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Inclusive innovation stems from environmental communication scholarship

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Environmental communication has led to expansive understanding of how to improve outcomes and processes to serve the underserved in natural resources and agricultural situations. As a practitioner, this article reflects on the pathway to build a profession outside of traditional academic careers to bring together diverse partners and disciplines.

KEYWORDS

environmental communication, community-engaged scholarship, inclusive innovation, entrepreneurship, agrifood technology, climate change adaptation

1 Introduction

While a Ph.D. student at Texas A&M University, despite a powerful, smart lab and a thought leader in the field as my chair, I realized the traditional path as a tenure track professor at a research-oriented university was not for me. I searched for alternative careers in science, ranging from nature writing to science communication to environmental and outdoor education. I considered joining my parents as teachers for secondary education students. Eventually I realized that my niche would be among those who weave together seemingly disparate strands of environmental science into a tapestry that enables the academic enterprise to impact society in the here and now.

The current scientific paradigm is diverse, deep, complex, and creative team science. To overcome academic siloes, connectors are needed to build mutual understanding and relationships over time. As public institutions of higher learning (or recipients of public funding) universities have a moral obligation to serve the people that fund their work. In my field, that is, we must ensure that the fruits reach the farmers. Critchley (2007) argues that ethical demands are not grounded in abstract principles or values, but rather emerge from specific situations that demand a response. Such demands stem from acknowledging the vulnerability of the *other* and the consequent responsibility to address their needs and alleviate their suffering. Grounded, emancipatory research comes with clear ethical demands and an often-unstated drive to improve current conditions. Within this perspective, successful research program coordination requires simultaneously recognizing the broad field, the vulnerability of the specific other, *and* attending to the details of the science, team, and those potentially affected. People trained in environmental communication are well-prepared for this translational, multi-faceted role.

Working as a research coordinator means that I facilitate granting and program execution with university faculty and our industry, community, and educational partners to deliver transformational research outcomes to those most affected by the status quo, the coming changes, or both. To increase access to research, I communicate our findings to a variety of audiences through multiple media and evaluate whether our work does what it is intended to do.

It took more than a decade for me to give up my aspirations of being a professor and recognize where my environmental training could be helpful. Although I sometimes feel like a "sell-out" for not working in the trenches as a researcher focused on environmental, wildlife and biodiversity problems directly, I believe the adjacent functions of our research and outreach programming offers powerful direction for meeting the ethical demands of our time. Humanity's existential need to address climate change and achieve triple bottom line sustainability through all means possible presents me, as an environmental communication professional, with an all-encompassing ethical demand.

I respond to that demand by working in agriculture, where marginal gains have large impacts. At the scale of California's agricultural system in the Central Valley—where 8.5 M acres of irrigated cropland uses on average 40% of the state's freshwater annually, and produces $51 B in revenues, but has an outsized impact on the local environmental health, small improvements to soil carbon storage, water efficiency or storage, and reduction of applications can produce transformational changes (CDFA, 2022).

Our environmental communication research has aligned with a current moment in climate change adaptation, a rare time when coalitions, funding, politicians, and the public are well-aligned for large-scale changes for the environment and all who dwell in the area. Our situation may differ from yours but like the change in team science, I feel a shift toward more progress for a more equitable and just world than we could in the decade prior.

As executive director of a new research center (est. 2023) at the newest campus (est. 2005) of the University of California system, I use my training as a researcher daily, ranging from environmental communication skills to principles and theory. Place-based scholarship, public participation in natural resources management, and co-development of truths, narratives and solutions are core to our daily work and help us build connections for a science-based, climate-adapted future. We generate new narratives, listen to emerging ones in the public and scientific discourses, and create new opportunities for access to technological innovation through environmental communication best practices for public participation and inclusive innovation.

2 Past, present, possible

University of California, Merced is in California's Central Valley (the Valley), which is defined by the three major watersheds: Sacramento River drainage to the north, San Joaquin River in the center, and Tulare Lake Basin—a terminal basin—at the southern end of the San Joaquin Valley (Figure 1). Historically herds of Grizzly bears foraged, and flocks of geese, cranes, ibis, and migratory ducks blocked the sun with their sheer numbers. Many tribes thrived in the valley and foothills and nearby Sierra Nevada, including the Miwok, Yokuts, and Tule Peoples (USGS, 2024).

The past century has transformed the Valley (Jones and Codding, 2019). Native American tribes remain strong in the region. Grizzlies have not been seen in the state in 100 years, but waterfowl rely on the preserved wetlands, gleaming white like a solar mirror, to navigate along the Pacific Flyway. Ten thousand cranes call in the sunset in the winter at Merced Wildlife Refuge (Kelly et al., 2006; Mychajliw et al., 2024). However, the Valley is a fractured lattice of suburban and rural towns, aqueducts, and canals, and nine million acres of agricultural production. Half of US fruits and vegetables are grown on this soil with snowmelt and fossil groundwater providing irrigation. Migrant farmworkers labor at night or through over 100° F (38°C) heat to harvest this produce. Almost 80% of the world's almonds are produced here. If you open a can of tomato sauce in the United States, it is from this pale brown ground, like the color of coffee with too much cream. What California produces, the nation and the world eats, drinks and wears (CDFA, 2022).

The most lucrative agricultural lands in the United States, however, do not make this level of profit and production without some externalities. The agricultural sector is a vast influence on the region's economy, but often jobs are low-paying and lack security or benefits. Despite water scarcity and multi-year drought, these conditions tend to not limit agriculture in terms of profits, as other sources of water are plumbed to new depths. Instead, limits are most acutely felt by people disconnected from large city water systems and the environment; the same actors who bear the highest risk in many development transitions (Dobbin and Lubell, 2021). Those most directly impacted by water shortages already pay transactional costs wrought by disenfranchisement and lack of engagement and resources. The problems are pervasive: Despite the many potential users of broadband internet access, the region lacks technological resources. Limited access to health care, affordable housing and employment further challenges individuals and communities. Poor air quality, water scarcity, and generational poverty create barriers to participation.

Acres and acres are in production, some of them marginal, salty, shallow soils, pressed under the plow, flooded with the water from tens to hundreds of miles away on the surface and deep within the crevices and layers of geologic time (Arax, 2019). California agriculture has been sustained by underground water sources, a disparate substructure of aquifers, finite and ancient, not to be replenished in this lifetime. Fossil water, deep water, ice age water, distant water, someone's water, public good water, who's water? In the early 1900's, artesian wells still spurted out clean water from the sediments, but amidst the hottest and driest drought of record and possibly of the past 1,000 years, state legislators made the unpopular choice to regulate groundwater extraction, the last state to do so in the United States of America (Arax, 2019).

Established in 2014 and with a lead up time to 2040, the Sustainable Groundwater Management Act is creating an opportunity for engagement in the governance of a common pool resource in California because it forces many entities into a novel relationship with each other, shifting power and economic drivers (California State Water Resources Control Board, 2014; Leahy, 2016; Downing, 2018). Groundwater limits to ensure the quality of ecosystems, communities, and the level of the resource through time in addition to a reckoning with climate change has opened the door to envision what is possible?

The Sustainable Groundwater Management Act, familiarly pronounced *sigma* or the Greek word for "change," has a long planning horizon. This state legislation is the main catalyst for a massive land use transition in the state as 500,000–1,000,000 acres of agricultural land are anticipated to come out of production.

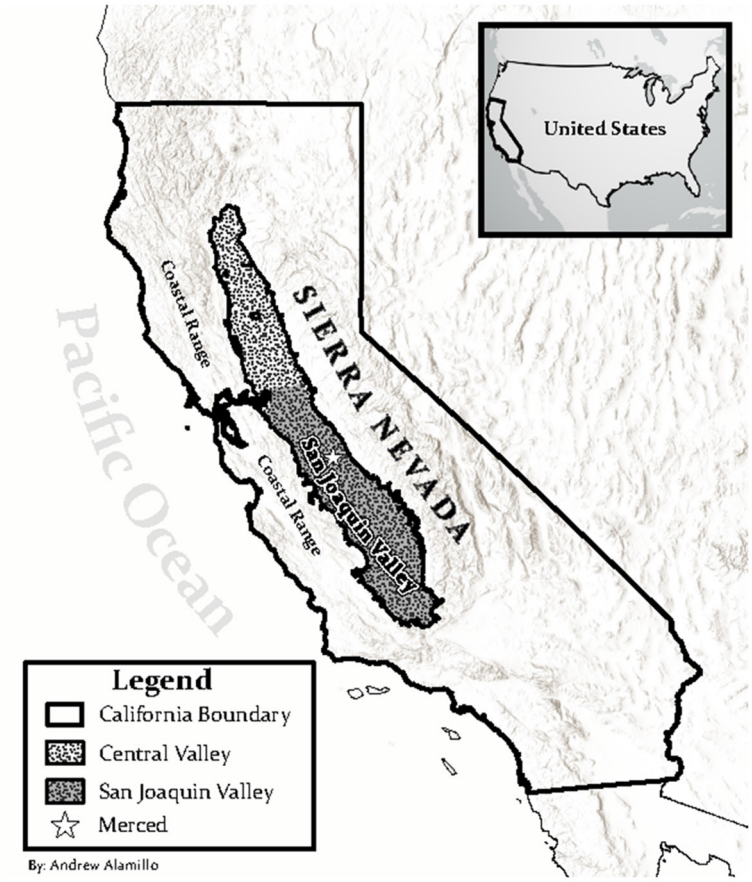

FIGURE 1
Map of California's San Joaquin Valley, within the greater Central Valley, ringed by the Sierra Nevada and Coastal Ranges and the City of Merced (A. Alamillo, UC Merced, 2023 using public data).

The Multi-Benefit Land Repurposing movement is intended to guide this transition for strategic and coordinated outcomes: community improvements, reduced pesticide drift near schools through buffers, water storage systems, wildlife habitat, alternative economic sectors including solar energy, alternative agricultural systems such as grazing and more.

These are the areas where environmental communication methods and co-developed technologies can help. Public participation techniques in the shared governance of natural resources, land, water, energy, life, which have been honed through environmental communication research, provide means for a just transition. My teams investigated the decision spaces as defined by the media and by communities, to learn what people would like done with the land in transition near them (Bernacchi et al., 2020).

From billboards to political ads, messaging around agricultural production "feeding the nation" and any alternative "use," such as sustaining a free-flowing river, or an endangered fish categorized as "waste" is pervasive. News media highlighted during droughts the voices of people most affected by dry wells and lack of access to water.

Our research on *sigma* representation in news media provided a snapshot of how the dominant narrative of production is troubled by a vision of the future Valley. I used research methods learned as an environmental communication student to trace the story about water management. I searched for representation of this new law in state newspapers. Interestingly, there were few instances where community members who are most affected by limited groundwater access were co-located in the same newspaper article as text about the law. The translation of the law into Spanish yielded few results—excluding a huge portion of the population. In the end we found that a common pool resource was likely to be co-located in the news with representation of agricultural interests. These findings led to consultations with non-profits and the state agency in charge of communicating water issues, the California Department of Water Resources. It also drew the ire of journalists who thought our framing implied that their reporting had been selective in ways that limited representation.

The alternative future provided by the news media around this new law gathered the categories of novel technologies, solutions for land use, economic incentives, investments in infrastructure, and alternative stores of water, including groundwater recharge (Bernacchi et al., 2020).

As researchers document a massive land use transition, from nine million acres of agriculture to a water limited future, we ask: What do the people who live here want their lives to look like? What opportunities do they want to have? How can a new vision of the

Valley lead to more inclusion of externalities within the systems of innovation and support economic and environmental equity? What can be learned in this great transformation of the Central Valley that will help other water-scarce agricultural regions in the world become climate-smart?

Our media analysis led us to deepen our engagement with agricultural communities in the region. We reached out to those communities during the pandemic through a survey delivered via SMS text. The Sustainable Groundwater Management Act and related land use transition open doors to envisioning a different Valley based on community engaged research. We sought to understand and to explore alternatives to water-intensive agriculture and preferences among those who currently live in an agriculturally dominated region. Our findings show that most respondents were somewhat (33%) or not at all (54%) familiar with the new groundwater law, highlighting the need for outreach efforts to overcome barriers to representation, translation, and education about potential engagement (Espinoza et al., 2023).

Environmental Communication scholarship is unusual in its capacity to live in the conditional tense: A place of possibility, creativity, freeing, crafting a future that meets many incongruous needs. In many ways it is a polite request, suggestion or recommendation, a way to create hypothetical shared interests without being stuck in positions of politics or personality (Daniels and Walker, 1996, 2001). The conditional tense asks what you would like without the mire of action items and pathways. It hinges on those actions with an oft unspoken "if." To conjugate, to bring together the present and the possible, conditional with the action, there is "would" and action. What would you change in your community?

3 Environmental communication's influence on inclusive innovation

We have devoted our university resources to encouraging climate-smart agriculture in the effort to build options for mitigating and adapting to climate change while growing food, for providing safe jobs in the region that enable individuals to experience a good quality of life, and to creating benefits for the Valley's denizens including the more-than-human world. As the economy is a driver in our relationship with the environment, and as I have been persuaded that we have to work with, rather than against, our local industry to make climate-smart agriculture a reality, we are working with companies, farmers, water managers, community members, big farms, small farms, and all people who live in the Valley to create incremental interventions, transformational technology, and an environment of innovation-in-community for our region.

Inclusive innovation is not a box to be checked. As representation is not a tokenism approach to diversity, inclusive innovation is a practice not a task, a process of intentionality with periodic check-ins for each stage. Yvonne Lincoln and Egon Guba wrote *Naturalistic Inquiry* in 1985. They took everything they knew about rationalistic, positivist and traditional scientific research paradigms and as Lincoln markedly repeated, "flipped them on its head," to yield the engaged, empowered, and democratic form of research that many researchers in environmental communication practice: a distributed form of truth that centers on values as reality for individuals. In the same way, inclusive innovation takes prior models of economic development and flips them. Historically, interventions like the Green Revolution relied on neoliberalism and corporate influence to serve as a rapid dissemination of proprietary tools to transform agriculture in impoverished regions, supplanting the cultural food sources with expensive seeds and applications (Patel, 2013). The land was more immediately productive, but it was not a co-developed solution that yielded equitable wealth and greater access to food and technology. Inclusive innovation struggles to balance the effort to create a better world with developing novel resources for problem-solving. To keep on track with federal and state investment, collaborators and I are developing principles to remain dedicated to all who dwell here with particular attention to those affecting technology, those affected by technology directly and those who are indirectly affected by the technological intervention's implications.

Climate-smart agtech is both a mitigation and efficiency tool, and an adaptation and sustainability tool. Food is more than just another consumer product. First, what is socially acceptable is democratically imagined. As a market, it can be influenced by individual choice and consumers have direct impact on the ways food is grown, labeled, processed, packaged, recycled and how the inputs and waste streams are managed. What we eat is the largest portion of our personal water footprint and a large part of our individual carbon footprints. Food policy and the way we communicate about the food system has real impacts on who and how food is produced and what consumers experience (Hunt et al., 2022; Wilkes et al., 2022). We perceive food safety as a common pool resource. Because of its large scale and global impact, food, and the ways in which it is produced are more than just another profitable product, but a crucial site for collaboration and collective action. Our hope is this region may become a leader in climate-smart agriculture and the technologies that facilitate adoption of greater sustainability. We all eat, and we all have a role in our food system.

The need for inclusive innovation, a way of co-developing ideas and opportunities with greater access and wider application for diverse communities and individuals, is a lesson learned the hard way. We can draw from Silicon Valley where the risk is distributed but the wealth isolated, from the COVID-19 learn-from-home era when the digital divide separated students who could not attend zoom class from those who could.

Environmental communication researchers have discovered and designed ways that public participation processes and outcomes can be improved. The principles of inclusive innovation described here demonstrate how environmental communication scholarship can be put into practice through examples. In this way, challenges of prior sustainable development or innovation schemes are resolved through intentional co-created practice.

The core criteria of inclusive innovation are defined and aligned with environmental communication scholarship. Co-development of solutions, relying on diverse inputs and planning for diverse applications stems from traditional ecological knowledge and collaborative learning: context-specific, process-driven engagements built through time and relationships yield

results that are more likely to be sustained and accepted (Daniels and Walker, 2001). If this is not employed in agritech innovation, then partial information may skew the design or decision-making. Clusters of innovation depend on the representation of the region, much like community-based planning and general public participation practices that seek meaningful representation in decisions, not just attendance (Clarke and Peterson, 2015). With these theories in practice, solutions in the food system can be made more accessible, affordable, and scalable so that there is greater adoption and greater likelihood of adaptation to climate change across the diverse food system (Hunt et al., 2022).

4 Listen and act

This is my story of choosing not only what could be, but what should be, in our communities. As Pezzulo and Cox (2021) write, the fundamental concept of e*nvironmental communication* is that our communication *constitutes* reality; the way we tell stories impacts the way we live; the narratives, diverse and disjunct, constitute our diverse and ephemeral physical worlds and back again. For example, Californians were compelled during the drought to create a new story of where our water comes from and where it stops along its cycles (Knowing Our Water, 2018; Water in the Balance, 2018) to show that California water is not simple, and neither are the solutions. Our words matter and our values must be spoken to be shared. In terms of the balance of inquiry and scholarship and turning environmental communication into action, I am remembering, that I am a part of these places, that I'm of and for this region, the water in my blood and brain, the food in my garden and muscle, and that the line between what could be to what should be can be crossed like a river overflowing its banks.

Although I get impatient and overwhelmed by the history and legacy of slow action—are things getting better?—our membership in the world at this moment demands a response, a clear choice. Climate hope, or climate coping, says we dream of a cleaner, greener, safer, healthier community comprised of connected and economically secure individuals living in ways that enable sustainable relationships with nature and the environment while provisioning for the more-than-human world to have access to resources and life.

May what we learn here—this team science in progress—support food-producing, idea-producing, nourishing places around our world. As environmental communication scholars and practitioners, we are listening, and we are speaking. In our pluralism, we wrestle with multi-purpose, multi-benefit, multiple contexts, needs, users. Promising ideas need to be spread to overcome the imposed isolation of economic exclusivity. Participation and access are the first step for what will be negotiated, contested, hidden, revealed. Through intentional investigation and then community building and investment, increasing the access to transitions, a new present will emerge in all its wild diversity.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

LB: Writing—original draft, Writing—review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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