Groundwater Recharge practices in production vineyards and SGMA implementation

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Outline

- Introduction to SGMA
- Aquifer recharge as a tool to support SGMA implementation
- Cosumnes river example: winter irrigation on vineyards → design and data collection
SGMA (Sustainable Groundwater Management Act)

- Historic drought
- Became law on January 1, 2015
- Medium/high priority basins must be managed sustainably
- Emphasis on local control with State oversight
  - State intervenes if local action not taken
- Requires Groundwater Sustainability Agencies (GSAs)
- Requires Groundwater Sustainability Plans (GSPs)
Who is interested?
What is sustainable management?
Keys to success

GSP accepted by DWR and local stakeholders

- Effective communication and community involvement
- On time, effective, and successful plans and implementation
- Tools (database, models) useful into the future
LEARN and ENGAGE! Participate NOW to represent your interest! SGMA stresses LOCAL group formation, LOCAL plans and LOCAL management!

SGMA plans will reflect local conditions and can include local solutions. Once approved by the state, your local plan represents a commitment to future actions.

- SGMA will affect your groundwater pumping
- SGMA establishes new responsibilities to share groundwater
- SGMA will change how we use land and water
- SGMA does not change water rights

Let's be clear:

- Your Groundwater Sustainability Plans will map out the road to sustainability

Participate now by:
- Learning about groundwater
- Contacting your Groundwater Sustainability Agency (GSA)
- Attending meetings
- Contacting your county Farm Bureau

All basins must achieve sustainability by 2042* (The difference in timing to achieve sustainability between 2040 and 2042 is due to when the GSP is required. See cover map.)
Groundwater Sustainability Plans

- Plan requirements
  - Measurable objectives/milestones to meet sustainability goal
  - Technical information
    - Hydrogeological conditions of the aquifer
    - Historical and projected water demands
    - Potential areas of recharge
    - Measurable objectives and milestones toward sustainability
    - Monitoring and management plan
- Result in “sustainable conditions” within 20 years of adoption
- Must be approved by DWR by 2022
SGMA – opportunities and challenges

Tools to balance supply and demand and help your GSA reach sustainability

**SUPPLY**
- New sources of supply
- Groundwater recharge
- Irrigation efficiencies

**DEMAND**
- Pumping constraints
- Changes in land use
- Credit for reduced pumping

GSP development and implementation: balancing act – between different interests, between water supply and water demand, between beneficial uses.
Groundwater Sustainability Agencies empowered to:

- Conduct studies
- Register and monitor groundwater wells
- Require reports of groundwater extraction
- Implement capital projects to meet goals
- Assess fees to cover cost of groundwater management

Some requirements do not apply to small groundwater users
MAR as a tool to facilitate SGMA

- Managed groundwater recharge to improve groundwater resources and enhance sustainability
- What more do we need to know to enhance MAR application in agricultural fields?
- Which are the main knowledge gaps?
  - Scientific/technological
  - Social
Cosumnes river example: what is the benefit and how can be demonstrated?

- Need consistent and continuous measures to show:
  - Where is the recharge water moving? Towards the South American subbasin? Towards the Cosumnes subbasin? Back in the river?
  - How can the river (and its habitat) and the aquifer both benefit from recharge?
  - How can the stakeholders benefit from it?
    - Energy
    - SGMA
  - What is the impact on the crops?
The Cosumnes River Runs Dry

- Allow the Cosumnes River to run for longer periods during the spring and summer and begin flowing earlier in the fall.

Dry Cosumnes River Bed in August, 2010
Cosumnes River Groundwater Recharge

- Integrated team, complementary skills
  - Omochumne-Hartnell Water District (OHWD)
  - Larry Walker Associates (LWA)
  - Cosumnes Coalition/TNC
  - UC Cooperative Extension
  - Sacramento State University
Comprehensive pilot study

- Irrigation design and installation
- Continuous groundwater monitoring
- ET and plant stress monitoring (UC Cooperative Extension)
- Extensive modelling
  - To understand benefits of recharge to aquifers, river, and GDEs
  - Many institutions and stakeholders involved
  - Synergistic effort

To understand benefits of recharge to aquifers, river, and GDEs. Many institutions and stakeholders involved. Synergistic effort.
Groundwater Recharge By Flooding Agricultural Land

A.T. O’Green, et al., Soil suitability index identifies potential areas for groundwater banking on agricultural lands, California Agriculture, 2015.
Why Interested in Recharge?

Annual Grassland

Vineyards (includes table grapes, wine grapes, and raisins)

Tomatoes (processing)

Corn (Field and Sweet)

Safflower

Turf farms

Pasture

Mostly vineyards
Recharge Site

- Region between Deer Creek and Cosumnes River → **ideal** for GW banking:
  - readily transmissible and low salinity soils,
  - suitable topography, and root zone residence time.
  - ag fields with good water access, crop suitability, soil permeability, and land owner interest and agreement.
Overall System Design

- **10 year period** → use two existing diversions on the River to flood dormant ag fields in the off-(irrigation) season (Nov-March) when streamflow is high and excess water is available.

- **GOAL** → divert a minimum of 4,000 AF per year, but system designed to divert/recharge up to 6,000
Available Water for Diversion

- 50% of water years have enough flow in the river to allow 6,000 AF diversion
- 70% of water years would allow at least 4,000 AF diversion.

Table 1. Percent exceedance of years with the listed number of days in December through February with diversion. Volumes diverted assume 50 cfs diversion when flows at Michigan Bar exceed 175 cfs, and 7.5 cfs diversion when flows at Michigan Bar are between 75 cfs and 175 cfs.

<table>
<thead>
<tr>
<th>Available Dec-Feb Days with 50 cfs of Diversion</th>
<th>Volume Diverted (af)</th>
<th>Percent Exceedance (%)</th>
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</thead>
<tbody>
<tr>
<td>All</td>
<td>6,000</td>
<td>7</td>
</tr>
<tr>
<td>60</td>
<td>6,000</td>
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<td>40</td>
<td>4,000</td>
<td>67</td>
</tr>
<tr>
<td>20</td>
<td>2,000</td>
<td>87</td>
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</tbody>
</table>
Groundwater Monitoring

- Monitoring to show performance of the project required by the grant
- GW monitoring for quantity and for water quality, and ET and soil moisture will provide a quantitative metric of the off-season irrigation on local groundwater levels and storage
Groundwater Observatory: continuous monitoring program

- Need observations to manage the GW system
- Continuous recording pressure transducers to capture relevant changes in GW levels at any time
- Telemetry-equipped GW observatory
- Data available in the form of well hydrographs on a web-based dashboard

→ Landowners and growers interested in understanding benefits of recharge and groundwater paths and directions (critical for SGMA)
5 lower Cosumnes sites (Oneto-Denier field site)

5-10 Cosumnes corridor wells plus wells of recharge project

5-10 South American River Sub-basin wells

Partners: UC Water, OHWD, Cosumnes Coalition, Sacramento County
Recharge scale monitoring network

- Verified for monitoring (blue)
- Existing, but not verified (yellow)
- 4 new wells drilled in February 2019
- Importance of monitoring the southern side
Soil and infiltration rate analysis

How is the water moving into the soil profile?

- Temperature probes and pressure transducers in shallow piezometers
- Soil samples
- Rain gages
- Continuous camera
Data collection set-up
Groundwater quality monitoring goals

- Stable isotopes → track movement of recharged water through aquifer
- Major ion chemistry → see if reactions between recharged water and local groundwater could clog pore space and slow infiltration
- Trace elements, nutrients, pesticides → ensure that recharge is not degrading groundwater quality
Groundwater quality monitoring expectations

- Infiltration should not be affected by reactions between recharge water and local groundwater. This area naturally flooded and infiltration is still high.

- Groundwater quality should not be degraded. Even if nutrients or pesticides are flushed out of the soil, the additional recharge will help dilute those contaminants.
Summary: MAR as a tool to facilitate SGMA

- Managed groundwater recharge to improve groundwater resources and enhance sustainability: need to support GSAs in overcoming challenges and develop opportunities

- What more do we need to know to enhance MAR application in agricultural fields?

- Which are the main knowledge gaps?
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  - Social
Summary

- Key to SGMA success:
  - Local management,
  - Outreach effort and community involvement,
  - Good science, and
  - Data collection
  - Successful projects

- Need to support GSAs in overcoming challenges and develop opportunities
THANK YOU!

QUESTIONS?