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The Impact of the 2001 Klamath Irrigation Project Operations Plan on the Economy of the Upper Klamath Basin

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Introduction

On April 6, 2001, the Bureau of Reclamation released the 2001 Klamath Project Operations Plan (KPOP) that severely limited irrigation water deliveries to project irrigators. This operations plan was based on new biological opinions that raised the required lake levels on Upper Klamath Lake and increased the required stream flows into the main stem of the Klamath River at Iron Gate Dam. In meeting these requirements in a critically dry year, the KPOP indicated that the Bureau would release no water to Klamath Irrigation Project irrigators in 2001.

This chapter provides an estimate of the short-run impact of the 2001 KPOP on the Upper Klamath Basin (UKB) regional economy. The analysis focuses on the short-run (i.e., first year) economic impacts. It is not a benefit/cost assessment of the Bureau's decision. We recognize that there may be economic impacts that extend beyond the first year. These potential impacts are discussed in this report, but are not formally assessed.

Estimating regional economic impacts with an input-output model

The input-output (IO) model described in a previous chapter contains information about economic transactions in an economy, and allows analysts to estimate the impact of a change in policy or an economic shock on output, personal income, and employment. The impacts include *direct impacts* (changes in spending by the sector(s) directly affected by the policy), *indirect impacts* (changes that occur in all sectors because the directly affected sectors have more or less money to respond to buy inputs from other businesses in the county), and *induced impacts* (changes in all sectors due to changes in household responding of income from directly and indirectly affected sectors).

Impacts can be estimated for gross *output* (sales), personal income, or employment. The output (sales) measure in an IO model does not net out input purchases from other businesses in the region and thus "double counts" sales in most cases. If a feed mill buys barley from a grain farmer and then produces and sells processed feed, both the processed feed and the barley from which the feed is made are counted in output. The output impact estimate for the feed mill thus "double counts" by including both the value of the final sales and the value of the feed input used to make the final product. The gross output measure of the IO model is thus inconsistent with the

usual “output” measures used in national income accounts (such as the Gross National Product), which count only “final sales” or value added.

Because those concerned about the well-being of county residents often care more about income and jobs than gross sales, and to avoid the “double counting” problem, economists prefer to estimate *income* impacts, which measure value added by economic activity in a region, or *employment* impacts, which measure jobs. When estimating income impacts, the IO model counts the income paid to feed-mill workers, for example, who produce exported feed, and the additional income in the region (including the wages to the farm worker and income of the land owner—both of which add value to the production process) generated by the export of feed. All of this income is reflected in the income impact estimate of the feed-mill sector exports.

Assumptions in an IO model affect the interpretation of the results. The most important assumptions are that:

- Prices of goods and services used as inputs in the production process are assumed not to change.
- Firms are assumed not to adjust their production processes—technology is assumed not to change.
- There are no economies of scale. If a firm cuts its production in half, it will halve its purchase of all inputs.
- There are no supply constraints. Firms can purchase all they want of any input at the initial price.

This implies that the model is most appropriate for short-run analysis of changes of modest size. Very large scale changes may involve supply constraints and price changes and substitution of one input for another. Prices and technology and production processes do change over the longer run.

Baseline and impact scenarios

Impact analysis requires the construction of an impact scenario identifying what is expected to happen under specified assumptions about a policy or other change. This impact scenario is compared with a baseline scenario based on assumptions about what is expected to happen *without* the specified policy or other changes. As in the previous chapter, the baseline scenario assumes a “normal” water year with pre-2001 biological opinion lake level and stream flow requirements. The impact scenario models the 2001 KPOP, which was designed to meet the stream flow and lake level water requirements of the 2001 biological opinions in a critically dry year. In meeting these stream flow and lake level requirements, the Bureau indicated in the 2001 KPOP that it would release no water for Klamath Irrigation Project (KIP) irrigators. The impact of the 2001 KPOP is the difference in estimated output, income, and employment between the baseline and an impact scenario incorporating the 2001 KPOP requirements. Since we estimate the impact of the 2001 KPOP, our estimates do not take into account the effects on production of unanticipated irrigation releases authorized in the summer of 2001 by Secretary Norton.

Constructing an impact scenario for the 2001 KPOP involves estimating the changes in KIP-related agricultural exports from implementation of the 2001 KPOP compared to agricultural exports in the baseline scenario. The changes in agricultural exports are entered into the UKB input-output model to estimate the changes in regional output, employment, and income in the UKB economy due to the 2001 KPOP in which the stream flow and lake-level requirements of the 2001 biological opinions are met in a critically dry year.

Estimating agricultural exports under the impact scenario

We start with the estimates of *on-farm crop production* in the *Klamath Irrigation Project* under the two scenarios from the previous chapter. Estimating the changes in KIP-related agricultural exports from the region under the 2001 KPOP scenario required four sets of adjustments to the KIP on-farm crop production impacts.

The first adjustment accounted for the fact that some crop production is used as inputs to other sectors. The pasture consumed by ranch-fed cattle, the potatoes used as inputs to the dehydrated food products plant, and the barley used in the production of prepared feeds were valued at \$2.9 million. Thus the crop production impact of \$74.2 million estimated in the previous chapter was reduced by \$2.9 million so that this production loss would not be counted twice. The \$2.9 million shows up as estimated losses in the cattle, dehydrated food products, and prepared feed, as described below

The second adjustment was to estimate livestock losses, which involved estimating the value of pasture fed to livestock. Livestock in the KIP rely on irrigated pasture primarily as a source of grazing forage during the spring, summer, and fall months of the year. Reduction in available forage translates into a loss of feed inputs to the livestock sector. The economic losses in the livestock sector were estimated as the reduced value of forage measured in terms of animal grazing units produced on the affected project acreage. Grazing rates applicable to irrigated pasture in the district were estimated as the 3-year (1998-2000) average private grazing rates reported for Oregon by the USDA National Agricultural Statistics Service.

In addition to the foregone value of grazing, livestock producers may have experienced additional losses associated with forced early sales of feeder cattle from these pastures. Without alternative grazing lands in the region, producers sell beef cattle at lower weights and/or prices than anticipated. The estimated losses from these forced sales were based on producer estimates of current returns from forced spring/summer liquidation, relative to expected returns with normal fall marketing. The extent of forced marketing was projected based on the size and composition of the herd displaced by the loss of grazing forage, as well as the projected liquidation rates. An adjustment was made to account for the grazing expenses that are not incurred as a result of early marketing. The forced sale losses are applied to feeder cattle only, and not the breeding herd. Losses to the breeding herd are discussed in a later section.

The third adjustment involved estimating changes in prepared feeds. Prepared feed mills purchase barley from local irrigators. The UKB input-output model estimates how much feed grain (barley) the feed mill purchased in the base year. The reduced export of the prepared feed sector is the value of the prepared feed that would be produced with this much less local barley. (The value of this barley is included in the reduced export of prepared feeds, not in reduced feed grain exports, as described above.)

The final change involved estimating losses to dehydrated foods manufacturing sector. Our estimates assumed that reduction in local potato production would very nearly eliminate the dehydrated foods products sector: the operations would cease to operate rather than attempt to import potatoes to supply their needs. The UKB IO model provides an estimate of total dehydrated food exports, the value of purchases of potatoes from local farmers, and the production technology of the dehydrated food products sector. This information was used to estimate the change in local potato exports that would result from almost eliminating the

dehydrated food products sector. (The impact of the reduced potato production is included in the estimated reduction in dehydrated food products sector exports, as noted above.)

This direct impact of implementation of the 2001 KPOP on *gross export sales* of the agricultural producers and processors is shown in Table 1.

Implementation of the 2001 KPOP was estimated to directly reduce gross agricultural sector output in the three-county Upper Klamath Basin region by \$95 million, as compared with a baseline scenario in which water for irrigation was unconstrained. This represents a 30 percent reduction in agricultural sector output.

Table 1. Klamath Project 2001 Operations Plan direct agricultural sector impacts (million \$).

IMPLAN sectors\scenarios	On-farm crops production		Agricultural sector export impact
	Baseline	Critically dry year & 2001 B.O.	
1 Dairy farm products			-1,098
3 Ranch fed cattle			-7,594
5 Cattle feedlots (increase)			421
6 Sheep, lambs, and goats			-527
8 Other meat animal products			-24
9 Miscellaneous livestock			-655
11 Food grains	2,581	2	-2,579
12 Feed grains	16,366	9	-15,539
13 Hay and pasture	40,721	12,773	-26,437
18 Vegetables	31,824	6,492	-24,776
20 Miscellaneous crops	7,313	5,317	-1,996
68 Dehydrated food products			-6,619
78 Prepared feeds, N.E.C			-7,254
Total	98,805	24,592	-94,677

Impact of 2001 KPOP on Upper Klamath Basin regional economy

Table 2 identifies the direct, indirect, and induced impacts of the implementation of the 2001 KPOP on gross output, income, and employment in the Upper Klamath Basin.

The 2001 KPOP is estimated to reduce gross output by about \$134 million, a reduction of 3.2 percent of total regional output.¹ The *direct* impact of the reduction in KIP agriculture and associated processing, derived in Table 1, is \$95 million. This reduction generates an additional *indirect* \$22 million output reduction (in industries that supply the directly affected sectors). And these direct and indirect impacts *induce* another \$17 million reduction in local spending by local households employed in the directly and indirectly affected sectors.

¹ Our gross output and income estimates are in 2001 dollars. As noted above, gross output is a measure of total local sales, which includes the full value of each local transaction before netting out costs.

Personal income is a measure of local employee compensation, net proprietor income,² and other property income. Implementation of the 2001 KPOP is estimated to reduce total personal income by \$68 million, about 3.1 percent of baseline income. Total regional employment is reduced by an estimated 2077 jobs, or 3.5 percent.

Table 2. Klamath Project 2001 operations plan regional impacts.

Upper Klamath Basin Economy	Baseline	Critically Dry Year, 2001 B.O.				Total % Change
		Direct	Indirect	Induced	Total	
Output (\$million)	4,032	-95	-22	-17	-134	-3.2%
Income (\$million)	2,167	-46	-12	-10	-68	-3.1%
Employment (jobs)	59,390	-1,356	-430	-270	-2,077	-3.5%

Longer-term economic impacts

The input-output analysis focuses on the short-run economic impacts. There are a number of potential longer-term economic impacts (e.g., those that occur in future water years, crop years, or calendar years). This section is intended to provide (1) an inventory of these potential impacts, and (2) a brief discussion of the economic rationale underlying the potential impacts. Given the current uncertainties underlying these effects and the fact that these impacts occur in future years, we do not attempt to quantify these potential impacts.

Land values

As a capital asset, the agricultural use value of land reflects the discounted present value of the stream of all future expected net cash flows arising from farming the land. Thus, factors that affect the expected future net cash flows from farming will in turn affect the agricultural use value of land. If the 2001 drought situation is merely an extreme weather event that reoccurs infrequently (e.g., 2 years out of 100) then the impact on land values would be minimal (particularly if land owners receive disaster payments or other assistance that helps offset the temporary decline in revenue). However, if the current operations plan reflects a fundamental change in the water allocation criteria that in turn reduces the expected quantity of irrigation water available in any given weather year, then this change in water regime would have a significant impact on agricultural use values.

The discussion of options in the Bureau of Reclamation's Environmental Assessment indicates that there may in fact be a change in the underlying allocation criteria that will likely reduce expected quantities of irrigation water available under any given weather year. If so, then a careful study of how the change in allocation criteria will affect expected future irrigation deliveries would be needed to assess the potential impact on agricultural use values of land. Such a study should also investigate the relationship between agricultural use values of land and

² Proprietor income is gross proprietor receipts less fixed and variable costs.

market values of land in the area. In agricultural areas these two values are generally quite close. In areas with significant development or other uses (e.g., recreational), market values often exceed agricultural use values. In these cases, market values are generally not significantly affected by changes in the profitability of agriculture.

Costs of reestablishing perennial crops

Stands of perennial crops (e.g., mint, alfalfa, grass hay) may also suffer from prolonged drought conditions resulting from the lack of irrigation. These losses are likely to be most acute for recently established forage stands, or shallow-rooted crops such as peppermint. Economic impacts arise to the extent that these reestablishment or renovation expenses exceed normal establishment expenses. Under normal conditions perennial crops are reestablished on intervals typically varying from 2 to 5 years, such that some stands are likely to be reestablished, regardless.

Establishment costs per acre for impacted perennial crops in the Klamath District are reported below as a reference to gauge loss potential. These are the variable costs of establishing a crop as estimated in crop enterprise budget prepared by the Oregon State University Extension Service, and do not include fixed machinery and land expenses.

Crop	Variable cost per acre
Alfalfa	\$305
Pasture	\$262
Peppermint	\$1,341

Stand survival could be monitored over the 2001-2002 year and a determination made as to the extent of increased costs incurred due to unanticipated reestablishment.

Loss of market contracts

Several important cash crops in the Klamath Irrigation District are produced under contract with processors or under long-standing marketing agreements with buyers. As a result of the disruption in supply, it is possible that these contracts or markets may have been lost and may not be regained in future years. Alternatively, growers may have arranged for crop sourcing outside the Klamath District in order to meet commitments, even though at a higher procurement cost. Again, the status of future contracts or marketing arrangements could be monitored as a basis for determining whether this impact warrants additional consideration.

Long-term costs of forced liquidation of the cattle-breeding herd

A critical aspect of the reduction in irrigation water releases is assessing how the decline in irrigated forage production affects livestock production in both the short and long run. As discussed earlier, the near-term impacts of reduced irrigated grazing for livestock are estimated as the foregone value of forage lost on irrigated pastures, as well as the decrease in sales value attributable to forced early sale of market animals.

Depending on the duration of the suspended irrigation, and the coincidental grazing conditions on other pastures and range in the region, beef cattle herds in the affected region

could experience additional losses arising from adjustments to reductions in irrigated pasture. Beef producers must locate replacement feed sources to offset the loss of irrigated pasture in the Klamath Project. Grazing rates on nearby pastures or ranges would be expected to increase, subject to even more limited availability in the event of a widespread, sustained drought. In this situation, resident beef producers reliant on Klamath Project irrigated pasture might face significant increases in grazing costs, either through higher local rates, higher purchased feed costs, provision of supplemental drinking water, or greater transportation costs incurred in moving cattle to other areas.

As an alternative to finding or paying higher feed costs, beef producers might be forced to reduce their cattle breeding herds (liquidation). This breeding herd (cows, bulls, and replacements) can be considered an asset, valued at the present value of the future stream of benefits (sales of the offspring in subsequent years). Herd liquidation provides a one-time increase in cash receipts, but erodes the longer-term economic viability of livestock operations by reducing or eliminating this asset. Forced sale of the breeding herd at prices below the asset value would generate additional losses.

Reduced property tax revenues and local government services

The Klamath County Assessor estimated that, as currently irrigated farmland was reassessed as dryland for property tax purposes this year, local government revenue from property taxes would decline by about \$480,000. The long-run impact of this reduction depends on whether the reduction is permanent (whether irrigation water deliveries are curtailed in future years), and on what program cuts are made in response to the reduction in property taxes of the county, school district, and other local governments. Here again, an ongoing assessment of local government revenues and service would provide a basis for understanding the long-term impacts of reduced water allocations.

Longer-term impacts on labor supply

When there are economic disruptions in a community and people lose their jobs, some who lose jobs move to other places where jobs are more plentiful. This applies to both the farm labor and the workers in nonfarm businesses that are affected by the reductions in farming activity. If additional people become unemployed due to the irrigation water reductions, it is not unreasonable to expect that some of them will move, particularly after unemployment benefits terminate, given the relatively unfavorable local unemployment situation. (Klamath County's unemployment rate is consistently 3 percentage points higher than the state average.) Some would return if the irrigation restrictions are lifted in future years, but others would not and employers would bear costs of finding and retraining workers.

Conclusion

Reduced water deliveries to agricultural operations in the Klamath Project are expected to have significant economic impact on UKB agriculture and a modest impact on the UKB regional economy. Based on our assumptions, a three-county IMPLAN model, and on estimates of crop production impacts from the previous chapter, we estimate that the 2001 Klamath Irrigation Project Operations Plan can be expected to reduce agricultural output in the UKB by 30 percent in the short run. This impact will be felt in other sectors of the UKB economy because of the economic interrelationships between sectors. The 2001 KPOP can be expected to reduce

personal income by 3.1 percent (almost \$70 million) in the three-county UKB region. As noted above, this impact measure estimates the change in employment compensation, proprietor income (net of costs), and other property income for those directly and indirectly affected by the reduced water allocation. The plan is expected to also reduce total gross sales (output) by 3.2 percent (\$134 million) in the three-county UKB region during the first year. Two-thirds of this impact is expected to be in the agricultural sector. The 2001 Klamath Irrigation Project Operations Plan will also affect jobs. Our estimate is that the plan would reduce employment by 3.5 percent (over 2,000 jobs) in the three-county region.

These estimates are for the first year, and do not take into account any long-run impacts. The effect of a prolonged reduction in irrigation water on the agricultural economy could involve some adjustments in the input supply and processing sectors as well as the long-term impacts described above. Changes in these sectors would have an impact on the viability of the agricultural production sectors. Possible longer-run impacts that ought to be monitored include these sectoral adjustments, as well as effects on land values, costs associated with reestablishing perennial crops, cattle herd liquidation and restocking, loss of market contracts, reduced property tax revenues and government services, and impacts on local labor supply.

References

Department of Agricultural and Resource Economics, "Economic Impacts of 2001 Klamath Project Water Allocation," Oregon State University, May 22, 2001.