



# RESEARCH BRIEF

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## Water-Energy-Food Nexus: A Novel Sustainability Assessment of Desalination for Agriculture

*Desalination is expanding within the agricultural sector as a water supply option, but assessing long-term sustainability using a novel 'triple bottom-line' framework may lead to better economic, environmental and societal outcomes.*

### Background

In the face of climate change and falling technology costs, desalination is an increasingly viable source of freshwater for communities around the world. Previously only adopted as an expensive solution to potable water shortages in the most arid regions, desalination technology is today being more widely applied to irrigated agriculture. This is particularly true in coastal regions where prolonged groundwater overdraft or over-pumping has caused seawater intrusion into the aquifer system resulting in brackish water supplies. To combat this problem, many agribusinesses have constructed private desalination plants to treat the brackish groundwater before using it for irrigation. However, managing desalination for agriculture presents a different set of sustainability challenges compared to its use for treating municipal water supplies.

The potential for desalination to disrupt existing water management regimes, and the populations dependent on them, means that the social dimension of any sustainability analysis is a particularly important consideration. Prior analyses have generally focused

### POINTS FOR POLICY MAKERS

- ▶ **Greater coordination between market-oriented water/energy/trade policy and public water policy can support more sustainable introduction of desalination technology.** In the SQV, agricultural energy subsidies and weak groundwater regulation played a critical role in enabling private adoption of desalination. However, this has come with unintended and unsustainable consequences for the local environment, in turn creating tensions over differential water access between private agribusinesses and the local public.
- ▶ **A wide range of interests, including local utility users, need to be incorporated into local and regional water policymaking.** Development of new desalinated water sources for public or private use can drive significant changes. For example, the SQV region saw significant economic migration due to expanded agricultural productivity. Incorporating perspectives from multiple sectors and interest groups into local and regional planning could help to bring early attention to emerging sustainability challenges or inequities arising from these changes.
- ▶ **Monitoring and attribution of the sustainability impacts of desalination for agriculture will be crucial for combatting trends such as freshwater aquifer depletion.** In the SQV region, a long-term impact of desalination is continued deterioration of the coastal freshwater aquifer system which will create even greater water access challenges for the local population and businesses in the future.



on identifying and mitigating the direct environmental impacts of desalination or calculating the economic cost of desalinated water in different contexts, but there is limited understanding of how introducing desalination technologies into an area can impact sustainability across environmental, economic and social outcomes: the triple bottom-line.

Stanford researchers developed a novel ‘triple bottom-line’ and water-energy-food (WEF) sustainability assessment framework with which to explore the sustainability impacts of desalination for agriculture using the San Quintín Valley (SQV) in Baja, Mexico as a case study. Agriculturally, the SQV is of enormous economic importance to Mexico, exporting large volumes of high-value, water-intensive crops such as berries and tomatoes to the lucrative U.S. market, representing a significant virtual water transfer. However, this large export economy comes at a cost to the area’s already limited water resources. It has also increased worker migration to the area, exacerbating the existing water access challenges of the local population and resulting in tension over differential water access between private agribusinesses and the local public.



## ABOUT THE AUTHORS



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This brief is based on the paper “Trade-offs Across the Water-Energy-Food Nexus: A Triple Bottom Line Sustainability Assessment of Desalination for Agriculture in the San Quintín Valley, Mexico” published in *Environmental Science & Policy*.

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## FOR MORE INFORMATION

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