Upper Feather River Irrigated Pasture and Alfalfa Production Survey Summary

Prepared by

Kenneth W. Tate[5], Tina L. Saitone[6], and Tracy K. Schohr[7]
UC Cooperative Extension and UC Davis

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Background Purpose

In collaboration with the Upper Feather River Watershed Group (UFRWG) and their seventy grower members, UC Cooperative Extension (UCCE), and the Central Valley Regional Water Quality Control Board (WB) we have compiled data and information on irrigated pasture and alfalfa production in the Upper Feather River sub-watershed of the Sacramento Valley Water Quality Coalition (SVWQC). The purpose being to provide information on 1) agronomic practices such as nitrogen fertilization, pesticide use, and irrigation methods; 2) best management practice (BMP) adoption for livestock grazing, irrigation water application, tail water management, and pesticide application to protect water quality; and 3) agricultural productivity and economics. UCCE collected this information from each of the seventy growers from late 2020 until early 2021 via a written survey (*Irrigated Pasture and Alfalfa Production Survey*) developed in collaboration with WB staff. At the time the survey was completed with each grower, UCCE worked with that grower to update their Farm Evaluation and to update/complete Irrigation and Nitrogen Management Plan worksheets for each parcel with reported nitrogen application. Information from these efforts is summarized below to aid WB staff and leadership, among others, in consideration of an alternative regulatory program/strategy for this sub-watershed group, similar sub-watershed groups, and/or similar commodities.

Production Practices and BMP Survey Results

***Survey Response Rates*.** We were able to conduct a complete survey of all 70 growers and the 30,411 irrigated agricultural acres they manage and have enrolled with the SVWQC across the sub-watershed.

[5] Professor and Cooperative Extension Specialist in Rangeland Watershed Sciences, Department of Plant Sciences, UC Davis.
[6] Associate Professor of Cooperative Extension in Livestock and Rangeland Economics, Department of Agricultural and Resource Economics, UC Davis.
[7] Livestock and Natural Resources Advisor, Plumas, Sierra, Butte Counties, UC Cooperative Extension.

Table 1. *Response rates for survey completion, Farm Evaluation update, and Irrigation and Nitrogen Management Plan worksheet update/completion.*

	Enrolled	**Surveyed**	**Response Rate (%)**
Acres	30,411	30,411	100
Growers	70	70	100

Irrigated Pasture Production Characteristics. Irrigated pasture represents 25,483 acres (84%) of total irrigated lands across the sub-watershed (Table 2). Sixty-two growers report that they use grazing as the sole harvest technique across 24,699 acres of irrigated pasture, and 6 growers report that they use haying as the sole harvest technique for the remaining 784 acres of irrigated pasture across the sub-watershed. Ninety-six percent of irrigated pasture acres are gravity flood irrigated, with the remaining 4% irrigated via sprinkler irrigation systems.

Table 2. *Characteristics of irrigated pasture operations.*

Acres, irrigated pasture	25,483 (84% of total irrigated lands) [1]
Growers	68 [2]
Acres, sprinkler irrigated	1,098 (4% of irrigated pasture)
Acres, flood irrigated	24,385 (96% of irrigated pasture)
Acres, N application	1,331 [3,4] (4.3% of total irrigated lands)
Growers, N application	7
Acres, field-scale pesticide use	0
Growers, pesticide spot treatment of pests	18 (26% of irrigated pasture growers)

[1] 62 growers graze only a total of 24,699 acres of irrigated pasture, 6 growers hay only a total of 784 acres of irrigated pasture

[2] Some growers produce both irrigated pasture and alfalfa

[3] 723 acres sprinkler irrigated (54%) by 2 growers, 608 acres flood irrigated (46%) by 4 growers.

[4] Nitrogen application below crop demand for all 1,331 acres.

Irrigated Alfalfa Production Characteristics. Irrigated alfalfa represents 4,928 acres (16%) of total irrigated lands across the sub-watershed (Table 3). All alfalfa growers (6) report that they use haying as the sole harvest technique for all alfalfa acres across the sub-watershed. All alfalfa acres are irrigated via low pressure sprinkler irrigation systems.

Table 3. *Characteristics of alfalfa production.*

Acres, alfalfa	4,928 (16% of total irrigated lands)
Growers	6 [1]
Acres, sprinkler irrigated	4,928 (100% of alfalfa acres)
Acres, flood irrigated	0
Acres, N application	0
Growers, N application	0
Acres, field-scale pesticide use	4,782 (97% of alfalfa acres, 16% of total irrigated lands)
Growers, field-scale pesticide use	5 (83% of alfalfa growers)

[1] Some growers produce both alfalfa and irrigated pasture

***External Nitrogen Application*.** The majority of acres in the sub-watershed (95.7%; 29,080 acres) do not receive any external nitrogen application. Two growers reported nitrogen application to a total of 723 acres of sprinkler irrigated pasture, and 4 growers reported nitrogen application to a total of 608 acres flood irrigated pasture (Table 2). All growers applying external nitrogen report no tail water discharge from those parcels. Irrigation and Nitrogen Management Plan worksheets (i.e., nitrogen input and output budget calculation) were completed for all irrigated pasture parcels with reported nitrogen application via the UC Rangelands Irrigated Pasture Management and Planning tool developed in collaboration with the WB (http://rangelands.ucdavis.edu/ipnmp/). Nitrogen applications across all 1,331 acres of irrigated pasture were below calculated crop demand with these pastures serving as nitrogen sinks (i.e., no nitrogen available for loss to surface runoff or leachate to groundwater). No nitrogen applications were reported for alfalfa (Table 3).

***Pesticide Use*.** Eighteen (26%) irrigated pasture managers reported the use of pesticides for targeted spot treatments of pests (weeds and insects) on an as needed basis (Table 2). Zero acres of field-scale pesticide use were reported by irrigated pasture growers. Five out of the 6 alfalfa growers reported field-scale application of pesticides to 4,782 acres of alfalfa to control a mixture of weeds and insects (Table 3). Based upon these results, UCCE collaborated with the WB, UFRWG, and the Plumas and Sierra County Agricultural Commissioner to examine Pesticide Use Reports from 2016 through 2021 to determine which types of pesticides are used and on which types of lands (irrigated pasture, alfalfa, dry rangelands, etc.) in the sub-watershed. Based upon Pesticide Use Reports it was determined that paraquat dichloride and lambda-cyhalothrin – both of potential concern to the WB – were applied to less than 5% of total irrigated acres in the

sub-watershed. Applications are occurring primarily on alfalfa with limited applications to irrigated pasture. During September and October of 2022, farm visits were conducted to assess the site-specific potential risk of hydrologic transport and subsequent downstream contamination of surface waters from applications of these pesticides. These assessments indicate extremely limited to no potential for hydrologic transport and downstream contamination. The full results of these case studies can be found in Appendix II.

***Irrigation Application BMPs*.** Twenty percent of total irrigated acres (6,026 acres) are reported with sprinkler irrigation systems – with no tail water runoff generation reported as an outcome/best management practice (Tables 2 and 3). Along with water quality protection concerns, persistent drought conditions and limited irrigation water supplies have driven substantial adoption of irrigation application BMPs and water conservation measures across growers and acres in the sub-watershed (Table 4).

Table 4. *Irrigation application best management practices (70 growers total).*

Practice	Number of Growers (%)	Acres Reported
Appropriate Application Rate	67 (96)	30,294
Soil Moisture Monitoring	65 (93)	28,545
Uniform Application	58 (83)	28,854
Visual Observation	68 (97)	30,044

***Grazing BMPs*.** Sixty-two growers report that they use grazing as the sole harvest technique across 24,699 acres of irrigated pasture (Table 2). Table 5 provides a breakdown by specific grazing best management practice for these growers. Grazing BMPs are clearly widely adopted across growers and acres, driven by synergistic water quality and productivity benefits from the practices listed in Table 5. Drought and climate change induced limits on irrigation water supplies and thus forage production make efficient grazing management to optimize forage and livestock harvest from irrigated pasture fundamentally important to agricultural sustainability in the sub-watershed.

Table 5. *Grazing management best management practices (62 growers total graze irrigated pasture).*

Practice	Number of Respondents (%)	Acres Reported
Grazing Management Plan	59 (95)	24,058
Appropriate Stocking Rate	62 (100)	24,699
Livestock Rotation	60 (97)	24,454
Pasture Rest Before Irrigation	35 (56)	15,061
Livestock Removed During Irrigation	39 (63)	16,768
Fencing to Control Access to Waterbodies	50 (81)	20,577
Defined Stream Crossings	53 (85)	22,595
Drinking Water Away from Waterbodies	39 (63)	15,907
Salt/Supplement Away from Waterbodies	60 (97)	24,549
Drag Pastures	48 (77)	18,758

***Tail Water BMPs*.** Ninety-six percent of irrigated pasture acres (24,385 acres) are gravity flood irrigated by 64 growers (Table 2). Of the flood irrigated pasture managers, 25% report no tail water generation across 3,894 acres (Table 6). Along with water quality protection concerns, persistent drought conditions and limited irrigation water supplies have driven substantial adoption of irrigation tail water recovery and re-use BMPs across the sub-watershed (Table 6). For example, 64% of growers report that the fate of pasture tail water is as irrigation application to other pastures, and 20% report having a tail water recovery system. The implementation of pollutant filtration BMPs such as vegetated ditches/filter strips and wetlands is also robust with 95 and 69% of growers reporting, respectively.

Table 6. *Tail water management best management practices (64 growers total flood irrigated pasture).*

Practice	Number of Respondents (%)	Acres Reported
No Tail Water	16 (25)	3,894
Pasture is Lower Elev. than surrounding terrain	7 (11)	3,011
Tail Water goes to another agricultural user via irrigation ditch	41 (64)	17,250
Tail Water Recovery/Return System	13 (20)	8,659
Vegetated Ditch/Buffer/Strip	61 (95)	24,120
Catchment/Sediment Basin	39 (61)	15,778
Wetlands to Filter Runoff	44 (69)	19,070

***Pesticide Application BMPs*.** Five of 6 alfalfa growers reported field-scale application of pesticides across 4,782 acres of irrigated alfalfa (Table 3). Table 7 reports pesticide application best management practices for these growers and the acres they manage. Growers report full adoption of 1 out of the 13 practices in Table 7. Please see Appendix II for additional information on pesticide application BMPs specific to growers applying paraquat dichloride and lambda-cyhalothrin.

Table 7. *Pesticide application best management practices (5 alfalfa growers reporting field-scale pesticide use)*

Practice	Number of Growers (%)	Acres Reported
County Applies Pesticides	5 (100)	4,782
County Permit Followed	5 (100)	4,782
Follow Label Restrictions	5 (100)	4,782
Sensitive Areas Mapped	5 (100)	4,782
Attend Trainings	5 (100)	4,782
Monitor Wind Conditions	5 (100)	4,782
Reapply Rinsate to Treated Field	5 (100)	4,782
Avoid Surface Water When Spraying	5 (100)	4,782
Use Appropriate Buffer Zones	5 (100)	4,782
Use Drift Control Agents	5 (100)	4,782
Monitor Rain Forecasts	5 (100)	4,782
Use PCA Recommendations	5 (100)	4,782
Ag Commissioner Conducts Pretreatment Inspection	2 (40)	3,089

Economic Analysis Results

In order to ascribe economic value and assess productivity of the agricultural activities in the sub-watershed, we categorize acres according to primary commodity type (i.e., alfalfa, irrigated pasture, hay). Table 8 summarizes this categorization and acreages for the UFRW.

Table 8. *Commodities, acreage, and gross revenue*

Commodity	Acres	Average Yield/Acre	Average Gross Revenue/Acre
Alfalfa	4,928	4.1 Tons	$340/Ton
Hay[1]	784	3.1 Tons	$460/Ton
Irrigated Pasture	24,699	5.1 AUMs	$29.75/AUM

[1] The hay category includes grass hay and alfalfa grass hay blends.

Value of forage harvested by livestock. More than 80% of the total irrigated acres reported in the survey are irrigated pastures grazed by livestock. The economic value derived from grazing is quantified based on animal unit months (AUMs) – the amount of forage required to support one animal for one month. Across the sub-watershed, survey respondents indicate that a total of 124,856 AUMs were supported by the total irrigated pasture acres. The average length grazing season reported by survey respondents was 5.9 months per calendar year. The average AUMs supported by an acre of irrigated pasture was estimated to be 5.1.

The most recent UC Cost and Returns Study to provide the estimated economic value derived from irrigated pasture is Macon and Stewart (2020).[8] This study considers irrigated pasture in the Sierra Foothills of Northern California and estimates the value of an acre of irrigated pasture to be between $25 and $55 per AUM. Given that the irrigation and grazing season in the UFRW is shorter than that experienced in the Sierra Foothills, we would anticipate that the value of an AUM in this sub-watershed would be on the lower end of the range -- $25/AUM.

The value of an AUM is derived from the value of the calves that livestock producers are able to market for sale. In 2020 (i.e., the time of the Macon and Stewart study) national calf prices averaged $1.57/lb. In the first 7 months of 2022, national calf prices averaged $1.88/lb., a 19% increase. Given the vintage of the most recent study, it is reasonable to scale the value of the AUMs derived from irrigated pasture to reflect the increase in the value of the marketable product (i.e., calves) -- $29.75/AUM. Based on this AUM value and the average grazing season length of 5.9 months, an acre of irrigated pasture in the sub-watershed is estimated to generate an average of $175.53 per year.

However, it should be noted that these gross revenue estimates do not take into account the total operating costs associated with irrigated pasture production and management. Forero et al. (2015) quantifies the total operating costs for irrigated pasture at $198/acre.[9,10] While the most recent available, the vintage of this study requires correction as well. The Bureau of Labor Statistics provides a measure of inflation specific to agricultural operations – the producer price index (PPI) for farm products. At the time of the Forero (2015) study, the average PPI for farm products for the year was 173.8. In September 2022, the PPI for farm products had escalated to 246.3, a 42% increase. Applying that percentage increase to the total operating costs for

[8] Macon, D. and D. Stewart. 2020. "Sample Costs to Establish, Reestablish, and Produce Irrigated Pasture in the Sierra Nevada Foothills." *University of California Agricultural and Natural Resources.* Available at: https://coststudyfiles.ucdavis.edu/uploads/cs_public/bb/94/bb94edc2-fbfb-4be0-8853-6565b486e032/20pasturesnfhproduction.pdf.

[9] Forero et al. 2015. "Sample Costs to Produce Pasture in the Sacramento Valley." *University of California Agricultural and Natural Resources.* Available at: https://coststudyfiles.ucdavis.edu/uploads/cs_public/0e/23/0e230982-8610-42a4-8a26-32a0b10a4c5c/pasture_sv_2015.pdf.

[10] Total operating costs in the study include irrigation (i.e., water delivered) and fertilizer, which are deducted from the cost presented here.

irrigated pasture from 2015 (i.e., $198/acre) yields an estimate much more relevant for 2022 -- $281.16/acre.

Value of hay harvested. A total of 784 acres of hay (e.g., grass hay, alfalfa/grass hay blends) were reported by survey respondents in the UFRW. The average yield of hay cut was 3.1 tons/acre. The United States Department of Agriculture's (USDA) California Direct Hay Report for October 14, 2022 reports that orchard grass hay (good/premium quality) in the North Inter-Mountain region of California was trading at $23.00/bale. Assuming that a bale of orchard grass weights approximately 100 lbs., a ton of hay would generate $460/ton in gross revenue. This translates to $1,426/acre in gross revenue from hay production per year. The Macon and Stewart (2020) study forecasts that the total operating costs associated with grass hay production at that time were $304/acre.[11] Adjusting this estimate for inflation results in total operating costs for an acre of hay in 2022 to be $474.24/acre.[12]

Value of alfalfa harvested. A total of 4,928 acres of alfalfa hay were reported by survey respondents in the UFRW. The irrigation season for alfalfa spans the months from May to September, with the average length of irrigation season being 4.5 calendar months per year. Survey responses indicated that the average yield is 4.1 tons of alfalfa per acre. The United States Department of Agriculture's (USDA) California Direct Hay Report for October 14, 2022 reports that alfalfa hay (good/premium quality) in the North Inter-Mountain region of California was trading at $340/ton. At this price, the average acre of alfalfa in the UFRW would generate $1,394 in gross revenue per year. Long et al. (2020) estimate the total operating costs associated with alfalfa production to be $522/acre in 2020.[13] Adjusting this value for inflation results in an estimate of total operating costs for 2022 of $814.32/acre.[14]

Economic implications. Although the agricultural activities conducted in the UFRW are extremely low-threat to water quality, the fees associated with compliance with the Irrigated Lands Regulatory Program (ILRP) fail to reflect this; the general fee structure is the same for more intensely cultivated crops in other regions of the Sacramento Valley Water Quality Coalition (SVWQC). One of the fundamental issues with the ILRP's compliance costs being apportioned on a per acre basis is those fees are not necessarily correlated with risk – not all acres pose equal risk to water quality. Given this structure, cross-commodity subsidization occurs with less intensive agricultural commodities, which are typically lower risk, subsidizing higher risk growers and

[11] These total operating costs do not include cash overhead (e.g., office expenses, liability insurance) or non-cash overhead (e.g., tools, replacement parts, pipe). The cost study included irrigation costs and land lease rates, these have been removed from this figure.

[12] In 2020 the PPI for farm products was 157.9. In September 2022 it was 246.3. This 56% increase was applied to the hay production total operating costs.

[13] Long et al. (2020). Sample Costs to Establish and Produce Alfalfa Hay. *University of California Agricultural and Natural Resources.* Available at: https://coststudyfiles.ucdavis.edu/uploads/cs_public/02/ee/02ee0710-8c2c-41ea-8b25-736d1854b737/alfalfasvdraft10420.pdf.

[14] See footnote 8.

crops.

During fiscal year 2021/22 the members of the UFRW were collectively assessed $40,395.91 by SVWQC – the sum of State Board oversight fee, SVWQC assessments, and UFRW compliance costs. During this FY, the State Board oversight fee was $1.04/acre for irrigated pasture and $1.29/acre for other agricultural commodities. Across the sub-watershed group, the total State Board oversight fee ($21,544.29) accounted for 53% of UFRW's total SVWQC assessment. The remaining 47% ($18,851.62) of UFRW members' annual SVQQC assessment is associated with regional plan program management ($4,595.81), groundwater quality planning and management ($7,420.75), coalition reporting requirements ($2,640.45), and general program management costs ($4,194.61). Based on SVWQC assessments and sub-watershed costs (e.g., insurance, administration, etc.) members were assessed $1.05/acre and a $200/person membership fee.[15]

As an illustration of the economic discrepancies in revenue and ILRP assessments, compare irrigated pasture ($176/acre/year gross revenue in the UFRW) and almonds ($5,500/acre gross revenue in the Sacramento Valley in 2020). This means that a cattle producer would have to graze more than 31 acres to generate the same revenue as a single acre of almonds.[16] If each were to pay approximately the same total ILRP compliance assessment fee per acre ($1.05), the almond producer would be assessed $1.05 to earn $5,500 in revenue whereas the irrigated pasture operator would be assessed $32.55 to earn $5,500 in revenue.[17] As such, the cattle producer would pay 31 *times* the regulatory compliance costs of the almond producer in the Sacramento Valley, despite the fact that they manage an extensive, low-threat agricultural crop.

[15] The watershed group also charged members with more than 1,000 enrolled acres an additional $0.25/acre.

[16] Although we present this information in terms of gross revenue herein, the results are very similar if comparisons are made based on net profit.

[17] The UFRW, following years of monitoring and reporting in the ILRP, secured reduced monitoring requirements in order to remain in compliance. As such, their per acre fee assessment is often lower than other sub-watersheds without the same designation.