



## Why Spring Diversions on the Sacramento River are Important to Serve Multiple Benefits

### Overview

In the Sacramento Valley, water systems including rivers, streams, reservoirs and diversions are carefully managed to serve [multiple benefits](#). To effectively serve multiple benefits, water resources must be managed in an efficient manner, with the same block of water often used to achieve several beneficial uses as it moves through the region's waterways. As such, any proposal to change water management operations will result in redirected impacts to the environment, species, farming, groundwater, and local communities in the Sacramento Valley.

During the dry years in 2014-15 and again in early 2018, National Marine Fisheries Service, the State Water Resources Control Board and others were recommending that water be held back in Shasta Lake to protect cold water for winter-run Chinook salmon. To do this, water releases out of Keswick Reservoir below Shasta would be limited during the spring to as low as 3,250 cubic feet per second (cfs), potentially limiting Sacramento River diversions until June 1. Cold water management is important for incubating salmon below Shasta Lake. But, it is also important that water management decisions be made with understanding and consideration of the tradeoffs involved and how the disruption in water diversions and supplies would impact Sacramento River diverters and all of the beneficial uses they support. To the extent possible, decisions should be made to maximize multiple benefits for all parts of the environment, farming and local communities. This proposed action would have the following impacts:

- Decreasing farmed and terrestrial habitat acreage
- Hampering ability of juvenile spring-run Chinook salmon to emigrate out of tributaries to the Sacramento River
- Limiting access to drinking water by local communities diverting from the Sacramento River
- Negatively impacting local economies
- Hindering the achievement of sustainability under SGMA

The following synopsis describes these impacts in more detail.

## Farming and Terrestrial Habitat

The agronomic season in the Sacramento Valley begins in early spring, both for farming and for refuges and managed wetlands, which are all closely integrated with respect to the importance of spring diversions. A successful fall harvest of the regions' crops begins with the early spring irrigation of lands to ensure the plants have adequate time to grow, mature and be harvested before winter rains. Similarly, managed wetlands, including the regions' refuges, need water in the spring to plant the food and organic matter that nourishes birds and other species throughout the summer, fall and winter. In the region, the number of acres of annual crops (e.g. rice, cereals and alfalfa), managed wetlands and refuge habitat, as well as the yield of tree crops in any given year is dependent upon the quantity of water diverted, starting in April and May.

### *Rice*

Each year, about 500,000 acres of rice are planted in the Sacramento Valley. In addition to its agricultural production value, rice also provides habitat for nearly 230 species, including birds using the Pacific Flyway and 30 species that have received a special-status designation (e.g. "threatened," "endangered," etc.).<sup>1</sup>

Since rice was first commercially planted and irrigated in the Sacramento Valley more than a century ago, April and May diversions have been critical to successful production of the rice varieties that grow well in this region. If water users on the Sacramento River were unable to divert water during the months of April and May, it is estimated that between 200,000 and 210,000 acres of rice (which equals approximately 40 percent of California's rice acreage) would be fallowed. This fallowing would be concentrated on the west side of the Sacramento Valley that depends upon the Sacramento River.

This level of estimated fallowing is primarily attributable to the time it takes for the varieties of rice that are planted in the Sacramento Valley to mature. This places tremendous risk on rice growers and the structure and sustainability of the industry in California if the crop is not able to be harvested before seasonal poor weather begins. If rice is planted after June 1 and is able to be harvested, studies show substantial declines in yield due to the crop not reaching maturity (reduced photosynthesis and increased blanking, i.e. the rice plant not producing rice grain).

According to rice breeders from the University of California Rice Experiment Station, developing very early maturing varieties of rice is not a feasible solution to a delayed irrigation season due to associated reduction in yield potential, increased weather related risks, and negative impact on grain quality (which is an essential requirement for growing and marketing California rice). The time required to develop new varieties of rice averages around a decade. Introducing non-adapted foreign germplasm for early maturity further complicates the breeding time and effort. All of this would result in most farmers not making the financial commitment of planting the crop, because with this likely risk it would not be economically viable.

Most significant is that if Sacramento River water users were unable to divert water until June 1, it also would create a series of substantial bottlenecks that further influence the decision not to plant, including: releases from Shasta Reservoir that are insufficient to meet the demands of all water

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<sup>1</sup> J. Sterling & P. Buttner. *Wildlife Known Top Use California Ricelands*, 2011.

users on the Sacramento River; a lack of internal conveyance capacity within water management entities to distribute water to all landowners trying to irrigate ground as fast as possible at the same time; and, inadequate numbers of trucks, airplanes and other infrastructure to provide fertilizer and seed to the fields with everyone trying to plant at the same time. The “lead time” that it takes for releases from Shasta to travel to the point of diversion (which in most cases is measured in days), also contributes to the delay – further pushing back the start of planting. The aggregation of these bottlenecks would be that lands would not be served until well into July.

This loss of this rice acreage (>200,000 acres) would decrease giant garter snake habitat on the west side of the Sacramento Valley and would also impact Pacific Flyway habitat in the fall and winter months. According to Ducks Unlimited, “Under current conditions, a 50 percent decrease in the number of acres in rice production [~ 275,000 acres] would result in a loss of capacity to support about 1 million ducks... a 25 percent reduction in the number of acres in rice production [~ 137,500 acres] would result in a loss of capacity to support about 500,000 ducks....”<sup>2</sup> Using this analysis, losing more than 200,000 acres of rice would likely result in a loss in capacity to support over 725,000 ducks, which is approximately one quarter (25%) of all the ducks wintering in the Sacramento Valley.

### *Cereals and Alfalfa*

The inability to provide spring irrigation to cereal crops such as wheat and barley can diminish crop yield. For barley, studies have indicated that it is most sensitive to a lack of water during or just before spike emergence and during the initial stages of grain development.<sup>3</sup> Lack of irrigation during these early stages in plant production results in a reduction in the grain size and number.<sup>4</sup> Wheat is also sensitive to a lack of water, especially during the vegetative and reproductive stages.<sup>5</sup> Lack of irrigation at these times results in a reduction in grain number for the plant.<sup>6</sup>

Alfalfa, which in addition to its crop yield also hosts many wading birds and raptors, is typically irrigated two times during April and May. Lack of irrigation during this time can result in a total crop loss or, at minimum, a 40 percent reduction in annual yield. This is because alfalfa crop yield is directly related to how much water is applied and the spring and early-summer cutting typically produce the highest yields.<sup>7</sup>

### *Trees*

Recent droughts have provided considerable information regarding the impacts of reduced April and May diversions on trees in the Sacramento Valley. For most trees in the region, the inability to

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<sup>2</sup> Ducks Unlimited, *Assessing Waterfowl Benefits from Water Used to Grow Rice in California*, 8.

<sup>3</sup> Nezar H. Samarah. *Effects of drought stress on growth and yield of barley*. *Agronomy for Sustainable Development*, 2005, pp. 145-149.

<sup>4</sup> P.D. Jamieson, R.J. Martin & G. S. Francis. *Drought influences on grain yield of barley, wheat and maize*. *New Zealand Journal of Crop and Horticultural Science*, 1995, pp. 55-66.

<sup>5</sup> S. Daryanto, L. Wang, & P. Jacinthe. *Global Synthesis of Drought Effects on Maize and Wheat Production*. *PLoS One*, 2016.

<sup>6</sup> P.D. Jamieson, R.J. Martin & G. S. Francis. *Drought influences on grain yield of barley, wheat and maize*. *New Zealand Journal of Crop and Horticultural Science*, 1995, pp. 55-66.

<sup>7</sup> S. Orloff, D Putnam & K. Bali. *Drought Strategies for Alfalfa*. University of California ANR Publication 8522, July 2015.

irrigate in April and May can have impacts on yield not only during harvest that year, but also in the following year as well. In general, “trees should not be stressed for water in the early season because early-season growth processes are sensitive to water deficits. Bud break, bloom, flowering, fruit set, and rapid shoot growth all occur in the early spring. Adequate shoot initiation and growth are necessary to establish the fruiting positions for the following year’s crop. Early in the season, the trees are hard-pressed to supply the carbohydrates required by the developing fruit. Rapid leaf growth is also necessary to maximize tree photosynthesis.”<sup>8</sup>

Many of the trees commonly grown in the Sacramento Valley are reliant upon April and May diversions to avoid negative impacts to yield and tree health. For almond trees, early season irrigation is critical not only for yield and quality of production, but also fruitwood growth, orchard longevity, disease suppression and insect damage control.<sup>9</sup> If irrigation of walnut trees is delayed, the trees become stressed and experience reductions in spur and shoot growth and current and future yields.<sup>10</sup> Irrigation water is critical in April and May because at this time walnuts have ended dormancy and begun leafout, followed by flowering and then fruit production.<sup>11</sup> If prune trees are not adequately irrigated during fruit production and subsequently receive water, it can result in cracking of the fruit.<sup>12</sup>

### *Sacramento National Wildlife Refuge Complex*

According to Curt McCasland, Project Leader for the Sacramento National Wildlife Refuge Complex, the five National Wildlife Refuges and three Wildlife Management Areas that make up the Complex are reliant upon spring water deliveries to support the establishment, growth and seed production for moist soil food crops (e.g., swamp timothy, water grass and smart weed) and to irrigate moist soil units to control invasive plants on the refuge. Absent spring deliveries, these lands will have reduced food value, which can negatively impact the energetic requirements of migratory birds and ultimately decrease survival.

In addition, approximately 20 percent of the wetlands in the refuge are managed as semi-permanent and permanent wetlands for breeding waterbirds and other local wildlife (including special status species such as giant garter snakes, tricolor blackbirds and western pond turtles). These wetlands require continuous maintenance flows of water in April and May to maintain surface elevation as well as water quality.

### *Managed Wetlands*

Similar to the refuge lands, managed wetlands are also reliant upon spring water deliveries to provide habitat for giant garter snakes, tricolored blackbirds and western pond turtles. This water is

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<sup>8</sup> D. Goldhamer. *Managing Irrigation in Fruit and Nut Trees During Drought*. Department of Land, Air and Water Resources, University of California Davis, 2003.

<sup>9</sup> Ibid. and T. Prichard. *Effects of Water Supply and Irrigation Strategies on Almonds*. 1994

<sup>10</sup> F. Niederholzer. *When Should You Apply the First Irrigation of the Season?* Sacramento Valley Orchard Source, January 2017

<sup>11</sup> *Irrigation Management of Walnut Trees with a Limited Water Supply*. University of California UC Drought Management.

<sup>12</sup> D. Goldhamer. *Managing Irrigation in Fruit and Nut Trees During Drought*. Department of Land, Air and Water Resources, University of California Davis, 2003.

especially critical to the end of giant garter snake brumation (hibernation) as the snakes are emerging in these spring months and need to feed as they begin seeking mates.

In addition, the number of acres of managed wetlands providing Pacific Flyway habitat will also likely be impacted by decreased rice acreage due to their reliance upon the tailwater from drained rice crops as water supply. According to Ducks Unlimited, “Results of the survey indicate that rice tailwater represents an important water source for many private and public owned wetlands in the Sacramento Valley. An estimated 56 percent of seasonal wetlands (nearly 45,000 acres) in the Sacramento Valley use tailwater for fall flooding.”<sup>13</sup> With over 200,000 fewer acres of rice ground planted, there will be less rice tailwater available in the fall to flood up managed wetlands.

### Fish

Fish screens along the Sacramento River are designed to work at higher flows. Even if there was a situation where Sacramento River water users were able to divert water during April and May at the lower flows, the water elevations and velocities in the river would not allow the screens to work as designed to protect fish, including listed runs of Chinook salmon.

In addition, spring diversions improve the transport timing of emigrating juvenile salmon from upstream areas to downstream areas via the conveyance of irrigation water in the Sacramento River. Faster outmigration may be a measure to increase survival of young salmon (e.g., reduced predation).

### Local Communities

When releases out of Keswick Reservoir are limited to 3,250 cfs (as was the case in early 2018), even if diverters were not fully curtailed, the lower water elevations the river would severely limit or prevent local communities from diverting water.

At this lower river level (3,250 cfs), the City of Redding is unable to pump water from its Sacramento River Diversion, which is its main source of surface water in the early part of the year. As a result, the city must rely upon groundwater wells, some of which contain high levels of constituents (e.g. iron, manganese and arsenic) that cause safe drinking water concerns.

The Bella Vista Water District, which serves residents to the north and east of Redding, also experiences difficulties diverting water from the Sacramento River at lower flows. The low flows out of Keswick drop the water elevation in the river, which prevents the district’s pumps from working properly. As mentioned above, these low flows also prevent the district’s fish screens from working as designed, further limiting the capacity to lift water out of the river.

Absent augmenting flows from upstream tributaries, at 3,250 cfs diversions for the cities of Sacramento, Davis and Woodland on the Sacramento River would also be restricted due to fish screen criteria.

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<sup>13</sup> Ducks Unlimited, *Assessing Waterfowl Benefits from Water Used to Grow Rice in California*, 4

## Local Economic Impacts

In addition to lost revenue from agricultural crops, it is important to note that there will be ripple effects on industries dependent upon crops if production is diminished by fallowing or decreased yields due to lack of spring diversions. These ripple effects will have a compounding impact on local economies in the regions where spring diversions are curtailed. This will also reduce local government revenues that are dependent upon these local economic drivers.

## Sustainable Groundwater Management Act

With the implementation of the Sustainable Groundwater Management Act (SGMA) in the Sacramento Valley and the requisite defining and achievement of “sustainability” for the basins within the region, the extent that groundwater resources could be used to replace curtailed April and May diversions is uncertain, at best.

## Conclusion

Multiple-benefit water management is the hallmark for the Sacramento Valley. Water resources managers have been very creative and innovative in serving water for various beneficial uses of water. With the challenges facing salmon on the upper Sacramento River, water resources managers have and will continue to find ways to provide cold water for incubating salmon, while also serving the other important parts of the environment, farming and cities.

In working through these decisions, it is important to understand and consider why spring surface water diversions are critical to the economy, environment and public safety of the Sacramento Valley. The consequences from reduced or eliminated spring diversions would still be experienced months after they occur and, in some cases, could have long-term impacts on populations of waterfowl, giant garter snakes and salmon as well as tree health and yield. Any proposals to reduce spring flows on the Sacramento River and the related elimination or reduction of diversions should include an evaluation of these known and wide-ranging economic, environmental and public safety impacts as well as with the recognition that there may be many impacts that are impossible to foresee and which could prove disastrous to wildlife, the environment and human beings.

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