		202 Nitrogenous and Phosphatic Fertilizer	0	0	0	0
		203 Fertilizers- Mixing Only	0	0	0	0
		204 Agricultural Chemicals- N.E.C	0	0	0	0
		205 Adhesives and Sealants	0	0	0	0
		206 Explosives	0	0	0	0
		207 Printing Ink	0	0	0	0
		208 Carbon Black	0	0	0	0
		209 Chemical Preparations- N.E.C	0	0	0	0
		210 Petroleum Refining	0	0	0	0
		211 Paving Mixtures and Blocks	0	0	0	0
		212 Asphalt Felts and Coatings	0	0	0	0
		213 Lubricating Oils and Greases	0	0	0	0
		214 Petroleum and Coal Products- N.E.C.	0	0	0	0
		215 Tires and Inner Tubes	0	0	0	0
		216 Rubber and Plastics Footwear	0	0	0	0
		217 Rubber and Plastics Hose and Belting	0	0	0	0
		218 Gaskets- Packing and Sealing Device	0	0	0	0
		219 Fabricated Rubber Products- N.E.C.	0	0	0	0
		220 Miscellaneous Plastics Products	0	0	0	0
		221 Leather Tanning and Finishing	0	0	0	0
		222 Footwear Cut Stock	0	0	0	0
		223 House Slippers	0	0	0	0
		224 Shoes- Except Rubber	0	0	0	0
		225 Leather Gloves and Mittens	0	0	0	0
		226 Luggage	0	0	0	0
		227 Womens Handbags and Purses	0	0	0	0
		228 Personal Leather Goods	0	0	0	0
		229 Leather Goods- N.E.C	0	0	0	0
		230 Glass and Glass Products- Exc Containers	0	0	0	0
		231 Glass Containers	0	0	0	0
		232 Cement- Hydraulic	0	0	0	0
		233 Brick and Structural Clay Tile	0	0	0	0
		234 Ceramic Wall and Floor Tile	0	0	0	0
		235 Clay Refractories	0	0	0	0
		236 Structural Clay Products- N.E.C	0	0	0	0
		237 Vitreous Plumbing Fixtures	0	0	0	0
		238 Vitreous China Food Utensils	0	0	0	0
		239 Fine Earthenware Food Utensils	0	0	0	0
		240 Porcelain Electrical Supplies	0	0	0	0
		241 Pottery Products- N.E.C	0	0	0	0
		242 Concrete Block and Brick	0	0	0	0
		243 Concrete Products- N.E.C	0	3	1	4
		244 Ready-mixed Concrete	0	8	4	12
		245 Lime	0	0	0	0
		246 Gypsum Products	0	0	0	0
		247 Cut Stone and Stone Products	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		248 Abrasive Products	0	0	0	0
		249 Asbestos Products	0	0	0	0
		250 Minerals- Ground Or Treated	0	0	0	0
		251 Mineral Wool	0	740	624	1,364
		252 Nonclay Refractories	0	0	0	0
		253 Nonmetallic Mineral Products- N.E.C	0	0	0	0
		254 Blast Furnaces and Steel Mills	0	0	0	0
		255 Electrometallurgical Products	0	0	0	0
		256 Steel Wire and Related Products	0	0	0	0
		257 Cold Finishing Of Steel Shapes	0	0	0	0
		258 Steel Pipe and Tubes	0	0	0	0
		259 Iron and Steel Foundries	0	0	0	0
		260 Primary Copper	0	0	0	0
		261 Primary Aluminum	0	0	0	0
		262 Primary Nonferrous Metals- N.E.C.	0	0	0	0
		263 Secondary Nonferrous Metals	0	0	0	0
		264 Copper Rolling and Drawing	0	0	0	0
		265 Aluminum Rolling and Drawing	0	0	0	0
		266 Nonferrous Rolling and Drawing- N.E	0	0	0	0
		267 Nonferrous Wire Drawing and Insulation	0	0	0	0
		268 Aluminum Foundries	0	0	0	0
		269 Brass- Bronze- and Copper Foundries	0	0	0	0
		270 Nonferrous Castings- N.E.C.	0	0	0	0
		271 Metal Heat Treating	0	0	0	0
		272 Primary Metal Products- N.E.C	0	0	0	0
		273 Metal Cans	0	0	0	0
		274 Metal Barrels- Drums and Pails	0	0	0	0
		275 Cutlery	0	0	0	0
		276 Hand and Edge Tools- N.E.C.	0	0	0	0
		277 Hand Saws and Saw Blades	0	0	0	0
		278 Hardware- N.E.C.	0	0	0	0
		279 Metal Sanitary Ware	0	0	0	0
		280 Plumbing Fixture Fittings and Trim	0	0	0	0
		281 Heating Equipment- Except Electric	0	0	0	0
		282 Fabricated Structural Metal	0	0	0	0
		283 Metal Doors- Sash- and Trim	0	0	0	0
		284 Fabricated Plate Work (Boiler Shops)	0	0	0	0
		285 Sheet Metal Work	0	0	0	0
		286 Architectural Metal Work	0	0	0	0
		287 Prefabricated Metal Buildings	0	0	0	0
		288 Miscellaneous Metal Work	0	0	0	0
		289 Screw Machine Products and Bolts- Et	0	0	0	0
		290 Iron and Steel Forgings	0	0	0	0
		291 Nonferrous Forgings	0	0	0	0
		292 Automotive Stampings	0	0	0	0
		293 Crowns and Closures	0	0	0	0
		294 Metal Stampings- N.E.C.	0	0	0	0
		295 Plating and Polishing	0	0	0	0
		296 Metal Coating and Allied Services	0	0	0	0
		297 Small Arms Ammunition	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		298 Ammunition- Except For Small Arms-	0	0	0	0
		299 Small Arms	0	0	0	0
		300 Other Ordnance and Accessories	0	0	0	0
		301 Industrial and Fluid Valves	0	0	0	0
		302 Steel Springs- Except Wire	0	0	0	0
		303 Pipe- Valves- and Pipe Fittings	0	0	0	0
		304 Miscellaneous Fabricated Wire Prod	0	0	0	0
		305 Metal Foil and Leaf	0	0	0	0
		306 Fabricated Metal Products- N.E.C.	0	113	26	139
		307 Steam Engines and Turbines	0	0	0	0
		308 Internal Combustion Engines- N.E.C.	0	0	0	0
		309 Farm Machinery and Equipment	0	2,040	16	2,056
		310 Lawn and Garden Equipment	0	0	0	0
		311 Construction Machinery and Equipment	0	0	0	0
		312 Mining Machinery- Except Oil Field	0	0	0	0
		313 Oil Field Machinery	0	0	0	0
		314 Elevators and Moving Stairways	0	0	0	0
		315 Conveyors and Conveying Equipment	0	0	0	0
		316 Hoists- Cranes- and Monorails	0	0	0	0
		317 Industrial Trucks and Tractors	0	0	0	0
		318 Machine Tools- Metal Cutting Types	0	0	0	0
		319 Machine Tools- Metal Forming Types	0	0	0	0
		320 Industrial Patterns	0	0	0	0
		321 Special Dies and Tools and Accessories	0	0	0	0
		322 Power Driven Hand Tools	0	0	0	0
		323 Rolling Mill Machinery	0	0	0	0
		324 Welding Apparatus	0	0	0	0
		325 Metalworking Machinery- N.E.C.	0	0	0	0
		326 Textile Machinery	0	0	0	0
		327 Woodworking Machinery	0	0	0	0
		328 Paper Industries Machinery	0	0	0	0
		329 Printing Trades Machinery	0	0	0	0
		330 Food Products Machinery	0	0	0	0
		331 Special Industry Machinery N.E.C.	0	0	0	0
		332 Pumps and Compressors	0	0	0	0
		333 Ball and Roller Bearings	0	0	0	0
		334 Blowers and Fans	0	0	0	0
		335 Packaging Machinery	0	0	0	0
		336 Power Transmission Equipment	0	0	0	0
		337 Industrial Furnaces and Ovens	0	0	0	0
		338 General Industrial Machinery- N.E.C	0	0	0	0
		339 Electronic Computers	0	0	0	0
		340 Computer Storage Devices	0	0	0	0
		341 Computer Terminals	0	0	0	0
		342 Computer Peripheral Equipment-	0	0	0	0
		343 Calculating and Accounting Machine	0	0	0	0
		344 Typewriters and Office Machines N.E	0	0	0	0
		345 Automatic Merchandising Machine	0	0	0	0
		346 Commercial Laundry Equipment	0	0	0	0
		347 Refrigeration and Heating Equipment	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		348 Measuring and Dispensing Pumps	0	0	0	0
		349 Service Industry Machines- N.E.C.	0	0	0	0
		350 Carburetors- Pistons- Rings- Valves	0	0	0	0
		351 Fluid Power Cylinders & Actuators	0	0	0	0
		352 Fluid Power Pumps & Motors	0	0	0	0
		353 Scales and Balances	0	0	0	0
		354 Industrial Machines N.E.C.	0	8	4	11
		355 Transformers	0	0	0	0
		356 Switchgear and Switchboard Apparatus	0	0	0	0
		357 Motors and Generators	0	0	0	0
		358 Carbon and Graphite Products	0	0	0	0
		359 Relays & Industrial Controls	0	0	0	0
		360 Electrical Industrial Apparatus- N.E.C	0	0	0	0
		361 Household Cooking Equipment	0	0	0	0
		362 Household Refrigerators and Freezers	0	0	0	0
		363 Household Laundry Equipment	0	0	0	0
		364 Electric Housewares and Fans	0	0	0	0
		365 Household Vacuum Cleaners	0	0	0	0
		366 Household Appliances- N.E.C.	0	0	0	0
		367 Electric Lamps	0	0	0	0
		368 Wiring Devices	0	0	0	0
		369 Lighting Fixtures and Equipment	0	0	0	0
		370 Radio and TV Receiving Sets	0	0	0	0
		371 Phonograph Records and Tape	0	0	0	0
		372 Telephone and Telegraph Apparatus	0	0	0	0
		373 Radio and TV Communication Equip	0	0	0	0
		374 Communications Equipment N.E.C.	0	0	0	0
		375 Electron Tubes	0	0	0	0
		376 Printed Circuit Boards	0	0	0	0
		377 Semiconductors and Related Devices	0	0	0	0
		378 Electronic Components- N.E.C.	0	0	0	0
		379 Storage Batteries	0	0	0	0
		380 Primary Batteries- Dry and Wet	0	0	0	0
		381 Engine Electrical Equipment	0	0	0	0
		382 Magnetic & Optical Recording Media	0	0	0	0
		383 Electrical Equipment- N.E.C.	0	0	0	0
		384 Motor Vehicles	0	0	0	0
		385 Truck and Bus Bodies	0	0	0	0
		386 Motor Vehicle Parts and Accessories	0	0	0	0
		387 Truck Trailers	0	0	0	0
		388 Motor Homes	0	0	0	0
		389 Aircraft	0	0	0	0
		390 Aircraft and Missile Engines and Part	0	0	0	0
		391 Aircraft and Missile Equipment-	0	0	0	0
		392 Ship Building and Repairing	0	0	0	0
		393 Boat Building and Repairing	0	0	0	0
		394 Railroad Equipment	0	0	0	0
		395 Motorcycles- Bicycles- and Parts	0	0	0	0
		396 Complete Guided Missiles	0	0	0	0
		397 Travel Trailers and Camper	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		398 Tanks and Tank Components	0	0	0	0
		399 Transportation Equipment- N.E.C	0	0	0	0
		400 Search & Navigation Equipment	0	0	0	0
		401 Laboratory Apparatus & Furniture	0	0	0	0
		402 Automatic Temperature Controls	0	0	0	0
		403 Mechanical Measuring Devices	0	0	0	0
		404 Instruments To Measure Electricity	0	0	0	0
		405 Analytical Instruments	0	0	0	0
		406 Optical Instruments & Lenses	0	0	0	0
		407 Surgical and Medical Instrument	0	0	0	0
		408 Surgical Appliances and Supplies	0	7	699	706
		409 Dental Equipment and Supplies	0	0	0	0
		410 X-Ray Apparatus	0	0	0	0
		411 Electromedical Apparatus	0	0	0	0
		412 Ophthalmic Goods	0	0	0	0
		413 Photographic Equipment and Supplies	0	0	0	0
		414 Watches- Clocks- and Parts	0	0	0	0
		415 Jewelry- Precious Metal	0	0	0	0
		416 Silverware and Plated Ware	0	0	0	0
		417 Jewelers Materials and Lapidary Work	0	0	0	0
		418 Musical Instruments	0	0	0	0
		419 Dolls	0	0	0	0
		420 Games- Toys- and Childrens Vehicles	0	18	1,312	1,330
		421 Sporting and Athletic Goods- N.E.C.	0	0	0	0
		422 Pens and Mechanical Pencils	0	0	0	0
		423 Lead Pencils and Art Goods	0	0	0	0
		424 Marking Devices	0	0	0	0
		425 Carbon Paper and Inked Ribbons	0	0	0	0
		426 Costume Jewellery	0	0	0	0
		427 Fasteners- Buttons- Needles- Pins	0	0	0	0
		428 Brooms and Brushes	0	0	0	0
		429 Signs and Advertising Displays	0	0	0	0
		430 Burial Caskets and Vaults	0	0	0	0
		431 Hard Surface Floor Coverings	0	0	0	0
		432 Manufacturing Industries- N.E.C.	0	0	0	0
		433 Railroads and Related Services	0	964	181	1,145
		434 Local- Interurban Passenger Transit	0	50	883	933
		435 Motor Freight Transport and Warehouse	0	56,726	9,273	65,998
		436 Water Transportation	0	0	0	0
		437 Air Transportation	0	326	457	782
		438 Pipe Lines- Except Natural Gas	0	0	0	0
		439 Arrangement Of Passenger Transport	0	55	280	334
		440 Transportation Services	0	0	0	0
		441 Communications- Except Radio and	0	1,631	2,303	3,934
		442 Radio and TV Broadcasting	0	314	513	827
		443 Electric Services	0	0	0	0
		444 Gas Production and Distribution	0	5,392	6,959	12,351
		445 Water Supply and Sewerage Systems	0	0	0	0
		446 Sanitary Services and Steam Supply	0	3,350	356	3,706
		447 Wholesale Trade	0	73,834	13,082	86,916

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		448 Building Materials & Gardening	0	337	25,456	25,793
		449 General Merchandise Stores	0	131	9,924	10,056
		450 Food Stores	0	222	16,755	16,977
		451 Automotive Dealers & Service Station	0	206	15,540	15,746
		452 Apparel & Accessory Stores	0	22	1,653	1,675
		453 Furniture & Home Furnishings Stores	0	11	796	807
		454 Eating & Drinking	0	847	30,965	31,811
		455 Miscellaneous Retail	0	234	17,700	17,934
		456 Banking	0	14,440	28,009	42,449
		457 Credit Agencies	0	1,841	1,066	2,907
		458 Security and Commodity Brokers	0	223	1,338	1,562
		459 Insurance Carriers	0	2,611	4,736	7,346
		460 Insurance Agents and Brokers	0	597	1,082	1,679
		461 Owner-occupied Dwellings	0	0	64,111	64,111
		462 Real Estate	0	45,696	18,422	64,118
		463 Hotels and Lodging Places	0	4,456	5,790	10,245
		464 Laundry- Cleaning and Shoe Repair	0	1,856	3,201	5,056
		465 Portrait and Photographic Studios	0	24	1,064	1,088
		466 Beauty and Barber Shops	0	0	2,673	2,673
		467 Funeral Service and Crematories	0	0	999	999
		468 Miscellaneous Personal Services	0	36	1,619	1,655
		469 Advertising	0	0	0	0
		470 Other Business Services	0	351	449	800
		471 Photofinishing- Commercial Photo	0	0	0	0
		472 Services To Buildings	0	132	205	337
		473 Equipment Rental and Leasing	0	8,377	1,024	9,400
		474 Personnel Supply Services	0	44	37	80
		475 Computer and Data Processing Service	0	0	0	0
		476 Detective and Protective Services	0	7	28	35
		477 Automobile Rental and Leasing	0	0	0	0
		478 Automobile Parking and Car Wash	0	27	567	594
		479 Automobile Repair and Services	0	3,528	10,379	13,907
		480 Electrical Repair Service	0	0	0	0
		481 Watch- Clock- Jewelry and Furniture	0	4	498	502
		482 Miscellaneous Repair Shops	0	9,807	1,013	10,820
		483 Motion Pictures	0	309	4,598	4,907
		484 Theatrical Producers- Bands Etc.	0	0	0	0
		485 Bowling Alleys and Pool Halls	0	0	543	543
		486 Commercial Sports Except Racing	0	0	0	0
		487 Racing and Track Operation	0	0	0	0
		488 Amusement and Recreation Services-	0	0	2,076	2,076
		489 Membership Sports and Recreation C	0	94	1,435	1,528
		490 Doctors and Dentists	0	0	23,298	23,298
		491 Nursing and Protective Care	0	0	2,679	2,679
		492 Hospitals	0	6	8,892	8,898
		493 Other Medical and Health Services	0	28	8,744	8,772
		494 Legal Services	0	2,176	4,822	6,998
		495 Elementary and Secondary Schools	0	0	138	138
		496 Colleges- Universities- Schools	0	0	140	140
		497 Other Educational Services	0	1	106	107

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		498 Job Trainings & Related Services	0	3	1,295	1,298
		499 Child Day Care Services	0	0	703	703
		500 Social Services- N.E.C.	0	0	0	0
		501 Residential Care	0	0	858	858
		502 Other Nonprofit Organizations	0	44	3,179	3,224
		503 Business Associations	0	0	0	0
		504 Labor and Civic Organizations	0	4	2,728	2,732
		505 Religious Organizations	0	0	4,719	4,719
		506 Engineering- Architectural Services	0	486	333	819
		507 Accounting- Auditing and Bookkeepi	0	6,334	2,707	9,041
		508 Management and Consulting Services	0	255	198	453
		509 Research- Development & Testing Ser	0	0	0	0
		510 Local Government Passenger Transit	0	0	0	0
		511 State and Local Electric Utilities	0	0	0	0
		512 Other State and Local Govt Enterprise	0	10,094	14,667	24,761
		513 U.S. Postal Service	0	1,403	2,782	4,184
		514 Federal Electric Utilities	0	0	0	0
		515 Other Federal Government Enterprise	0	0	0	0
		516 Noncomparable Imports	0	0	0	0
		517 Scrap	0	0	0	0
		518 Used and Secondhand Goods	0	0	0	0
		519 Federal Government - Military	0	0	0	0
		520 Federal Government - Non-Military	0	0	0	0
		521 Commodity Credit Corporation	0	0	0	0
		522 State & Local Government – Education	0	0	0	0
		523 State & Local Government - Non-Ed	0	0	0	0
		524 Rest Of The World Industry	0	0	0	0
		525 Domestic Services	0	0	2,192	2,192
		526 Dummy	0	0	0	0
		527 Dummy	0	0	0	0
		528 Inventory Valuation Adjustment	0	0	0	0
		25001 Foreign Trade	0	0	0	0
		28001 Domestic Trade	0	0	0	0
		Total	3,783,274	749,493	429,931	4,962,699

The direct output originates with agriculture.

The indirect output is generated in all industries due to purchases by agriculture.

The induced output is generated in all industries due to increased spending by individuals.

IMPLAN, “IMPLAN Professional 2.0”, Minnesota IMPLAN Group Inc., 2000.

**Table A-2. Direct , indirect , induced and total output generated by agriculture in the Sacramento River Conservation Area less the Inner River Zone, Glenn County expressed in 1997\$.**

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		1 Dairy Farm Products	0	15,799	14,744	30,543
		2 Poultry and Eggs	0	0	0	0
		3 Ranch Fed Cattle	0	13,149	1,486	14,634
		4 Range Fed Cattle	0	10,114	1,877	11,991
		5 Cattle Feedlots	0	11,647	204	11,850
		6 Sheep- Lambs and Goats	0	1,687	450	2,137
		7 Hogs- Pigs and Swine	0	6,916	91	7,007
		8 Other Meat Animal Products	0	80	12	93
		9 Miscellaneous Livestock	0	2,267	3,294	5,561
		10 Cotton	0	1,744	41	1,785
		11 Food Grains	5,063,464	104,556	7,251	5,175,271
		12 Feed Grains	1,638,818	6,701	676	1,646,195
		13 Hay and Pasture	1,145,882	12,326	1,244	1,159,451
		14 Grass Seeds	0	2,230	65	2,295
		15 Tobacco	0	0	0	0
		16 Fruits	7,834,831	36,578	12,859	7,884,268
		17 Tree Nuts	12,394,664	59,189	13,500	12,467,353
		18 Vegetables	690,202	7,105	10,167	707,474
		19 Sugar Crops	1,669,644	19,476	482	1,689,602
		20 Miscellaneous Crops	0	0	0	0
		21 Oil Bearing Crops	464,015	5,619	607	470,242
		22 Forest Products	0	453	48	501
		23 Greenhouse and Nursery Products	0	188,354	5,594	193,948
		24 Forestry Products	0	1	0	1
		25 Commercial Fishing	0	0	0	0
		26 Agricultural- Forestry- Fishery Service	0	2,571,090	6,463	2,577,553
		27 Landscape and Horticultural Services	0	659	1,141	1,800
		28 Iron Ores	0	0	0	0
		29 Copper Ores	0	0	0	0
		30 Lead and Zinc Ores	0	0	0	0
		31 Gold Ores	0	0	0	0
		32 Silver Ores	0	0	0	0
		33 Ferroalloy Ores- Except Vanadium	0	0	0	0
		34 Metal Mining Services	0	0	0	0
		35 Uranium-radium-vanadium Ores	0	0	0	0
		36 Metal Ores- Not Elsewhere Classified	0	0	0	0
		37 Coal Mining	0	0	0	0
		38 Natural Gas & Crude Petroleum	0	0	0	0
		39 Natural Gas Liquids	0	0	0	0
		40 Dimension Stone	0	0	0	0
		41 Sand and Gravel	0	34	11	45
		42 Clay- Ceramic- Refractory Minerals-	0	0	0	0
		43 Potash- Soda- and Borate Minerals	0	0	0	0
		44 Phosphate Rock	0	0	0	0
		45 Chemical- Fertilizer Mineral Mining	0	0	0	0
		46 Nonmetallic Minerals (Except Fuels)	0	0	0	0
		47 Misc. Nonmetallic Minerals- N.E.C.	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		48 New Residential Structures	0	0	0	0
		49 New Industrial and Commercial Build	0	0	0	0
		50 New Utility Structures	0	0	0	0
		51 New Highways and Streets	0	0	0	0
		52 New Farm Structures	0	0	0	0
		53 New Mineral Extraction Facilities	0	0	0	0
		54 New Government Facilities	0	0	0	0
		55 Maintenance and Repair- Residential	0	25,875	41,175	67,051
		56 Maintenance and Repair Other Facilities	0	202,462	27,678	230,140
		57 Maintenance and Repair Oil and Gas	0	0	0	0
		58 Meat Packing Plants	0	0	0	0
		59 Sausages and Other Prepared Meats	0	0	0	0
		60 Poultry Processing	0	0	0	0
		61 Creamery Butter	0	0	0	0
		62 Cheese- Natural and Processed	0	153	30,389	30,543
		63 Condensed and Evaporated Milk	0	59	10,832	10,891
		64 Ice Cream and Frozen Desserts	0	0	0	0
		65 Fluid Milk	0	0	0	0
		66 Canned Specialties	0	0	0	0
		67 Canned Fruits and Vegetables	0	0	0	0
		68 Dehydrated Food Products	0	7	6,293	6,300
		69 Pickles- Sauces- and Salad Dressings	0	22	1,843	1,865
		70 Frozen Fruits- Juices and Vegetables	0	0	0	0
		71 Frozen Specialties	0	0	0	0
		72 Flour and Other Grain Mill Products	0	0	0	0
		73 Cereal Preparations	0	0	0	0
		74 Rice Milling	0	0	0	0
		75 Blended and Prepared Flour	0	0	0	0
		76 Wet Corn Milling	0	0	0	0
		77 Dog- Cat- and Other Pet Food	0	0	0	0
		78 Prepared Feeds- N.E.C	0	299	389	688
		79 Bread- Cake- and Related Products	0	0	0	0
		80 Cookies and Crackers	0	0	0	0
		81 Sugar	0	1	28	29
		82 Confectionery Products	0	0	0	0
		83 Chocolate and Cocoa Products	0	0	0	0
		84 Chewing Gum	0	0	0	0
		85 Salted and Roasted Nuts & Seeds	0	66	18,356	18,422
		86 Cottonseed Oil Mills	0	0	0	0
		87 Soybean Oil Mills	0	0	0	0
		88 Vegetable Oil Mills- N.E.C	0	0	0	0
		89 Animal and Marine Fats and Oils	0	0	0	0
		90 Shortening and Cooking Oils	0	395	6,322	6,718
		91 Malt Beverages	0	0	0	0
		92 Malt	0	0	0	0
		93 Wines- Brandy- and Brandy Spirits	0	0	0	0
		94 Distilled Liquor- Except Brandy	0	0	0	0
		95 Bottled and Canned Soft Drinks & Wa	0	0	0	0
		96 Flavoring Extracts and Syrups- N.E.C	0	0	0	0
		97 Canned and Cured Sea Foods	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		98 Prepared Fresh Or Frozen Fish Or Sea	0	0	0	0
		99 Roasted Coffee	0	0	0	0
		100 Potato Chips & Similar Snacks	0	0	0	0
		101 Manufactured Ice	0	0	0	0
		102 Macaroni and Spaghetti	0	0	0	0
		103 Food Preparations- N.E.C	0	0	0	0
		104 Cigarettes	0	0	0	0
		105 Cigars	0	0	0	0
		106 Chewing and Smoking Tobacco	0	0	0	0
		107 Tobacco Stemming and Redrying	0	0	0	0
		108 Broadwoven Fabric Mills and Finishi	0	0	0	0
		109 Narrow Fabric Mills	0	0	0	0
		110 Womens Hosiery- Except Socks	0	0	0	0
		111 Hosiery- N.E.C	0	0	0	0
		112 Knit Outerwear Mills	0	0	0	0
		113 Knit Underwear Mills	0	0	0	0
		114 Knit Fabric Mills	0	0	0	0
		115 Knitting Mills- N.E.C.	0	0	0	0
		116 Yarn Mills and Finishing Of Textiles-	0	0	0	0
		117 Carpets and Rugs	0	0	0	0
		118 Thread Mills	0	0	0	0
		119 Coated Fabrics- Not Rubberized	0	0	0	0
		120 Tire Cord and Fabric	0	0	0	0
		121 Nonwoven Fabrics	0	0	0	0
		122 Cordage and Twine	0	0	0	0
		123 Textile Goods- N.E.C	0	0	0	0
		124 Apparel Made From Purchased Material	0	0	0	0
		125 Curtains and Draperies	0	0	0	0
		126 Housefurnishings- N.E.C	0	0	0	0
		127 Textile Bags	0	50,646	2,053	52,699
		128 Canvas Products	0	0	0	0
		129 Pleating and Stitching	0	0	0	0
		130 Automotive and Apparel Trimmings	0	0	0	0
		131 Schiffi Machine Embroideries	0	0	0	0
		132 Fabricated Textile Products- N.E.C.	0	0	0	0
		133 Logging Camps and Logging Contract	0	877	285	1,162
		134 Sawmills and Planing Mills- General	0	2,295	780	3,075
		135 Hardwood Dimension and Flooring Mi	0	0	0	0
		136 Special Product Sawmills- N.E.C	0	0	0	0
		137 Millwork	0	0	0	0
		138 Wood Kitchen Cabinets	0	685	514	1,199
		139 Veneer and Plywood	0	0	0	0
		140 Structural Wood Members- N.E.C	0	478	254	732
		141 Wood Containers	0	0	0	0
		142 Wood Pallets and Skids	0	0	0	0
		143 Mobile Homes	0	0	0	0
		144 Prefabricated Wood Buildings	0	0	0	0
		145 Wood Preserving	0	0	0	0
		146 Reconstituted Wood Products	0	0	0	0
		147 Wood Products- N.E.C	0	8,990	2,375	11,365

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		148 Wood Household Furniture	0	0	0	0
		149 Upholstered Household Furniture	0	0	0	0
		150 Metal Household Furniture	0	0	0	0
		151 Mattresses and Bedsprings	0	0	0	0
		152 Wood Tv and Radio Cabinets	0	0	0	0
		153 Household Furniture- N.E.C	0	0	0	0
		154 Wood Office Furniture	0	0	0	0
		155 Metal Office Furniture	0	0	0	0
		156 Public Building Furniture	0	0	0	0
		157 Wood Partitions and Fixtures	0	47	47	94
		158 Metal Partitions and Fixtures	0	0	0	0
		159 Blinds- Shades- and Drapery Hardware	0	0	0	0
		160 Furniture and Fixtures- N.E.C	0	0	0	0
		161 Pulp Mills	0	0	0	0
		162 Paper Mills- Except Building Paper	0	0	0	0
		163 Paperboard Mills	0	0	0	0
		164 Paperboard Containers and Boxes	0	0	0	0
		165 Paper Coated & Laminated Packaging	0	0	0	0
		166 Paper Coated & Laminated N.E.C.	0	0	0	0
		167 Bags- Plastic	0	0	0	0
		168 Bags- Paper	0	0	0	0
		169 Die-cut Paper and Board	0	0	0	0
		170 Sanitary Paper Products	0	0	0	0
		171 Envelopes	0	0	0	0
		172 Stationery Products	0	0	0	0
		173 Converted Paper Products- N.E.C	0	0	0	0
		174 Newspapers	0	1,417	2,529	3,946
		175 Periodicals	0	0	0	0
		176 Book Publishing	0	0	0	0
		177 Book Printing	0	0	0	0
		178 Miscellaneous Publishing	0	0	0	0
		179 Commercial Printing	0	1,610	1,761	3,371
		180 Manifold Business Forms	0	0	0	0
		181 Greeting Card Publishing	0	0	0	0
		182 Blankbooks and Looseleaf Binder	0	0	0	0
		183 Bookbinding & Related	0	0	0	0
		184 Typesetting	0	0	0	0
		185 Plate Making	0	0	0	0
		186 Alkalies & Chlorine	0	0	0	0
		187 Industrial Gases	0	0	0	0
		188 Inorganic Pigments	0	0	0	0
		189 Inorganic Chemicals Nec.	0	0	0	0
		190 Cyclic Crudes- Interm. & Indus. Org	0	0	0	0
		191 Plastics Materials and Resins	0	0	0	0
		192 Synthetic Rubber	0	0	0	0
		193 Cellulosic Man-made Fibers	0	0	0	0
		194 Organic Fibers- Noncellulosic	0	0	0	0
		195 Drugs	0	0	0	0
		196 Soap and Other Detergents	0	0	0	0
		197 Polishes and Sanitation Goods	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		198 Surface Active Agents	0	0	0	0
		199 Toilet Preparations	0	0	0	0
		200 Paints and Allied Products	0	0	0	0
		201 Gum and Wood Chemicals	0	0	0	0
		202 Nitrogenous and Phosphatic Fertilizer	0	0	0	0
		203 Fertilizers- Mixing Only	0	0	0	0
		204 Agricultural Chemicals- N.E.C	0	0	0	0
		205 Adhesives and Sealants	0	0	0	0
		206 Explosives	0	0	0	0
		207 Printing Ink	0	0	0	0
		208 Carbon Black	0	0	0	0
		209 Chemical Preparations- N.E.C	0	0	0	0
		210 Petroleum Refining	0	0	0	0
		211 Paving Mixtures and Blocks	0	0	0	0
		212 Asphalt Felts and Coatings	0	0	0	0
		213 Lubricating Oils and Greases	0	0	0	0
		214 Petroleum and Coal Products- N.E.C.	0	0	0	0
		215 Tires and Inner Tubes	0	0	0	0
		216 Rubber and Plastics Footwear	0	0	0	0
		217 Rubber and Plastics Hose and Belting	0	0	0	0
		218 Gaskets- Packing and Sealing Device	0	0	0	0
		219 Fabricated Rubber Products- N.E.C.	0	0	0	0
		220 Miscellaneous Plastics Products	0	0	0	0
		221 Leather Tanning and Finishing	0	0	0	0
		222 Footwear Cut Stock	0	0	0	0
		223 House Slippers	0	0	0	0
		224 Shoes- Except Rubber	0	0	0	0
		225 Leather Gloves and Mittens	0	0	0	0
		226 Luggage	0	0	0	0
		227 Womens Handbags and Purses	0	0	0	0
		228 Personal Leather Goods	0	0	0	0
		229 Leather Goods- N.E.C	0	0	0	0
		230 Glass and Glass Products- Exc Containers	0	0	0	0
		231 Glass Containers	0	0	0	0
		232 Cement- Hydraulic	0	0	0	0
		233 Brick and Structural Clay Tile	0	0	0	0
		234 Ceramic Wall and Floor Tile	0	0	0	0
		235 Clay Refractories	0	0	0	0
		236 Structural Clay Products- N.E.C	0	0	0	0
		237 Vitreous Plumbing Fixtures	0	0	0	0
		238 Vitreous China Food Utensils	0	0	0	0
		239 Fine Earthenware Food Utensils	0	0	0	0
		240 Porcelain Electrical Supplies	0	0	0	0
		241 Pottery Products- N.E.C	0	0	0	0
		242 Concrete Block and Brick	0	0	0	0
		243 Concrete Products- N.E.C	0	30	4	34
		244 Ready-mixed Concrete	0	86	31	116
		245 Lime	0	0	0	0
		246 Gypsum Products	0	0	0	0
		247 Cut Stone and Stone Products	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		248 Abrasive Products	0	0	0	0
		249 Asbestos Products	0	0	0	0
		250 Minerals- Ground Or Treated	0	0	0	0
		251 Mineral Wool	0	6,061	4,612	10,673
		252 Nonclay Refractories	0	0	0	0
		253 Nonmetallic Mineral Products- N.E.C	0	0	0	0
		254 Blast Furnaces and Steel Mills	0	0	0	0
		255 Electrometallurgical Products	0	0	0	0
		256 Steel Wire and Related Products	0	0	0	0
		257 Cold Finishing Of Steel Shapes	0	0	0	0
		258 Steel Pipe and Tubes	0	0	0	0
		259 Iron and Steel Foundries	0	0	0	0
		260 Primary Copper	0	0	0	0
		261 Primary Aluminum	0	0	0	0
		262 Primary Nonferrous Metals- N.E.C.	0	0	0	0
		263 Secondary Nonferrous Metals	0	0	0	0
		264 Copper Rolling and Drawing	0	0	0	0
		265 Aluminum Rolling and Drawing	0	0	0	0
		266 Nonferrous Rolling and Drawing- N.E	0	0	0	0
		267 Nonferrous Wire Drawing and Insulation	0	0	0	0
		268 Aluminum Foundries	0	0	0	0
		269 Brass- Bronze- and Copper Foundries	0	0	0	0
		270 Nonferrous Castings- N.E.C.	0	0	0	0
		271 Metal Heat Treating	0	0	0	0
		272 Primary Metal Products- N.E.C	0	0	0	0
		273 Metal Cans	0	0	0	0
		274 Metal Barrels- Drums and Pails	0	0	0	0
		275 Cutlery	0	0	0	0
		276 Hand and Edge Tools- N.E.C.	0	0	0	0
		277 Hand Saws and Saw Blades	0	0	0	0
		278 Hardware- N.E.C.	0	0	0	0
		279 Metal Sanitary Ware	0	0	0	0
		280 Plumbing Fixture Fittings and Trim	0	0	0	0
		281 Heating Equipment- Except Electric	0	0	0	0
		282 Fabricated Structural Metal	0	0	0	0
		283 Metal Doors- Sash- and Trim	0	0	0	0
		284 Fabricated Plate Work (Boiler Shops)	0	0	0	0
		285 Sheet Metal Work	0	0	0	0
		286 Architectural Metal Work	0	0	0	0
		287 Prefabricated Metal Buildings	0	0	0	0
		288 Miscellaneous Metal Work	0	0	0	0
		289 Screw Machine Products and Bolts- Et	0	0	0	0
		290 Iron and Steel Forgings	0	0	0	0
		291 Nonferrous Forgings	0	0	0	0
		292 Automotive Stampings	0	0	0	0
		293 Crowns and Closures	0	0	0	0
		294 Metal Stampings- N.E.C.	0	0	0	0
		295 Plating and Polishing	0	0	0	0
		296 Metal Coating and Allied Services	0	0	0	0
		297 Small Arms Ammunition	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		298 Ammunition- Except For Small Arms-	0	0	0	0
		299 Small Arms	0	0	0	0
		300 Other Ordnance and Accessories	0	0	0	0
		301 Industrial and Fluid Valves	0	0	0	0
		302 Steel Springs- Except Wire	0	0	0	0
		303 Pipe- Valves- and Pipe Fittings	0	0	0	0
		304 Miscellaneous Fabricated Wire Prod	0	0	0	0
		305 Metal Foil and Leaf	0	0	0	0
		306 Fabricated Metal Products- N.E.C.	0	813	194	1,007
		307 Steam Engines and Turbines	0	0	0	0
		308 Internal Combustion Engines- N.E.C.	0	0	0	0
		309 Farm Machinery and Equipment	0	21,518	119	21,637
		310 Lawn and Garden Equipment	0	0	0	0
		311 Construction Machinery and Equipment	0	0	0	0
		312 Mining Machinery- Except Oil Field	0	0	0	0
		313 Oil Field Machinery	0	0	0	0
		314 Elevators and Moving Stairways	0	0	0	0
		315 Conveyors and Conveying Equipment	0	0	0	0
		316 Hoists- Cranes- and Monorails	0	0	0	0
		317 Industrial Trucks and Tractors	0	0	0	0
		318 Machine Tools- Metal Cutting Types	0	0	0	0
		319 Machine Tools- Metal Forming Types	0	0	0	0
		320 Industrial Patterns	0	0	0	0
		321 Special Dies and Tools and Accessories	0	0	0	0
		322 Power Driven Hand Tools	0	0	0	0
		323 Rolling Mill Machinery	0	0	0	0
		324 Welding Apparatus	0	0	0	0
		325 Metalworking Machinery- N.E.C.	0	0	0	0
		326 Textile Machinery	0	0	0	0
		327 Woodworking Machinery	0	0	0	0
		328 Paper Industries Machinery	0	0	0	0
		329 Printing Trades Machinery	0	0	0	0
		330 Food Products Machinery	0	0	0	0
		331 Special Industry Machinery N.E.C.	0	0	0	0
		332 Pumps and Compressors	0	0	0	0
		333 Ball and Roller Bearings	0	0	0	0
		334 Blowers and Fans	0	0	0	0
		335 Packaging Machinery	0	0	0	0
		336 Power Transmission Equipment	0	0	0	0
		337 Industrial Furnaces and Ovens	0	0	0	0
		338 General Industrial Machinery- N.E.C	0	0	0	0
		339 Electronic Computers	0	0	0	0
		340 Computer Storage Devices	0	0	0	0
		341 Computer Terminals	0	0	0	0
		342 Computer Peripheral Equipment-	0	0	0	0
		343 Calculating and Accounting Machine	0	0	0	0
		344 Typewriters and Office Machines N.E	0	0	0	0
		345 Automatic Merchandising Machine	0	0	0	0
		346 Commercial Laundry Equipment	0	0	0	0
		347 Refrigeration and Heating Equipment	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		348 Measuring and Dispensing Pumps	0	0	0	0
		349 Service Industry Machines- N.E.C.	0	0	0	0
		350 Carburetors- Pistons- Rings- Valves	0	0	0	0
		351 Fluid Power Cylinders & Actuators	0	0	0	0
		352 Fluid Power Pumps & Motors	0	0	0	0
		353 Scales and Balances	0	0	0	0
		354 Industrial Machines N.E.C.	0	67	26	93
		355 Transformers	0	0	0	0
		356 Switchgear and Switchboard Apparatus	0	0	0	0
		357 Motors and Generators	0	0	0	0
		358 Carbon and Graphite Products	0	0	0	0
		359 Relays & Industrial Controls	0	0	0	0
		360 Electrical Industrial Apparatus- N.E.C	0	0	0	0
		361 Household Cooking Equipment	0	0	0	0
		362 Household Refrigerators and Freezers	0	0	0	0
		363 Household Laundry Equipment	0	0	0	0
		364 Electric Housewares and Fans	0	0	0	0
		365 Household Vacuum Cleaners	0	0	0	0
		366 Household Appliances- N.E.C.	0	0	0	0
		367 Electric Lamps	0	0	0	0
		368 Wiring Devices	0	0	0	0
		369 Lighting Fixtures and Equipment	0	0	0	0
		370 Radio and TV Receiving Sets	0	0	0	0
		371 Phonograph Records and Tape	0	0	0	0
		372 Telephone and Telegraph Apparatus	0	0	0	0
		373 Radio and TV Communication Equip	0	0	0	0
		374 Communications Equipment N.E.C.	0	0	0	0
		375 Electron Tubes	0	0	0	0
		376 Printed Circuit Boards	0	0	0	0
		377 Semiconductors and Related Devices	0	0	0	0
		378 Electronic Components- N.E.C.	0	0	0	0
		379 Storage Batteries	0	0	0	0
		380 Primary Batteries- Dry and Wet	0	0	0	0
		381 Engine Electrical Equipment	0	0	0	0
		382 Magnetic & Optical Recording Media	0	0	0	0
		383 Electrical Equipment- N.E.C.	0	0	0	0
		384 Motor Vehicles	0	0	0	0
		385 Truck and Bus Bodies	0	0	0	0
		386 Motor Vehicle Parts and Accessories	0	0	0	0
		387 Truck Trailers	0	0	0	0
		388 Motor Homes	0	0	0	0
		389 Aircraft	0	0	0	0
		390 Aircraft and Missile Engines and Part	0	0	0	0
		391 Aircraft and Missile Equipment-	0	0	0	0
		392 Ship Building and Repairing	0	0	0	0
		393 Boat Building and Repairing	0	0	0	0
		394 Railroad Equipment	0	0	0	0
		395 Motorcycles- Bicycles- and Parts	0	0	0	0
		396 Complete Guided Missiles	0	0	0	0
		397 Travel Trailers and Camper	0	0	0	0

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		398 Tanks and Tank Components	0	0	0	0
		399 Transportation Equipment- N.E.C	0	0	0	0
		400 Search & Navigation Equipment	0	0	0	0
		401 Laboratory Apparatus & Furniture	0	0	0	0
		402 Automatic Temperature Controls	0	0	0	0
		403 Mechanical Measuring Devices	0	0	0	0
		404 Instruments To Measure Electricity	0	0	0	0
		405 Analytical Instruments	0	0	0	0
		406 Optical Instruments & Lenses	0	0	0	0
		407 Surgical and Medical Instrument	0	0	0	0
		408 Surgical Appliances and Supplies	0	65	5,147	5,212
		409 Dental Equipment and Supplies	0	0	0	0
		410 X-Ray Apparatus	0	0	0	0
		411 Electromedical Apparatus	0	0	0	0
		412 Ophthalmic Goods	0	0	0	0
		413 Photographic Equipment and Supplies	0	0	0	0
		414 Watches- Clocks- and Parts	0	0	0	0
		415 Jewelry- Precious Metal	0	0	0	0
		416 Silverware and Plated Ware	0	0	0	0
		417 Jewelers Materials and Lapidary Work	0	0	0	0
		418 Musical Instruments	0	0	0	0
		419 Dolls	0	0	0	0
		420 Games- Toys- and Childrens Vehicles	0	140	9,681	9,821
		421 Sporting and Athletic Goods- N.E.C.	0	0	0	0
		422 Pens and Mechanical Pencils	0	0	0	0
		423 Lead Pencils and Art Goods	0	0	0	0
		424 Marking Devices	0	0	0	0
		425 Carbon Paper and Inked Ribbons	0	0	0	0
		426 Costume Jewellery	0	0	0	0
		427 Fasteners- Buttons- Needles- Pins	0	0	0	0
		428 Brooms and Brushes	0	0	0	0
		429 Signs and Advertising Displays	0	0	0	0
		430 Burial Caskets and Vaults	0	0	0	0
		431 Hard Surface Floor Coverings	0	0	0	0
		432 Manufacturing Industries- N.E.C.	0	0	0	0
		433 Railroads and Related Services	0	10,912	1,341	12,252
		434 Local- Interurban Passenger Transit	0	409	6,516	6,925
		435 Motor Freight Transport and Warehouse	0	473,312	68,469	541,781
		436 Water Transportation	0	0	0	0
		437 Air Transportation	0	2,213	3,390	5,603
		438 Pipe Lines- Except Natural Gas	0	0	0	0
		439 Arrangement Of Passenger Transport	0	444	2,075	2,519
		440 Transportation Services	0	0	0	0
		441 Communications- Except Radio and	0	13,966	16,954	30,919
		442 Radio and TV Broadcasting	0	2,655	3,789	6,444
		443 Electric Services	0	0	0	0
		444 Gas Production and Distribution	0	48,314	51,260	99,575
		445 Water Supply and Sewerage Systems	0	0	0	0
		446 Sanitary Services and Steam Supply	0	26,873	2,624	29,497
		447 Wholesale Trade	0	602,140	96,453	698,593

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		448 Building Materials & Gardening	0	3,212	187,697	190,909
		449 General Merchandise Stores	0	1,252	73,175	74,427
		450 Food Stores	0	2,114	123,539	125,653
		451 Automotive Dealers & Service Station	0	1,961	114,581	116,542
		452 Apparel & Accessory Stores	0	209	12,192	12,400
		453 Furniture & Home Furnishings Stores	0	101	5,873	5,973
		454 Eating & Drinking	0	6,736	228,617	235,353
		455 Miscellaneous Retail	0	2,234	130,508	132,742
		456 Banking	0	125,966	206,153	332,119
		457 Credit Agencies	0	16,028	7,867	23,895
		458 Security and Commodity Brokers	0	2,000	9,830	11,830
		459 Insurance Carriers	0	21,258	35,048	56,306
		460 Insurance Agents and Brokers	0	4,858	8,009	12,866
		461 Owner-occupied Dwellings	0	0	475,072	475,072
		462 Real Estate	0	595,323	135,266	730,590
		463 Hotels and Lodging Places	0	36,898	42,932	79,831
		464 Laundry- Cleaning and Shoe Repair	0	12,856	23,678	36,534
		465 Portrait and Photographic Studios	0	190	7,872	8,063
		466 Beauty and Barber Shops	0	0	19,713	19,713
		467 Funeral Service and Crematories	0	0	7,330	7,330
		468 Miscellaneous Personal Services	0	290	11,977	12,266
		469 Advertising	0	0	0	0
		470 Other Business Services	0	3,022	3,313	6,335
		471 Photofinishing- Commercial Photo	0	0	0	0
		472 Services To Buildings	0	1,547	1,512	3,059
		473 Equipment Rental and Leasing	0	60,813	7,564	68,377
		474 Personnel Supply Services	0	356	270	627
		475 Computer and Data Processing Service	0	0	0	0
		476 Detective and Protective Services	0	65	210	275
		477 Automobile Rental and Leasing	0	0	0	0
		478 Automobile Parking and Car Wash	0	430	4,189	4,620
		479 Automobile Repair and Services	0	26,389	76,685	103,074
		480 Electrical Repair Service	0	0	0	0
		481 Watch- Clock- Jewelry and Furniture	0	35	3,691	3,726
		482 Miscellaneous Repair Shops	0	104,157	7,497	111,654
		483 Motion Pictures	0	2,579	34,027	36,606
		484 Theatrical Producers- Bands Etc.	0	0	0	0
		485 Bowling Alleys and Pool Halls	0	3	4,013	4,017
		486 Commercial Sports Except Racing	0	0	0	0
		487 Racing and Track Operation	0	0	0	0
		488 Amusement and Recreation Services-	0	0	15,355	15,355
		489 Membership Sports and Recreation C	0	764	10,637	11,401
		490 Doctors and Dentists	0	0	171,886	171,886
		491 Nursing and Protective Care	0	0	19,537	19,537
		492 Hospitals	0	48	65,325	65,373
		493 Other Medical and Health Services	0	193	64,410	64,603
		494 Legal Services	0	16,806	35,439	52,245
		495 Elementary and Secondary Schools	0	0	1,030	1,030
		496 Colleges- Universities- Schools	0	1	1,044	1,045
		497 Other Educational Services	0	13	784	797

IMPLAN	Sector	Industry	Direct	Indirect	Induced	Total
		498 Job Trainings & Related Services	0	23	9,582	9,604
		499 Child Day Care Services	0	0	5,209	5,209
		500 Social Services- N.E.C.	0	0	0	0
		501 Residential Care	0	0	6,350	6,350
		502 Other Nonprofit Organizations	0	354	23,529	23,883
		503 Business Associations	0	0	0	0
		504 Labor and Civic Organizations	0	34	20,173	20,207
		505 Religious Organizations	0	0	34,917	34,917
		506 Engineering- Architectural Services	0	5,279	2,456	7,735
		507 Accounting- Auditing and Bookkeepi	0	48,527	19,975	68,502
		508 Management and Consulting Services	0	2,087	1,463	3,550
		509 Research- Development & Testing Ser	0	0	0	0
		510 Local Government Passenger Transit	0	0	0	0
		511 State and Local Electric Utilities	0	0	0	0
		512 Other State and Local Govt Enterprise	0	114,326	108,096	222,422
		513 U.S. Postal Service	0	12,843	20,567	33,410
		514 Federal Electric Utilities	0	0	0	0
		515 Other Federal Government Enterprise	0	0	0	0
		516 Noncomparable Imports	0	0	0	0
		517 Scrap	0	0	0	0
		518 Used and Secondhand Goods	0	0	0	0
		519 Federal Government - Military	0	0	0	0
		520 Federal Government - Non-Military	0	0	0	0
		521 Commodity Credit Corporation	0	0	0	0
		522 State & Local Government – Education	0	0	0	0
		523 State & Local Government - Non-Ed	0	0	0	0
		524 Rest Of The World Industry	0	0	0	0
		525 Domestic Services	0	0	16,184	16,184
		526 Dummy	0	0	0	0
		527 Dummy	0	0	0	0
		528 Inventory Valuation Adjustment	0	0	0	0
		25001 Foreign Trade	0	0	0	0
		28001 Domestic Trade	0	0	0	0
		Total	30,901,520	5,818,354	3,172,743	39,892,617

The direct output originates with agriculture.

The indirect output is generated in all industries due to purchases by agriculture.

The induced output is generated in all industries due to increased spending by individuals.

IMPLAN, “IMPLAN Professional 2.0”, Minnesota IMPLAN Group Inc., 2000.

## APPENDIX B

### Acreage by Land Use and Ownership in the Sacramento River Conservation Area (SRCA) in Glenn County

Inner River Zone			
	Private	Public	Total
Agriculture	2,637	808	3,445
Orchard	2,109	637	2,745
Other, field crops	528	171	700
Riparian Native	2,555	2,059	4,614
Farmstead, Urban	47	7	54
<b>Total</b>	<b>5,239</b>	<b>2,874</b>	<b>8,113</b>

SRCA less Inner River Zone			
	Private	Public	Total
Agriculture	24,612	2,272	26,884
Orchard	9,998	1,603	11,601
Other, field crops	14,614	670	15,284
Riparian Native	968	541	1,509
Farmstead, Urban	383	8	391
<b>Total</b>	<b>25,963</b>	<b>2,821</b>	<b>28,785</b>

Sacramento River Conservation Area			
	Private	Public	Total
Agriculture	27,249	3,080	30,330
Orchard	12,107	2,239	14,346
Other, field crops	15,142	841	15,983
Riparian Native	3,523	2,600	6,123
Farmstead, Urban	430	15	445
<b>Total</b>	<b>31,202</b>	<b>5,695</b>	<b>36,897</b>

Based on Geographic Information System data, 1994, California State University, Chico.

## APPENDIX C

### Technical Advisory Committee

John Benoit  
Director of Resource Planning and Development for Glenn County

Denny Bungarz  
Member of the Glenn County Board of Supervisors, District 4 and Chair of the SRCA Board

Burt Bundy  
Manager of the SRCA

Ramon Vega  
Manager for the Sacramento River National Wildlife Refuge, USFWS

Sam Larson  
The Nature Conservancy, Chico Office

Vincent Minto  
Glenn County Assessor

Marlyce Myers  
The Nature Conservancy, Sacramento Office

John Merz  
Sacramento River Preservation Trust

John Carlon  
Sacramento River Partners

### Role of the Technical Advisory Committee

The members of the technical advisory committee were involved in all phases of this study, from the writing of the proposals for funding to review of the draft document. The first meeting was in April 1998 where the members offered their suggestions as to what issues they would like to see addressed. Additional meetings in June and July of that year were for purposes of refining the proposal. Due to funding limitations the study was separated into two phases. The first phase addressed the impacts on Glenn county property tax revenues. The final report entitled The Impact on Glenn County Property Tax Revenues of Public Land Acquisitions in the Sacramento River Conservation Area was completed in June 1999. The advisory committee reviewed that document and participated in developing a new proposal for the current study, The Economic Impact on Glenn County of Public Land Acquisition and Habitat Restoration Activities in the Sacramento River Conservation Area. Committee members were apprised of the progress of the study and consulted regarding issues to be assessed and the appropriateness of assumptions. The initial presentation of the study results was before the advisory committee on April 5, 2001.

### **Public Presentations of the Draft Report**

The draft report was completed on December 23, 2000 and sent out to the members of the technical advisory committee in January 2001. The summary of the results was presented to that committee at a meeting in Willows, California on April 5 and comments were solicited from members. Following that meeting additional copies of the report were circulated to members of the SB1086 Technical Advisory Committee (TAC). A summary of the results was presented at a regular meeting of the TAC on April 19 in Willows. Oral and written comments were solicited from the members present. The TAC decided to form a subcommittee to review the document and to submit written comments for inclusion in a public review appendix of the final draft. A draft of the subcommittee's comments was emailed to the authors on May 20, 2001 followed by a meeting between the authors and two members of the subcommittee on May 21, 2001 at the Chico office of the California Department of Fish and Game. The comments were discussed and a revised version of the comments is to be submitted by June 1, 2001. The final version of the comments is included in this appendix along with the author's response to the issues raised.

### **Peer Reviews and Public Comment**

The following peer reviews and public comments were submitted and made available to the authors for inclusion in the report. The reviews and comments are based on the December 23, 2000 draft report that was circulated in March and April of 2001. The reviews are included in their entirety but with comments from the authors. All author's responses are in italics and are entered immediately following the reviewer comment.

### **Reviewer Evaluation Comments on Ronald G. Adams and David E. Gallo: The Economic Impact on Glenn County of Public Land Acquisition and Habitat Restoration Activities in the Sacramento River Conservation Area**

**Reviewed by Thomas Wegge and Roger Trott, TCW Economics**

Is the report technically sound and based on the best available science?

With the exception of the comments noted below, the report appears to incorporate reasonable objectives and to employ appropriate methodologies. Data sources appear to be adequate, although some relevant studies for the benefits analysis apparently were not reviewed as indicated below. The range of cases evaluated appears reasonable. Out-of-area benefits and impacts are not evaluated; however, the exclusion of these effects is appropriate given the limited objectives and geographic scope of the study. The assumptions employed by the study generally appear to be reasonable, although the reasons for some assumptions are not well documented (e.g., the 3% discount rate introduced in the second paragraph of page 53). The authors should review assumptions cited in the report and provide a rationale or basis for each assumption.

Following are specific comments on the scope and technical aspects of the report.

1. On some pages of the report, the purpose of the study is stated as determining the impact on the Glenn County economy (see second paragraph in the Preface) or the economic impacts

on Glenn County (see Purpose and Scope section). Much of the analysis focuses on effects to residents of Glenn County. Because the nature and approach to evaluating effects on residents versus effects on the economy are fundamentally different (one involves welfare analysis and the other involves regional economic analysis), the purpose of the study should be stated more clearly and consistently. Furthermore, we recommend that the distinction between these two types of effects (changes in resource costs and benefits versus changes in regional economic activity) be maintained throughout the study to avoid confusion between these different types of effects.

*Author's Response-* This is a concern we had in doing the study. The original study proposal specified an analysis of the impact on Glenn County agriculture. We interpreted that to mean the output effects of converting land from agricultural uses to riparian habitat. The benefits of increased visitor spending and the impact of habitat restoration activities are also in terms of output effects. However, the benefits to residents are in terms of an income equivalent which is a different basis than output. The problem arises in the final section of the report when the costs and benefits are compared. A more appropriate comparison is the net loss in personal income due to elimination of agricultural activity, additional visitor spending, and habitat restoration activities, and, the recreational benefits accruing to Glenn County residents. Clearly the approach we used overstates the net loss. For that reason the final draft includes a comparison of benefits and the loss of value added. Those results are summarized in Table 4c.

2. The report does not address fiscal issues. The fiscal impacts of farmland conversion and habitat development would have indirect effects on Glenn County residents by resulting in changes in tax revenues and potentially on service levels. While it may be appropriate to exclude fiscal effects since these effects are indirect, the report should at least acknowledge that fiscal effects could occur and discuss why they have been excluded from the report. Gallo has previously prepared an assessment of the fiscal effects of habitat restoration in Glenn County. Perhaps this report should be referenced.

*Author's Response-* This report is actually the second phase of a project which began with our 1999 report, Adams, R., D. Gallo, and J. Hurst 1999, *The Impact on Glenn County Property Tax Revenues of Public Land Acquisitions in the Sacramento River Conservation Area*, USFWS Contract Number 11332-8-G100, June, 1999. In that report we analyzed the impacts of the public land acquisition process on Glenn County property tax revenues. The conclusion of that report was that there was no significant impact on county property tax revenues since in lieu payments by the state and federal governments would offset the loss of property tax collections from private landowners.

3. Many of the report's tables lack sources. Sources should be provided for secondary data included in tables.

*Author's Response-* All data sources are provided in the text associated with the tables.

4. Numbers from the IMPLAN analyses are presented to the nearest dollar, suggesting a level of precision that cannot be supported by the analysis. In the text, we suggest rounding dollar

values predicted by IMPLAN to the nearest \$1,000 value. The employment estimates also should be rounded to the nearest job.

5. The report appears to use 1997 as its base year for dollar figures. On page 3, paragraph 2, however, personal income figures are based in 1998 dollars. Early on, the report should clearly indicate what base year is being used. Reasons from deviating from this base year should be clearly noted in the report.

*Author's Response- While there is some difference in the base years- IMPLAN uses 1997\$ while some other sources use 1998\$- all comparisons were made using a consistent base year.*

6. Page 9: The soils discussion on this page infers that the quality of soils within the IRZ is not high. Although the quality of IRZ soils is not as uniformly high as elsewhere in the SRCA, the IRZ is composed of a high percentage (71%) of Class I and II soils, which typically qualify for prime farmland designations under USDA and California Department of Conservation definitions. Although flooding frequency could diminish the productivity of these soils, the overall high quality of IRZ soils should be discussed so as to not appear biased.

*Author's Response- The use of the IRZ soil classes from Table 9 is consistent with the subsequent discussion and intended to offer a partial explanation of the IRZ orchard productivity data included in Table 8. The analysis specifically refers to the difference in the ratio of Class I to Class II soils in the IRZ and in the remainder of the SRCA, not the comparative ratios of prime and non-prime soils.*

7. Page 10, paragraph 2: IMPLAN is a backward-linked model, meaning that it will only measure indirect effects on sectors selling to the agricultural sector. Was the model modified to pick up forward-linked effects, such as on the trucking and processing sectors? If not, the modeling output could underestimate adverse effects of farmland conversion within the county. This issue should be discussed.

*Authors Response- The reviewer correctly points out that the statement on page 10 is incorrect and has been changed in the final draft. The model was not modified. Our treatment of the agricultural sector is equivalent to the implicit assumption that all output is exported with no further processing. While that approach ignores the impacts on processing industries, we felt that it was not a serious omission in the case of Glenn County. There are two reasons why we felt that this was the most reasonable interpretation of the impacts. First there is very little processing done in Glenn County so that the omission does little to bias the results. Second, where there is an economically viable processor, reducing agricultural production does not necessarily have an impact on supplies of raw material to the processor. Particularly where transportation costs are a factor, sources within the county or in adjacent counties are likely to divert formerly exported and unprocessed crops to the local processor. If this is the case then the reduction in county production and export of the raw agricultural products is responsible for the entire local economic impact.*

8. Page 11, last paragraph: This paragraph is confusing. Is the first sentence supposed to mean that there have been no land use changes before or since 1994? If before, what period is being discussed? All years before 1994? And why 1994? In the second sentence, is there a difference in meaning between the “purchase” of parcels and the “acquisition” of parcels. The third sentence does not seem to follow logically from the previous two sentences. Clarification is needed.

*Author's Response-* The sentence says, “there were no significant changes in land use on the publicly owned lands in the SRCA by 1994 when the latest GIS data were collected”. The issue addressed in the subsequent discussion is that from the public acquisition date to the date the GIS data were collected agricultural land use was not measurably altered from its prior use under private ownership. That fact establishes the year 1995 as the base year for all conversion of agricultural lands in the SRCA to riparian habitat, and therefore for all associated economic impacts.

9. Page 24, first paragraph, last sentence: The impacts referenced in this sentence (i.e., \$2,168,928 in output, 26.9 jobs) do not match the related figures in Table 16a.

*Author's response-* The error is in the text, not the table, and has been corrected in the final draft.

10. Page 27, first paragraph, first and second sentence. Why the reference to “socioeconomic costs”? This section is dealing with benefits.

*Author's Response-* This sentence is to remind the reader of the context of the benefits assessment; that is, there are costs associated with the benefits that are to be discussed in the following section.

11. Pages 27-29. The contribution that the restoration program makes to achieving the goals of CVPIA and the AFRP needs to be discussed more thoroughly. Because the fishery benefits that are estimated for the study are tied to achieving these goals, a more definitive relationship between the restoration program and fish doubling needs to be established. It would appear that the restoration program could take credit for only some portion of the fish doubling benefits. The economic benefits to recreational anglers and commercial fishermen of achieving the goals of the CVPIA were analyzed in the EIS/EIR for implementing CVPIA. The Fish, Wildlife, and Recreation Economics Technical Appendix that accompanied the EIS/EIR describes the regression models and results of analyzing fish doubling and other scenarios.

*Author's Response-* The connection is made in the second sentence, paragraph one on page 29 of the draft report. Habitat restoration is but one part of the AFRP, but the one that imposes economic costs on Glenn County residents.

12. Page 31, Table 1b. This table includes many studies that are either old or are not focused on anadromous species. A more updated list of studies that focus on salmon can be found in a

technical memorandum developed by Jonathan Platt entitled “Benefits Transfer Approach to Estimating Recreation Value.” A copy of this table is enclosed.

*Author’s Response-* The literature review done in connection to this part of the study was limited to studies in refereed economics journals. The sample included in the table was to indicate the range of values obtained, and with the exception of the Huppert and Taylor and Douglas studies, were not used in the benefits calculations.

13. Page 33. The calculation of the number of angler days by Glenn County residents should take into account the proportion of anglers that are fishing for salmon and striped bass on the Sacramento River because these are the species that are assumed to be enhanced by the restoration, according to information on the bottom of page 29.

*Author’s Response-* The angler days by Glenn County residents were taken from an excel file provided by DFG and did not include the species sought. However, that file was used only to determine the proportion of anglers using river reach 5 that were Glenn County residents or residents of other areas. The proportion of angler days by region were used to allocate the angler day population estimates provided in the DFG annual report (California Department of Fish and Game (“Preliminary Creel Survey Data for 1998, Table 3”, Received January 25, 2000) to the various regions. Those figures did include fishing hours by species sought. We made the implicit assumption that visitors and residents target species in approximately the same proportion.

14. Page 33, second paragraph. Does the \$93.56 for expenditures per day cited from the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation include spending for durable items used for fishing? If so, these items should not be considered variable for purposes of estimating changes in spending associated with changes in the number of fishing days.

*Author’s Response-* Expenditures per day were used to calculate the willingness-to-pay for a single fish of a particular species. It is appropriate in this case to use all costs, fixed and variable. In the case of visitor expenditures only variable costs were included.

15. Pages 34-35. The appropriate measure for valuing changes in fishing quality is the change in consumer surplus, or net willingness to pay. The \$114 value cited in Method 1 is a gross value figure and is not appropriate for valuing the benefits to anglers of changes in fishing quality.

*Author’s Response-* This is a misunderstanding of the method employed. Gross willingness-to-pay was used to value a fish. The change in resource quality was defined as an increase in the catch and the derived value was also assumed for the additional fish caught. This was one of three valuation methods used (the highest estimate), and our concern with the compromises involved with this and the other approaches employed is clearly expressed in the first paragraph of page 36. Whether an angler values the second fish caught as highly as the first is unknowable in the absence of a demand curve derived from site-specific data.

In “Economic benefits of rare and endangered species: summary and meta-analysis”, *Ecological Economics* 18(1996), pp. 197-206 by John B. Loomis and Douglas S. White, the authors examine the impact of several variables on willingness to pay measures. The coefficient of change in population size (for the double log form) is 0.803 implying that a 100% increase in species population would increase willingness to pay by 80%. Multiplying the high benefit estimate by 0.80 reduces the estimate using method 1 to roughly the median benefits value used in Table 1c-4c and between the values obtained using methods 2 and 3.

16. Pages 36. At least two of the three studies cited in Table 6b pertain to the responsiveness of marine anglers to quality changes, which is likely to be different from Sacramento River anglers. As indicated in Comment #11 above, the responsiveness of Sacramento River anglers to changes in fishing quality was evaluated as part of the EIS/EIR on the CVPIA.

*Author's Response-* The studies included in Table 3b and used to calculate angler response to a change in fish abundance were chosen based on our assessment of the quality of the data and analysis, and, the specific characteristics of the output. For example, in the Andrews and Wilen study they assessed the difference between local and visitor angler response rates to changes in fish abundance. We considered this information particularly important since our focus was on local anglers. We felt that the added information the study provided was worth the compromise that the results were based on marine salmon fishing.

17. Page 40-41. As mentioned in Comment #15, the appropriate measure for valuing changes in the quality of wildlife viewing is consumer surplus, not the “gross” economic value of the activity. The rationale explained in the second full paragraph on page 41 for how changes in wildlife viewing quality are valued is confusing.

*Author's Response-* In this case the “change in resource quality” is the creation of an area for viewing wildlife. The gross willingness-to-pay, which includes expenditures and consumer surplus, is the appropriate measure of the resource value.

18. Page 42. The value to non-users associated with the restoration presumably is tied to the recovery of anadromous species, particularly listed species such as Winter-Run salmon on the Sacramento River. The non-use benefits associated with wetlands preservation estimated by Whitehead (1994) and in numerous other studies would appear to be only marginally related to the restoration program. We suggest focusing on the non-use benefits of fishery restoration and modifying the discussion of the Taylor and Douglas study to reflect the fishery restoration aspect of that study. Other research on the non-use values of salmon restoration that is often cited is “Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs” by Daryll Olsen, Jack Richards, and R. Douglas Scott. The article appeared in Volume 2 of *Rivers*, 1991.

*Author's Response-* There was no assumption that non-user value is tied exclusively to recovery of anadromous species. The existence, bequest, altruistic and other values associated with aquatic species preservation are not unique. Aesthetic benefits and those connected to recovery of threatened terrestrial species due to habitat preservation and restoration may be as important for determining non-use values.

19. Pages 45-48: Benefits excluded from the benefits total should be discussed elsewhere. The discussion of these benefits in the midst of the discussion of included benefits is confusing. Perhaps the excluded benefits could be discussed in an introductory section, where they could be quickly discussed with reasons given for their exclusion.

*Author's response- Including the benefits not assessed with those for which estimates were presented is mainly due to considerations of process. These were among the issues raised by various members of the Technical Advisory Committee. The committee had an important role in establishing the parameters of the study. The fact that we did not find sufficient evidence to support a non-zero value does not lessen their importance to the public members who suggested they be included.*

20. Page 51, first paragraph: Why is the value of agricultural production assumed to be constant in real terms while benefits are assumed to increase in value due to population and income growth over the 35-year period? Admittedly, crop values would not be expected to change at the same rate as population and income growth, but they would likely change in real terms over this period. The assumption that they wouldn't change doesn't seem reasonable and appears to bias the analysis. If benefits are being adjusted over time, crop values should also be adjusted, or at least a rationale should be provided for why they aren't being adjusted. Adjustments could be made using longterm trends in the producer price index for California farm commodities or for specific crops grown in the SRCA.

*Author's Response- The "assumptions" are based on historical trends. Due, in part to productivity improvements in agriculture, real crop values on a per unit basis have actually declined. Real revenues per acre for almonds (three year average) were unchanged for the 1970-1999 period. Real per acre revenues for walnuts declined somewhat over the last ten years although there is no clear trend. For the 20-year period between 1965 and 1985 real expenditures per freshwater fishing participant increased by 1.42 times the rate of growth in Real GDP (page 44, paragraph 2).*

Does the organizational and writing style effectively deliver the findings?

Although the report appears to be objective and generally sensitive to potential political issues, it was very difficult to read. It seemed unnecessarily long and redundant. At times, it was difficult to wade through the discussions of competing methodologies that were intermixed with the impact analyses. A lay person would have a difficult time reading and understanding this report. Once reached, the findings are generally expressed clearly, but sorting out how the authors came to those findings requires a great deal of effort. The following suggestions are offered to improve the readability of the report.

1. The executive summary could be shortened, focusing solely on the purpose, objectives, scope, conclusions, and limitations of the study.
2. Methods and assumptions are sprinkled throughout the discussions of cost and benefit effects in sections two and three, resulting in redundancy and confusion. These should all be

brought together in the “Methods and Assumptions” portions of each section. The impact discussions should be streamlined, focusing on the cause, level, and intensity of impacts.

*Author’s Response- The comments in this section are associated with questions of style. But, in this case we disagree with the reviewer’s point of view because we believe a listing of assumptions without firm links to the material affected by the assumptions would be meaningless and confusing to most readers. While this approach may be appropriate for a journal article, it is not for a study intended for use by the general public.*

3. Case descriptions and related assumptions should be dealt with in the “Introduction” section of the report. The cases should be described in more detail, including the reasons for selecting them. Case descriptions should not appear elsewhere, except in relating elements of each case to the impacts they are causing.
4. On pages 20-24, the impact analysis is divided into a number of geographic segments (i.e., public lands inside the IRZ, private lands inside the IRZ, public lands outside the IRZ, parcel segments outside the IRZ). Couldn’t effects within these segments be added together and discussed as one to reduce redundancy and confusion? A summary table could be presented showing affects by category of land (similar to Table 16a, except with sector detail).

*Author’s Response- Aggregating the various geographical elements used in the base-case and other cases would ignore the differences in agricultural land use in various parts of the SRCA. In addition, those differences were used in calculating the impact of reducing the acquisitions of overlapping parcels. Those parcels were not characterized adequately by the general land uses in the SRCA.*

5. The lengthy discussion of methods used to evaluate fishery resources on pages 29-37 should be placed in an appendix. The body of the report should only discuss the actual methods used to evaluate fishery benefits.

*Author’s Response- The methods discussed were the methods used to evaluate fishery benefits.*

#### Areas of future work needed?

We suggest that this section include a discussion of research topics addressed in the report that would benefit from further refinements, such as the three benefit topics (savings on public facilities, flood damage reductions, freed up water) that were addressed but not quantified for purposes of the benefit and cost assessment. In addition, the need for further research to understand key physical/biological/economic relationships such as the relationship between the restoration program and achieving the fishery benefits should be mentioned.

5/17/01

Dear Mr. Bundy,

I have read the draft manuscript, “The Economic Impact on Glenn County of Public Land Acquisition and Habitat Restoration Activities in the Sacramento River Conservation Area.” Overall, I find that the manuscript includes some interesting analysis and most of its assumptions seem reasonable. However, most importantly, I find that a fundamental flaw leads costs to be greatly overstated. In addition, some of the techniques used in the analysis need to be more thoroughly qualified for a multidisciplinary audience. Finally, there are a number of places where the manuscript is either inconsistent or unclear. If the document were used as is, I believe it would be misleading, particularly to non-economists. I recommend that the manuscript be accepted only in the case that it incorporates the following 3 substantial revisions, which are listed in order of importance:

- 1) It is extremely misleading to count decreased agricultural production due to acquisition of privately owned farmland as a cost to Glenn County. Removing this “cost” from the analysis would cut the reported losses to Glenn County in half.

Presumably, farmers whose land is acquired for habitat restoration are duly compensated. A rational landowner will not sell a parcel of agricultural land unless the sale price at least equals their expected present value of that land during the remainder of its productive lifetime. In other words, the cost of foregone production from privately-owned farmland that is acquired for habitat restoration will be matched by a benefit that at least equals this cost, if not exceeds it. No such benefits appear to be included in this manuscript. It is true that the potential annual production value of the agriculture industry in Glenn County will be decreased by conversion out of agriculture, but those landowners who converted will be at least as well off as before.

I recommend that the annual direct impacts of output and employment in the agricultural sector from conversion to habitat uses be removed from the analysis as a cost. It may still be useful to show these impacts in the manuscript since they are used to calculate indirect and induced costs. However, it should be made explicitly clear that private owners of farmland are compensated for their land. A more transparent and probably useful way to discuss costs and benefits of agricultural land acquisition would be in terms of the net costs/benefits to various key groups that would be affected including (a) landowners who sell their land for habitat, (b) farmers who are no longer able to use public land for agriculture, (c) suppliers of inputs and processing services to local agriculture, (d) anglers, (e) recreational enthusiasts, etc. IMPLAN may be too rigid for this type of analysis, but even a qualitative discussion would help frame the issues.

*Author's Response- The question raised by the reviewer is similar to one discussed in the review by Wegge; that is, what is the frame of reference for assessing costs. It is clear that the landowner is no worse off in that the sale of property to various public entities and NGO's is on a voluntary basis. Yet there is still a cost to the County beyond the third party effects. The appropriate measure of the direct cost is the loss in county personal income less proprietor's income (since that is presumably compensated for in the land sale). Including all of the direct output effects as a cost does overstate the cost to county residents, but removing all direct impacts would result in understatement of the costs.*

*The consequences of this overstatement of the costs were addressed at two points in the final section. On page 57 of the draft report the question of the impact of proceeds of land sales is addressed. If a local resident sells land and reinvests the receipts within the county there is an additional benefit to the extent that the assets increase production in any sector of the local economy. A lack of information made it impossible to address this issue in the report. On page 58 of the draft report (conclusions) the output change is compared to county output, not county personal income.*

*In order to further clarify this point an additional table and associated discussion has been added to the “Comparison of Costs and Benefits” section. The results are summarized in Table 4c where the benefits are compared to the losses in value added. The change in value added within Glenn County is approximately equal to the change in personal income.*

- 2) Some of the more important caveats to the IMPLAN model need to be explained in the manuscript. Particularly for those not familiar with the model, it is not enough to refer them to a website that gives a list of others who have used the model. My understanding of IMPLAN is that for a county-level analysis like this one it does not allow for economic transactions across county lines. Of course, in reality, business transactions do not stop at the county line. Thus, an important unstated assumption in the results of the analysis is that suppliers of inputs and processing services to agriculture in Glenn County are totally inflexible and unable to adjust by finding new customers outside of county lines in the event that local agricultural land is acquired for habitat. This implicit assumption should be made explicit. I suspect this inflexibility is unrealistic and leads to the indirect and induced costs being overstated somewhat. The manuscript should provide a section describing this and other important caveats of the IMPLAN model, with perhaps more detail in an appendix. Non-economists would also benefit from an expanded explanation of how multiplier effects work to cause the “indirect” and “induced” effects cited in the text.

*Author’s Response- The IMPLAN model is a backward linked model and does not include impacts on processing industries. There was a mistake in the description of the model in the original draft that has been corrected in the final draft. For the reasons given by the reviewer we do not believe that the results are biased by this omission. The IMPLAN model deals with a change in agricultural output as a change in exports of raw agricultural products. This is consistent with the specific conditions present in Glenn County; that is, very little processing occurs within the county and the small amount that does need not be affected by decreasing agricultural production. There is no reason that processing inputs cannot be found elsewhere within the county or imported from adjacent counties.*

- 3) A paragraph or two on the difficulty of valuing non-market goods should be added to the beginning of the “benefits” section. The paragraphs should note that the economic methods used to generate the specific estimates which are used in that section are far from precise and that their usefulness is often debated in the economics profession. Specifically, the travel cost and contingent valuation approaches have well known problems; value estimates generated using those methods may or may not be close to

actual values. This explanation is probably essential for non-economists who want to understand the analysis and why it is important to calculate the benefits under different scenarios. In its current state, a non-economist could easily read the benefits section and mistakenly think there is an element of precision in the dollar value of benefits that does not exist.

*Author's Response- We believe it was made adequately clear that the benefits estimation techniques used in the study are subject to considerable criticism. On page 30 we raise the issue of using studies based on data from other areas to estimate the value of fishery resources on the Sacramento River. On page 36 of the same draft we explain that there are problems with each of the three methods used to estimate benefits to anglers.*

In addition to the three previous essential revisions, I have a number of other suggestions that I believe would improve the manuscript and correct existing problems. They are listed here in no particular order:

- A) The GIS data for Glenn County agricultural land that is used in the report is dated from 1994. More recent GIS data for crop distribution in Glenn County for 1998 is available to the public in electronic form at no charge from the California Department of Water Resources. This data should be substituted in the report to better reflect the current situation.

*Author's Response- At the time we did that portion of the study the 1994 GIS data set was the only one available that separated the deciduous orchards category into the specific types of tree crop. Given the differences in gross revenues per acre for walnuts, almonds, and prunes this quality was particularly important. While the 1998 data may now be available at the same level of detail, it is not worth revising the entire study to incorporate the newest numbers. Whether the 1994 or 1998 land use patterns more accurately portray future uses is impossible to determine.*

- B) When introduced on page 1-2, conservation easements are poorly defined. It should be mentioned that they are mainly used to purchase the development rights to farmland in perpetuity, and that this usually does not impinge on agricultural production.

*Author's Response- The reference is to conservation easements; that is, purchasing the right to farm the land.*

- C) "The Economic Impact of Past Land Acquisitions in the Butte Sink" section given on page 12 should be removed from the report since it is not part of the study and the authors do not relate it to the study. It can be provided to interested parties through a more suitable medium.
- D) It would be useful to give some summary statistics on the type of land in Glenn County (acres of cropland, grazing land, public land, private land, urban land, native vegetation, etc). Having a summary table with this information would help put the particular case study into a larger perspective. This data is available to the public from the Department

of Water Resources and the Department of Conservation, Farmland Mapping and Monitoring Program.

*Author's Response- Much of that information is contained in a summary table in Appendix B. The final draft will also include some color maps that will contain much of the information the reviewer mentions. They were omitted from the draft report due to budget considerations.*

- E) Table 5a should make it clear that the numbers in the table are **annual** impacts
- F) Page 20 refers to “tables 9a and 10a” when it means 8a and 9a, and later on that page “Table 11a and 12a” when it means 10a and 11a.
- G) In table 16a, it is not clear how the following two numbers are derived: \$2,610,957 and \$2,068,586. It seems to me they should have been listed in some of the previous tables, but they are not.
- H) Page 27 says that “the benefits to the county can be separated into four categories....” and then lists 5 categories.

*Author's Response- Through several revisions prior to the release of the draft report many changes were made, sometimes resulting in improperly numbered tables and other residual errors. Further editing will be done before the final draft is completed. All of the changes specified in E-H above have been made including, where appropriate, labeling all tables with "annual impacts".*

- I) Page 29 says that “For purposes of this study it is assumed that the [CVPIA] AFRP target is met for the year 2002 and beyond.....”, while page 51 reads, “While the CVPIA [AFRP] goals regarding populations of anadromous fish species are to be met by 2002, we assume the goals are met in 2005.” This discrepancy needs to be corrected somehow.
- J) I do not claim to know much about fishery populations and recent success or failure in building them up, but I question whether it is realistic to assume that the populations will increase by 279% and 257% by 2002 or 2005 (p.29). If this assumption is not realistic, it would change the results of the benefits analysis.

*Author's Response- We had to depend on the involved agencies and their opinions on this point. Although the law states that the goal is to achieve the fish population targets by 2002, discussions with individuals within the agencies expressed that the goals would be achieved (at least for salmon) but at a somewhat later date.*

- K) On page 49-50, it is unclear why the direct expenditures for habitat restoration are allocated to the agricultural sector. How will expenditures on habitat restoration create 192 jobs in agriculture?

*Author's Response- Because habitat restoration is a labor intensive agricultural operation.*

- L) Given the lack of precision inherent in the IMPLAN model, it is misleading to display dollar values in the tables down to single digits or jobs down to fractions of jobs. Doing so gives a false sense of precision. These numbers should be rounded off to be more consistent with the reality that the numbers are rough estimates, not precise figures.
- M) In reading the document, I found a few technical grammatical errors and places where ideas could be stated more clearly. Although it is relatively clean, the document could still benefit from being read by a technical editor.

**Public Comments on  
The Economic Impact on Glenn County of Public Land Acquisition and Habitat  
Restoration Activities in the Sacramento River Conservation Area**

**Background**

The document entitled “The Economic Impact on Glenn County of Public Land Acquisition and Habitat Restoration Activities in the Sacramento River Conservation Area” was prepared by California State University, Chico Research Foundation for the Sacramento River Conservation Area Non-Profit Organization (SRCA) under contract from the U.S. Fish and Wildlife Service. As stated in the study’s Preface, “its purpose is to determine the impact on the Glenn County Economy of public land acquisition and habitat restoration activities in the SRCA.” These comments have been prepared to summarize important issues related to the study. These comments are intended as an addendum to study in order to ensure that future reference to the study properly assesses varying opinions to the true economic impact of land acquisitions in Glenn County.

**Summary of Key concerns with the Economic Study**

Summaries of key concerns are outlined below. Further discussion on each item listed will follow as warranted.

- **The study’s conclusions are based on favorable economic findings by limiting the scope of the study.**
- **The study asserts that it addresses direct, indirect, and induced effects, however it does not attempt to assess cumulative impacts associated with additional impacts of other land acquisition and habitat conversion programs outside the SRCA but within Glenn County. (CALFED, TNC, Corps of Engineers, NRCS, WCB, CVJHV)**

- **The IMPLAN model cannot truly assess the total economic impact of land conversions because the model fails to address impacts related to increased wildlife foraging, crop damage, etc. The model only has the capacity to assess “direct economic loss” associated with acquisition, but fails to address loss in productivity to surrounding lands. Increased ESA regulatory constraints on surrounding farming operations.**
- **The sources of information used to determine impacts require additional justification. (*land productivity, etc.*)**
- **The study does not address increased flooding risk and associated economic impacts resulting from revegetating floodplain areas.**
- **The future value of recreation benefits are largely dependant on the development of proper management plans and infrastructure needs i.e. boat ramps, hunting access, etc. and future legislative appropriations.**
- **The number and value of fish species of direct benefit to the SRCA reach requires justification.**

### **Key Concerns**

**The study’s conclusions are based on favorable economic findings by limiting the scope of the study.**

In order for the study to be truly representative of the economic impacts to Glenn County due to land acquisitions, the scope of the study should be expanded to include all parcels included in the SRCA, i.e. those parcels adjacent to or extending beyond the levees. The scope of the study was limited because the true economic loss would be closer to \$90 million according to original figures submitted to the authors. (still need original finding from the author)

Additionally, the data used in this study was cut off at 1994, prior to the influx of land acquisition activities currently being undertaken. With regard to the date used, most of the benefits have already been realized and should not be considered.

*Author’s Response- The total contribution of agriculture in the SRCA to Glenn County output is \$44,855,317 (see Table 2a and 5a). The 1994 date was used as a baseline and all conversions of agricultural land to habitat were assumed to take place after 1994. That assumption is consistent with the data supplied by the Glenn County Assessor.*

**The study asserts that it addresses direct, indirect, and induced effects, however it does not attempt to assess cumulative impacts associated with additional impacts of other**

**land acquisition and habitat conversion programs outside the SRCA but with in Glenn County.**

Again, by limiting the scope of the study the assessment of cumulative impacts can not be determined given the impact of other public and private land conversion programs currently being operated in the County. Specifically, programs administered by the Wildlife Conservation Board, Central Valley Joint Habitat Venture, The Nature Conservancy, CALFED and others. The importance of a complete assessment of all land conversion programs is warranted because each program in and of itself may not seem significant.

*Author's Response- The scope of the study was to assess the impact of land acquisitions within the SRCA only. Lands administered by the Wildlife Conservation Board and those held by the Nature Conservancy (although most of their holdings are ultimately transferred to various government agencies) are included in the analysis. If there are other lands within the SRCA not included they are likely to be small acreages and their exclusion would not significantly affect the results. All public land holdings were considered in the analysis as the GIS data provide that information as a broad category without regard to the agency holding title.*

**The IMPLAN model cannot truly assess the total economic impact of land conversions because the model fails to address impacts related to increased wildlife foraging, crop damage, etc. The model only has the capacity to assess “direct economic loss” associated with acquisition, but fails to address loss in productivity to surrounding lands. The model is also limited because it is unable to assess loss associated with increased Endangered Species Act (ESA) regulatory constraints on surrounding farming operations.**

The accurate assessment of total economic impact, even within the limited scope of the study, should attempt to quantify real economic loss to surrounding lands. This loss includes not only decrease in land value, but also the decrease in productively associated with increased invasive foraging animals.

*Author's Response- It is true that there was no attempt to estimate wildlife damage. The problem is that the wildlife damage relevant to the analysis is the increment in damage due to extension of wildlife habitat. Lacking baseline data and the biological information needed to estimate the change in damages it was impossible to account for this cost factor. However to put this in perspective, due to a lack of reliable data many of the potential benefits were also excluded from the analysis.*

**The sources of information used to determine agricultural impacts require additional justification.**

The study sites that “data provided by The Nature Conservancy (TNC) on orchard lands ...are less productive than the county average.” (Page 8) However, the 70% discounting of the county average production of walnut, almonds and prunes is in effect “double discounting” since the originating figure is an “average of the county” including those acres with in the SRCA.

Additionally, data used to determine the soil class within the meander belt to be “only 7.4% class 1”(Page 9) does not attempt to differentiate between actual planted acres vs. total acreage that includes gravel bars.

Flood damage in relation to productivity of orchards is misrepresented. The frequency of flood events in relation to the extended productivity of an average walnut, almond or prune orchard and the subsequent annual income derived from that production into the local economy is ignored. The study also states that “We could locate no research delineating the relative productivity of orchards planted on class I or class II soils” (Page 9) but discounts them by 70% anyway.

*Author's Response- We used the best data available to adjust orchard productivity in the IRZ. If better data were available for the IRZ and the portion of the SRCA outside of the IRZ we would have used it. However, the yearly sample (for 1994-1999) averaged 75% of the 1994 walnut acreage in the IRZ. It is not likely that adding in the 25% of walnut acreage not included would significantly alter the result.*

**The study does not address increased flooding risk and associated economic impacts resulting from revegetating floodplain areas.**

The information presented in this study does not correspond with other damage assessment currently being undertaken by other parties, for example the Army Corps of Engineers Sacramento River Comprehensive Study.

The study does not attempt to address the increase in flood risk and the impact to areas outside of the SRCA. Additionally, the study should attempt to quantify the investment of reforestation on a per acre basis in relation to the no action alternative of letting nature take its course.

*Author's Response- There is no attempt to assess increases or decreases in the risk of flooding due to expansion of riparian habitat. There are cases where decreases in flow velocity may reduce channel capacity and increase flooding and others where additional vegetation may protect levees and riverbanks and thus reduce flood damage.*

**The future value of recreation benefits are largely dependant on the development of proper management plans and infrastructure needs i.e. boat ramps, hunting access, etc. and future legislative appropriations.**

In order to realize any benefits associated with increase fishing as a direct result of land acquisition and habitat restoration activities access to this resource must be maintained and increased. However, it is widely held that decreases rather than increases in access, maintenance of facilities i.e. boat ramps, trails, and general management activities associated with restoration activities. The study concludes that benefits will only be realized if management activities are undertaken and existing facilities are maintained and expanded only then “will generate the use levels necessary to realize the projected benefits” (Page 59). Recent audits by Assemblyman Richard Dickerson and U.S. Congressman Doug Ose point to the lack of expenditures by state and federal agencies to adequately manage and maintain acquired lands.

*Author's Response- That was a point that was made in the benefits section. It is clear that to achieve the estimated benefits the state and federal governments need to provide the necessary access and facilities.*

**The number and value of fish species of direct benefit to the SRCA reach requires justification.**

The benefits of the fishery resources are questionable given the author's admission that "Estimates can vary **considerably** depending on proximity to population centers, species of fish sought, availability of substitute sites and **other factors**" (Page 30). Furthermore, the sources cited in the study do not represent data gathered within the SRCA, again citing the author, "the main difficulty is that studies are site-specific" and "the use of the results of a study based on one set of site-specific parameter value to estimate the economic value of fisher resources in an area where parameter value differ substantially can result in significant errors in the estimates" (Page 30).

Economic benefits associated with average fishing days by Glenn County residents and the corresponding economic benefits derived from such activity are again in question due to the author's own assumptions to the relativity to the SRCA.

*Author's Response- There is no question that the science of estimating recreational benefits is an imprecise one. For that reason three alternative methods were used to estimate angler benefits (the majority of the estimated recreational benefits) and low, median, and high benefits estimates were used in the cost-benefit comparisons. Whether the actual benefits fall within that range or outside of it can only be answered with further research. However, as stated in the benefits section of the study, in spite of our reservations regarding the methodologies employed, we believe that the estimates are the best that can be made with the limited data.*

**Conclusions**

We commend the SRCA Board of Directors for asking for an assessment to qualify and quantify economic impacts to Glenn County as a result of the land acquisition activities within the Sacramento River Conservation Area. However, due to the limited scope of the study to reduce the impacts associated with such activities the study does not provide an accurate measurement of reduced agricultural production and its associated impacts to the county.

Therefore, we recommend that the author reassess the data used for the assumptions. Specifically, 1) include total acreage of all parcels located within the SRCA, whether located inside or outside of the meander belt; 2) include impacts associated with cumulative impacts of all land acquisitions programs within the county; 3) incorporate data of land acquisitions to date not just prior to 1994; 4) verify flood damage assessments are concurrent with existing comprehensive data available from the Army Corps of Engineers; and finally 5) provide a map with current land holdings by both governmental and non-profit agencies located within the SRCA.

*Author's Response- Responses to many of these items are included above. 1) All acreage within the SRCA is included, however, impacts are differentiated according to whether it is inside or outside of the IRZ. 2) The study scope is limited to land acquisitions within the SRCA. 3) The study incorporates the impact of land acquisitions as described in the base case. It includes acquisitions made prior to 1994 and projects significant acquisitions after that date (some of which have already occurred). 4) There were insufficient data to project changes in flood damage due to additional restoration of riparian habitat. 5) Maps are included in the final report.*

These comments were prepared and or reviewed by a number of concerned stakeholders representing state and federal legislative representatives, landowners, local agencies, and county government.

Kim Davis  
Senator Maurice Johannessen

Kim Dolbow  
U.S. Congressman Doug Ose

Les Heringer  
M & T Ranches

Shirley Lewis  
Director  
Sacramento River  
Conservation Area

Mike Madden  
Butte County Office of Emergency Services

Anjanette Martin  
Northern California Water Association

### **Other Comments**

The following public comment and peer review were not sent in electronic form. They are included on the next two pages as they were received. The statement of Ed Romano from the Glenn County Agricultural Commissioner is similar to that of the public group. The author's response to point four above is applicable here as well.

County of **Glenn** DEPARTMENT OF AGRICULTURE

**ED ROMANO**, Agricultural Commissioner  
Sealer of Weights and Measures

**WILLIAM R. DUCKWORTH**, Assistant Commissioner  
Assistant Sealer

Date: May 31, 2001  
To: David Gallo  
From: Ed Romano  
Glenn County Agricultural Commissioner  
Subject: "Economic Impact on Glenn County of Public Land Acquisition and  
Habitat Restoration Activities in the Sacramento River Conservation  
Area" Comments

Comments on report page 8 & 9 productivity and soil class in the SRCA.

In my contacts with growers who have orchards in the SRCA productivity of the class I & II soils is higher than productivity in the soils found in the other parts of Glenn County.

As for the three orchards owned by TNC, my observation of those orchards were that they lacked the necessary long term care to be productive. In particular, one of the orchards was not of the varieties suited to the location in which it was planted. Also, orchards operated by the SRNWR especially suffered for lack of long term care, and adequate cultural practices. I would suggest you attempt to expand your sample to well managed orchards that are not owned by TNC or SRNWR to get an accurate picture of productivity of orchards in the SRCA.

In my observation of orchards in the SRCA I observed that productivity is effective by factors in the following order; crop and variety selection, soil type, cultural practices, and flooding.

Thank you for the opportunity to comment on your report, if you have questions give me a call.

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Email: [gwiring@maxinet.com](mailto:gwiring@maxinet.com)

Reviewer Evaluation Form

Please return this form and the manuscript to the following by May 10, 2001:

Burt Bundy  
Manager, Sacramento River Conservation Area  
2440 Main Street  
Red Bluff, CA 96080  
Phone: (530)-528-7411  
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Email: bundy@water.ca.gov

**Author(s):** Ronald G. Adams and David E. Gallo  
**Title:** The Economic Impact on Glenn County of Public Land Acquisition  
And Habitat Restoration Activities in the Sacramento River Conservation Area

1. Is the report technically sound and based on the best available science?

- yes. Reasonable objectives and limits on scope of study
- yes. Appropriate methodologies for the interdisciplinary nature of the issue
- yes. Adequate data sources
- yes. Reasonable baseline assumptions and base case
- yes. Suitable range in cases analyzed
- yes. Proper handling of out-of-area benefits/impacts
- Other comments *Very comprehensive*

2. Does the organizational and writing style effectively deliver the findings?

- yes. Appropriateness for an audience with diverse interests in habitat restoration, agricultural production, and policy formation of rural communities
- yes. Captures and expresses clearly the critical findings from the economic analysis
- yes. Demonstrates all reasonable effort to provide objective analysis and interpretation of a technically complex and politically sensitive issue
- Other comments *Very objective*

3. Areas of future work needed?

- yes. Appropriately identifies limits on scope, findings, and implications of this study
- yes. Accurately identifies future work needed
- Other work needed

**Recommendation** (Please substantiate with written comments):

- ✓ Accept without revisions
  - Accept with revisions
  - Other recommendations:
- Hard to improve this comprehensive, objective study. The results are startling from a "base case" perspective. Perhaps this is a call for regional thinking...*

Signed: Larry Lloyd

Date: May 10, 2001

Name: (please print): Larry Lloyd

Affiliation: Great Valley Center

**Comments:** (use additional pages as needed)