

**Economic Impacts,  
Rice Crop Land to Wetlands Reserve Program,  
The First Results**

**Report Requested by**

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## Executive Summary

**First Results:** The first results consider only the economic impacts of the loss of rice crop land and do not consider the economic impacts of the addition of wetlands to the regional economy.

The first results indicate that restoring rice production acreage to wetlands does affect the local agricultural economy. The initial impact analysis assumed 1,000 acres of rice were taken out of production with a yield of 80 cwt/acre and a gross revenue of \$9/cwt. The initial impact analysis, reported below, is likely to be the worst case because no off-setting economic activity has been assumed. The first results show:

An estimated total loss of 21 jobs, and an estimated total loss of \$1,150,000 in total sales, and an estimated total loss of \$837,000 in wages, profits, and indirect taxes could occur within the Yuba-Sutter Region every time 1,000 acres of riceland is restored to wetlands. Approximately 2/3 of these losses are estimated to be occur within the Food Grains Industry, and the remaining 1/3 are estimated to be spread out over the remaining industries.

**Next Steps** The next steps would (a) acquire additional data to ground-truth the first results and (b) construct the assumptions about the likely impact of the new wetlands activity on the regional economy. Specifically, the next steps are:

- (1) Interview rice farmers who have sold an easement to NRCS.
- (2) Interview rice farmers who have decided not to sell an easement to NRCS.
- (3) Interview the two Tax Assessor Offices to obtain their rules/data for assessing rice production acreage which has been restored to wetlands.
- (4) Interview the local Agricultural Extension rice crop budget expert to more accurately estimate the employment consequences of reduced rice production, and other economic links between rice production and the rest of the economy.
- (5) Construct a wetlands budget describing the economic activity resulting from newly restored wetlands as they affect the local economy.

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Dr. Jerry Horner, former USDA ERS economist, has provided the theoretical background for this study. The economics specialty required for this study is one of his major fields and he has been generous. He has guided the NRCS economist to the appropriate literature, thus enabling an understanding of the theoretical potential and limits of this branch of economic analysis.

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**Introduction** This report is responding to a request from the Yuba City Field Office. Some traditional rice production acres are being restored to wetlands by means of the USDA NRCS Wetlands Reserve Program (WRP) which purchases easements from private landowners. There is a question about whether or not WRP will create unintended negative economic impacts within the Yuba-Sutter Region. We have been asked to assess the impacts of WRP on the local economy. This report provides the first results which indicate that additional information is needed to ground-truth the economic model and to develop alternative scenarios.

This study uses a branch of economics which has been developed to assess the impacts of specific changes on the general, local economy. This branch is variously called “Regional Economics”, “Input-Output Analysis”, or “Interindustry Economics”. Appendix A contains a brief description.

**The Region for this Regional Economic Analysis** For this study the “region” is defined to be Yuba County and Sutter County considered together as one economic system. Thus, the Yuba County data are considered together with the Sutter County data when assessing the impact of reduced rice production acreage. For the purposes of this report, “Region” will always mean the Yuba-Sutter Region which includes all of Yuba County and all of Sutter County.

**IMPLAN, Regional Economics Software used for this Analysis** The specific method chosen for this study is an economics software named IMPLAN. IMPLAN was developed by the USDA Forest Service in the mid-1970s for community impact analysis. The current IMPLAN database and model are maintained and sold by the Minnesota IMPLAN Group, Inc. Over 500 clients across the country use the IMPLAN model. The NRCS Natural Resources Inventory and Analysis Institute supports using IMPLAN throughout the NRCS.

The Minnesota IMPLAN Group not only maintains and modifies the software, it also assembles data. IMPLAN data are available for each county in the United States, and for the nation as a whole. The IMPLAN Group uses many data sources such as Census, Agricultural Census, at the county, state, and national levels. The IMPLAN Group extrapolates and interpolates data as necessary in order to create a database which blends the best of each data source in order to produce data which are consistent at county, state, and local levels. The California NRCS has purchased the IMPLAN county data for both Yuba and Sutter counties.

For more information about the model see [http:// www.IMPLAN.com](http://www.IMPLAN.com).  
For NRCS examples, see [http:// waterhome.brc.tamus.edu/NRCSdata/implan](http://waterhome.brc.tamus.edu/NRCSdata/implan).

IMPLAN defines the regional economy as all of industries which operate within the boundaries of Yuba County and Sutter County. IMPLAN defines a maximum of 525 possible industries. Of those, IMPLAN identifies approximately 200 industries as active

industries within the Yuba-Sutter Region. Rice production is contained in the IMPLAN industry named "Food Grains" (IMPLAN Manual, p.347).

**Assessing IMPLAN** The following section presents IMPLAN's regional economics data. If these data make sense, that is, if they are "ballpark values", then we can have more confidence that IMPLAN will be useful as a tool to distinguish significant impacts from insignificant ones. The degree to which IMPLAN data are consistent with other well documented data is the degree to which we can have confidence in IMPLAN's impact analysis. Thus, it is important to compare IMPLAN data with other, proven data. This has been done when possible. The data indicate that some model validation is required.

**Assumptions in IMPLAN** These are the assumptions which are required by IMPLAN.

(1) Closed Sectors: "Closed sectors" are those which are not affected by WRP. IMPLAN recognizes that there are approximately 200 sectors in the Yuba-Sutter Region. Two of these are not likely to be affected by the WRP (see page 237 of IMPLAN Manual for sector definitions):

1. Federal Government Defense: In the Yuba-Sutter Region, this is most notably Beale Air Force Base. Changes in the WRP are not likely to change the size or types of operations on the air force base. Thus, Beale AFB expenditures are not likely to change as a result of WRP.

2. Federal Government Investment: This sector represents investments which are made by the federal government. It consists of things such as a new field office, a new highway. It is not likely that WRP will affect such federal activities.

Note: It is quite unlikely that the WRP will affect State and Local Government activities because the WRP activities are likely to involve less than one percent of the total rice acreage in the Region. However, because the effects of the federal WRP are a concern to the local people, we have assumed that the State and Local Government activities may be affected. Including the State and Local Government sectors will overestimate the negative effects of WRP on county government.

(2) Multipliers: IMPLAN was run with all of the multipliers possible. It was run in "SAM" mode. This created the maximum multiplier values including the all of the effects within the Food Grains Industry and all other industries which are indirectly connected to rice production. This includes households and institutions.

(3) Impact Analysis Assumptions: One impact analysis was run. We assumed that 1,000 acres of rice per year were restored to wetlands. Further, we assumed that a total of \$720,000 would be directly removed from the Food Grains Industry.

$$\$720,000 = 1,000 \text{ acres/year} * \$9 \text{ gross revenue/cwt} * 80 \text{ cwt yield/acre.}$$

**IMPLAN's "Food Grains" Industry is 95% Rice in this Region** The IMPLAN industry named "Food Grains" contains all food grains: rice, wheat, sweet corn, barley, oats, etc (IMPLAN Manual, p.347). Table 1 shows that in the Yuba-Sutter Region, rice is approximately 95% of the Food Grains Industry. Thus, in order to strictly interpret Food Grains Industry descriptive data in terms of rice, the Food Grains Industry descriptive data would be multiplied by 0.95. However, because rice is such a dominant food grain in the Yuba-Sutter Region, the IMPLAN data for Food Grains will be interpreted as "rice".

<b>Table 1: Food Grains is Rice in the Yuba-Sutter Region</b>				
	Rice	Wheat	Rice + Wheat	Percent in Rice
Acreage 1997				
Sutter County (1)	90,437 acres	11,168 acres	101,605 acres	89%
Yuba County (2)	36,509 acres	930 acres	37,439 acres	97.5%
Total Value 1997				
Sutter County (1)	\$63,512,300	\$4,713,600	\$68,225,900	93%
Yuba County (2)	\$32,814,000	\$271,000	\$33,085,000	99%
(1) Sutter County: Yuba County Agricultural Crop Report for 1998, Yuba County Dept of Agriculture				
(2) Yuba County: Sutter County Crop Report 1998, Agricultural Commissioner Sutter County				

**Riceland, Cropland, Total Land** Table 2 shows that rice production for the Region is approximately one-fifth of the total land mass of the two counties considered together as one region.

<b>Table 2: Riceland, Cropland, and Total Land</b>	
Yuba County Acreage, 1997	
Rice, Harvested Acres (1)	36,509 acres
Total Crop Acreage Harvested (1)	281,673 acres
Total Land Area in Yuba County (2)	403,490 acres
Sutter County Acreage, 1997	
Rice Harvested Acres (3)	90,437 acres
Total Farmland Acres (3)	320,000 acres
Total Land Area in Sutter County (2)	385,720 acres
Percent of Regional Cropland in Rice = (36,509 rice + 90,437 rice) / (281,673 all crop + 320,000 all crop)	21%
Percent of Regional Land Mass in Rice = (36,509 rice + 90,437 rice) / (403,490 all land + 385,720 all land)	16%
(1) Yuba County Agricultural Report (2) California County Profiles, 1998 (3) Sutter County Agricultural Report	

The acres of rice production has varied over time. In Sutter County, the acreage has varied from 81,000 acres to 94,000 acres between 1993 and 1998. In Yuba County, the variation has been from 31,300 acres to 37,300 between 1993 and 1998. In general, the acreage has tended to increase between 1993 and 1998 (National Agricultural Statistics Service at [http:// www.nass.usda.gov/ca](http://www.nass.usda.gov/ca)).

**Employment** Table 3 shows that, according to the IMPLAN data, total employment in the Yuba-Sutter Region was 63,068 jobs in 1996. Of these, 10,586 jobs were in agriculture. And, within agriculture, 2,286 jobs were in the Food Grains Industry. The Food Grains Industry provides approximately 3.6% of all jobs in the Yuba-Sutter Region.

<b>Table 3: Employment</b>	
Industry Name	Number of Jobs
Services	13,901
Government	12,939
Trade	11,894
Agriculture	10,586
Food Grains Industry	2,286
All Other Agricultural Industries	8,300
Construction	3,726
Manufacturing	3,720
Other	6,303
<b>Total Employment</b>	<b>63,069</b>
Percent Employment in Food Grains (2,286 / 63069)	3.6%
Data Source: IMPLAN Data, 1996	

The California statistics for 1997 (California Statistical Abstract, Department of Finance, Sacramento, California, November 1997), shows the following employment numbers which are smaller than the IMPLAN numbers reported in Table 3:

Yuba 1997 Civilian Employment = 18,500  
 Sutter 1997 Civilian Employment = 29,800  
 Total Civilian Employment for Region = 48,300

The difference in the employment numbers is explained by differences in data definitions. IMPLAN's employment numbers are larger because IMPLAN includes military personnel from Beale AFB, migrant agricultural workers, self-employed, railroad and mine employees, and part-time employees. California state employment data exclude those groups (see <http://www.calmis.ca.gov/htmlfile/subject/indtable.htm>). The IMPLAN definition of employment presents an analytical problem. IMPLAN counts any job as "one job". Thus, if there were 1,000 part time jobs in Food Grains and 1,286 full time jobs in Food Grains, then IMPLAN counts the total as being 2,286 jobs. Any job is a job (IMPLAN Manual, p.247). Although IMPLAN presents a method for constructing full-time equivalent (FTE) employment numbers, IMPLAN does not provide any *data* which can be used to quickly convert the currently reported employment number to a full time equivalency.

Next Steps Interview the local Agricultural Extension rice crop budget expert to more accurately estimate the employment consequences of reduced rice production. Interview rice farmers who have restored wetlands in order to obtain employment estimates for creating and maintaining wetlands.

**Total Sales** Total sales is the sum of business receipts. Each industry has its own total sales number. In IMPLAN total sales are called “Output Value”. For the purposes of this report, we will use the phrase “total sales” when we are referring to IMPLAN’s Output Value.

<b>Table 4: Total Sales</b>	
Industry Name	Dollars of Sales
Services	\$ 753,000,000
Government	\$ 676,000,000
Agriculture	\$ 628,000,000
Food Grains Industry	\$115,537,000
All Other Agricultural Industries	\$512,463,000
Manufacturing	\$ 528,000,000
Trade	\$ 483,000,000
Construction	\$ 321,000,000
Other	\$ 867,000,000
Total Sales	\$4,256,000,000
Percent Total Sales in Food Grains	2.7%
Data Source: IMPLAN Output Value Data, 1996	

Table 4 shows that the Agriculture sector ranks third in terms of total sales in the Yuba-Sutter Region. Agriculture provides approximately \$628,000,000 in sales. This is about 15% of the total sales in the Yuba-Sutter Region. The Food Grains Industry provides about 18% of the agricultural total sales (\$115,537,000 / \$628,000,000).

**Value Added** “Value added” is the value which is added to the cost of the physical inputs during the production process. Value added is payment made by each industry to workers, business owners, other resources owners, and certain taxes (IMPLAN Manual, p.99). Thus, value added can be seen as income to workers, resource owners, and certain categories of government.

IMPLAN defines Value Added to be (IMPLAN Manual, p.126):

- (1) Income to labor ("Employee Compensation" in IMPLAN)  
This is the total payroll costs including benefits.
- (2) Income to the business owner ("Proprietary Income" in IMPLAN)  
This consists of the payments received by self-employed people.
- (3) Income to other resource owners ("Other Property Income" in IMPLAN)  
This consists of payments for rents, royalties, and dividends paid by corporations.
- (4) Income to government ("Indirect Business Taxes" in IMPLAN).  
This consists of excise taxes, property taxes, fees, licenses, and sales taxes.  
Does NOT include taxes on profit or income.

Value Added is the sum of wages and profits which come from the industries in the Yuba-Sutter Region and which stay in the Region. Table 5 shows that \$88,236,000 are wages and profits which come from the Food Grain sector and which stay in the Yuba-Sutter Region as wages and profits. IMPLAN states that the sum of wages and profits is 76% of the total sales in the Food Grain sector.

<b>Table 5: Value Added</b>		
Food Grains Industry	Value in Dollars	Percent
Total Value Added	\$88,236,000	76%
Employee Compensation paid by Food Grains Industry (1)	\$4,443,000	
Proprietors Income paid by Food Grains Industry (1)	\$23,387,000	
Other Property Income paid by Food Grains Industry (1)	\$52,903,000	
Indirect Business Taxes paid by Food Grains Industry (1)	\$7,503,000	
Purchases from All Industries made by Food Grains Industry (2)	\$27,301,000	24%
Total Output Value (1)	\$115,537,000	100 %
(1) IMPLAN Reports, Study Area, Output-ValueAdded-Employment		
(2) IMPLAN Reports, Social Accounts, Food Grains, Industry Balance Sheet		

**Value Added** (con't)

The Food Grain Sector contributes more to value added (3.2% in Table 5.1 below) than to total sales (2.7% from Table 4). This is because the Food Grain industry keeps a higher percentage of gross sales in wages, profits, and land rental than does the average industry in the Yuba-Sutter Region.

<b>Table 5.1: Value Added, Food Grains and Total</b>		
Value Added paid by Food Grains Industry	\$ 88,236,000	3.2%
Value Added paid by All Industries	\$2,763,950,000	100%
IMPLAN Reports, Study Area, Output-ValueAdded-Employment		

Next Step Interview the local Agricultural Extension rice crop budget expert to more accurately estimate the proportion of Value Added. Table 5, above, showed IMPLAN as suggesting that 76% of the total sales for the Food Grains Industry consists of Value Added. Table 5.2 below uses the UC Agricultural Extension rice crop budget and suggests that, perhaps, 48% of total sales consists of Value Added. In terms of the Extension Rice Crop Budget, Value Added is assumed to be the total gross revenue per acre minus those input costs which are not income to labor, business owners, other resource owners, or taxes.

<b>Table 5.2: Value Added inferred from Rice Crop Budget</b>	
Gross Revenue per Acre	\$842
- (Total Cultural Costs - Cultural Labor)	- (323 - 37)
- (Total Harvest Costs - Harvest Labor)	- (155 - 8)
- (Total Post Harvest Costs - Post Harvest Labor)	- (17 - 9)
Inferred Value Added	\$401
Percent Value Added (\$401/\$842)	48%
Data Source: University of California Cooperative Extension, "Sample Costs to Produce Rice, Sacramento Valley, Rice Only Rotation", 1998.	

**Industry Data and Commodity Data** The regional economy is examined in terms of both industries and commodities. For business accounting purposes, each business enterprise is given one Standard Industrial Classification Code (SIC code) even if that business produces several commodities which are very different. For example, a rice farmer who produces rice and provides duck hunters access is only classified as being in rice production even though he also provides a recreation commodity.

The SIC code is used to gather many economic data. However, because each business can only have one SIC code, the SIC data do not tell the whole economic story. The SIC data cannot be used to correctly account for the commodities (the goods and services) which are produced and used in the economy. This is why IMPLAN uses and produces both industry and commodity data. This section of the report presents IMPLAN data about the Food Grains *Industry* and the Food Grains *Commodity*.

The Food Grains Industry is Sector Number 11 in IMPLAN and is the collection of businesses whose SIC Code is either 0111 or 0112 (IMPLAN Manual, p.347). IMPLAN identifies rice, buckwheat, rye, and wheat as the commodities included in "Food Grains Commodity".

Because the Food Grains Industry produces Food Grains Commodities as well as other commodities, and because the Food Grains Commodities may be imported or may be produced by businesses classified in industries which are not Food Grains, the total dollar values of Food Grains Industry and Food Grains Commodities are not likely to be equal. And, in the Yuba-Sutter Region, the *industry data* is different from the *commodity data*.

**Food Grain Industry produces Four Different Commodities** Table 6.1 shows that the Food Grains Industry produces not only food grains, but also provides some agricultural services, some amusement/recreational services, and some warehousing services.

In Table 6.1, the byproduct coefficient is the proportion of the industry sales which come from the given commodity. For example, 98% of the Food Grain Industry produces the Food Grain Commodity. On the other hand, the market share represents the proportion of the given commodity which is produced by the Food Grains Industry. For example, 100% of the Food Grains Commodity is produced by the Food Grains Industry. However, only 1.9% of the Agricultural Services Commodity is produced by the Food Grains Industry.

Important to stress in Table 6.1 is the observation that the total production of the Food Grains *Commodity* equals \$113,330,000 which is less than the total production of the Food Grains *Industry* which equals \$115,530,000.

<b>Table 6.1: Food Grain Industry produces Four Different Commodities</b>			
Commodities the Food Grains Industry Produces	Commodity Production	Byproduct Coefficient	Market Share %
Food Grain Commodity	\$113,330,000	0.980919	100 %
Agricultural Services Commodity	\$ 1,390,000	0.012029	1.9 %
Amusement/Recreation Commodity	\$ 680,000	0.005911	7.1 %
Warehousing Commodity	\$ 130,000	0.001141	0.1 %
Total Sales of the Food Grains Industry	\$115,530,000	1.000000	
IMPLAN Reports, Social Accounts, Industry Balance Sheet, Food Grains			

Next Step Interview local rice experts to estimate the total value of rice produced in the Yuba-Sutter Region. Table 6.1 showed the value of the Food Grains Commodity to be \$113,330,000. This is about 20% greater than sales which would be implied by the rice crop budget and total rice acreage. Consider the following:

From the UC Extension Rice Crop Budget, we have an average yield of 80 cwt per acre, and \$9 per cwt (1998 values). From the county crop reports, we know we have approximately 127,000 acres of rice in the Yuba-Sutter Region (1997 values). Thus, one estimate of total sales is:

$$\text{Total Sales} = 80 \text{ cwt/acre} * \$9/\text{cwt} * 127,000 \text{ acres} = \$91,440,000.$$

\$91,440,000 from the rice crop budget is about 20% smaller than the \$113,330,000 from IMPLAN. This is enough of a difference to suggest validation.

**Food Grains Industry Expenditures and Sales** Table 6.2 shows that the Food Grains Industry expenditures equal the industry's sales. In an Input-Output Analysis, this must be true.

Table 6.2 shows that the Food Grains Industry spends money for intermediate goods (these are the physical production inputs such as chemicals, custom services, equipment), for imports (most likely seed for planting), and Value Added. Notice that the Value Added number in Table 6.2 equals the Value Added number in Tables 5 and 5.1. Recall that Value Added contains the income to resource owners and this is where profit exists. Profit is the difference between total revenue and total costs. Profit is the residual which creates the equality between expenditures and sales.

Table 6.2 further shows that the Food Grains Industry sold its commodities to industries for the production processes of those industries. Notice that the first industry listed in the Intermediate Goods is "Food Grains Industry". This means that businesses within the Food Grains Industry buy and sell from each other. For example, a rice farmer might rent riceland from another farmer. When it is cash rent, which is most likely in the Yuba-Sutter Region, then the economic transaction is from one farmer directly to another farmer. Thus, this would be a case of the Food Grains Industry providing input to the Food Grains Industry. Table 6.2 shows that, according to IMPLAN, the Food Grains Industry sells commodities to not only itself, but also to the Rice Milling Industry, the Cattle Industry, the Dairy Industry, and other industries.

<b>Table 6.2: Food Grains Industry Expenditures and Sales Data</b>	
<b>Expenditures</b>	
Expenditure for Intermediate Goods (1)	\$12,000,000
Expenditure for Imports (1)	\$15,300,000
Expenditure for Value Added (1)	\$88,200,000
<b>Total Expenditures of the Food Grains Industry (1)</b>	<b>\$115,537,000</b>
<b>Sales</b>	
Sales to Intermediate Goods (3)	\$ 1,100,000
Sales to Food Grains Industry (2)	\$542,000
Sales to Rice Milling Industry (2)	\$506,000
Sales to Ranch Fed Cattle Industry (2)	\$ 7,000
Sales to Dairy Farms Industry (2)	\$ 2,000
Sales to Other Industries (2)	\$ 43,000
Sales to Final Demand (1)	\$114,437,000
<b>Total Sales of Food Grains Industry (1)</b>	<b>\$115,537,000</b>
(1) IMPLAN Reports, Industry X Industry, Industry Output-Outlay Summary	
(2) IMPLAN Reports, Social Accounts, Commodity Balance Sheet, Food Grains, Gross Inputs	
(3) This is "Total Industry Demand" in reference (2)	

## Food Grains Commodity Supply and Demand

In an Input-Output Analysis, the amount supplied must equal the amount demanded. Table 6.3 presents the supply and demand values and they are equal.

On the supply side, Table 6.3 shows there are two supply sources. The larger one is the Food Grains Industry within the Yuba-Sutter Region which supplies \$113,332,000 worth of Food Grains Commodity. Notice that this is the same number (except for a minor discrepancy in the IMPLAN outputs due to rounding differences in the different IMPLAN tables) as that reported in Table 6.1 as the production value of the Food Grains Commodity. The second supply source is imports. These are Food Grains Commodities which were made in locations outside of the Yuba-Sutter Region.

On the demand side, Table 6.3 shows that there are two basic sources of demand. The first and larger one is "Institutional Demand". This is comprised of six categories. The first is "Foreign Exports", commodities which leave the Yuba-Sutter Region. The second is inventories. The next three, Households, Government, and Capital, show a demand of zero because the Food Grains Commodity is not sold directly to households, or government, nor is it used as capital. The last Institutional Demand category is "Domestic Trade" whose definition could not be found and may be "Domestic Exports" which is that part of the regional supply exported outside of the region (Manual, p.148).

<b>Table 6.3: Food Grains Commodity Supply and Demand Data</b>	
<b>Commodity Supply</b>	
Food Grains Commodity Supplied by Food Grains Industry (1)	\$113,332,000
Food Grains Commodity Supplied by Imports (2) (4)	\$ 10,806,450
<b>Total Supply of Food Grains Commodity</b>	<b>\$124,138,450</b>
<b>Commodity Demand</b>	
Commodity sent out as Foreign Exports (3)	\$ 82,273,000
Commodity stored in Inventory (3)	\$ 13,270,000
Commodity sold to Households in Region (3)	\$ 0
Commodity sold to Government (3)	\$ 0
Commodity used as Capital (3)	\$ 0
Commodity used in Domestic Trade (1)	\$ 27,528,000
<b>Institutional Demand for Food Grains Commodity</b>	<b>\$123,071,000</b>
<b>Regional Industry Demand for Food Grains Commodity (1)</b>	<b>\$ 1,068,000</b>
<b>Total Demand for Food Grains Commodity</b>	<b>\$124,139,000</b>
(1) IMPLAN Reports, Social Accounts, Commodity Balance Sheet, Food Grains	
(2) IMPLAN Reports, Social Accounts, Commodity Trade, Food Grains	
(3) IMPLAN Reports, Study Area, Institution Commodity Demand	
(4) Clue indicating the necessity of including imports on the supply side: "Demands are commodity based and include imports" (footnote on IMPLAN, Reports, Social Accounts, Institution Local Commodity Demand).	

**Commodities Purchased by the Food Grains Industry** In IMPLAN the "Gross Inputs" are the commodities which the Food Grains Industry purchases in order to produce its commodities (IMPLAN Manual, p.376).

Table 7.1 lists the top seven industries from which the Food Grains Industry makes purchases in the Yuba-Sutter Region. All other purchases are aggregated into a category named Other Industry Commodities.

<b>Table 7.1: Food Grains Industry Purchases</b>	
Food Grains Industry Purchases (IMPLAN Industry Number) Name of Industry from which purchase is made	Gross Inputs
(462) Real Estate Commodities	\$ 7,070,000
(447) Wholesale Trade Commodities	\$ 4,040,000
(210) Petroleum Refining Commodities	\$ 2,390,000
(204) Agricultural Chemicals Commodities	\$ 2,230,000
(202) Nitrogenous & Phosphatic Fertilizers Commodities	\$ 1,680,000
(026) Agricultural Services Commodities	\$ 1,310,000
(213) Lubricating Oils and Greases Commodities	\$ 900,000
Other Industry Commodities	\$ 7,681,000
Total Purchases by the Food Grains Industry	\$27,301,000
IMPLAN, Reports, Social Accounts, Industry Balance Sheet, Food Grains	

Next Step Work with local rice experts to estimate the most important rice industry purchases. These are the industries most directly affected by a reduction in rice production. It is interesting that, according to IMPLAN, the single most important commodity is real estate. Most of the rice acreage rentals in the Yuba-Sutter Region are cash rents transacted directly between farmers. Most of the agricultural appraisers are private consultants who do their work for banks to assess loan applications, or for the individual farmers who are applying for the various easement programs, or for the real estate industry for sales. It is also interesting that the second most important rice industry purchases are wholesale trade commodities.

## Commodities Purchased by the Food Grains Industry (con't)

Which commodities purchased by the Food Grains Industry are mostly supplied from within the Yuba-Sutter Region? In IMPLAN this question is answered by the Regional Purchase Coefficient, the RPC, the proportion of commodity supplied from within the region (Manual, p.274).

IMPLAN shows that the Food Grains Industry uses about 70 commodities. Table 7.2 lists all of the commodities which are more than 50% supplied from within the Yuba-Sutter Region,  $RPC \geq 0.5$  (Please note, the last entry violates this rule). Table 7.2 shows that all of the Sanitary Services come from within the Yuba-Sutter Region,  $RPC = 1$ . The last entry of Table 7.2 shows that, although the Food Grains Industry does use commodities from the Rubber and Plastics Hose and Belting Industry, none of those commodities are supplied from within the Yuba-Sutter Region,  $RPC = 0$ .

Thus, Table 7.2 indicates some of the significant ripple effects that a reduction in rice acreage could impose on the economic activities within the Yuba-Sutter Region.

<b>Table 7.2: Commodities mostly Supplied from within the Region</b>	
Food Grains Industry Purchases (IMPLAN Industry Number) Name of Commodity Purchased	Percent Supplied within the Yuba-Sutter Region, "RPC"
(446) Sanitary Services	100
(026) Agricultural Services	97
(056) Maintenance/Repair	97
(454) Eating & Drinking	90
(480) Electrical Repair Service	90
(507) Accounting	90
(473) Equipment Rental	80
(482) Miscellaneous Repair Shops	80
(435) Motor Frieght Transport & Warehousing	78
(503) Business Associations	78
(513) US Postal Service	74
(309) Farm Machinery	73
(456) Banking	70
(462) Real Estate	70
(470) Other Business Services	70
(009) Miscellaneous Livestock	61
(494) Legal Services	56
(433) Railroads	52
(447) Wholesale Trade	52
(512) Other State & Local Government Enterprises	51
(217) Rubber and Plastics Hose and Belting	0
IMPLAN, Reports, Social Accounts, Industry Balance Sheet, Food Grains	

## Commodities Purchased by the Food Grains Industry (con't)

When we combine the dollar value of purchases made by the Food Grains Industry (Table 7.1) with the proportion of those purchases supplied from within the Yuba-Sutter Region (Table 7.2), we obtain Table 7.3. Table 7.3 shows which commodities are most likely to experience a ripple effect either because of the dollar size or because of the supply significance from within the region. Table 7.3 lists those industries from which the purchases by the Food Grains Industry are greater than \$1 million **or** the percent supplied from within the Yuba-Sutter Region is greater than 50%.

Food Grains Industry Purchases (IMPLAN Industry Number) Name of Industry from which purchase is made	Gross Inputs, \$	Percent Supplied within the Yuba-Sutter Region, "RPC"
(462) Real Estate	\$7,070,000	70
(447) Wholesale Trade	\$4,040,000	50
(210) Petroleum Refining	\$2,390,000	.7
(204) Agricultural Chemicals	\$2,230,000	.1
(202) Nitrogenous & Phosphatic Fertilizers	\$1,680,000	6
(026) Agricultural Services	\$1,300,000	97
(056) Maintenance/Repair	\$ 760,000	97
(309) Farm Machinery	\$ 760,000	70
(435) Motor Freight Transport & Warehousing	\$ 700,000	78
(433) Railroads	\$ 300,000	51
(446) Sanitary Services	\$ 180,000	100
(454) Eating & Drinking	\$ 10,000	90
(480) Electrical Repair Service	\$ 30,000	90
(507) Accounting	\$ 30,000	90
(473) Equipment Rental	\$ 80,000	80
(482) Miscellaneous Repair Shops	\$ 380,000	80
(503) Business Associations	\$ 30,000	78
(513) US Postal Service	\$ 10,000	74
(456) Banking	\$ 370,000	70
(470) Other Business Services	\$ 10,000	70
(494) Legal Services	\$ 10,000	56
(512) Other State & Local Government Enterprises	\$ 10,000	51
(009) Miscellaneous Livestock	\$ 0	61
IMPLAN Reports, Social Accounts, Food Grains, Industry Balance Sheet		

**Commodities Purchased by the Food Grains Industry (con't)**

Table 7.4 gives those industries for which the purchases from the Food Grains Industry are greater than \$1 million and the percent purchased from within the Yuba-Sutter Region is greater than 50%. Three industries fill these requirements. Table 7.4 implies that these three industries will likely be affected by ripple effects.

Please recall the discussion (following Table 7.1) about the prominence of Real Estate in the purchases made by the Food Grains Industry.

<b>Table 7.4: Purchases Greater than \$1 Million and Percent from within Region <math>\geq</math> 50%</b>		
Food Grains Industry Purchases (IMPLAN Industry Number) Name of Industry from which purchase is made	Gross Inputs, \$	Percent Supplied within the Yuba-Sutter Region, "RPC"
(462) Real Estate	\$7,070,000	70
(447) Wholesale Trade	\$4,040,000	50
(026) Agricultural Services	\$1,300,000	97
IMPLAN Reports, Social Accounts, Food Grains, Industry Balance Sheet		

The data which have been discussed throughout this section are used by IMPLAN to calculate multipliers. Multipliers are the topic of the next section.

**Multipliers** Multipliers are numbers which account not only for the effects of the spending implied by a specific program (such as the WRP), but also for the subsequent rounds of spending generated by the initial change. IMPLAN reports nine types of multipliers. Table 8.1 presents the nine types of multipliers and gives the multiplier values which came from the first IMPLAN model created for the Yuba-Sutter Region. The rest of this section explains each of the multipliers given in Table 8.1.

<b>Table 8.1: Food Grains Industry Multipliers</b>			
	Employment Multiplier	Total Sales Multiplier	Value Added Multiplier
Direct Multiplier	20 jobs	1.0	0.76
Indirect Multiplier	2 jobs	0.12	0.08
Induced Multiplier	8 jobs	0.48	0.32
IMPLAN output, base model using IMPLAN 1996 county data.			

The following multipliers are across the top of Table 8.1:

Employment Multiplier This is the effect of a change in Food Grain Industry sales on the number of jobs. If there is a reduction in rice production, the number of jobs in the Food Grains Industry will decline.

Total Sales Multiplier This is the effect of a change in Food Grain Industry sales on the sales within the Yuba-Sutter Region. If there is a reduction in rice production, the total sales in the Region may decline.

Value Added Multiplier This is the effect of a change in Food Grain Industry sales on the Value Added within the Yuba-Sutter Region.

The following multipliers are down along the side of Table 8.1:

Direct Multiplier This shows the effect of a change in rice production on all other businesses which are in the Food Grains Industry. If the rice growers obtain most of their production inputs from the businesses within the Yuba-Sutter Region (the RPC of Table 7.2), the direct multiplier will be larger than if they obtained their inputs from businesses outside of the Yuba-Sutter Region.

Indirect Multiplier This shows the ripple effect of a reduction in rice production on those businesses which are not in the Food Grains Industry. These are typically businesses which are at least one step removed from rice production such as Maintenance and Repair Other Facilities.

Induced Multiplier This shows the ripple effect of a reduction in rice production on those businesses which serve the households and/or institutions within the Yuba-Sutter Region. When rice production is decreased, some households and institutions will experience a reduced income. A lower income lowers household and institution purchases. In IMPLAN this is known as the Social Accounting Matrices, "SAM" (Manual, p.149).

**Employment Multiplier** The Employment Multiplier was introduced in the second column of Table 8.1. It is discussed in more detail here. The Employment Multiplier describes the effect of lost gross revenues in rice on employment within the Yuba-Sutter Region. Table 8.2 shows the Direct, Indirect, Induced, and Total Employment Multipliers. For every million dollar decrease in rice gross revenue, the following job losses are estimated in IMPLAN:

<b>Table 8.2: Employment Multipliers, Yuba-Sutter Region</b>		
Multiplier Type	IMPLAN Multiplier expressed in Number of Jobs	Description of the Multiplier For every one million dollars lost in gross sales in the Food Grains industry, the following is estimated:
Direct	20 jobs	For every one million dollars loss in the total sales of the Food Grains industry, 20 jobs which directly support the Food Grains industry are lost.
Indirect	2 jobs	For every one million dollars loss in the total sales of the Food Grains industry, 2 jobs are lost as a ripple effect. Notice this figure is very low compared with the direct effect. This is because most of the rice is exported from the Region to be processed and transported. Hence, the loss of these jobs is not accounted for in the Yuba-Sutter Region.
Induced	8 jobs	For every one million dollars loss in the total sales of the Food Grains industry, 8 jobs are lost due to the ripple effect caused by reduced incomes to households and institutions.
Total	30 jobs	The total (initial plus both ripple effects) loss in jobs in the Yuba-Sutter Region due to the one million dollars lost in the Food Grains industry is estimated to be 30 jobs
Data Source: IMPLAN Reports, Multipliers, Employment.		

**Total Sales Multiplier** The Total Sales Multiplier was introduced in the third column of Table 8.1. It is discussed in more detail here. The Total Sales Multiplier describes the effect of lost gross revenues in rice on the total sales within the Yuba-Sutter Region. Table 8.3 shows the Direct, Indirect, Induced, and Total Sales Multipliers. For every dollar dollar decrease in rice gross revenue, the following proportional total sales losses are estimated in IMPLAN:

<b>Table 8.3: Total Sales Multipliers, Yuba-Sutter Region</b>		
Multiplier Type	IMPLAN Multiplier	Description of the Multiplier
Direct	1.0	The initial loss in the total sales of the Food Grains industry, for every million dollars lost in Food Grains, one million must be directly lost from the Food Grains Industry.
Indirect	0.12	The ripple effect loss in the total sales of other industries directly related to the Food Grains industry. A one million dollar loss in the Food Grains industry produces about \$120,000 loss in other industries which directly transact with Food Grains.
Induced	0.48	The ripple effect loss in the total sales of the remaining industries which are served by the households and institutions which lost income. A one million dollar loss in the Food Grains industry produces \$ 480,000 loss in those industries which are served by the households and institutions affected by the initial loss in Food Grains total sales.
Total	1.6	The total (initial plus both ripple effects) lost sales in the Yuba-Sutter Region due to the one million dollars lost in the Food Grains industry. A one million dollar loss in total sales of the Food Grains industry produces a total loss of \$1,600,000 in the region.
Data Source: IMPLAN Reports, Multipliers, Output.		

**Value Added Multiplier** The Value Added Multiplier was introduced in the fourth column of Table 8.1. It is discussed in more detail here. The Value Added Multiplier describes the effect of lost gross revenues in rice on the value added which is earned within the Yuba-Sutter Region. Table 8.4 shows the Direct, Indirect, Induced, and Total Value Added Multipliers. For every million dollar decrease in rice gross revenue, the following proportional value added losses are estimated in IMPLAN:

Multiplier Type	IMPLAN Multiplier	Description of the Multiplier
Direct	0.76	The initial loss in the total sales of the Food Grains industry, for every million dollars lost in Food Grains, one million must be represented in the Food Grains industry. For each dollar of lost rice sales, 76 cents of value added (income) is lost in the Food Grains Sector.
Indirect	0.08	The ripple effect loss in the total sales of other industries directly related to the Food Grains industry. A one million dollar loss in the Food Grains industry produces about \$120,000 loss in other industries which directly transact with Food Grains. For each dollar of income lost in the Food Grains Sector, 8 cents is lost in a ripple effect to other businesses in the Region.
Induced	0.32	The ripple effect loss in the total sales of the remaining industries which are served by the households and institutions which lost jobs. A one million dollar loss in the Food Grains industry produces \$ 480,000 loss in those industries which are served by the households affected by the initial loss in Food Grains total sales. For each dollar of income lost in the Food Grains Sector, 32 cents of income is lost to households.
Total	1.16	The total (initial plus both ripple effects) lost sales in the Yuba-Sutter Region due to the one million dollars lost in the Food Grains industry. A one million dollar loss in total sales of the Food Grains industry produces a total loss of \$1,600,000 in the region. For every dollar of income lost in Food Grains Sector, \$1.16 of regional income is lost.
Data Source: IMPLAN Reports, Multipliers, Total Value Added.		

**Impacts** The multipliers are used to estimate the impacts that a reduction of 1,000 acres in rice production would create within the Yuba-Sutter Region. Table 9 presents the impacts.

<b>Table 9: Estimated Impacts of 1,000 Acre Reduction in Rice Production</b>			
	Employment Loss (1)	Total Sales Loss (2)	Value Added Loss (3)
Direct Effect	14 jobs	\$ 720,000	\$550,000
Indirect Effect	1 job	\$ 90,000	\$ 56,500
Induced Effect	6 jobs	\$ 340,000	\$230,500
Total Effect	21 jobs	\$1,150,000	\$837,000
<p>(1) IMPLAN Impacts, Group = 1000 acres decreased rice, Impact Results, Impact Name = 1000 acres decreased rice, Employment.</p> <p>(2) IMPLAN Impacts, Group = 1000 acres decreased rice, Impact Results, Impact Name = 1000 acres decreased rice, Output.</p> <p>(3) IMPLAN Impacts, Group = 1000 acres decreased rice, Impact Results, Impact Name = 1000 acres decreased rice, Value Added.</p>			

## Appendix A: Regional Economics

Regional Economics, or Input-Output Analysis, concerns the structure of an economy and the way individual sectors fit together (Miernyk, p.4). Knowing how individual sectors fit together allows an analysis of a change in one sector on all other sectors.

The basic objectives of a Regional Economics study are to (1) describe the economy of the region, (2) estimate the impact of a change in one industry, such as the reduction of rice production acreage, on the whole economy of region. The strength of a regional economics study is the detailed presentation of the production (who creates what) and distribution (who gets what) of the industries in the region. Regional economics depicts the nature of the various interrelationships among the industrial and agricultural sectors and between these business sectors and other economic components (such as households) of the region. Given the data provided by an I/O table, the planner can work up consistent and thoughtful answers to the questions faced in comprehensive regional planning. For more about the basics of I/O, consult Isard, Chapter 1. For a distinction between and "industry" and a "sector", see Miernyk p.18.

Regional Economics and Agronomy Regional economics and agronomy share the same analytical problem. Regional economics looks at systems such as the Yuba-Sutter Region which is a complex economic system of about 200 industries producing many goods and services. Many of the industries are directly related to one another. Either the output of one industry is an input to another industry, or several different industries use the same resource. Because of these production interrelationships, a change in one industry can produce ripple effects to other industries. In order to look at such an integrated production system, it is necessary to slice the system up in different ways. We do this in order to look into the system and see what's related to what, one simple slice at a time. Each slice looks different from any other slice, yet all the slices fit together to form the business ecosystem of interrelations in the Yuba-Sutter Region. This economic analysis problem is no different from the problem of the agronomist. An agronomist must look at the whole integrated plant/soil system as if it were a series of parts: one part is the roots' interactions with the soil, another part is the leaves' interactions with the roots, and yet another part is the leaves' interactions with the air. No one part tells the whole agronomic story, and each part is needed in order to understand the whole agronomic story, and each part looks different. In both regional economics and agronomy, there is a constant shuffling between looking at the parts and looking at the whole.

Degree of Production Connectedness between Industries, Short Run Some of the 200 industries in the Yuba-Sutter Region are closely connected to one another. This means a change in one industry directly and quickly affects the closely connected industries. For example, IMPLAN shows that a reduction in the Food Grains Industry will reduce employment in the Agricultural Services Industry. However, some industries are not closely connected to others. This means that a change in one industry does not directly or quickly affect others. For example, IMPLAN shows that a reduction in the Food Grains Industry will not significantly change the employment in the Commercial Fishing Industry.

Degree of Production Connectedness between Industries, Longer Run Ultimately, however, all industries are connected to one another in the longer run by means of the larger market process of state-wide, or nation-wide, or world-wide demand and supply. This is another way of saying that change will happen within the Yuba-Sutter Region regardless of any one conservation program. For example, even though the output of the Food Grains Industry is not a production input to the Natural Gas Liquids Industry, these two industries are still ultimately connected through the larger integrated economic system. A reduction in the Food Grains Industry within the Yuba-Sutter Region may result from the same world-wide forces which create reductions in the Natural Gas Liquids Industry within the Yuba-Sutter Region. Thus, the Food Grains Industry and the Natural Gas Liquids Industry in the Yuba-Sutter Region are economically connected even though their production processes cannot be vertically integrated to form one process. All of this is to say that when assessing the impacts of WRP, we must acknowledge that the Yuba-Sutter Region is constantly changing because of many forces which are within and outside the region.

Economic Activity Within or Across the Region's Boundary For this study we are concerned only about the economic impacts within the Yuba-Sutter Region. In order to do this, we must understand not only how industries are related to each other through the production process, but also where they are geographically located. Consider two examples. First, it is possible that an industry entirely produces its products within the region. IMPLAN shows that the industry named Maintenance and Repair Other Facilities produces about 97% of its products within the Yuba-Sutter Region. Thus, when the Food Grains Industry needs maintenance or repair services, it is most likely to obtain those from businesses which are located within the Yuba-Sutter Region. This economic activity is almost entirely within the region. Second and conversely, it is possible that an industry does not produce very much of its products within the region. IMPLAN shows that the industry named Agricultural Chemicals produces less than 1% of its products within the Yuba-Sutter Region. Thus, when the Food Grains Industry needs chemicals, it cannot purchase them directly from this industry and must purchase them through other industries such as Agricultural Services or Other Business Services within the Yuba-Sutter Region. The economic activity between the Agricultural Chemicals Industry and the Food Grains Industry is most likely to occur across the region's boundary. Considering the two examples together we can generalize that a reduction in the Food Grains Industry will more directly and immediately affect the maintenance and repair businesses within the region but will not affect agricultural chemical manufacturing.

Recent Changes not Considered in the Regional Economics The IMPLAN data use 1996 data sources. It is unlikely that these data reflect two recent changes. First, the Yuba-Sutter Region has recently built a Graham Presents Amphitheater for concerts with a seating capacity of about 20-thousand people. It is possible that this facility will start operation by mid-2000. Second, the Region has voted to build a raceway in south Yuba County with a possible seating capacity of 60-thousand people. Neither the amphitheater nor the possible raceway have been considered in this first analysis.

Hence, the new employment opportunities due to the amphitheater and the possible raceway have not been considered in the assessment of the impact of reduced rice production. As a result, this report produces the worst-case assessment of the effects of WRP on the regional economy. It reports a reduction in rice employment without offsetting employment opportunities from other, new economic activities such as the recreation activities of the amphitheater.

Future studies could address the most likely changes in the regional economy in the longer term. As the longer run is considered, the existing IMPLAN coefficients would have to be changed to include the new industries and the new interrelationships among industries within the Region. For a discussion about forecasting using Input-Output Analysis over the longer run, see Miernyk, pp.32-42.

Multipliers Multipliers are numbers which account not only for the effects of the spending implied by a specific program (such as the WRP), but also for the subsequent rounds of spending generated by the initial change (Pleeter, p.86). When people hear the word "multiplier", they often think about nation-wide changes. However, the IMPLAN multipliers are industry specific within the Yuba-Sutter Region. Thus, we can speak about the multiplier effect of spending less money for rice production within the Yuba-Sutter Region. There are many different multipliers referred to in the literature (Pleeter, p.90).

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