Evaluating Winter Recharge on Alfalfa for Sustainable Groundwater Management

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Photo: Liz Bowen
Agricultural Groundwater Banking:

- Utilizes flood flows and agricultural lands for recharging groundwater during winter months
- To capture runoff from high intensity, short-duration rainfall-runoff events large spreading areas are needed
- California’s Central Valley provides 8 million acres of irrigated cropland that could serve as spreading grounds for ag-recharge

1. Evaluate suitability of alfalfa for ag-recharge
2. SV: assess benefit of recharge for instream flows
Scott Valley Pilot Project

[Map showing Scott Valley and project areas]
On-farm recharge experiments

- 15 acre (6 ha) field; 10-year old alfalfa stand, flood irrigated, Stoner gravelly sandy loam
- Applied water at 3 days/wk (Low), 5 days/wk (High) and continuously (Continuous)
# Applied Water Rates Table

<table>
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<tr>
<th>Treatment</th>
<th>Check</th>
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<th>2014-2015 (02/17-04/09/2015)</th>
<th>2015-2016 (02/04-03/21/2016)</th>
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<td>2</td>
<td>1.1</td>
<td>26.49</td>
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<td>3</td>
<td>1.19</td>
<td>24.87</td>
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<td>High</td>
<td>4</td>
<td>1.18</td>
<td>7.20</td>
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<td>1.44</td>
<td>8.16</td>
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<td>Low</td>
<td>7*</td>
<td>1.41</td>
<td>5.20</td>
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Winter Recharge Effects on Groundwater Levels and Alfalfa Yield

Graphs showing the effects of winter recharge on groundwater levels and alfalfa yield. The graphs compare the groundwater level (in feet) and diverted surface water (in cfs) over time for different applied winter water levels (in ft) for the years 2015 and 2016. The yield of alfalfa is also shown for each level of applied winter water.

Key:
- Groundwater level (ft)
- Diverted surface water (cfs)
- Rainfall (in)

Legend for applied winter water levels:
- Standard
- Low
- High
- Continuous

Data for 2015:
- 0 ft: Standard (1st cut, 2nd cut)
- 4.2 ft: Low (1st cut, 2nd cut)
- 7.3 ft: High (1st cut, 2nd cut)
- 28 ft: Continuous (1st cut, 2nd cut)

Data for 2016:
- 0 ft: Standard (1st cut, 2nd cut)
- 1.6 ft: Low (1st cut, 2nd cut)
- 4.1 ft: High (1st cut, 2nd cut)
- 11.1 ft: Continuous (1st cut, 2nd cut)
Travel time through 25 ft vadose zone

Graph showing relative groundwater level and applied water from 2/5/15 to 6/5/15.

 Highlight areas A and B with red circles.

Irrigation indicated by red arrow.

- Time scales:
  - 2/5/15 to 6/5/15
  - 2/17/15 to 3/13/15

- Measurement scales:
  - Relative Groundwater Level (m)
  - Applied Water (L/s)

- Observations:
  - ~19 hrs travel time in area A
  - ~11 hrs travel time in area B

Graphs indicate changes in groundwater level and applied water over time, possibly correlating with irrigation events.
Water Right Permit for Recharge:
Demonstration of Beneficial Use
Scott River Flow

USFS Decreed Right

MAR Diversion

Diversions in excess of 7.5 cfs totalled 680 acft.
Scott Valley Integrated Hydrologic Model: Scenario Analysis
Scott River
Outflow from Scott Valley

Flow Difference and Recovery at USGS Gage
Temporary Groundwater Storage Permit

total simulated streamflow recovery after 13 years: > 99.5%