Next-Generation Desalination for Treatment and Reuse of Agricultural Drainage Wastewater

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How can NAWI help solve problems related to salts, contaminants, and scarcity in regions that rely on irrigation?

The problem:

California's San Joaquin Valley exemplifies challenges facing regions that rely upon modern irrigation methods and intensified agricultural practices:

(1) Crop productivity is threatened by **salinization** of soil and water resources, exacerbated by irrigation methods that have trapped salts in the basin.

(2) Agricultural drainage has **contaminated** surface and groundwater with nitrates, selenium, and pesticides, threatening drinking water and ecosystems.

(3) Overuse of water has led to **scarcity**—a phenomenon that limits agricultural productivity and places stress on municipal and community water supplies.

Project goal:

Identify pathways for desalination and advanced water technologies to be widely adopted in regions facing the challenges described above.

Our approach:

In this project, we focus on three application areas that could benefit from more widespread technology adoption: drinking water treatment and access (especially in small communities), agricultural water supplies, and valley-wide salinity management. We do so by:

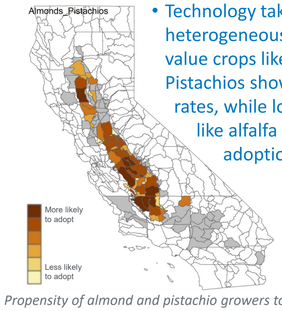
- Identifying candidate technologies and process innovations
- Employing targeted interviews to understand needs, concerns, priorities, and limitations of key stakeholders
- Developing an economic model to understand the best opportunities for uptake and diffusion of desalination and advanced water treatment technologies
- Conducting a stakeholder workshop to formulate recommendations and identify future actions to expand opportunities for desalination

Findings from interviews and workshop [formatting needed]

- DRINKING WATER TREATMENT AND ACCESS:
  - BARRIERS
    - ❖ Treatment viewed as a last resort
    - ❖ Cost and funding structures
    - ❖ Risk aversion
    - ❖ Brine management
  - OPPORTUNITIES
    - ❖ Remote operability and real-time monitoring
    - ❖ Selective contaminant removal
    - ❖ Affordable point of use/point of entry for homes
- AGRICULTURAL WATER SUPPLIES:
  - BARRIERS
    - ❖ Cost, especially capital cost
    - ❖ Value of water varies year to year
    - ❖ Uncertainty from climate change and SGMA
    - ❖ Sustainable business models
    - ❖ Brine management
    - ❖ Irrigation is intermittent and high flow
  - OPPORTUNITIES
    - ❖ Small-scale, distributed systems
    - ❖ Water supply reliability
    - ❖ Previously unusable brackish supplies
    - ❖ Small quantities of water to keep tree crops alive
    - ❖ Selective contaminant removal

Findings and outputs from economic model

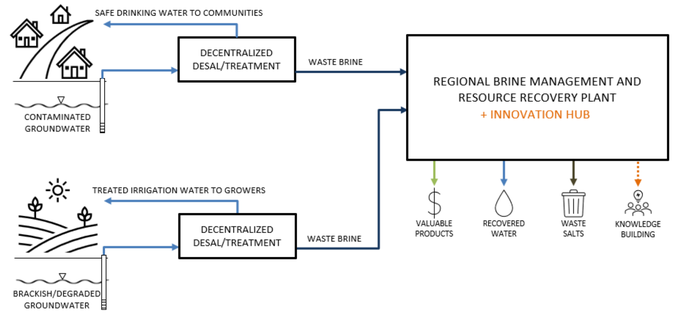
- Growers are more likely to adopt if they expect the price of water to increase in the future (i.e., higher drift rate)
- Growers are more likely to adopt if the amount that they pay for water remains relatively constant (i.e., low variance rate).
- Technology take-up is highly heterogeneous by crop. High-value crops like Almonds and Pistachios show high adoption rates, while low-value crops like alfalfa show zero adoption.



Propensity of almond and pistachio growers to adopt desalination technology; results preliminary

Regional, multi-benefit brine management solutions

- **High demand for decentralized treatment technology:** [elaborate]
- **Brine management a key barrier:** [elaborate]
- **Opportunities for multi-benefit solutions:** [elaborate]



NAWI CONNECTIONS

Challenge Area/Topic Area: DMA
We anticipate that the outcomes of this project will provide a basis for identifying the advances in water treatment technologies that are needed to enable their adoption in the San Joaquin Valley.

NAWI Leverage
In this project, we rely on the expertise of NAWI Alliance members, on NAWI baselining studies, and on insights from the NAWI Analysis team.

KEY FINDINGS

- Small-scale modular desalination systems may offer the fastest path for adoption in agriculture.
- Blending desalinated water with saline water is an opportunity to lower the threshold price.
- Cost, reliability, and brine management are key technical barriers to adoption.
- Local and regional regulations significantly impact adoption drivers and barriers.
- Regional brine management may enable more efficient resource recovery and support adoption of distributed treatment for communities and growers.

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