

SPOTLIGHT

Co-Production of Knowledge at Sumida Farm Trains a New Generation of Community-Engaged Scientists

By Jennifer Engels, Barbara C. Bruno, Emi Suzuki, Kyle Suzuki, Henrietta Dulai, Mackenzie Manning, Donn Viviani, Keku'iapōiula Keliipuleole, Brandon Dela Cruz, Kathy Ho, Kyle Kila, Tehani Malterre, Ariel Thepsenavong, Leah Bremer, Christopher Wada, Sheree Watson, Ahmed S. Elshall, Aida D. Arik, and Kimberly Burnett

The Sumida watercress farm near Pu'uloa (Pearl Harbor), O'ahu has been in continuous operation since 1928. This family-run farm (Figure 1a) produces 70% of the state's watercress crop, making it critical to Hawai'i's food production. The farm's watercress relies completely on water from freshwater springs. However, the amount of water flowing from the springs has declined by half over the last century as a result of groundwater pumping, climate change, and other drivers (Oki, 2005). Mo'olelo (oral

histories) published in Hawaiian language newspapers from 1834 to 1948 document the springs' use for agriculture and recreation by Hawaiian ali'i (chiefs) for more than 1,000 years (Engels et al., 2020).

A collaboration between the University of Hawai'i (UH), Hawai'i Sea Grant, and the fourth generation of Sumida farmers focuses on training a new generation of community-engaged scientists. A key partner is the UH Economic Research Organization, an interdisciplinary research group that informs public policy across Hawai'i. The overarching goal is to build a healthy, resilient, and sustainable agricultural community in the face of environmental and social change. To do that, we are following University of Hawai'i Sea Grant best practices for community-engaged research (Kūlana Noi'i Working Group, 2021). UH scientists, local and Native Hawaiian students, and the farmers co-design research directions and co-produce knowledge in response to the farm's needs. Since 2017, about once a month, we have tested water quality and monitored the springs' salinity (Figure 1b).

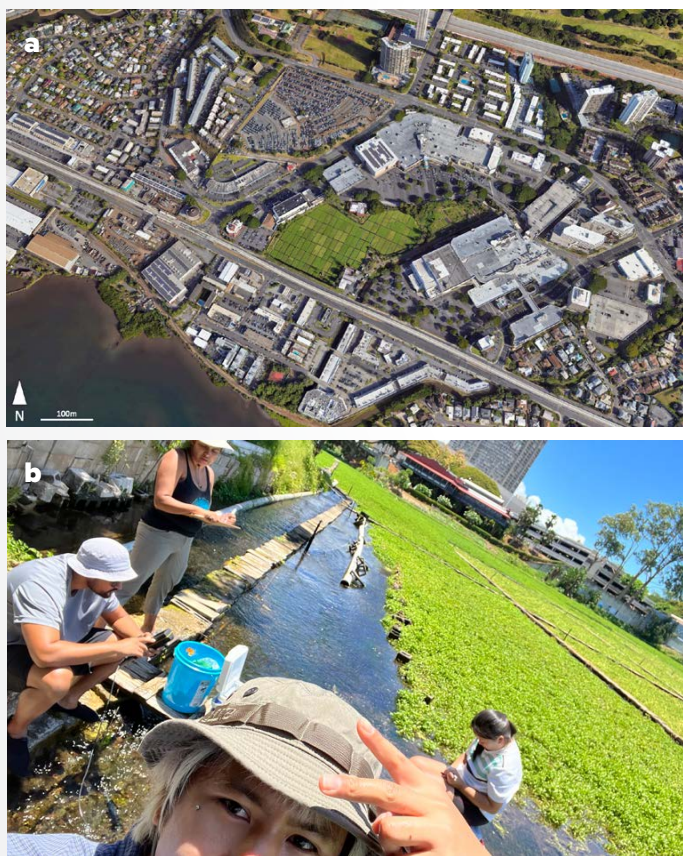


FIGURE 1. (a) Sumida Farm is surrounded by parking lots, shops, restaurants, and roads and is ~200 m from the northeastern edge of Pu'uloa (Pearl Harbor). (b) Students collect water samples at Sumida Farm. (c) A student analyzes freshwater samples for the presence of contaminants. (d) Watercress is grown experimentally in varying seawater salinities.



These data help the farmers identify potential contaminants from the surrounding urban communities (Figure 1c), forecast climate-change-driven sea level rise impacts, plan for future watercress species resilient to increasingly saline conditions, and consider alternative growth methods to ensure crop viability.

In addition to water quality, students are co-designing research projects on a range of topics, including native bird biodiversity, freshwater and saltwater plankton, watercress adaptability (Figure 1d), nitrogen cycling, the effects of groundwater pumping on the springs' water flow, and watercress economics. The participants' engagement is reflected in the fact that all have continued on their educational and career pathways (e.g., from community college to four-year colleges, graduate school, or employment). A four-question survey administered in September 2023 reveals how participants are impacted by this research (Table 1).

Respondents reported increased awareness of sea level rise and Hawai'i's food security as well as a strong commitment to community partnerships, and many students reported an increased commitment to working in Hawai'i after graduation. The UH-Sumida project has created lasting relationships between a local farming family, UH researchers, and Sea Grant, and may serve as a model for training a new generation of community-engaged scientists.

REFERENCES

- Engels, J.L., S. Watson, H. Dulai, K.M. Burnett, C.A. Wada, 'A. Aga, N. DeMaagd, J. McHugh, B. Sumida, and L. Bremer. 2020. Collaborative research to support urban agriculture in the face of change: The case of the Sumida watercress farm on O'ahu. *PLOS ONE* 15(7):e0235661, <https://doi.org/10.1371/journal.pone.0235661>.
- Kūlana Noi'i Working Group. 2021. Kūlana Noi'i v. 2. University of Hawai'i Sea Grant College Program, Honolulu, Hawai'i.
- Oki, D.S. 2005. Numerical simulation of the effects of low-permeability valley-fill barriers and the redistribution of ground-water withdrawals in the Pearl Harbor area, Oahu, Hawaii: Scientific Investigations Report 2005–5253.

ACKNOWLEDGMENTS

Major support was provided by NSF/OIA#1557349, NSF/GEO#2022937 and Hawai'i Sea Grant. Additional support was provided by NSF#1645515.

AUTHORS

Jennifer Engels (jenny.engels@oregonstate.edu), Oregon Sea Grant, Corvallis, OR, and University of Hawai'i, Honolulu, HI, USA. **Barbara C. Bruno**, **Henrietta Dulai**, **Mackenzie Manning**, **Donn Viviani**, **Keku'iapōiula Keliipuleole**, **Brandon Dela Cruz**, **Kathy Ho**, **Kyle Kila**, **Tehani Malterre**, **Ariel Thepsenavong**, **Leah Bremer**, **Christopher Wada**, **Sheree Watson**, and **Kimberly Burnett**, University of Hawai'i, Honolulu, HI, USA. **Emi Suzuki** and **Kyle Suzuki**, Sumida Farm, Aiea, HI, USA. **Ahmed S. Elshall**, University of Hawai'i, Honolulu, HI, and Florida Gulf Coast University, Fort Myers, FL, USA. **Aida D. Arik**, University of Hawai'i, Honolulu, HI, USA, and Université Grenoble Alpes, Saint-Martin-d'Hères, France.

DOI. <https://doi.org/10.5670/oceanog.2024.212>

TABLE 1. Sample quotes from the University of Hawai'i (UH)-Sumida Farm partnership participant survey (n = 19).

Participant role (and number of respondents)	How has the UH-Sumida Farm partnership affected your interest and knowledge about topics such as sea level rise, food sovereignty, climate resiliency, sustainable agriculture, etc.?	How has the UH-Sumida Farm partnership affected your interest in mālama 'āina (caring for the land) and community partnerships?	How has the UH-Sumida Farm partnership affected your career interests or other future plans?
Sumida farmers (2)	"We are more aware of the potential risks of rising sea levels, the impact climate change can have on our crop, and how important it is for us to try to utilize sustainable practices on our farm."	"Our farm is more willing to partner with researchers after going through the UH-Sumida Farm study, knowing how beneficial a partnership and the research can be for both our farm and the community."	"We are making future crop plans and infrastructure updates based on the findings of the research and are able to be better advocates for water conservation and use because of what we learned from this study."
Undergraduates (5)	"This project increased my awareness about the many ways that climate change may impact our local food systems in the future."	"Walking around the plots, interacting with nature, and learning about the farm's history was very fun and made me feel connected to the land."	"The partnership helped solidify my desire to stay in Hawai'i and do community-driven work in my future career."
Graduate students and postdocs (4)	"Working at Sumida Farm and seeing all that we have learned in just a few years has really expanded my knowledge and increased my interests in all topics related to food, water, climate, and coasts."	"I find farms, such as Sumida, that operate according to the hydrology of the system (instead of the colonial modernist method of mastering water resources and nature) to embody the ideas of sustainability and mālama 'āina."	"The partnership affected the type of work that I seek to do and continue to do, specifically focused on co-production of research and applied science."
UH faculty (8)	"The UH-Sumida partnership definitely got me thinking a lot more about agriculture (and especially urban agriculture) and the effects of sea level rise."	"This isn't something I was really trained for, but it seems important and useful (and something that might resonate with student researchers and give them opportunities to learn valuable skills)."	"As a faculty member, it's a wake-up call. I can no longer conduct research in a bubble."