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Affective political ecology in California’s Sacramento-San Joaquin Delta

Author
Kraus-Polk, Alejo Willis

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Affective political ecology in California's Sacramento-San Joaquin Delta

By

ALEJO KRAUS-POLK

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Approved:

Brett Milligan

Stephen M. Wheeler

Thomas D. Beamish

Committee in Charge

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This dissertation is dedicated to past, present and future Delta denizens, dependents, and descendants.

Abstract

This dissertation's root is a belief in the goodness of places, people, and placemaking. My experience has shown me that people are deeply affected by being in places, which can manifest in loving care, fierce protection, “restoration,” or other desires for future transformations. My dissertation focuses on places undergoing or anticipating changes either by disaster or design that are part of what is collectively referred to as California’s Sacramento-San Joaquin Delta or the Delta. The collection of articles that form my dissertation chronicles related efforts to sense how people are affected by being in the Delta and how these diverse experiences can change how we plan for just Delta’s futures. Together, these chapters describe parts of a pluriverse Delta, a Delta in which many understandings and ways of being fit - but not without friction. The methods employed represent different modes of sensing, with their own affordances and limitations, all providing a partial, situated perspective. These modes of sensing are currently not widely used in understanding the Delta’s wicked problems but could expand to augment and perhaps challenge the biophysical understandings. I am excited to be contributing ideas to what I hope is a growing conversation regarding the use of new methods and modes of sensing to understand and intervene responsibly in the coevolution of the Delta.

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Introduction

Climate change elucidates and exacerbates the precarity of the complex, novel, interconnected ecological, infrastructural, and cultural systems that are a hallmark of "Anthropocene"[1] landscapes. The Delta is an exemplary Anthropocene landscape, characterized by large-scale, rapidly accelerating, and irreversible change - and other complex challenges that this era presents (Kraus-Polk & Fulton, 2020). The collection of articles that form my dissertation follows an affective political ecology of climate change adaptation, concerned with infrastructure, ecology, and everyday life in the Anthropocene Delta.

My conception of affective political ecology derives from a coevolutionary understanding of interactions between evolving human systems and biophysical systems at multiple spatiotemporal scales (Kallis, 2007). My affective political ecology explores these interactions at the scale of human encounters, understanding that being in a landscape affects us, and we affect the landscape assemblage (Singh, 2018). These encounters can result in new understandings of the landscape, ourselves, and others. These new understandings, which at times challenge a nature-culture binary, are consequential for how we act in a landscape and our desire for transformation or stasis.

On the "human" side, affective political ecology draws from a growing body of literature that combines Spinozan affect theory with an embodied ecological perspective (Deleuze, 1988; Singh, 2018). These ideas connect to what Guattari called the "three ecologies" of more-than-human environment, social relations, and human subjectivity (2005). Related work in feminist political ecology emphasizes the role of emotions and subjectivities in resources commons and conservation landscapes (González-Hidalgo & Zografos, 2017; Nightingale, 2011; Singh, 2018; Sultana, 2011, 2015).

[1] The Anthropocene concept has been critiqued by those concerned with how the concept attributes responsibility to people (anthropos) in general, rather than calling attention to the specific human actors and ideologies that bear a greater responsibility (Altvater et al., 2016; Haraway, 2015; Norgaard, 2013).

On the “nature” side, landscape ecology and coevolution inform an understanding of Delta landscapes “as multifunctional, multi-scalar, and composed of a heterogeneous ‘mosaic’ of interdependent land uses, flows, and coevolving processes" (Milligan & Kraus–Polk, 2017). As Norgaard posits, these processes include “coevolution between values, knowledge, organization, technology and the environment” (Norgaard, 1994).[2] These processes occur in a context where values are plural, knowledge is situated, governance is historically contingent, technology is cosmological, and environments are dynamic and nonequilibrium.

Political ecology, critical physical geography, and political ontology complement my understanding of affect, landscape ecology, and coevolution. A political ecology of Delta restoration and infrastructure illuminates the redistribution challenges with an enlarging “pie” of benefits, including concerns with “flavor,” i.e., aesthetics, multi-functionality, multiple benefits, or cultural and ecosystem services. Critical physical geography offers a realistic approach to navigating a political ecology of restoration attuned to the power dynamics at play in the production of ecological science (Doyle et al., 2015; Dufour et al., 2017; Lave, 2012; Lave et al., 2014). Political ontology exists apart from the political economy of the Delta - as well as the political ecology that often operates on its economic terms - to reveal contestations related to the unrecognized ways of knowing that exist in the spaces of uncommoning, i.e., that exceed and cannot be articulated by state or other dominant actors (Blaser & de la Cadena, 2017; Milligan et al., 2020).

Together these theoretical bases inform an affective political ecology of the Delta, which flows from pluralistic and relational understanding(s) of the landscape-as-infrastructure/ecology that is concerned with the (in)sufficiency of adaptation efforts to confront climate change effects and affects.

[2] Brett Milligan and I have applied a coevolutionary theory to our work in the Delta to understand the ways in which restoration efforts shape and are shaped by sociopolitical dynamics (Kraus-Polk & Milligan, 2019; Milligan & Kraus-Polk, 2017).

My guiding research questions examine how Delta publics are engaging with (using and perceiving) Delta landscapes and how knowledge of practice and perception can inform adaptation planning that supports a just transition[3] for the Delta and Delta-dependent communities. These questions bring human subjectivity and lived experience into conversation with ecological and infrastructural concerns that in the Delta have come to dominate and diminish the everyday thoughts and practices of a key faction of affected Delta participants.

The dominant scientific regime has overlooked the affective and embodied experience of these complex infrastructural and logistics landscapes in favor of their purportedly objective biophysical and economic dimensions (DISB, 2017). Yet, understanding how people experience these landscapes is crucial to understanding how they may (or may better) address the many pressing concerns they are designed to assuage. Everyday life is the terrain of climate change adaptation (Federici, 2015; U. Kothari & Arnall, 2019). When planning and designing major adaptation interventions, including infrastructure, it is vital to understand how people are affected by these interventions and how affect contributes to how an intervention coevolves.

Conservation actions are attempts to recover and reconnect that which was degraded and lost in making the Delta what it is today. However, as Brett Milligan and I have argued, "…as mitigatory response, restoration planning continues some of the same spatial abstractions and inequities by failing to account for the Delta as an urbanized, cultural and unique place" (Milligan & Kraus-Polk, 2017). My research intends to support the promise of State policy and practice that is attendant to nurturing other ways of relating to the Delta.

[3] The idea of 'just transitions' originally began with trade unions in the 1980s (CJA, 2018; JTA, 2019). The concept is currently being used by climate justice scholars to establish principles or processes that will ensure equity and justice as we transition away from an extractive economy to a decarbonized, regenerative one (Newell and Mulvaney 2013, McCauley and Heffron 2018)

My research components engage this question using a different methodology from unique phases in the planning or adaptive management cycle.

1. The first chapter, *Affective ecologies, adaptive management and restoration efforts in the Sacramento-San Joaquin Delta* describes ecological recovery efforts as a crucial component of the strategic delta planning framework. Connecting strategic delta planning to adaptive management, we investigate a 'socioecological monitoring' program that uses existing biophysical monitoring protocols to collect data on human use. Our approach highlights the importance of user experiences and affective labor to bring people into the design of restoration areas, both as actors to be managed for and agents whose values and desires can help guide landscape evolution.

2. The second chapter, *Park, Fish, Salt and Marshes: Participatory Mapping and Design in a Watery Uncommons* examines the iterative application of participatory mapping and web-based public surveys (softGIS) within a broader, mixed-method co-design process involving state agencies, local residents, regional stakeholders, consultant experts, and publics. We conclude that reciprocal iterative change among stakeholders and designers was demonstrated across the surveys, based on shifts in stakeholder preferences as achieved through iterative revision of design concepts that better addressed a broad range of stakeholder values and concerns. Within this reconciliation, the uncommons was retained rather than suppressed.

3. The third chapter, *Map-based survey affects: a critical SoftGIS case study from the Sacramento San Joaquin Delta of California,* critically assesses the structure, function, and analysis of a map-based survey method (softGIS) applied as part of a complex, highly contentious, and continuous Franks Tract Futures co-design process detailed in the previous chapter.

Acknowledging the affective role of the survey, we recommend that planners and co-designers use softGIS with the specific affordances and limitations of the interface and the technology in mind. Exploring the role of the survey brought us greater awareness of mediation, aesthetics, and translation as aspects of co-design and situated creative knowledge-making.

4. The fourth chapter, *Embodied ethnography for critical infrastructural studies: A case study of a multi-benefit levee setback in the Sacramento-San Joaquin Delta of California,* details embodied experience of the now "completed" Southport Levee Improvement Project located in the far northern reaches of the Sacramento-San Joaquin Delta. Our findings across five domains of change speak to the emergent properties of infrastructural landscapes. These include physical forms such as trails and unresolved access questions, which may exceed what planners and the public expect. We posit that planning processes that recognize the affective and dynamic qualities of infrastructural landscapes can better address the effects and affect of infrastructural landscape change.

As these chapters show, planning efforts to adapt to a changing climate while retaining or enhancing the function and resilience of interconnected ecological, infrastructural, and cultural systems contend with diverse and often conflicting considerations. Such adaptation efforts draw from and reinforce certain paradigms of conservation planning, engineering, and community engagement in ways that privilege certain notions of ecological, infrastructural, and cultural resilience above others. This privileging is evident in the push towards a Delta conveyance system that might provide water supply reliability for some but at the expense of in-Delta communities and Delta-dependent species and ecosystems. This privileging is also evident in a water management system that strives to maintain a future of economic

growth at the expense of alternate futures, some of which may include greater flourishing for people and place, or at least do not consign us to a future without futures.[4]

Despite considerable investment, there is mounting evidence from "developing countries" of a failure of adaptation efforts to reduce vulnerability and maladaptive outcomes where vulnerability increases (Eriksen et al., 2021; Webber, 2016). There is similar evidence of adaptation efforts in "developed countries" that have increased vulnerability (Christian-Smith et al., 2015) and reproduced racialized environmental injustice (Hardy et al., 2017). Although there are many explanations and excuses for these failures, we are most compelled by those that are critical of technical fixes for policy and practice, rooted in a dualistic conception of the social and the environmental as separate yet interacting forces (Merchant, 1981; Moore, 2015; Nightingale et al., 2020; Patel & Moore, 2017).

As with "post-development" (Demaria & Kothari, 2017; Demaria & Latouche, 2019; Escobar, 2011), the call by Eriksen et al. for a "post-adaptation[5] turn" in adaptation practice and scholarship is applicable beyond the developing country context from which it emerges (2021). In the spirit of this post-adaptation turn, the critical softGIS chapter explores an attempt to use an online participatory mapping method to support an adaptation-oriented planning and design effort in the Sacramento-San Joaquin Delta of California. The second chapter discusses how these surveys helped broader project functionality by co-producing common knowledge of place, practices, and values while retaining knowledge not held in common (uncommons) (Milligan et al., 2020). However, reconciling conflicting considerations and achieving multiple benefits may require relinquishing the siloed ways of knowing and replacing them with new forms of more interdisciplinary, relational, and participatory conservation planning and

[4] The idea of a future without futures comes from Austrailian design theorist Tony Fry who writes of the defuturing designs that negates world futures (Fry 1999). Defuturing stands in direct opposition to the Zapatista notion of a world where many worlds fit.
[5] Following Webber (2016), the authors see post-adaptation as a "concept that has potential to point to the risks of overly technocratic and Western-driven models of adaptation" (Eriksen et al., 2021).

landscape design. Examples include the structured decision-making informed co-design described in my second chapter. This form of co-design benefits from a rigorous evaluation of multiple criteria based on various ways of knowing and recognizes how diverse values give weight to objectives.

My first chapter details these new forms of planning and (co)-design recognize cultural systems beyond those from which they emerged and find validation and are receptive to diverse and shifting human subjectivities. My fourth chapter explores one method (embodied landscape ethnography) we used to understand infrastructure as an ontological experiment and affective ecology. The chapter concludes by emphasizing the affective political ecology of infrastructural landscapes, pointing to adaptation planning more attuned to coevolution and experimentation.

My chapters describe parts of a pluriverse Delta, a Delta in which many understandings and ways of being fit - but not without friction. The methods employed represent different modes of sensing, with their own affordances and limitations, all providing a partial perspective. These modes of sensing are currently not widely used in understanding the Delta's wicked problems but could expand to augment and perhaps challenge the biophysical understandings. I am excited to be contributing ideas to what I hope is a growing conversation regarding the use of new methods and modes of sensing to understand and intervene in the coevolution of the Delta.

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Chapter 1. Affective ecologies, adaptive management and restoration efforts in the Sacramento-San Joaquin Delta[6]

Alejo Kraus-Polk and Brett Milligan

Abstract

In this article, we describe ecological recovery efforts – restoration – as a crucial component of strategic delta planning. We present restoration as a design process at once biogeophysical and territorial that entails socioecological uncertainties. Adaptive management is an approach to dealing with uncertainties through active monitoring and recalibration of actions taken. We have developed a 'socioecological monitoring' program that uses existing biophysical monitoring protocols to collect data on human use. Beyond provisioning demographic and use data, this program also helps to change the relationship between the monitors and managers involved in adaptive management and diverse non-scientific publics, who have thus far been removed from the process. Our approach highlights the importance of user experiences and affective labor to bring people into the design of restoration areas, both as actors to be managed for, as well as agents whose values and desires can help guide landscape evolution.

[6] This article was original published in the Journal of Environmental Planning and Management. Volume 62, 2019 - Issue 9: Strategic Delta Planning as a Mind Changer in Delta Planning. https://doi.org/10.1080/09640568.2018.1530099

Introduction: ecological restoration and strategic delta planning

Worldwide, deltas have been highly modified by humans (Carlin and Dellapenna 2015; Norgaard 2013; Renaud et al. 2013; van Staveren and van Tatenhove 2016). Modifications have changed the form and function of these landscapes, as well as the human relationship to them, i.e., their affective ecologies (Singh 2018). Strategic delta planning is a process that seeks to influence the ongoing coevolution of deltas and people through design, long-term participation, collaboration and the construction of constituency (Norgaard, Kallis, and Kiparsky 2009; Welch, Nicholls, and Lazar 2017). This process aims for sustainable and desirable delta trajectories (van Staveren and van Tatenhove 2016).

In this article, we argue for the importance of affect and embodied experience in strategic delta planning related to restoration. The everyday lives of those who experience the rapid change in deltas matter to how they are planned, managed and designed, both by whom and for whom. Negotiating consent for strategic delta planning benefits from a deepened understanding of the "emotional geographies" (Sultana 2011, 163) and affective ecologies of socioecological change. Extending Sultana's observation regarding conservation, we see that strategic delta planning is, "never just a material endeavour, and emotions are never simply individually isolate but both are part of the co-construction of people and place" (Sultana 2011, 4). Our emphasis on the affective responds to the 'affective turn' in the social sciences and related disciplines (Bakko and Merz 2015; Hardt et al. 2007), which generally sees affect as a relational force between bodies that differentially empowers and disempowers their acting (Deleuze and Guattari 1987). Following Neera Singh (2017) and Haggerty et al. we see affective ecologies of restoration as, "systems or spaces that create possibilities for iterative and reciprocal interspecies exchanges and communications" (2018, 23). Singh's formulation of an affective ecology of conservation draws from, "affect theory, new materialism, and indigenous ontologies to illustrate the practical significance of paying attention to affect in understanding nature-society relations" (Singh 2018, 1), and for us, we approach affective ecologies of "nature, society, and the self" as a way of designing and manifesting change in their relations (Singh

2018, 5).

Our emphasis on embodied experience is similar to the embodied ecosystems approached, as outlined in Raymond, Giusti, and Barthel (2018). Following the authors, we recommend that strategic delta plans be likewise, "targeted at the web of relations which exist between mind, body, culture, and the environment", with the understanding that such relations are situational and dynamic (Raymond, Giusti, and Barthel 2018, 791). Designs of strategic plans should seek to understand existing rela- tions and anticipate both their emergence and collapse (Raymond, Giusti, and Barthel 2018). Strategic delta planning encounters 'restoration' as a co-evolutionary process in which people and places are transformed to support desirable delta trajectories. Desirability is defined by the more quantitative measures of ecosystem function as it interacts with the qualitative dimensions of the human experience of these landscapes, i.e., sense of place. Ecosystem functions are monitored to inform adaptive management and science-based decision making. However, there is limited knowledge on how to monitor human use in restoration areas and link the knowledge and related learning to decision-making in delta planning.

Case studies in South Africa and the Netherlands illustrate the disjuncts between restoration plans, implementation, and adaptive management based on monitoring (Hermans, Slinger, and Cunningham 2013; Slinger et al. 2005). Decisions that affect how people relate to the landscape are rarely informed by information that is collected from monitoring these relations. As noted by Hermans et al., there can be tensions between the common good of social or collaborative learning and the investments in monitoring by agencies and organizations (2017). Monitoring has real costs that are often unaccounted for or underestimated. Monitoring for human use goes beyond the core concerns of regulatory agencies (i.e., regulatory and biophysical compliance mon- itoring) and thus operates in a nominal space. Although the information about human use is seen as important, there remains a lack of support for formal monitoring programs.

In this paper, we will describe the development and prototyping of an integrative, low-cost monitoring protocol for human use in restoration areas of California's Sacramento-San Joaquin Delta (Delta). Our explicit research questions are (1) how can existing biophysical monitoring programs be leveraged to collect data on human use and (2) does this integrated modeling promote social learning and affective relations between people and place that are crucial to restoration 'success'? Our approach is premised on the importance of embodied user experience and affect. Our research tested whether having biophysical monitors collecting data on human use could improve adaptive management programs by better accounting for diverse human uses, agencies, emotions, and effects that are otherwise externalized, unknown or ignored in these restoration efforts.

Our paper draws from our ongoing research in the Delta, where the implementation of the comprehensive Delta Plan (DSC 2017b) entails efforts to 'restore' ecological form and function. In this Delta, as in others, these efforts are inherently experimental as they concern novel socioecological conditions and occur at an unprecedented scale and conditions. As experiments, delta restorations are characterized by social, ecological, geomorphological, political and infrastructural uncertainties as well as total unknowns (Cloern et al. 2011; Jassby and Cloern 2000; Mount and Twiss 2005).

Theory: the case for social as well as ecological adaptive management

Adaptive management has been prescribed to deal with the multiple and interacting uncertainties inherent in large-scale ecological restoration. Adaptive management is premised on the recognition that knowledge of the (socio)ecosystem is incomplete and elusive (Walters and Holling 1990). Adaptive management in the Delta is defined as, "flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation, leading to continuous improvements in management planning and implementation of a project to achieve specified objectives" CWC section 85052 (California Water Code Section 85052).

The adaptive management cycle is fundamentally a process of 'learning by doing.' Under ideal circumstances, the process would begin with stakeholders negotiating consent (Seijger et al. 2017) around fundamental design questions, including project goals, planned activities, conceptual models, and thresholds or triggers for action. Once the project is underway, it enters an iterative phase which focuses on monitoring and assessment, the outcome of which determines whether management adjustments are warranted. This process is well established for ecological restoration projects. However, the socio-cultural dimensions of social learning in adaptive management are less developed (Stringer et al. 2006), particularly as regards affect.[7]

Of central concern to our exploration of social learning is embodied landscape experience, affect, and values. Following Clemmensen, we understand that the conception and experience of restored or rewilded landscapes differ between individuals and user groups (2014). This difference, or 'dissonance' (Clemmensen 2014), is exemplified in the various ways in which a single restoration area is seen and experienced, affects and is affected by a user.

Our previous work documented how the expansion of restored and naturalized areas in the Delta corresponds to a demographic shift in their human user community (Milligan and Kraus-Polk 2016, 2017a, 2017b). We examined how land that was previously subject to restricted access, mainly due to private ownership, is 'recommoned' – opened up to new users, either explicitly through the creation of formal public access points or recreation facilities, or implicitly through the creation of publicly accessible navigable waterways or areas that, while restricted, are under-enforced or poorly signed. Our research identified the 'eyes to acres ratio' as well as a 'positive bystander effect' as concepts that describe the way human presence can dissuade undesirable activities. We concluded that the expansion of

[7] Adaptive co-management, is an iteration of adaptive management where social and cultural considerations have been more robustly integrated (Armitage et al. 2009; Berkes 2009; Cundill and Fabricius 2009; Leys and Vanclay 2011), and is one of a number of biocultural approaches to conservation (Gavin et al. 2015; Maffi and Woodley 2010).

restored and naturalized landscapes would lead to a shift in the degree, character and, magnitude of human use in the Delta landscape (Milligan and Kraus-Polk 2017a). Our current work seeks to better understand how actors and institutions learn through the acknowledgment and incorporation of information related to the sociocultural dimensions of ecological restoration.

Social learning is a particular kind of learning that is considered crucial to the adaptive management process because it (co)creates the shared knowledge upon which to make decisions (Armitage et al. 2009; Berkes 2009). Here we refer to social learn- ing as the evolving relationship between the knowledge (and power) of institutions, communities, individuals related to the management landscape (Fernandez-Gimenez, Ballard, and Sturtevant 2008; Fujitani, McFall, Randler, and Arlinghaus 2017; Leys and Vanclay 2011). Social learning, as described in (Keen and Mahanty 2006) and (Keen, Brown, and Dyball 2005) includes three levels of 'loops', from 'learning about the consequences of specific actions (single-loop learning), to learning about the assumptions underlying our actions (double-loop learning), to learning that challenges the values and norms that underpin our assumptions and actions (triple-loop learning)' (Fernandez-Gimenez, Ballard, and Sturtevant 2008, 4).[8]

The integration of 'social metrics' into adaptive management holds the potential to recognize the uneven ecological impact of human uses, both sanctioned and unsanctioned, in restoration areas. The field of recreation ecology has developed statistically rigorous methods for monitoring human use of wilderness and protected areas, with the intent of establishing relationships between use patterns and ecological impacts (Cole 2004, 2006; Hadwen, Hill, and Pickering 2008; Monz et al. 2010).[9] Prescribed monitoring programs vary in methods used to collect data, including varieties of direct observation, mechanical counters, surveys, permits, aerial observation, registration, indirect estimations, etc. Choices are based on

[8] We acknowledge the similarities between this definition and the criteria of Reed et al. (2010). has a change in understanding taken place in individuals involved? Has this change become situated in wider social units? Did change occur through social interactions between actors in a social network? (Reed et al. 2010).
[9] To our knowledge, the field of recreation ecology has, thus far, avoided looking at the ecological impact of scientific monitoring, via the 'observer effect'.

the type of questions being asked by researchers, planners and policymakers, the data needed for management, logistical constraints and the contextual characteristics of the study area and study population (Leung and Marion 2000). Collected data on a sample, site or time is analyzed through statistical means to infer trends within a larger population, multisite region, or longer period.

Theoretical understandings of the relationship between visitors (how many, for how long, and what they do) and the ecological response is based on the accumulated knowledge from over a thousand individual studies (Buckley 2013; Monz, Pickering, and Hadwen 2013). However, recent advances in recreation ecology have, following the advances in disequilibrium ecology, moved from models of static causality to models of trajectories, which can better integrate the uncertainties introduced by climate change (i.e., hydrologic non-stationarity) and shifting sociopolitical frames (i.e., sociopolitical non-stationarity) (Cole 2004). Such more advanced models are necessary for highly altered, novel Delta socioecosystems where there exists an inherent tension between the desire for monitoring consistency and the capacity to adapt monitoring regimes to changing conditions (Hermans et al. 2017).

Co-created knowledge of human use can inform planning and design decisions. However, to facilitate this linkage requires acceptance of the importance of people in restoration. Paradoxically, knowledge is often required to foster acceptance. This creates the challenge of illuminating the initial knowledge that can expose unknowns and elevate uncertainties. Existing (biogeophysical) monitoring frameworks can create such knowledge of non-target phenomena (i.e., human use and values). Effective social learning allows for monitoring teams to recognize such phenomena and respond either through the expansion of scope or by the creation of new monitoring regimes or protocols.

In the Delta, the adaptive management approach to restoration has thus far mostly engaged in single loop learning on ecological phenomena. This single loop learning has been achieved through monitoring of biogeophysical developments and responses to restoration actions. Thus far, monitoring regimes have by and large ignored the presence and pressures of human activities, including monitoring activities themselves, i.e., the 'observer effect.' This omission comes despite general (i.e., regional) and project-specific objectives related to human use. These goals, which include the expansion of public access and the enhancement of recreational facilities, are discussed below in greater depth. This disjunct between monitoring and objectives illustrates a shortcoming in the dominant practices of adaptive management in the Delta (DISB 2016; Nagarkar and Raulund-Rasmussen 2016).

This shortcoming has not gone unnoticed. The Delta Independent Science Board (DISB), a standing board of nationally or internationally prominent scientists responsible for the evaluation of scientific programs that support adaptive management of the Delta, has recently advocated for the integration of human responses to adaptive management actions (DISB 2017c; DSC 2017a). Their forthcoming monitoring review will include a compilation of monitoring activities focused on physical, chemical and biological components of the Delta, as well as "social-science drivers of ecosystem function and processes" (DISB 2017b). Similarly, the Interagency Adaptive Management Integration Team (IAMIT), in which the

authors are a part, recently published a white paper[10], which emphasizes that the "IAMIT could develop a strategy with recommendations for how to better meet the monitoring and research needs for conservation adaptive management, including those addressing perspectives from Delta residents, landowners, farmers, tribes, and nongovernmental organizations" (IAMIT 2019, 9).

However, little research has been conducted in the Delta on either the ecological effects, much less the social and emotional effects of sanctioned or unsanctioned uses in restoration areas. Sanctioned uses, including such activities as invasive species management and recreation, are understood to have an ecological impact. However, as mentioned above, the magnitude remains uncertain due to the lack of consistent monitoring programs (Ta et al. 2017) and visitation studies. Unsanctioned uses, such as poaching, vandalism, illegal cannabis growing, dumping, and trespassing, are also understood to have ecological impacts. Anecdotal evidence, as well as studies conducted in other systems, on for example illegal cannabis growing, attest to the degree of degradation that is probable (Bauer et al. 2015; Carah et al. 2015; Rose, Brownlee, and Bricker 2016; Thompson et al. 2014).

Acknowledging the degrading effects that human uses have on restored areas is significant. However, the legal rights of use endowed by the public trust doctrine and other legal principles must also be considered.[11] As stated above, the (active) adaptive management of restoration areas in the Delta will also require ongoing human interventions. Although state personnel may coordinate and lead these activities,

[10] EcoRestore, the current restoration plan for Sacramento San Joaquin Delta (Delta) will create 30,000 acres of aquatic and terrestrial habitat by 2020 (CNRA 2018). This restoration will occur at multiple sites throughout the Delta and will entail large-scale land conversions and management shifts that affect socio-cultural patterns of use. In addition to planned 'restoration', unplanned 'naturalization' will likely continue to occur in the Delta, including the flooding of heavily subsided Delta islands.

[11] California's Public Resources Code, Section 6301, gives the California State Lands Commission (SLC) jurisdiction over navigable and tidally influenced waterways. Furthermore, recreational access is protected and encouraged in regional laws throughout California, including, the California Coastal Act, managed by the California Coastal Commission, which protects public access to the coastline and tidelands; the aforementioned Delta Reform Act of 2009; and the Integrated Regional Water Management Planning Act, which requires integrated regional water management plans to consider California Water Plan recommendations related to recreational access (CWC Section 10541[e][1]).

they can also include citizen volunteers, tribal members, local landowners, reclamation district personnel, and NGO and private contractors. Non-management oriented activities can also improve the efficacy of restoration, through the dissuasion of undesirable uses to the contributions to the local economy, which increase the value and support for these projects.

It is important to note that neither the discussions on public access nor the studies on the ecological impact of use address the pronounced experiential and aesthetic differences of various users. To do so requires engaging with the qualitative dimensions of user experience and the dissonance that exists between different conceptions of place.

Method: socioecological monitoring for integrated adaptive management

One explicit objective of our research project was to collect quantitative data on the types, timing, and degree of human use in evolving restoration projects, through new collaborations with existing scientific research monitors. We choose to work with monitors as they are an organized group with a frequent presence in the landscapes of interest and have the capacity to collect data. A secondary objective of this project was to change the relationship between the monitors and the other Delta publics who also use these landscapes. In our findings, we present the outcome of the initial learn- ing and transformations that occurred while developing, disseminating, and deploying this protocol.

Case study: ecological restoration in the Sacramento-San Joaquin Delta

The Delta is foremost a logistical landscape, with water delivery as the primary function of its current economic value (Milligan and Kraus-Polk 2017a). In this management context, the Delta Plan establishes protecting, restoring, and enhancing the Delta ecosystem as a means of providing a more reliable water supply. These are the two 'co-equal goals' of Delta management. Ecosystem protection, restoration, and enhancement are legally bound to water supply reliability, which is the unquestionable driver. Delta restoration projects must and do meet legal regulatory thresholds for public outreach. However, these requirements do not always result in full, robust representation of diverse stakeholder perspectives. Previously we have argued that,

> Restoration is an attempt to recover what was externalized by the logic and abstractions of this logistical infrastructure … as mitigatory response, restoration planning continues some of the same spatial abstractions and inequities by failing to account for the Delta as an urbanized, cultural and unique place. (Milligan and Kraus-Polk 2017a, 93)

This failure stems in part from the dominance of the natural or 'unsocial' sciences within the Delta 'science enterprise,' which, while it does react to a select suite of economic values, is ill-suited for understanding the local and cultural realities of the land-use conversions that restoration entails.

While it is codified that, "[t]he co-equal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place" (the de facto 'third co-equal goal') (CA Water Code §85054), thus far, efforts have focused on the protection of legacy towns (23 CCR § 5010) and agricultural lands (23 CCR § 5011).[12] This focus is part

[12] These legacy town and farmland protection efforts have been spearheaded on the regional level by the Delta Protection Commission (DPC), the state agency charged with developing and implementing a land use plans to address agriculture, natural resources, access and recreation and access, and utilities and infrastructure

of a siloed division of labor where restoration lands are managed by natural scientists for ecosystem function, while legacy towns and agriculture are protected by land use planners for their sociocultural value.

This divide is detrimental to the achievement of the 'three co-equal goals': water supply reliability, habitat expansion and the protection and enhancement of unique and evolving place values. The latter cultural, recreational, natural resource and agricultural values of the Delta as an evolving place are not limited to the legacy towns and agricultural lands. Place-values encompass the whole of the Delta, including those (co)evolving restoration landscapes. To cross this sectoral divide requires acknowledgment that the human uses of restored landscapes have sociocultural values that need protection and enhancement.

However, the lack of information regarding these values has hindered their protection and enhancement in the context of restoration (DISB 2017a). We seek to address this lack of information by developing monitoring protocols that will help bring people into the planning and management of 'ecological restoration,'; as consistent with this 'third co-equal goal.' Recognizing the sociocultural value of restored landscapes begins with the recognition of diverse and pervasive human presence in these places.

This project developed out of our previous work, where we found that failure to account for human uses and evolving place values could diminish performance and public support for Delta restoration efforts (Milligan and Kraus-Polk 2017b). We saw monitoring as a way to address this failure and to encourage social learning related to restoration, the constituency building process, and the roles, rights and, responsibilities of those who live, work and play in the Delta.

Initial monitoring is intended to provide baseline human use data before restoration and through early

within the Delta (DPC 2018).

implementation. Enrolling monitoring teams to assist in our data collection, we were able to work with people who were regularly in restoration and pre-restoration sites and had the skill to conduct rigorous data collection. We were also able to obtain feedback from these monitors regarding their perspective and values. This collaboration enabled the prototyping and deployment of our socio-ecological monitoring protocol.

As stated above, our previous research had shown that data on human presence in these landscapes is virtually nonexistent.[13] Therefore, we were confronted with the challenge of building and prototyping a monitoring program from the ground up. Where in previous work we had relied on anecdotal evidence, in this new phase of our research, we wanted to augment anecdote with quantifiable data. We saw this expansion as necessary to achieving our research aim of supporting social learning by making knowledge of human use accessible and actionable in planning and adaptive management discussions.[14]

Our overall research method combines a human use data collection sheet, fieldwork, and semi-structured interviews with monitoring personnel and members of Delta publics. Our human use data collection sheet (see Figure 1.1) is intended to generate quantitative data on the use of specified restoration areas over time. This data shows how the type, timing, and degree of human use responds to restoration. This can be seen a single loop social learning (i.e., learning about the social consequences of specific restoration management actions). Data collection will ideally begin before a site undergoes restoration, proceed while initial restoration activities are underway, and continue after these activities have been completed. In this

[13] As a 1997 report by the DPC states, "[the] basic problem is that there are numerous roads and highways across the Delta, but there is no single entrance where visitors can be counted and surveyed. This makes any meaningful effort to measure total recreation use time consuming and expensive" (DPC 1997).

[14] The field of restoration ecology has developed methods to assess biophysical changes associated with environmental impacts. The most common method being the Before-After- Control-Impact (BACI) design, a statistically robust experimental design in environmental impact studies (Paul 2011) and econometrics (Smith 2006). Our quantitative methods combine methods from restoration and recreation ecology to determine how human use changes in response to restoration, and how human use affects the efficacy of restoration. Our qualitative methods will be used to augment quantitative data and provide insights into those sociocultural place values that motivate use, and how these values respond to restoration.

way, human use data collection follows the same timeline as existing biogeophysical compliance and regulatory site monitoring.

The prototyping process was informed by some agency scientists who were responding to emerging research that demonstrated the magnitude of human use and presence in these landscapes (Milligan and Kraus-Polk 2017b). These agency scientist understood that baseline data on human use could provide a useful foundation for understanding the current role of human activities in the system, and to examine how patterns may change with different issues, such as habitat restoration projects, new water infrastructure, species invasions, regulations, and climate change. The idea of using the capacity of existing biogeophysical monitoring teams to gather data on human uses emerged from these discussions. Some agency scientists also wanted to explore ways to make the relationship between monitors and the non-scientific public more recognized, amiable, and mutually supportive.

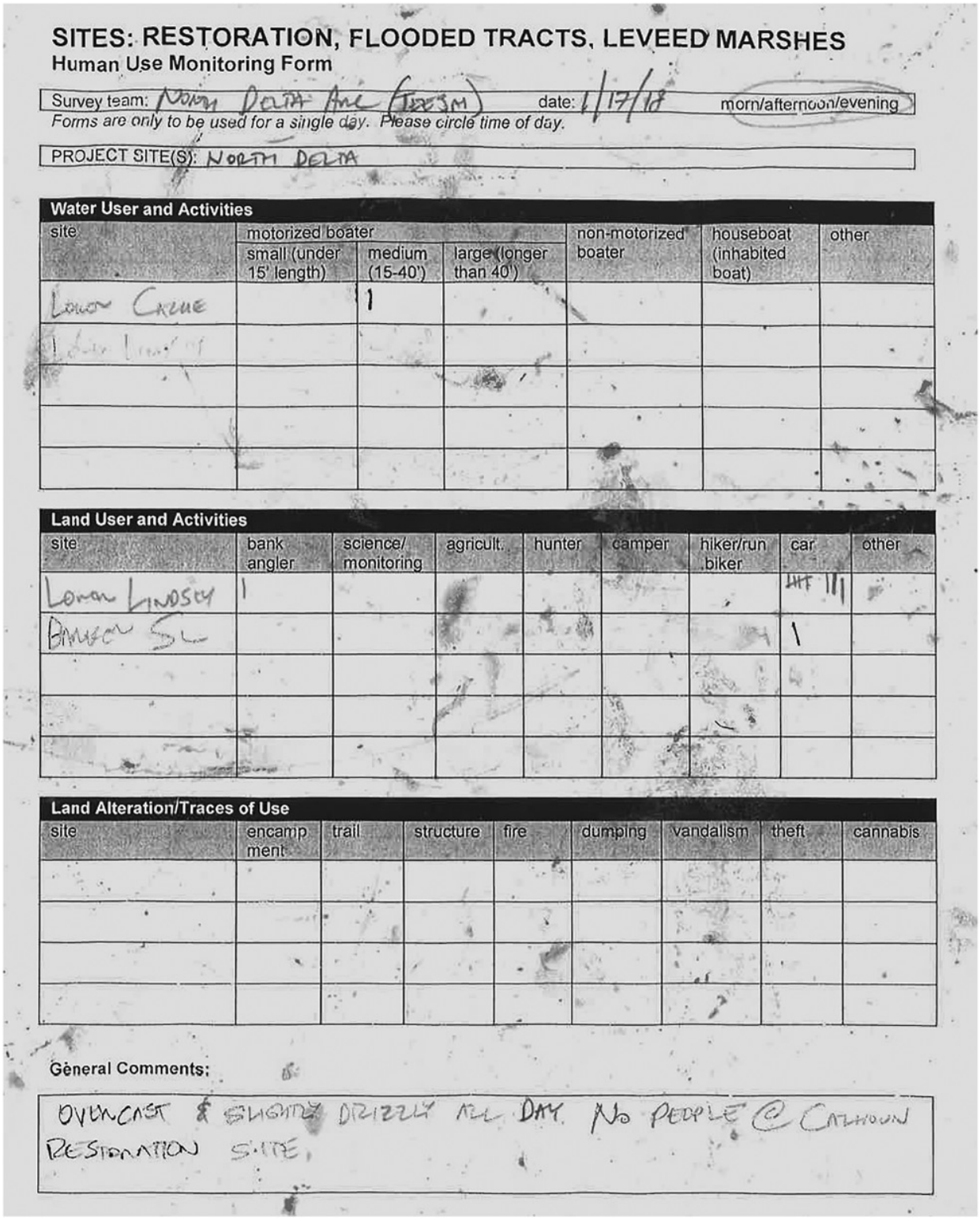
Along with these agency scientists, we identified potential partner monitoring teams who would assist in the development protocols for human use data collection. The next step was to refine the categories and format of the data collection sheet to accommodate monitors, suggestions regarding effectiveness and ease-of-use. These discussions prompted us to articulate what we perceived as indicators of sociocultural change in the landscape and to be realistic about the capacity of monitors to collect very specific, and sometimes sensitive, data related to illegal and criminal activities. The final indicators included general demographic information regarding the type of users, but did not specify any personal information. To gather personal information, such as age, the area of residence, etc. would have led to ethical concerns, and required monitors to make contact with other people, which would distract from primary monitoring objectives.

We realized early on that the creation of categories or typologies would influence what is seen by monitors by dictating what they will be looking for in the landscape. We also learned that our initial

categorizations did not always sync with the experience of monitors. Through our conversations, we expanded categories to include activities and occurrences of which we were unaware. While at times it seemed that we were sorting out minutiae (are sailboats with motors sailboats or motorboats? What are the dimensions of litter versus dumped trash?), our communication also helped to address some fundamental assumptions.

For example, the monitors were concerned about the collection of data on what they called junk, and we called ruins. When asking for evidence of human uses we had not thought about the derelict equipment, buildings, boats, levees, etc. that are everywhere evidence of the human history in this landscape. This conversation validated the significance of anthropocene baselines in the Delta context and the suggestion of Kopf et al. that "management of human-dominated ecosystems must move beyond historical constraints toward new points of reference dictated by social–ecological sustainability" (Kopf et al. 2015, 798). Ultimately, we decided that this problem required that we conduct an inventory of existing ruins, creating a provisional, 'anthropocene' baseline. Any traces of human activity that came after would be considered 'new' and should be noted.

However, monitors remained concerned about the redundancy of counting traces such as structures, trash, and homeless encampments, which are likely to be present for months. We responded to this concern by explaining the value of capturing data regarding ongoing real-time totals, which led to a protocol whereby they would 'recount' semi-permanent structures and alterations. It was understood that we would factor this into the presentation of the data on landscape alterations to recognize the relative permanence of some of these features.



SITES: RESTORATION, FLOODED TRACTS, LEVEED MARSHES

Human Use Monitoring Form

Survey team: North Delta Ane (TEESM) date: 1/17/18 morn/afternoon/evening

Forms are only to be used for a single day. Please circle time of day.

PROJECT SITE(S): North Delta

Water User and Activities

site	motorized boater			non-motorized boater	houseboat (inhabited boat)	other
	small (under 15' length)	medium (15-40')	large (longer than 40')			
Lower Cache		1				
Lower Lindsey						

Land User and Activities

site	bank angler	science/ monitoring	agricult.	hunter	camper	hiker/run biker	car	other
Lower Lindsey	1						IIII	
Barker Sl							1	

Land Alteration/Traces of Use

site	encampment	trail	structure	fire	dumping	vandalism	theft	cannabis

General Comments:

Overcast & slightly drizzly all day. No people @ Calhoun restoration site.

Figure 1.1 Completed human use data collection sheet. It was a drizzly day midweek, and there were few people on the water.

We were also confronted with the problem of regular activities, such as ferry crossings and the movement of tankers through the two deep-water shipping channels that traverse the Delta. Documenting such regular activities was identified as an avoidable burden, which we relieved by looking at ferry schedules, tanker itineraries, and other known and recurrent patterns of activity. Gathering existing data on recurrent activities allowed monitors to focus on those activities with greater variation.

When designing the collection sheet, we intended that the monitors would not deviate from their existing path to collect data. However, we were unsure of the existing protocol and what coverage it would allow. Talking with, and later accompanying, monitors enabled us to get a better sense of the locations frequented, for how long, at approximately what time of day, how often, and in what seasons. We also got a sense of how far water-based monitoring groups would venture onto land. Better knowledge of the monitoring regime provided insights into the movements of monitors, as well as identified spatial and temporal gaps in our data collection.

We shared a concern that monitoring activities limited to state and federal work weeks would not capture the spikes in use that occur during weekends and holidays. We addressed this issue by bounding our quantitative analysis to the places and times in which monitoring did occur. While this would limit our insights into absolute use numbers, it would allow us to track use over time and extrapolate season. Once the initial protocols were developed, we did the first round of in-field testing.

For this first round, we joined the monitors during a fish sampling run and observed their capacity to fill out the form. During these ride-alongs, we assisted in both the collection of human use data, as well as the primary fish sampling tasks, which included beach seining, as well as the collection of data on the size and type of fish caught.

The development and implementation of this prototype was itself an experiment in adaptive management and social learning. Collaboratively developing the protocol with agency monitors provided an opportunity to learn from them how they viewed the landscapes in which they work. It also provided an opportunity for us to explain the rationale behind our proposed expanded protocol.

Results: co-creating knowledge on human uses of restored and naturalized Delta landscapes

In summary, the data collected indicated varying degrees of human use of the areas in, and adjacent to, restoration sites. The collection process itself, and the conversations surrounding its use, appear to have shifted perspectives regarding the role of people in restoration projects. Monitor involvement is already supporting planners and managers in taking human affects more seriously and supporting efforts to quantify and qualify impacts, emotions, and values associated with a diversity of user experiences. Given their adjacency to open-access navigable and tidally-influenced waterways, boating and fishing were predominant uses. Data on trails, fires, dumping, encampments, and animal grazing were also collected. In several sites, monitors identified other people at work, including scientists, other agency staff, or maintenance workers (including maintainers of levee, electricity, and natural gas infrastructures).

Our first round of in-field testing led to further refinement of protocol categories and format, which we then began to share with other monitoring teams. In almost all cases, the introduction of the human use data collection sheet was accompanied by a ride-along in which we could walk the monitoring teams through the protocol for data collection. These ride-alongs ensured consistency in data collection across monitoring teams and provided an additional opportunity for feedback.

Figure 1.2 Monitoring in Suisun Marsh. Photo by Alejo Kraus-Polk.

Our initial experience of developing and prototyping this protocol indicates that it has changed the relationship between existing monitors and members of various Delta publics. This change began with our early conversations in which we discussed project rationale. We found that most monitors required little convincing of the importance of collecting data on human use. However, we did encounter skepticism as to whether these sites would be, or should be, used by the public, which we perceived as illustrative of known differences in opinion within the agency regarding whether or not use should be encouraged.

We talked with one monitor who reflected that “tracking other people has me noticing how the Delta is part of people’s lives including my own”. Here we see a develop- ing understanding of who uses the Delta, including and beyond the other scientific and monitoring groups. “Observing these people has given me a sense of what the Delta means to them”. Grappling with questions of plural meanings obviously goes far deeper than the mere presence-absence data which we asked for in the collection sheet,

and speaks to the ways in which monitors connected the appearance of people in the landscape to the larger sociocultural context of their presence. For several monitors, there was an extension of understanding to the other "people at work" in a landscape that was their shared place of work. The recreating public was understood differently, as their entirely voluntary presence was a clearer indication of a desire to be in a place.

Another monitor, although adamant that he was a "fish guy", shared "the overarch- ing idea that people are a part of the ecosystem". For him, "people can't be 'harmful to the ecosystem' because they are within it". He posited that "species need to coevolve with people", as this was their long-term future in the novel Delta ecosystem. He acknowledged "the [human use data collection] sheet makes you more aware of this". Here humans, including scientists and non-scientific publics are part of a larger affective ecology. We see scientists hoping to help certain species, acknowledge the need to consider the humans who may currently or in the future cohabitate the landscape.

Figure 1.3. Delta houseboats. Photo by Alejo Kraus-Polk.

While a monitor expressed they are aware of other boats in the water, when they stopped to fill out the collection sheet, they are counting boats, which they wouldn't do otherwise. Another monitor discussed how the human use data collection sheets help them notice more people fishing on the banks. Increased awareness of other peo- ple sometimes validated what they already thought they knew about other users. One monitor reflected that filing out the sheet supported their assumptions that people are mostly in the channel, and mostly fishing, and there are more people on nicer days. Another monitor shared that in the more remote North Delta, where he worked, "the sheet really showed me there are so many researchers relative to the public" and "no one is out there when the weather is crap", conditions of which he is fond. For these monitors, quantitative validation has the power to render fact of anecdotes, including their own.

Although poaching was not a discrete category in the data collection sheet, and, in general, data on the ecological impact of poaching is non-existent, monitors expressed concern about this practice in interviews. As one explained, "if a person looks starving or like they really need it, I am not going to report it … but I have come across guys, who are fit, well-fed, with all the equipment. And these guys are gill-netting … they are just lazy. I am going to confront these guys because this is a shared resource". Another moni- tor shared a different, yet equally nuanced, perspective on the potential benefits of poaching non-native predator fish, such as black bass. The first perspective shows an extension of empathy toward subsistence anglers and acknowledgment of a commons, whereas the second remains focused on ecological function and habitat benefits related to native fish survival.

Data collection caused some monitors to think beyond their primary concern with ecological function and look at how, for example, fish access and people access is related. Participant monitors identified a double-edged sword. Making sites hard to access by people might negatively affect fish. Many of these projects are about improving access, which makes channels accessible to people. However, human barriers that are permeable tof fish might encourage illegal use, by creating unsanctioned space. Furthermore, for sites to be accessible to water-based monitors, they will also have to be accessible to the boating public. Although monitors do not play a direct role in the design decisions, it is evident that people are part of their personal design considerations. Many monitors were aware of the myriad ecological parameters that go into the design of a site. These considerations can be overwhelmingly complex in their own right. The monitors see themselves as scientists concerned foremost with addressing the non-human ecological complexity. However, by doing field-based science they become a part of their system of study, motivated by their own intents and desires. Talking with monitors in the field showed that they enjoyed being out in the landscapes in which they worked. Although hours could be long and weather inclement, the physical component of their job was appreciated, and they were happy not to be in the office. Many had actively sought employment that would allow for this type of outdoor activity.

Furthermore, there were many parts of the job that they genuinely enjoyed, including, interacting with (sampled fish), taking in the scenery, maintaining boats and equipment, and in the case of some boat operators, hook, and line fishing.

However, monitoring is confronting challenges. During our exit interviews, we heard from several monitors that lack of staff had limited their ability to collect human use data. These challenges existed despite the fact the affected monitoring is held in high regard within the scientific enterprise and resonates with the challenges observed by Hermans et al. (2017). While monitoring forms did not yield the extent of quantitative data we had hoped for, the experience influenced the way in which traditionally biophysical-focused monitoring groups view the human dimensions of ecosystem management and the importance of relevant data collection. The updated Delta Science Plan, which, "provides a framework for science cooperation across authorities vested in multiple agencies and programs",[15] reflects a concentrated emphasis on social factors. The update calls for the establishment of a social science taskforce to, "[i]dentify critical steps and priorities for establishing a social science research program that enhances our understanding of human responses to management actions, of evaluating what value-based tradeoffs exist among alternative actions, and of balancing limited resources among humans and wildlife for creating effective policy decisions that are cognizant of the values of a changing Delta to both people and the environment" [16](1). Furthermore, the update stresses that "[m]onitoring programs also need to include social characteristics of the Delta, which help to provide insight on risk, habitat, and sense of place" (22).

Discussion: the influence of social learning with data and affect

Our initial experiences indicate that our protocol may enable 'double loop' social learning, where monitors, managers, and planners reassess the assumptions underlying adaptive management actions

[15] http://deltacouncil.ca.gov/docs/delta-science-plan/draft-delta-science-plan-update-public-review-august-22-2018
[16] This is a passage from a draft charge that has been circulated internally among taskforce participants.

(Keen, Brown, and Dyball 2005; Keen and Mahanty 2006) by encountering the vital presence of humans in the affective ecologies of restored and naturalized landscapes. Where previous projects might have relied on public comment and outreach to select local stakeholders, such as landowners and agricultural operators, this type of data collection brings into the adaptive management process other actors, both their quantifiable presence as well as their non-representational affect. For example, restoration planners identify adjacent landowners as stakeholders whose presence, either physical and or financial and legal, is considered. Landowners may make comments in a public meeting, but it is highly unlikely that farmworkers or subsistence anglers will do the same, this despite the fact that in many cases they have a far more frequent presence in the landscape. With presence comes embodied experience, which is intrinsically non-representational, and unquantifiable. This embodied experience is part of a sense of place, which co-occurs within the larger affective ecology of "nature, society, and self" (Singh 2017, 761).

Being with other people in the landscape as part of the ecosystem allows monitors – meaning those specifically tasked with encountering and observing dynamic phenomena in the landscape – to re-evaluate assumptions as to what restoration entails and the role of people, including themselves, in these landscapes. Observing the regular interactions that occur between monitoring teams and the Delta publics we saw how members of the public often ask for certain information related to things such as water quality and the location of fish. According to one of the monitors we spoke with, people are often less interested in the bugs that are actually being sampled. Monitors are seeking to strike the right balance between communicating the relevance of their studies while avoiding their politically contentious impetus.

This type of nuanced science communication is seen as increasingly valuable in the Delta science enterprise.[17] These interactions are usually brief but hold the potential help 'manage dissonance' and in so doing build relationships and more reciprocal knowledge exchange (Clemmensen 2014). These interactions entail affective labor, especially when the monitors confront members of the public who are skeptical as to the costs, need, intent, motives and efficacy of monitoring efforts.

Although our monitor partners are tracking boats and people, their primary efforts remain devoted to biophysical monitoring. This is what they are paid to do, what is in their job description, what they were trained to do, and what their supervisors expect.

However, monitors reflected that collecting data on the boats and people they see while working has contributed to them noticing how the Delta is a part of people's lives, including their own. We take this as evidence of these monitors developing a growing understanding of who uses the Delta, including and

[17] Several science communication workshops have been held for Delta scientists, focusing on topics including science-policy integration, media relations, social media, and public and visual communication.

beyond the other scientific and monitoring groups. Being tasked with observing these people gives monitors a sense of what the Delta means to a variety of different user groups, many of whom are distinctly absent from planning discussions.

Monitors seem to acknowledge the importance of incorporating these diverse place values into the science, planning and management discussions. In the words of a monitor, “who uses the Delta now is an important variable in how the Delta will look in 100 years”. We see, in this quote, an expression of a more general acknowledgment of the role of people in the evolution of the Delta, but more importantly for our study the importance of the everyday experience of those who live work and play in the Delta.

From conversations with monitors, we discovered that very few lived near the areas of the Delta where they worked. This physical distance may explain, in part, a widespread feeling that they are outsiders. Such outsider feelings may be countered by the establishment of a Delta Research Station (DRS), a science and research center in the Delta that is in the latter planning stages. The DRS would bring together scientists, engineers, technicians, computer scientists, and office staff from the Bureau of Reclamation, the California Department of Fish and Wildlife, the California Department of Water Resources, the National Marine Fisheries Service, US Fish and Wildlife Service, and other state and federal agencies (IEP 2014). In all likelihood, the DRS, would encourage these staff members to choose to live closer to the areas of the Delta in which they worked.

Program managers echoed this concern of monitors when discussing the way in which Delta public perceive the scientific programs of which they are part. While they hoped that the Delta publics valued their scientific work, they were realistic in their acknowledgment that many members of the public are skeptical of the intent, motivations, and costs of Delta science programs. While biogeophysical monitoring is neces- sary for the adaptive management of fisheries and waterways on which Delta publics depend, it can be challenging to communicate the process by which these data inform management and

policy.

The collection of data on human use may create a clearer connection in this regard. Most of the people who use these areas are largely unaccounted for. This may contribute to the common feeling that the major decision-makers are out of touch with the lived reality of Delta residents and the larger users' community. The collection of human use data provides the opportunity for the meaningful representation of these diverse users groups. The initial data that has been collected on our forms is an example of people being counted who were not previously and who have a vested interest in the ecosystem within of which they live and for whom the uncertain future of these landscapes matters. As human use numbers and typologies enter into the planning, policy, and management deliberations, the connection between monitoring activities and adaptive management responses can be made clearer. Quantitative data on user numbers hold weight in planning and management deliberations.[18] These data aid in the representation of people who had been not represented or were underrepresented.

Legibility is necessary for effective representation. Data and data synthesis must be presented in a way that is legible to the scientists, planners, and policymakers. Our data collection sheet has the potential to inform human use conceptual models that are very similar to those which have been developed for native fish, such as Delta Smelt (Geach, Suria, and Jones 2017) and Chinook Salmon (Goertler et al. 2017). Such conceptual models are seen as a critical component of the adaptive management approach, describing the interrelationships among key variables and consequences of alternative management actions (Hermans, Naber, and Enserink 2012; Margoluis et al. 2009). Conceptual models are currently being used to identify areas of uncertainty and potential restoration actions concerning EcoRestore projects, as well as define

[18] Similar data has been used to place an economic value on recreational uses through the hedonic and travel cost method. However, given our resource constraints, we rely on presence as a proxy for value. In so doing we assume that those who choose to engage in activities in restoration areas value both the area and the activity. Qualitative methods, such as surveys or interviews are required to enhance this basic picture. Also, the satisfaction of Delta publics can be roughly accessed by way of proxies such as fish abundance, aquatic vegetation coverage, or water quality, once the connection between these metrics and user values are established.

monitoring needs, develop performance measures, and assess the likelihood of success for achieving the goals and objectives.

In addition to the prototyping of the human use data collection sheet, we also worked with agency partners to secure permission to access EcoRestore sites. We were able to secure temporary entry permits (TEPs) to those lands owned and managed by the California Department of Water Resources (DWR). These lands account for the overwhelming majority of EcoRestore acreage. For lands not owned by state agencies, we performed site visits accompanied by monitors or management personnel, which were essential to 'ground-truth' the information received from monitoring teams as well as the information that is contained in project reports, EIRs, and management plans as well as to develop a direct sense of the landscape through embodied experiences. The site visits are also an opportunity to fill the spatial and temporal gaps identified by the monitoring teams. Although many of our agency partners were immediately receptive to our propositions, there remains the fundamental fact that what we proposed was novel. However, it seems that we have tapped into a brewing interest in distinctly different forms of thinking about and looking at restored landscapes and those who inhabit them.

Here, we see the initial spark of double and triple loop learning as agency staff, academic researchers, land managers, planners, and regulators awaken to the diverse suite of perspectives, values, and proclivities that influence human use within the complex cultural landscapes in which they work, and upon which they regulate and plan. What began as an individual shift of perspective is, through formal meetings, workshops, presentations, planning documents, as well as informal conversations, becoming situated in the wider communities of practice within the science, policy and planning enterprises, meeting the criteria for social learning as described by Reed et al. (2010).

Despite new language in updated planning documents, it remains to be seen how exactly our co-created knowledge of human use will impact the planning and design of restoration areas. Our research is featured

in a synthesis paper on protection, restoration, and enhancement of the Delta ecosystem to inform the amendment of the Delta Plan (DSC 2016b). The first chapter of this synthesis paper is focused on society and restoration and features sections on human benefits in the Delta, ecosystem services, economic benefits, social benefits, cultural/psychological benefits, and restoration for society. This chapter contains the following statement: "considering social benefits as a core part of the planning and management practices of restoration will maximize the benefits provided by restoration" (DSC 2016b, 11). Bringing the consideration of social benefits to the forefront of the Delta Plan, the strategic delta plan for the Sacramento-San Joaquin Delta has the potential to change its process and ultimate outcomes.

Our research is also influencing the Delta Conservation Framework (DCF), which seeks to guide Delta conservation efforts to 2050. This framework represents an attempt to address the need for: integration of conservation, agriculture, and community goals, conservation of ecosystem processes to promote function, and addressing conservation implementation challenges and establishing good-neighbor practices (CDFW 2017).[19]These needs have been identified by a broad suite of stakeholders and reflect shortcomings of existing planning processes. In its attempt to open up the planning conversation to a broad set of socio-political interests, this framework resonates with the strategic delta planning process, as described in (Seijger et al. 2017). The DCF has influenced amendments to both the Delta Plan and Delta Science Plan update by adding language related to human use, based in part on our initial research (DSC 2016a; Milligan and Kraus-Polk 2016).

Recommendations: socioecological monitoring for integrated adaptive management

Our general recommendation is to encourage more research and experimentation on integrative

[19] We contributed a chapter on community perspective in the Franks Tract Feasibility Study, a restoration planning study for a 3,000 acre flooded tract, which is seen by agency proponents as a pilot for the DCF. To inform our contribution, we conducted interviews, a survey with approximately 750 respondents, and a community design charrette. The report and survey results (appendix) can be found here: https://www.wildlife.ca.gov/conservation/watersheds/dcf

monitoring and adaptive management within the context of strategic delta plans and their intentional (and unintentional) large-scale landscape transformations. Our initial findings indicate that integrated socioecological monitoring has the potential to influence integrated adaptive management decisions through social learning related to affect.

Although the disjuncts between plans, implementation and, adaptive management based on monitoring remain a challenge, we see in realized and incipient double and triple loop learning, the potential for a significant shift in consciousness concerning the role of people in the restoration process. To further nourish this shift we recommend:

- Institutionalization of the protocol.
- Expansion of the protocol to include other-than-scientist monitors, such as citizen and community scientists and tribal members.
- Incorporation of data into site-specific conceptual models.
- Recognition of social learning and its potential benefits for socioecological restoration.
- Continued research on eyes to acres ratio, positive bystander effect, and observer effect.

To effectively track how human use responds to restoration activities, we need ongoing monitoring of current and future restoration sites. Our integrated socioecological monitoring approach is a practical and relatively cheap way to ensure monitoring coverage over time and across place.

Although our initial monitoring protocol was intended for use by monitoring teams affiliated with State and Federal agencies, we would like to see it expand to include other user groups, including citizen scientists and volunteers involved in management and enforcement. Unlike the adjacent San Francisco Bay Area, which is a bastion of citizen science, the Delta sorely lacks any established programs or institutional support. Although citizen science does not exist, several volunteer monitoring programs

enroll regular citizens in the monitoring of Delta landscapes and waterways, such as the California Department of Fish and Wildlife's Natural Resources Volunteer Program (NRVP) and the US Coast Guard (USCG) Auxiliary. While the auxiliary may have reached its maximum potential, the NRVP could be expanded or adapted by state agencies for other restoration areas under public management.

Figure 1.4. Resource enforcement officer inspecting the weapon of recreational target shooters. Proximity to cities such as Stockton and Sacramento make unmanaged areas of the Delta attractive locations for unsanctioned activities. Photo by Alejo Kraus-Polk.

In addition to aiding in human use data collection, these programs have the potential to increase the 'eyes to acres' ratio on a landscape and contribute to a 'positive bystander effect', whereby human presence discourages illicit activities and unsanctioned uses.

Figure 1.5. Boat theft is a regular occurrence in the Delta. Once the valuable components have been stripped, boats are often burnt to destroy evidence. Photo by Alejo Kraus-Polk.

Although these ‘eyes’ can belong to citizen volunteers, they could also belong to farmers, or more likely farmworkers, who have a regular presence in a landscape and can thus observe and dissuade the undesirable. This is just one example of human presence on a landscape contributing beneficially to its ecological function. Other examples include the public stewardship of parkland, the role of volunteers in the restoration activities themselves, and the suite of regenerative agricultural practices that, in addition to producing food, can reverse subsidence, sequester carbon, and ‘grow’ habitat.

Conceptual models related to human use can effectively communicate actionable knowledge. Site-specific conceptual models of human use can be used to further adapt ours or other monitoring approaches to the site-specific performance measures, goals and objectives. These conceptual models can also influence the larger adaptive management frameworks, which are in development, by encouraging consideration of how landscape-scale interventions will impede and facilitate use, both the sanctioned as well as the unsanctioned.

We also recommend that this project further engage the conversation around social learning in the context of the adaptive management of Delta restoration. This type of integrated monitoring not only provides data necessary to inform adaptive management decisions, but it can also change the perspectives of monitors, the Delta publics, and the relationship between them, thus changing assumptions that define the context in which decisions are made. This is important given the observation by Sayre et al. that, "the social relations through which monitoring takes place may be as important to successful adaptive management as the protocols employed or the data obtained" (Sayre, Biber, and Marchesi 2013, 92).

Understanding the causal connections between restoration actions and affective social responses through monitoring is a clear example of single loop social learning.[20] However, our approach takes steps toward 'higher-order learning,' which could be further encouraged by the development of a more collaborative and participatory monitoring program. Challenging the values and norms that underlie restoration actions will require engagement with the Delta lawscape, i.e., the physical manifestation of laws (Graham 2010). We hope the expansion of this protocol can continue to foster a 'common ground' between managers, monitors, citizen scientists, and other users based on a shared interest in stewardship. This common

[20] We interpret values related to 'Delta as an Evolving Place' as consisting of both the economic and non-economic, tangible and intangible. Methods for non-economic value solicitation include scenario planning, participatory mapping, and deliberative multi-criteria evaluation (DMCE) (Mavrommati, Borsuk, and Howarth 2017). Application of these methods may support double or triple-loop learning (i.e. 'higher-order learning') that will begin to challenge the assumptions that are foundational to restoration actions, and transform the values and norms that have dictated restoration planning and management.

ground could emerge from a dual recognition. Recognition by the Delta publics that scientists and monitors create knowledge that is beneficial to the place they love. As German sociologist and science studies scholar Matthias Gross argues, robust restoration strategies need to, "include knowledge that is widely shared and has a strong hold on the minds and consciences of a community or society" (Gross 2006, 178) (Figure 1.6).

Figure 1.6. UC Davis Researchers measuring, recording and sampling hunted waterfowl at the Yolo Bypass Wildlife Area. Recreational hunters voluntarily participate in the effort and researchers gain valuable wildlife data. This is an example of public participation in resource management related research. Similar programs exist for fish species of interest, such as White Sturgeon and Salmon. Photo by Brett Milligan

Conclusion: integrated adaptive management, restoration, and strategic Delta planning

Strategic delta planning and design for sustainability in highly altered urbanizing deltas often entail the restoration of ecological functions through land conversions and management shifts. In the Sacramento-San Joaquin Delta, the primary impetus for restoration is mitigatory. Although restoration projects already comply with existing regulations that require public engagement and feedback, we are advocating for methods that could support a higher degree of inclusion, one that is being called for by both agencies and stakeholders.

Monitoring efforts focused on learning about the effects of restoration have keyed in on specific species of concern. However, these conversions and shifts also affect the people who live, work and play within and around the sites of restoration. The values, sense of place, and affective well-being of people will respond to restoration in uncertain ways (Breslow et al. 2017; Luhmann et al. 2012; Poe and Donatuto 2015; Poe, Donatuto, and Satterfield 2016). Adaptive management can be used to promote desirable human uses that support wellbeing, are consistent with the ecological (and social) objectives of the project, and dissuade undesirable uses. Social learning is already occurring as monitors, scientists, planners, policymakers and the public confront assumptions related to the role of people in restored landscapes envision, plan and enact multi-benefit projects. This learning is supported by the emerging field of reconciliation ecology, defined as, “the science of inventing, establishing and maintaining new habitats to conserve species diversity in places where people live, work and play” (Rosenzweig 2003, 7). However, for adaptive management to be more reconciliatory, information on the effect of people who live, work, and play is necessary.

Our initial results have identified existing scientific monitoring programs as crucial partners in the collection of this information. In addition to their knowledge of sampling techniques and presence in the

landscapes of interest, personnel from scientific monitoring programs are receptive to new ways of thinking about these landscapes that can change their relationship to the other people who share their passion for, if not an exact sense of, place. However, our integrated socioecological monitoring approach would benefit from more monitors, either formal scientists, or informal community and citizen scientists to assist in data collection.[21] To sustain this project will require proactively advocating for its expansion and institutionalization through the work of synthesis and communication through conceptual models. It will also require additional outreach with non-state stakeholder groups, such as NGO's, environmental consultants, community groups, recreation advocates, landowners who are emerging as valuable collaborators in a conviviality-based conservation ethic.

[21] Following Newman et al. we would encourage citizen science programs to "leverage the power of place" (Newman et al. 2017, 55).

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Chapter 2. Park, Fish, Salt and Marshes: Participatory Mapping and Design in a Watery Uncommons[22]

Brett Milligan, Alejo Kraus-Polk, Yiwei Huang

Abstract

The Franks Tract State Recreation Area (Franks Tract) is an example of a complex contemporary park mired in ecological and socio-political contestation of what it is and should be. Located in the Sacramento-San Joaquin Delta, it is a central hub in California's immense and contentious water infrastructure; an accidental shallow lake on subsided land due to unrepaired levee breaks; a novel ecosystem full of 'invasive' species; a world-class bass fishing area; and a water transportation corridor. Franks Tract is an example of an uncommons: a place where multiple realities (or ontologies) exist, negotiate and co-create one another. As a case study, this article focuses on a planning e ort to simultaneously improve water quality, recreation and ecology in Franks Tract through a state-led project. The article examines the iterative application of participatory mapping and web-based public surveys within a broader, mixed method co-design process involving state agencies, local residents, regional stakeholders, consultant experts and publics. We focus on what was learned in this process by all involved, and what might be transferable in the methods. We conclude that reciprocal iterative change among stakeholders and designers was demonstrated across the surveys, based on shifts in stakeholder preferences as achieved through iterative revision of design concepts that better addressed a broad range of stakeholder values and concerns. Within this reconciliation, the uncommons was retained, rather than suppressed.

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Introduction

Background

The Franks Tract State Recreation Area occupies two flooded areas of formerly reclaimed land, Franks Tract (3000 acres flooded since 1938) and Little Franks Tract (330 acres flooded since 1982), hereafter collectively referred to as Franks Tract, located in the Western Sacramento-San-Joaquin Delta of California (Delta) (Figure 2.1). These shallow, tidal lakes-novel to the Delta-were created after multiple levee failures, after which they were abandoned. They have since evolved into a major water recreation and navigation hub for the entire Delta. The tidal lake has also become the home of expanding numbers of aquatic introduced weeds that blanket its surface and fill the water column, making navigation difficult and deeply affecting local ecology. Franks Tract is dominated by predatory introduced species that thrive in these altered conditions, such as black bass, which support economically significant tournaments, but reduce the habitat value for critically endangered species such as Delta smelt and Chinook salmon. As some have claimed, Franks Tract is more akin to a lake in Arkansas and its associated fish species, than a California Deltaic environment [1]. There are fishing tournaments year-round here. During March, April and May, there is a tournament every weekend, the largest of which can generate a half a million dollars in economic activity [2].

Franks Tract is also a problematic source of salinity intrusion into the western Delta from the saltier Bay. In increasingly frequent drought conditions, salinity threatens water supply reliability of regional diverters and contentious Delta exports [3,4]. These exports provide water to the Southern Bay Area, San Joaquin Valley agriculture, and Southern California cities, often at the expense of Delta ecology and local communities [5]. Franks Tract Futures (FTF) is the latest in a string of planning efforts seeking to address water supply reliability issues related to Franks Tract. Tied to water supply reliability are restoration mandates, which are “heavily driven by the detrimental effects of water exports and the

reengineering of the Delta as logistical infrastructure for its conveyance" [6]. Restoration mandates across the Delta call for the recreation of tidal marshes, which were 98% eradicated during the diked reclamation of the region in the late 19th to early 20th century [7], along with the eradication of what was left of nomadic to semi-nomadic native American Delta tribes, which had been largely decimated by colonial persecution and European-introduced diseases prior to that time.

Current ecological restoration mandates for Franks Tract are guided by multitudes of scientific and legislative literature. A Delta Renewed [8] is an influential state-funded science-based guide that draws from extensive research on historical ecology [7], landscape change [9] and future scenarios to "discuss where and how to re-establish the dynamic natural processes that can sustain native Delta habitats and wildlife into the future" [8]. The guidelines in A Delta Renewed were specifically applied in initial FTF planning efforts to help set performance goals for conservation, including the size and design of tidal marshes and their dendritic channels.

Unlike previous planning efforts [10,11], the FTF effort has expanded goals of providing enhanced recreational opportunities and community benefits and benefiting native and desirable species by reestablishing lost ecological habitats and processes (The project website: https://franks-tract-futures-ucdavis.hub.arcgis.com/). Thus the FTF effort exists within a dynamic context of interconnected efforts of landscape-scale mitigatory restoration, coordinated adaptation planning on public lands, and a massive and controversial proposed water conveyance project.

Similar conveyance projects, which originated as part of the State Water Project (SWP) and Federal Central Valley Project (CVP) but were never implemented, have been proposed several times. The current project entails a tunnel underneath the Delta that would allow water exports to draw water from the fresher Northern Delta, mitigating issues related to salinity intrusion, water quality and export restrictions related to the endangered species act. Over the course of the FTF project, a new governor took office and downsized the current proposal from two tunnels to one. Yet the project remains contentious, seen by many Delta locals as a water grab, and many FTF stakeholders were skeptical that the Franks Tract project was connected, for example by serving as a repository for tunnel spoils. As noted by Milligan and Kraus-Polk, regarding the Delta's indeterminate future water infrastructure, "Many plans to alter or sustain these logistical works are uncertain (both in execution, budget, and timeline) and likely to be changed and superseded by new propositions. Given the dominant agency of this planning arena, it renders planning in all others challenging and unpredictable" [6].

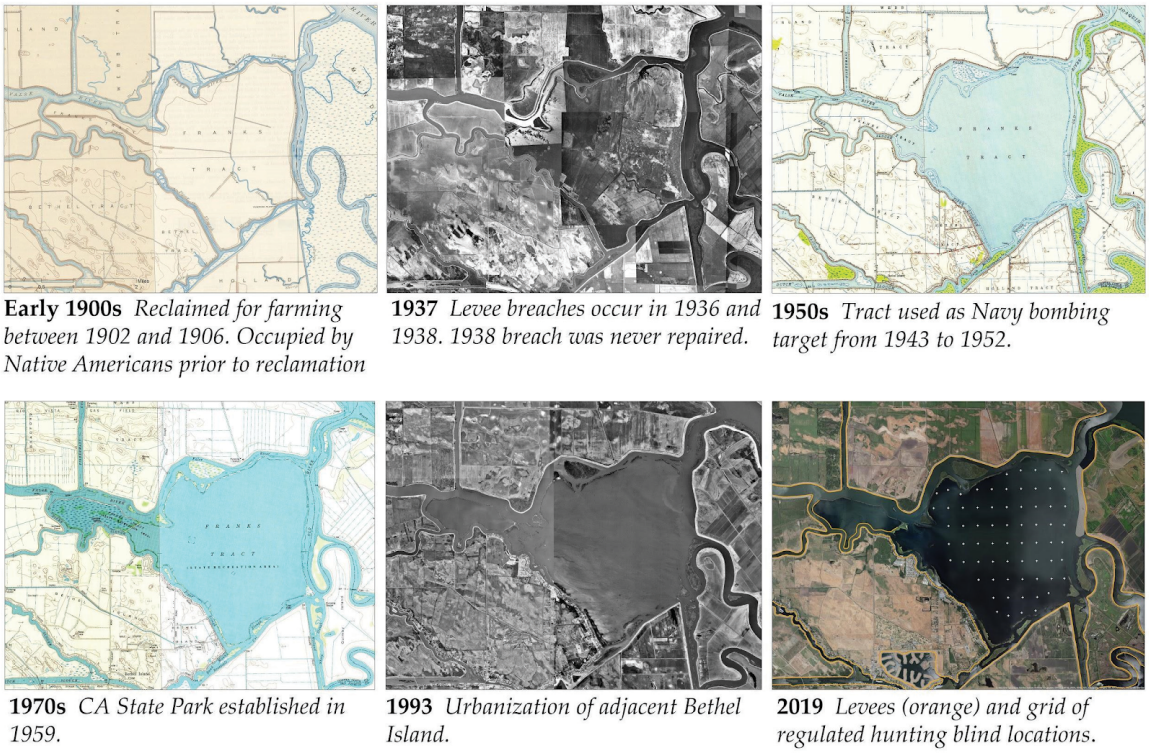


Figure 2.1. Co-evolution of Franks Tract: 1900-present.

We understand Franks Tract as a contested part of the Sacramento-San Joaquin Delta's far-flung infrastructural landscape, a boating highway, a world-class bass fishery, a novel ecosystem and a chronically underfunded state park. As such, we approach Franks Tract as an uncommons [12,13], meaning there are divergent realities and presuppositions of what the landscape is, all of which exist simultaneously and in relation to one another. Accordingly, our work attempted to engage with the diverse and entangled "ecologies of practice" of this place [14,15].

In practice, we contend that working within an uncommons, of which there are multitudes in the socio-political and ecological crises characterizing the current neo-liberal, late capitalist dominated Anthropocene era, entails accepting that planning and design processes begin and possibly end with a diversity of participant perspectives on what a landscape is and should be [16,17]. This acceptance requires the development and application of methods to "establish a shared understanding of knowledge for action across multiple knowledge domains," [18] or what is referred to as boundary objects [19–21]. Boundary objects are coproduced and adaptable to different viewpoints, but yet are also robust enough to maintain identity across those viewpoints. In co-planning and design contexts the creation of boundary objects can "allow local understanding and interests of participating groups to be reframed in the context of some wider collective activity, which can promote cooperation among stakeholders." [18] Franks tract, as the spatial milieu of an uncommons, is itself a boundary object. It is a place that is empirically present and aesthetically accessible to all who enter it. Yet it is used, valued and interpreted in radically different ways. To quote from Joan Nassauer, "While we might 'see' the landscape through different disciplinary or experiential frameworks, we can point to the same locations or relevant characteristics in a landscape or in a spatial representation of the landscape, and describe what we see there" [10].

In this manuscript, we will present a series of public surveys and co-mapping efforts as landscape boundary objects that facilitated the boundary work of "bridging boundaries between groups of people with differing views of what constitutes reliable or useful knowledge in a co-design process" [18,22] to engender mutual learning and equitable cooperation [23].

Some see Franks Tract as "nature" or "natural." Some understand Franks Tract, colonized with a fluctuating mix of native and introduced aquatic weeds, as ecologically broken. Those that rely on South Delta exports and diversions perceive Franks Tract as a threat to water supply reliability. For others, Franks Tract is working just fine, and any State-led intervention is unnecessary or malicious meddling: "If it ain't broke don't fix it". These and other ontological differences are part of the 'politics of nature' that defines many conservation challenges in the Anthropocene [24] in general and the Anthropocene Delta [25] in particular.

The Need for Co-Design and Effective Transdisciplinary Practices in Park Planning

Both national and state US park plans have a history of being imposed by outside actors with little to no regard for endemic inhabitants and their co-formative relationships to place, for example, Native Americans [26,27]. While there have been many examples of planners and designers of parks and protected areas considering affected communities, there remain many that have not [28]. There are several motivations driving a recent emphasis on public and stakeholder engagement. However, they can broadly be said to concern issues of social justice and ecological efficacy or some combination thereof, based on the understanding that communities affect and are strongly affected by park management [29]. Research on these social dimensions of parks has focused on collecting, analyzing and utilizing social knowledge. Methodologies include visitor counts, participatory mapping, surveys, interviews and focus groups, text analysis, meta-analyses, scenario planning, structured decision-making [30,31] and co-design.

Co-design broadly refers to designers and people and publics not trained in design, working collaboratively in the design development process [32]. In co-design, the team of participants design with, rather than for those who will use or inhabit the designed landscape, through meaningful and integral stakeholder engagement in the process [33]. We see co-design for parks and protected areas as challenging opportunities to improve upon transdisciplinary processes [34], in that a successful process must integrate and share knowledge from a variety of disciplines (such as engineering, design, social and physical sciences), with the knowledge and values of locals, publics and other stakeholders [35,36].

When properly employed, design research [37–44] can expose differences within the affected communities themselves, and find ways to integrate and design for those differences, especially in complex cultural landscapes with diverse social actors [6,37–39]. However, faulty or insufficient research may fail to discern differences [39,40]. False ascription of homogenous non-scientific

perspectives, while perhaps convenient, can threaten the trust necessary for transdisciplinary collaboration. Grappling with difference is harder, but necessary for socially just and ecologically efficacious co-design [41].

Planners, designers, and managers have used participation geographic information systems (PPGIS) as one method to give voice to diverse user values in park and conservation planning [42,43]. Brown and Weber describe PPGIS as, " . . . the practice of GIS and mapping at local levels to produce knowledge of place" [44]. PPGIS was developed to engage and empower user communities, especially marginalized populations [45], and deepen understanding of perceptions, preferences and spatial issues [46]. However, effective public participation can be challenging due to uneven power relations, level of participation, technological access and experience [47,48]. Moreover, as with other participatory methods, PPGIS can be "superficial, obligatory, or token" if no broader, meaningful engagement is encouraged by planning proponents [45]. These challenges persist despite methodological advances, expanded options and greater acceptance by academics, practitioners, and the public [45].

SoftGIS refers to an online PPGIS survey approach developed in response to some of the identified challenges associated with PPGIS, particularly the one-way interaction between communities and planners [49–52]. The "soft" refers to subjective, qualitative and experiential local knowledge as opposed to the "hard" knowledge of technical professional expertise [49,52]. A rationale for softGIS is that attaching soft knowledge to place by means of a planner-produced map-based survey renders it legible and thus usable in a planning context, where it can be processed alongside other spatial information [49]. For our purposes softGIS had the additional appeal of supporting relatively easy survey set-up and online data visualization. SoftGIS has primarily been deployed in urban planning contexts, however, it is applicable to conservation contexts [53], as well as park planning [49,50], as we will show.

Structured decision making (SDM) is a participatory decision analysis support tool that is considered a conservation social science method [31] and has been used by park planners [54]. SDM relies on clearly articulated objectives, recognition of scientific prediction and uncertainty and the transparent response to societal values to guide decision making [55]. SDM integrates technical information with value-based deliberation and seeks to provide a clearer picture of tradeoffs and uncertainties associated with complex decisions. Most importantly, the SDM approach focuses on reciprocal co-learning and knowledge production for all involved in the project.

The Franks Tract Futures planning effort highlights an innovative application of SoftGIS (in the form of map-based surveys), choreographed into a mixed-methods SDM process to create diverse knowledge for the co-design of a complex and politically fraught park landscape. Our effort proceeded with an awareness of some of the critiques of collaborative and communicative planning related to neglecting power and difference [56]. While we were drawing from established urban SoftGIS approaches, our application was adapted to the parks, public, and infrastructural context of Franks Tract as well as its diverse stakeholders and their varied familiarity with the process. Thus we created survey questions that were widely accessible, and assumed limited project background. While charting a path for collective future action and place remaking, the process and tools also gave representation to ontological differences and 'uncommon' understandings of what the park is or could be and applied those differences, rather than suppressing them.

We write as researchers and designers who participated in the Franks Tracts Futures planning effort's engagement and co-design components. While together we have more than a decade of experience working in the Delta, we began without any significant personal or research-related connection to Franks Tract. When planning and designing with Franks Tract, we recognize that we are engaging a wide array of people, including those who see Franks Tract as central to the way of life and livelihoods. We also sought to engage with, or at least consider potential or prospective users, such as those who

might frequent Franks Tract should public access options expand or new recreational features be created. We recognize there is no way of determining this stakeholder population, and thus no way of conducting representative sampling. However, we did assume, based on previous experiences in the Delta, that stakeholders would hold particular sets of interests and many perspectives not held in common about what Franks Tract is, its past and its potential futures.

Design Research Methods

In this section, we detail the SoftGIS and other co-design research methods that were applied in the FTF park planning effort. We describe these methods in relation to the process, timing and sequencing of how they were developed and deployed. We feel this is the most effective way to detail the methods, since the FTF case study is useful both in terms of what it did and did not do well (it got off to a difficult start), and to detail how learning and adaptation might occur in transdisciplinary co-design efforts.

Survey 1: First Feasibility Study

Public engagement for FTF began with an initial Franks Tract feasibility study of a previously developed State plan for Franks Tract. The first survey was conducted from 12 December 2017, through 22 April 2018, after the inadvertent public release of the State plan, and thus captured responses to that design concept. The process was backwards, from a co-design perspective, as the design preceded public and stakeholder output. In developing the survey, we intended for it to provide insights into the demographics and landscape values of a substantial group of people who live, work and play in and around Franks and Little Franks Tracts. (Community perspectives had been gathered as part of a 1985 State Parks planning initiative entitled the Optimum Plan [10]. Prior to that, there were community perspectives gathered as part of the writing of the State Parks general plan for Brannan Island and Franks Tract (which remain co-managed) [57], and as part of a Parks general plan for Brannan Island and Franks Tract (which remain co-managed) [57], and as part of a February 25, 1972, California Senate hearing on Natural Resources and Wildlife [58]. However, little information existed on present-day use).

These insights would aid the design refinement of a project that recognized the multiple values of Franks Tract. Thus instead of creative input, we largely received critical feedback on a design concept that only met narrow, state defined criteria, actualized in a manner that was perceived as detrimental to those who live, work and recreate in the area (We attribute the large response numbers, relative to other surveys conducted in the area, to the availability of the early design plan, and the strong response it generated).

The feasibility study recognized its flawed process whereby public engagement came after plan formulation. As part of this recognition, the study highlighted an alternative plan developed by a local resident that was fostered by our outreach and interview efforts. The limited but positive reception of the "locally proposed alternative" indicated the potential for a design that addressed certain local concerns. The study's recommendations, supported by the Delta Conservation Framework, which was being developed simultaneously, called for early, consistent and transparent public engagement in any future co-design/co-planning process [59].

The feasibility survey was complemented by a series of in person, semi-informal interviews with multiple stakeholders, wherein we were able to ask similar questions, but also had the chance to ask follow-up questions and questions prompted by the online survey. The survey was anonymous and any identifying information that was provided was erased prior to analysis (Data was collected in a Google Sheet that was synced to the live Google Form. The Google Sheet was converted to .csv and .xlsl for analysis in various platforms including Excel, Qualtrics, MaxQDA, Kepler.gl, and R. Each tool allowed for a different view of the data and we found that using one would raise certain questions that would inform our use of the other. After considerable experimentation, we decided to use Qualtrics XM and RStudio 1.1.463 for the majority of the quantitative and qualitative analysis. The geospatial analysis was conducted in Kepler.gl and Excel 2019). Quantitative analysis was conducted using Cross Tabs in Qualtrics and pivot tables in Excel. Self-defined user category was the primary variable used to group

responses. Analysis of quantitative variables such as age, length of relation to Franks Tract, and visitation frequency was then conducted within and between groups). See Appendix A. for initial feasibility study survey results.

Our recommendation at the end of the feasibility study stated that the, “community is wary of significant change to the region as well as any top-down decision-making that does not take their interests into account” [60]. And that “local communities are highly interested in being involved in the design and planning process for any potential changes to Franks and Little Franks Tracts” [60]. The study resolved that “more detailed restoration planning will take into account the social, economic, and recreational interests of the affected local communities and user groups” [60]. Reflecting on the conclusion of the feasibility study, we noted that the value of the survey remains contingent on the willingness and ability of facilitators, designers, planners and managers to integrate this information into this next phase of thinking about the coevolution of Franks Tract and the diverse group of people and communities who have a relationship to it.

Survey 2: User Survey

The second survey was part of a follow-up, and highly revised planning effort built upon the lessons learned from the previous efforts (see Figure 2.2). The survey was conducted from 11 July 2019 through 13 September 2019.

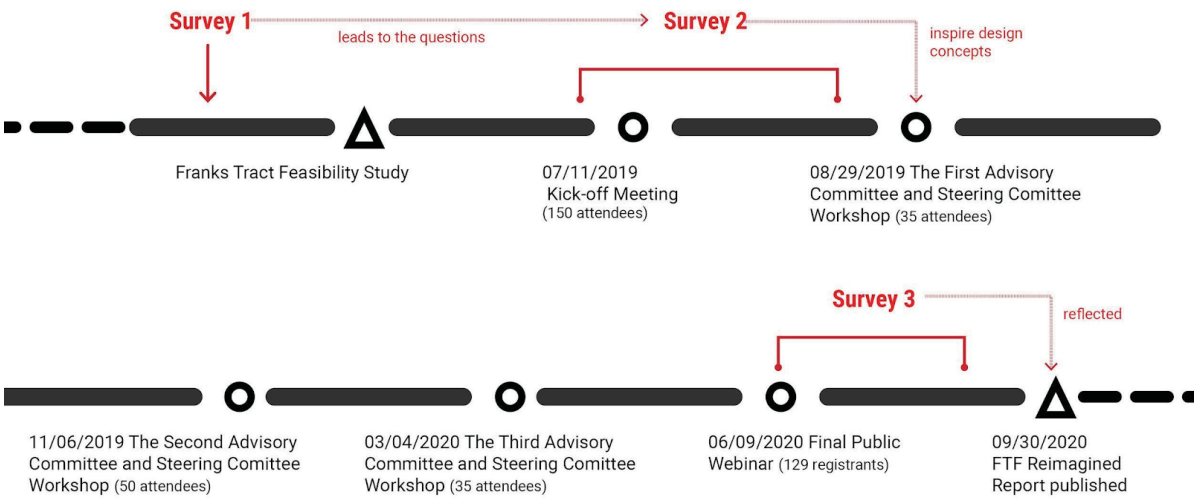


Figure 2.2. Survey sequence diagram showing the location of the surveys in the overall project timeline. Credit: Yiwei Huang

The primary focus of the second FTF planning effort was determining if a multi-value project could be designed to benefit local and regional communities (by addressing concerns raised in the first effort and via the creation of recreational amenities), and to minimize detrimental impacts of the project to these same communities, while still meeting ecological and water quality goals. The FTF engagement process started in June 2019 and ended in September 2020 (For more information see Final Report Appendix A. Public and Stakeholder Engagement: https://ucdavis.box.com/s/hl3qpglcu9ibf919sfby1txeb8qu6unl). The effort began with creating a steering and advisory committee, which participated in regular design charrettes and reviews. At the packed, public kickoff meeting (approximately 150 attendants), the team openly solicited feedback on the objectives of the project, described the structured decision planning process and expressed a commitment to meaningful engagement with the public to co-design the project design concepts.

The project team pursued this design challenge by engaging the public and stakeholders throughout the design process. During the co-design process, a diverse group of experts in different realms were involved in the design development, including engineers, scientists, public agency representatives,

boaters, fishers, hunters and local residents and business owners all contributing their own knowledge of the landscape as well as unique, i.e., uncommon, perspectives. The project team used multiple engagement methods, including two map-based surveys and a non-map-based survey, iterative stakeholder-driven research by design, group and individual interviews, and two public meetings, including a webinar necessitated by COVID 19 restrictions on public gatherings.

Structured decision making (SDM) was used as a decision analysis tool to develop and evaluate performance criteria related to these multiple interests and concerns. The SDM approach was also used to guide and integrate technical design and engagement results during planning. Design and engagement results were integrated using a research by design [61] approach in which design concepts were iteratively refined and narrowed down through inclusive rounds of review by participants, including advisory and steering committee members. Refinements occurred primarily during in-person meetings with the steering and advisory committee. Public meetings provided another opportunity for broader public participation. Map-based surveys were the primary platform for public participation in the co-design process. Surveys were conducted at the start and finish of a second planning round, after initial comments from the public kickoff meeting were integrated.

The user survey, launched at the public project kickoff meeting, was intended to collect information on where and how people recreate in Franks Tract and identify areas of Franks Tract that were deemed to need improvement and where tidal marsh might optimally (or least detrimentally) be located within the shallow lake. After extensive research on map-based survey platforms we selected Maptionnaire, “an advanced example of PPGIS methodology enabling the mapping of environmental experiences, daily behaviour practices and localised knowledge and ideas for spatial development” [50]. See Appendix B for a link to the no longer active survey (Quantitative analysis was conducted in google sheets and Excel. Spatial analysis was conducted in ArcGIS Pro 2.6.1). We chose this platform, in part, because it allowed for intensive customization and data transferability across other software platforms, per our

specific needs. Asking demographic questions, informed by the previous feasibility survey, enabled an analysis of the relationship between demographic variables, such as age, income, area of residence, user category and perspectives. The maps created from this survey are crowdsourced and user-drawn rather than primarily authored, and composed or decided on by the consultant team (Figure 2.3). We also asked participants to rank concerns and state their perspective regarding climate change in relation to Franks Tract.

The project team used the information solicited from the second survey to revise design features, which were then presented and discussed in the following design charrettes and later publicly on the project website. During the design charrettes, steering and advisory committee members had another opportunity to modify the designs and ask questions.

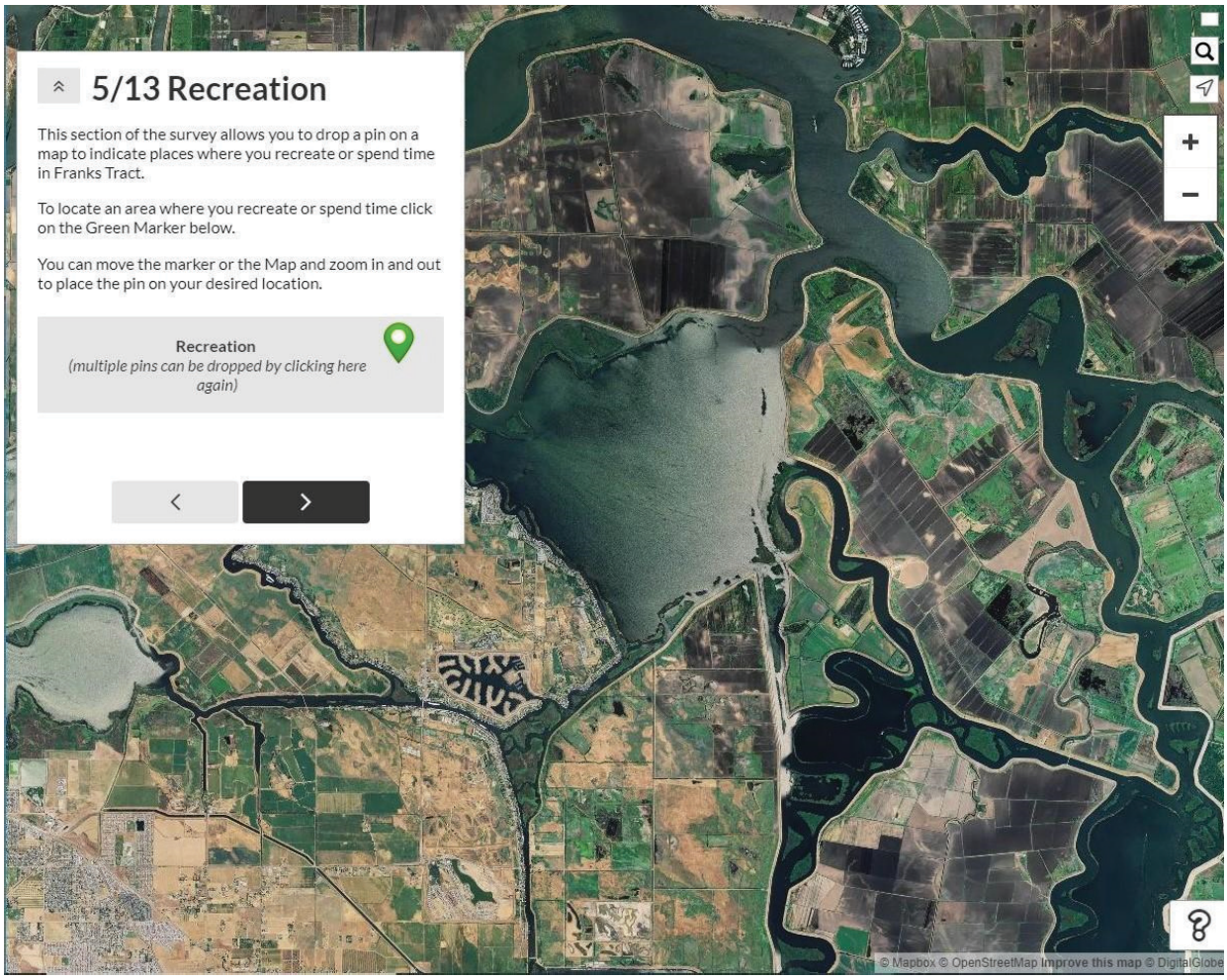


Figure 2.3. Image of the user survey interface.

Survey 3: Design Concept Survey

The design concept survey gathered feedback on three design concepts that were developed with input from the previous survey, and the FTF advisory and steering committees. Before taking this survey, we encouraged participants to attend or watch a recording of a live webinar (129 registrants), which presented all the design concepts and how they were developed.

We designed the design concept survey using an updated version of the same Maptionnaire platform for user familiarity. Photographs, rendered images, flyover videos (See Appendix D for links to concept flyover videos), and links to the previous survey results were embedded within the survey to provide project background and give a better sense of the proposed concepts. The survey was designed to allow participants to indicate what they like, didn't like and ask questions spatially.

After placing a like or dislike pin, follow-up questions related to location and access were asked in order to discern the reasons for liking or disliking a feature more clearly. A question pin could also be placed by participants to ask about a specific location or feature (Figure 2.4). The third survey also contained a final question where participants were asked to rank the design concepts and no action alternative. See Appendix C for a link to the defunct design concept survey. (3D models of the designs were created in Lumion 10 to produce animated flyovers. Detailed still renderings of site features-such as beaches, day use areas and waterfowl hunting ponds, were finessed in Adobe Photoshop CC 2019. Quantitative analysis was conducted in google sheets and Excel. Spatial analysis was conducted in ArcGIS Pro).

Figure 2.4. Image of the design concept survey interface.

Results

Survey 1. Feasibility Survey

Feasibility survey results provided a picture of participant demographics, the majority of which are older, local and identified as the boater or angler category (Figure 2.5). The majority of participants provided a local zip code of residence; however, participants were distributed across California as well as adjacent states. The presence of participants on Franks Tract is seasonally influenced and dependent on type of activity and affiliations, but overall is heavily used and recreated in year-round, with activity highest in the summer (Figure 6). Of note, approximately 45% of survey respondents (308 of 728) were firmly against the project, and preferred that Franks Tract be left as it is.

Extensive qualitative survey results captured the strong response to the initial state proposal map (Table 1) and a widespread desire for Franks Tract to be left alone (Table 2). Survey responses were coded inductively for themes and subthemes, although there were similar themes from the previous survey. The subthemes included in Tables 1 and 2 include major concerns that emerged through other modes of engagement.

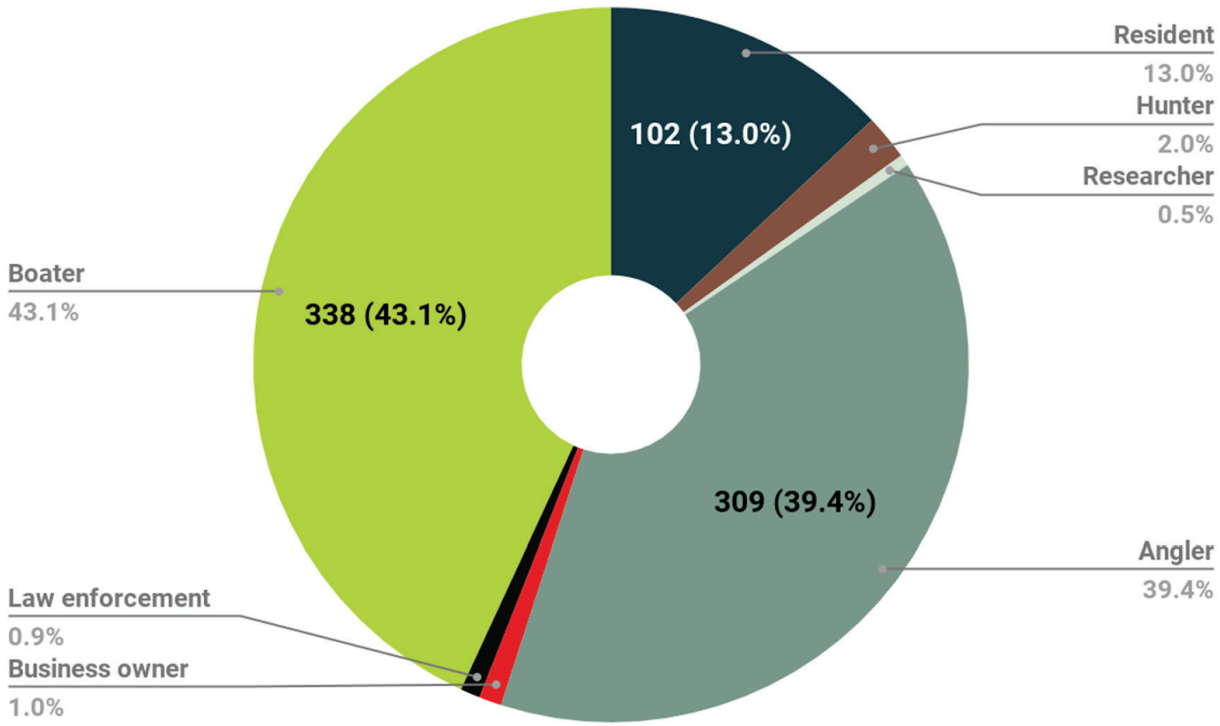


Figure 2.5. Which user category do you identify with most?

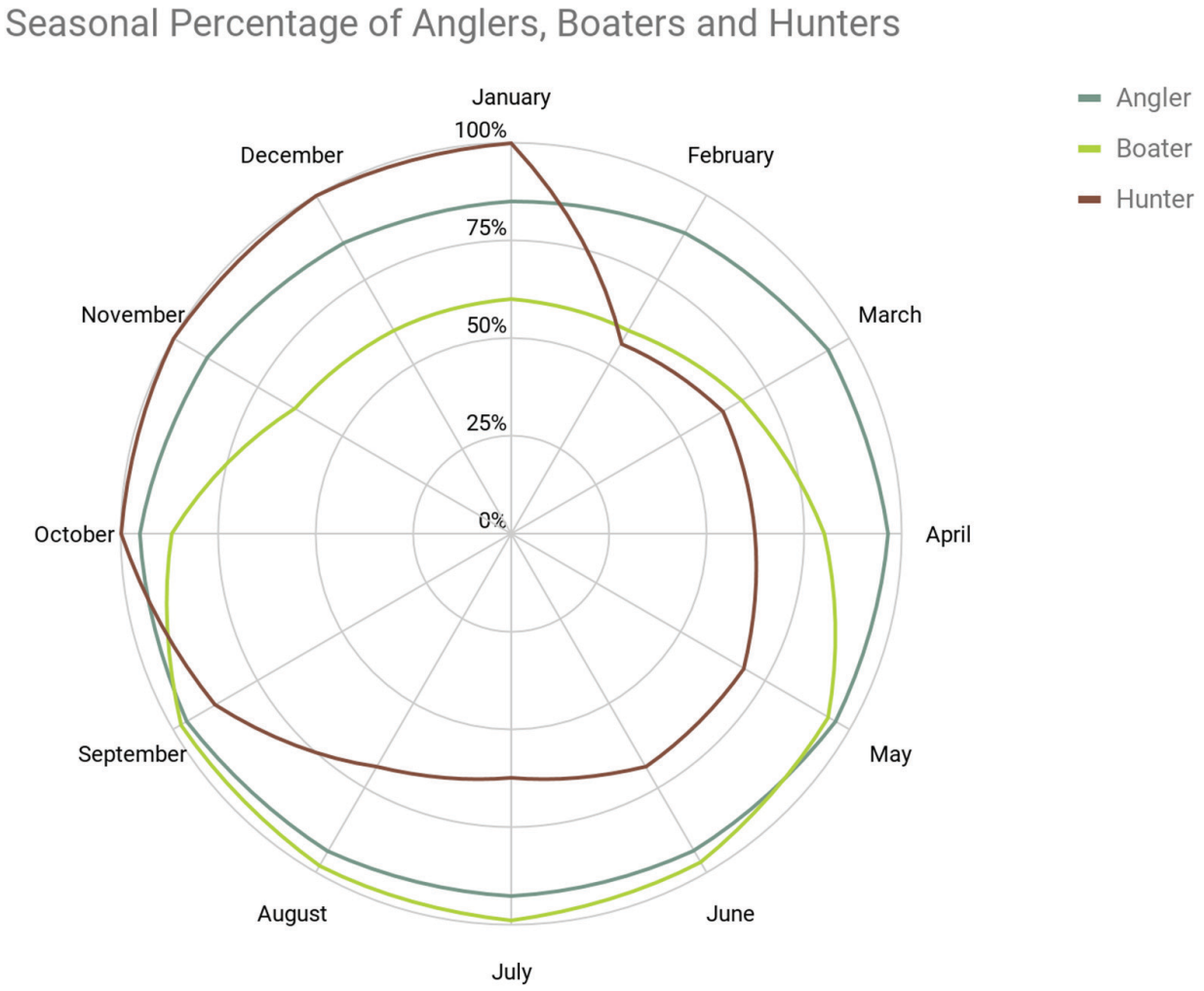


Figure 2.6. Calendar chart derived from categorized responses to the question: In what months are you out in Franks Tract or Little Franks Tract? Note October through November corresponds to the duck hunting season.

Table 1. Select sampling of state distrust/dissatisfaction survey responses.

Subtheme	Examples (from Multiple Respondents)
Water grab	We need protection from Southern California water grab schemes. The tract has been and should continue to be a natural water resource. Any plans to alter or convert the tract so that more water can be exported needs to be strongly resisted. We need to institute long term restrictions on any and all "PLANS" for development and/or conversion of Franks or Little Franks Tract for other uses than are currently in place.
Economic impacts	What's going to happen to the Bethel Island Marinas when you wall them off? Poker runs will no longer be stopping at Bethel Island and the bass fishing tournaments that go out from Russo's or Sugar Barge will dwindle down to none. The restaurants and marinas that will be walled off from Frank's Tract won't get the business anymore. Those businesses support Bethel Island and give people a reason to come out here and buy homes here. Our local businesses will be negatively impacted and our property values will be impacted.
Government inflicted harm	If Mother Nature plays a roll it will thrive... if the government keeps spraying an using pellets to kill off the grass it definitely does damage
Non-intervention	I can't believe you are considering filling in so much of a designated State Recreation Area, known throughout the U.S. as one of the primo bass fishing sites. Franks tract does not require a design or any management, save waterfowl blind placement. It should remain as it is and has been for my life. Little franks tract should be opened to waterfowl hunting, just like Franks tract. It is currently a wildlife sanctuary of some sort, all the signs are gone now. Please do not attempt to add islands or camping or anything else here. Some things are better left alone. These two very special places fit in that description. If the state can keep their hands out. I see mother nature reclaiming the area as a tidal marsh.

Table 2. Select sampling of "leave it alone" survey responses.

Subtheme	Examples (from Multiple Respondents)
Nature	leave it alone! It's natural nature! Leave it alone and let nature take care of itself like it has for the past 20 years. let nature take its course, leave it alone Don't change a running system-preserve a piece of nature as it is! Do not change the natural landscaping! I would suggest that these areas and others remain untouched by human hands!
Human intervention	Let nature take care of herself with out mans interference Leave it alone, except in cases of safety. Man tried to impound it before, nature took it back.
Design	Design? Manage?, Just leave it be. Design? Don't design it. Leave it alone but maintain boater access

Survey 2. User Survey

User survey results reassessed user demographics and types from the previous survey, and created new knowledge of geospatial use patterns in and around Franks Tract as well as divergent perspectives on Franks Tract's potential futures. See Table 3 for main geospatial takeaways and associated figures.

Table 3. Main geospatial takeaways

Main Geospatial Takeaways	Figure Number
Activities are diverse and occur throughout the Tract. Primary activities are boating and recreational fishing.	Figure 2.7.
The Tract is a major boating hub and includes highly tracked routes that leave and return from Bethel Island destinations and routes that traverse the Tract to and from locations outside the project bounds	Figure 2.8.
Public access was desired, especially along the shoreline	Figure 2.9.
Respondents indicated that many parts of the Tract need improvement	Figure 2.10.
Tidal marsh preferences appeared to overlap most in the Northeastern portion of the Tract, farthest away from Bethel Island homes and business	Figure 2.11.

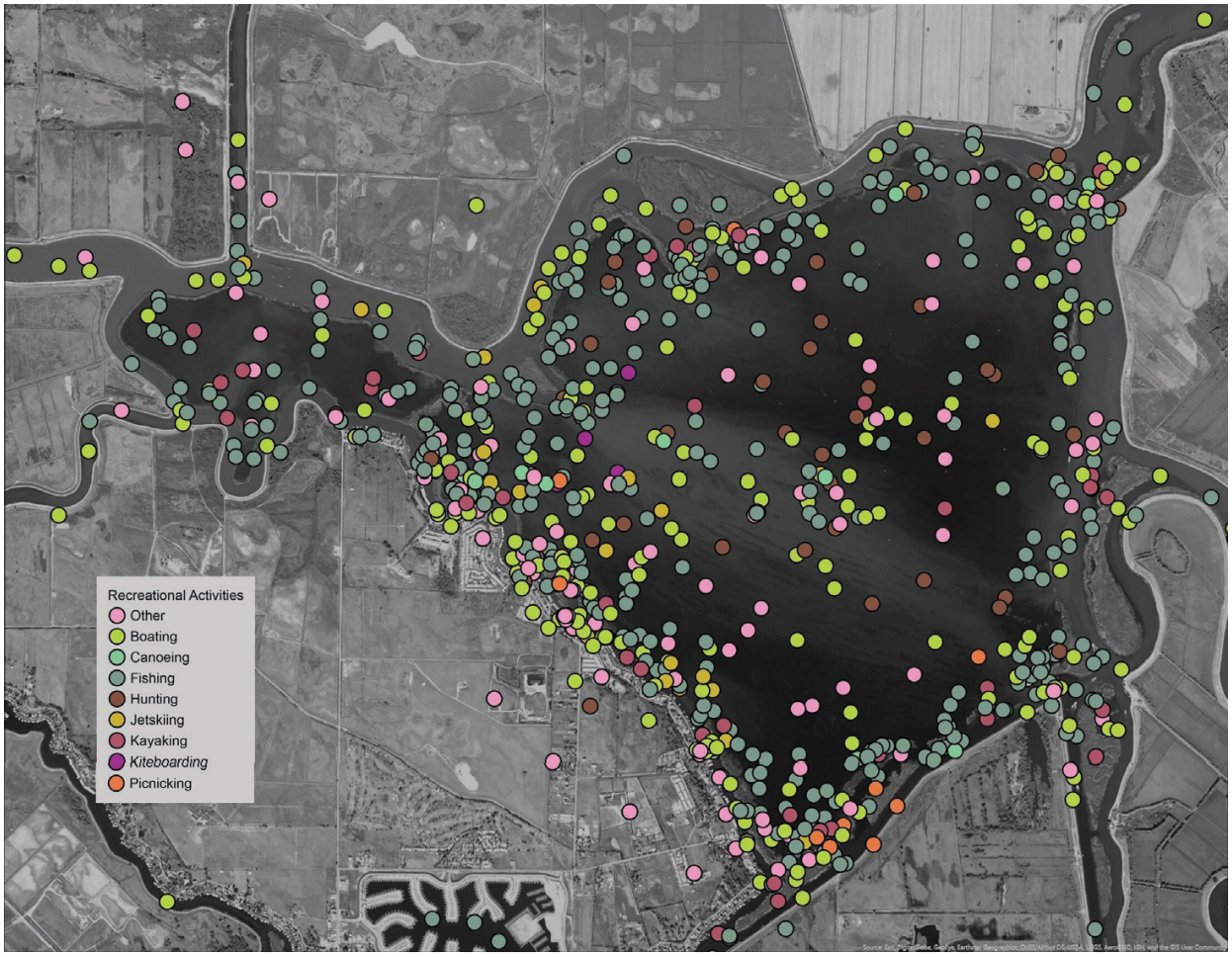


Figure 2.7. If tidal marsh areas are created in Franks Tract, where would they be best located? Where would they have the least detrimental impacts and greatest amenity value (such as new hunting opportunities, wildlife viewing, non-motorized boating, etc.) for how you and others use Franks Tract? How could tidal marsh be designed for recreational uses (I.e., hunting, fishing, kayaking, boating)?

The user survey had roughly the same demographic composition of participants as the feasibility survey. The user survey results related to activities and desires validated those of the feasibility survey and other methods of research and engagement while adding a spatial dimension that could more directly inform concept co-design.

The results from the public access-related questions both indicate (spatially) where public access is desired and allude to a tension between those who support greater public access (51.6%) and those who do not (48.4%). The relationship between distance from Franks Tract of participant's zip code and their public access perspectives proved statistically insignificant. However, a tension between locals and visitors became evident in later design charrettes, primarily related to the impact of new, free public access on existing businesses on Bethel Island that charge for access.

Results indicate the persistence of concerns related to the site and smell of tidal marsh that were raised in the initial feasibility study. Desired locations tended to be located in the Northeast of Franks Tract furthest away from the waterfront residence and business on Bethel Island, as well as in Little Franks Tract.

The map-based questions' results were directly integrated into the iterative concept design process, particularly the siting of public access, the preservation of highly trafficked boating routes, and the general preference for marsh placement in the North and Northeastern portion of Franks Tract. The geospatial data was analyzed in ArcGIS Pro and the preliminary results were presented in the August advisory and steering committee meeting before the design charrette. By overlaying the results on top of each other as semitransparent layers, a strong correlation showed up in terms of improvement areas (Figure 2.11) and preferred marshland best locations (Figure 2.12).

Figure 2.8. Tidal marsh survey responses superimposed on preferred alternative.

The visualizations of the first survey sparked conversation of meeting participants, allowing for more thinking on the pros and cons of proposed marshland configurations. The geospatial result was compared with other sources of spatially explicit knowledge that was co-produced during design charrettes and stakeholder interviews, and was also made available to the public through an online interactive map hosted on the project website. These maps allowed users to explore both the spatial data (points, lines, and polygons) and the associated qualitative data (map-based comments). Sharing the data in this way increased transparency and trust building, which is a critical factor in engendering equitable PPGIS approaches [50].

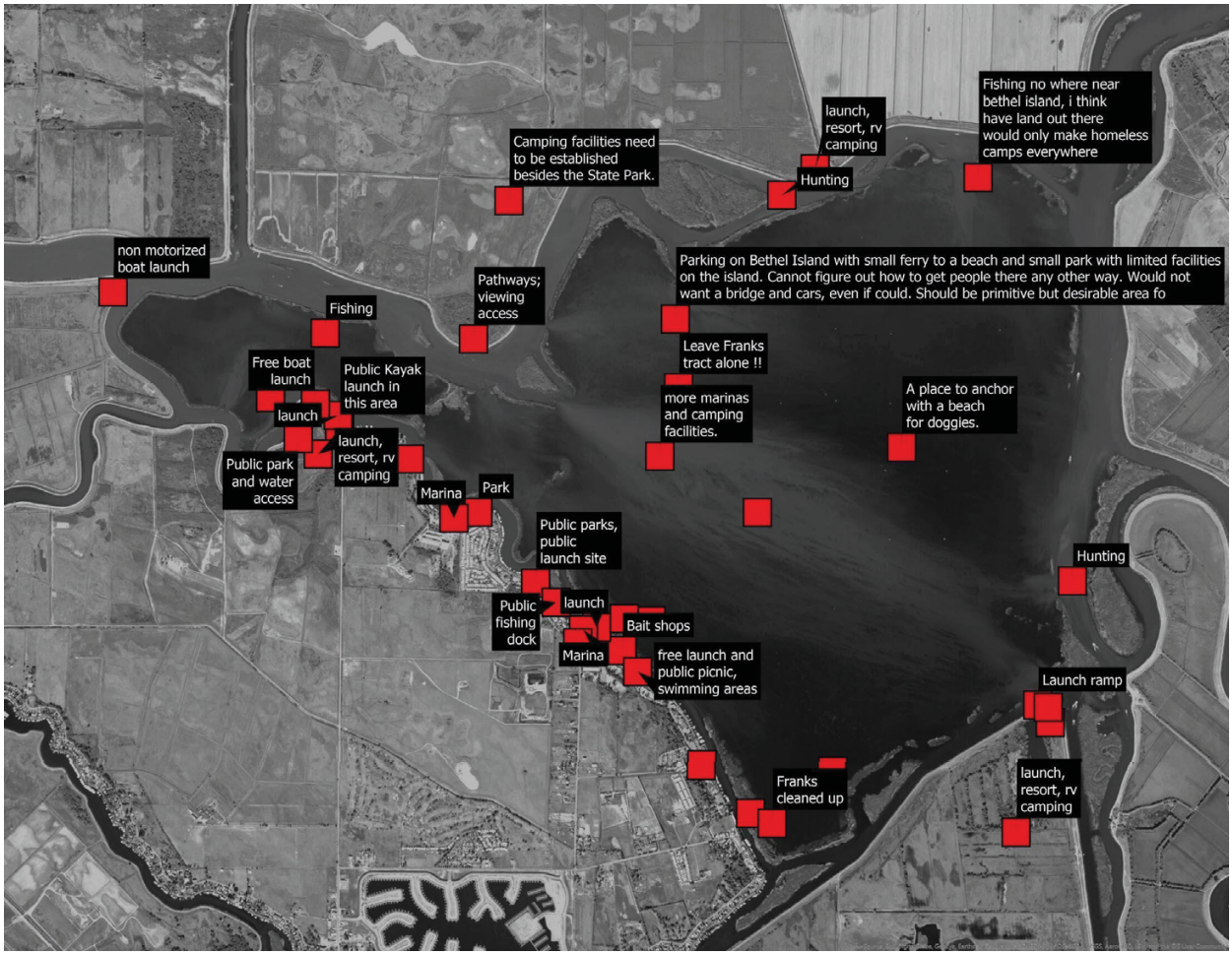


Figure 2.9. Where do you recreate and what activities do you do at this location? Results indicate the diversity of recreational uses and their use patterns across Franks Tract. Fishing appears to be most common along the vegetated remnant levees, which was validated in conversations with local anglers.

Figure 2.10. What are your regular boating routes across and within Franks Tract? Results indicate that Franks Tract is a major boating hub for both trips within Franks Tract as well navigation in the greater region. Results also reveal distinct traffic flow patterns across and within Franks Tract itself.

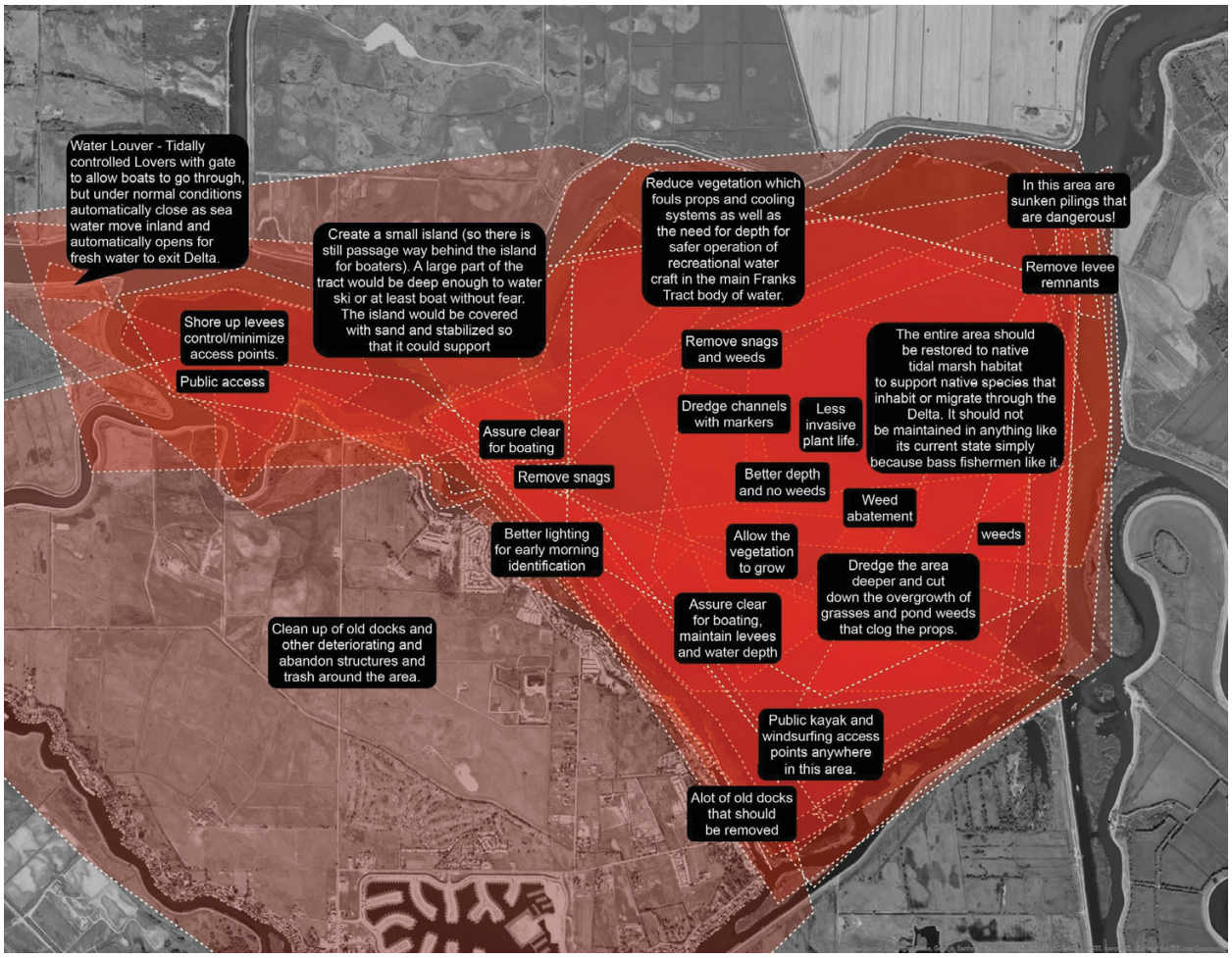


Figure 2.11. Where are desired sites for public access? What would you like to see? Results indicate that public access points are desired throughout Franks Tract, especially on the Bethel Island shoreline on Franks Tract's West side. Common types of access included non-motorized and motorized launch sites as well as general public access to the water, which is non-existent currently. Contradictory opinions were presented at a later design workshop by Bethel Island residents and business owners.

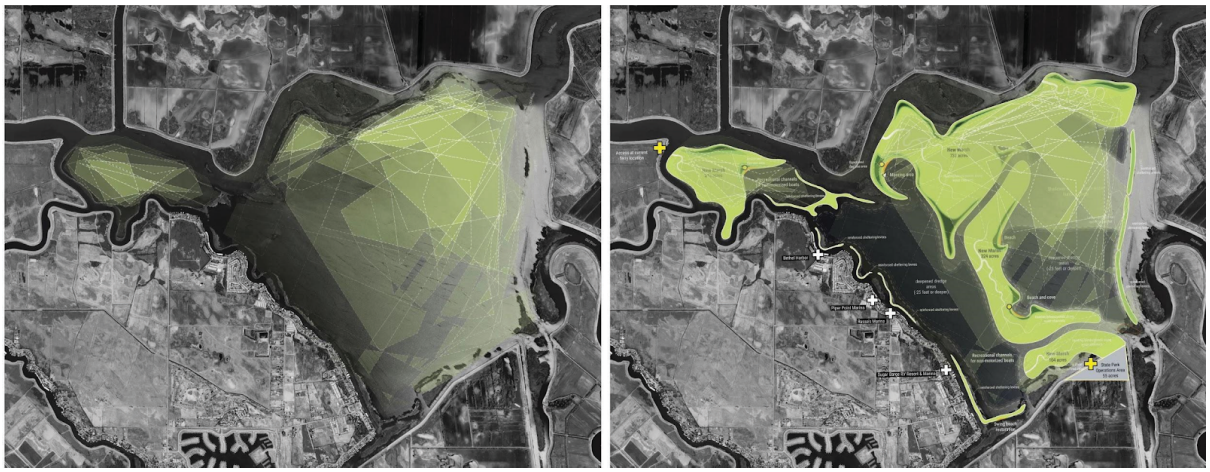


Figure 2.12. Where are the areas in Franks Tract that most need improvement? What improvements can be made? Results identify many types of desired improvement throughout Franks Tract, with some comments in opposition. Common improvements include addressing boating hazards (which includes removal of weeds, snags, submerged levee remnants and deepening of shallow areas).

Survey 3. Concept Design Survey

Concept design survey results include substantial and detailed consideration (likes and dislikes) of the design concepts. This result alone represents a significant change from the feasibility survey, where nearly all the comments on the plan were negative. Participants still voiced similar concerns as those collected in the feasibility survey. However, there were also new concerns and detailed design questions (such as placement of features, the design of tidal marsh to optimize recreational and ecological benefits) that indicate an investment in a future for Franks Tract other than the continuation of a status quo.

The above figure (Figure 2.13) represents the average comparative ranking for each concept scenario, with 4 corresponding to the lowest ranking and 1 corresponding to the highest on average the Design Concept B (Central landmass) was the highest ranked (2.35). The NAA (No Action Alternative) was the lowest-ranked (2.66), but only by a small margin with Design Concept A (2.60). (Open water berm and channel) only closely ahead, and Design Concept C (Eastern Landmass) slightly more preferred (2.49).

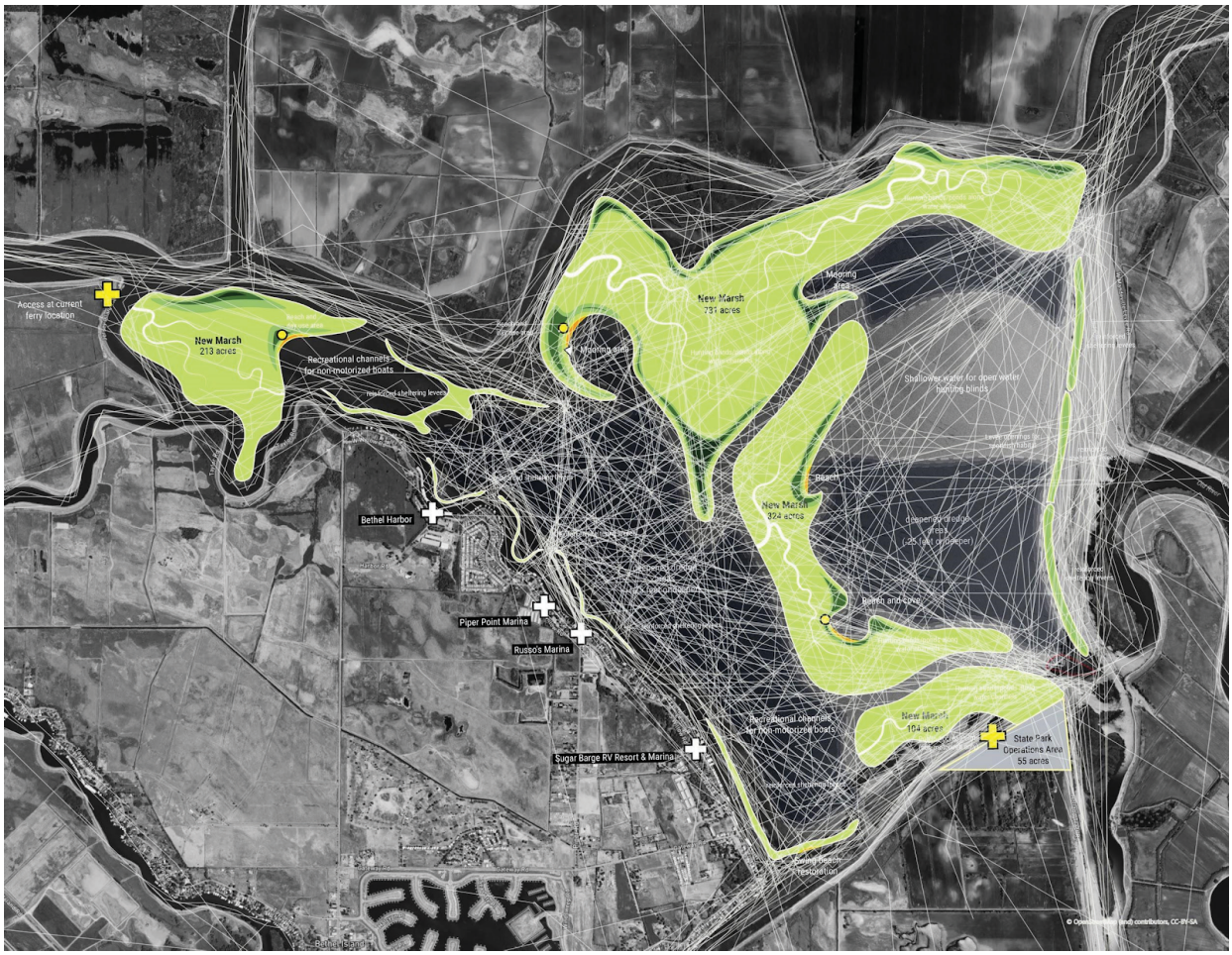


Figure 2.13. Boating route survey responses (white lines) superimposed on the preferred alternative.

What is notable in the design concept survey is that there was, on average, similar support across the NAA and the design concepts (Figure 2.14). Such similarity implies that there was considerably more 'most preferred' voting for the design concepts (collectively) than for the NAA. Specifically, although 36 (39%) respondents chose the NAA as their most preferred option over two times as many (75) selected at least one of the three design concepts as their most preferred, suggesting significantly higher preferences overall for the design concepts over a NAA.

Supportive comments for the NAA focused on unique features such as open water, spawning areas, fishing, hunting, good flows and access. Some respondents were concerned that these features might be lost or diminished if a project were implemented.

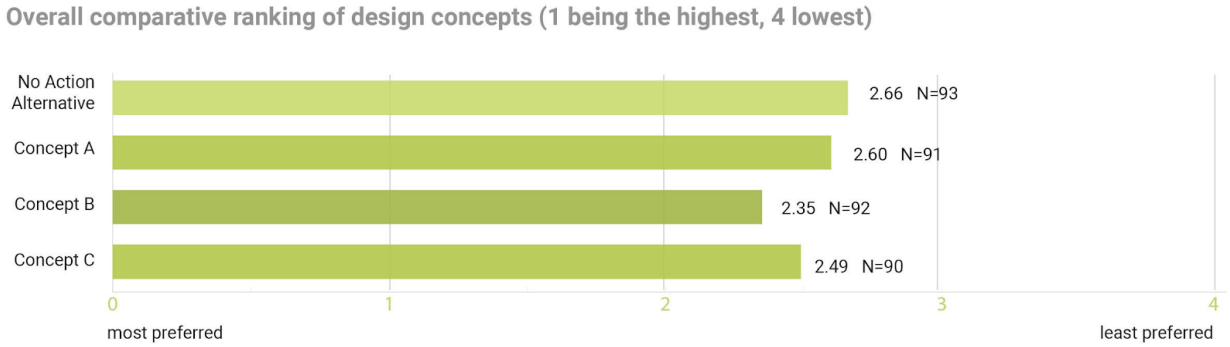
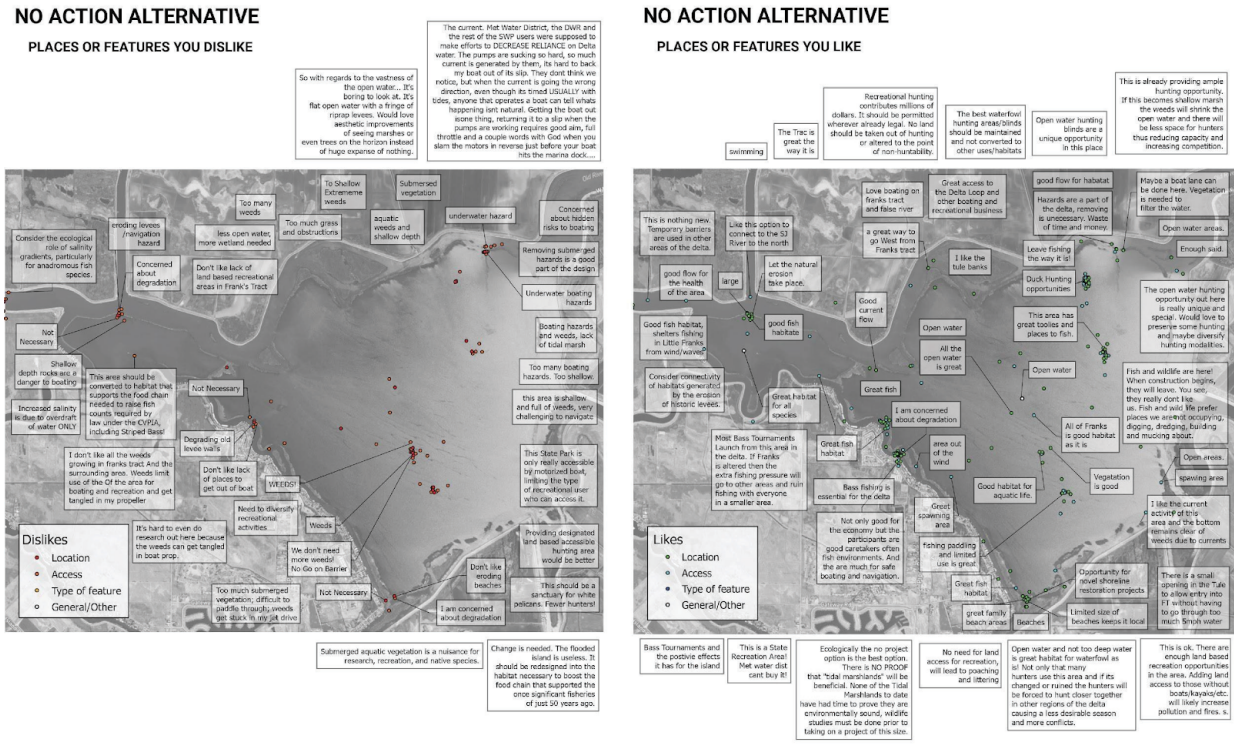


Figure 2.14. Overall comparative ranking of design concepts.

However, there were also supportive comments regarding potential modifications with the design concepts that could enhance these unique existing features, address current concerns and create new opportunities based on improved navigability, additional features and the general diversification of Franks Tract (Figure 2.15).



(**a**) (**b**)

Figure 2.15. No Action Alternative (NAA) community comments. (**a**) Places or features you dislike for NAA (**b**) Places or features you like for NAA.

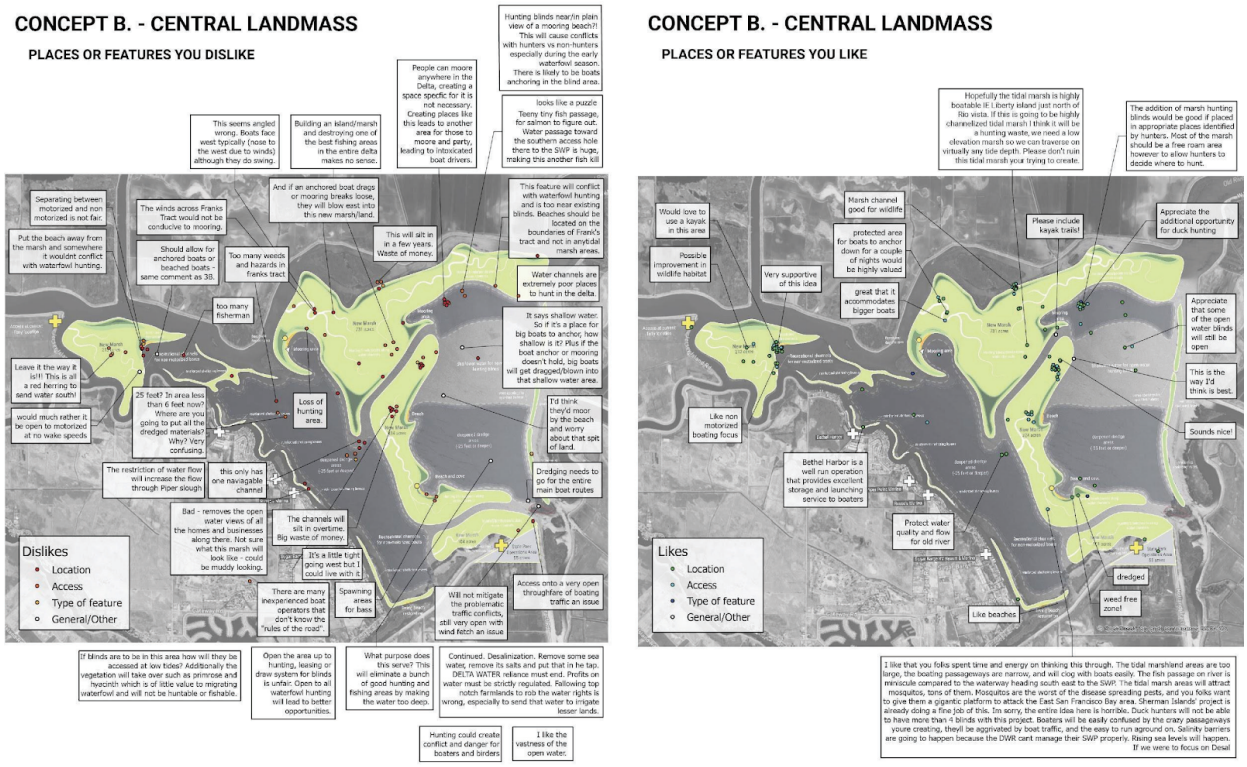
Beaches were a common liked feature across the design concepts. However, there were concerns voiced about their proximity to hunting areas and their potential to become too popular and thus an attractive nuisance. There was a recurrent concern voiced regarding the channel widths and navigability in the design concepts. Comments to this effect included potential problems with inexperienced boaters, the narrowness of the channels and the hazard created by adjacent tidal marsh. There were also concerns that channels would silt in.

In general, there was widespread support for the proposed modifications to Little Franks Tract (which were the same across all design concepts). There were concerns raised about the potential exclusion of

motorized boats in the area. Some thought this unfair, while others questioned the accessibility of the area for non-motorized boaters. Others were supportive of the idea of a portion of Franks Tract in which motorized boats are excluded.

There were many comments across all concepts related to hunting. Several voiced concerns about the potential eradication of existing hunting opportunities, where others appeared supportive of new marsh-based hunting opportunities, often contingent upon the resolution of access issues, and the inclusion of hunter preferences in the marsh habitat design. There were also concerns about the potential conflict between hunting and other recreational activities, especially where hunting and recreational features might be nearby.

Comments diverged regarding the benefits of creating marshlands and dividing Franks Tract into two separate water bodies (Figure 2.16). While many supported the idea based on improved navigability, habitat, and recreation, others were concerned about navigation, local businesses, aesthetics and existing recreational opportunities. Participants commented on mosquitoes and the marsh smell, which had come up in previous surveys and elsewhere in the process.



(**a**) (**b**)

Figure 2.16. Concept B (the preferred concept)-Central Landmass community comments. (**a**) Places or features you dislike for Concept B (**b**) Places or features you like for Concept B.

As with the second user survey, geospatial results were shared with the public through an online interactive map hosted on the project website. Ranking results were also included. These results were shared shortly after the release of the final report, and although they were not integrated into the final designs, they are now available to the public and other stakeholders and can be used to inform future design development.

Discussion

The approximate demographic makeup of survey participants was consistent and similar across all three surveys (Figure 2.17). The majority of the participants were local, and most participants categorized themselves as boaters or anglers, which we understand to be the most prevalent Tract activities.

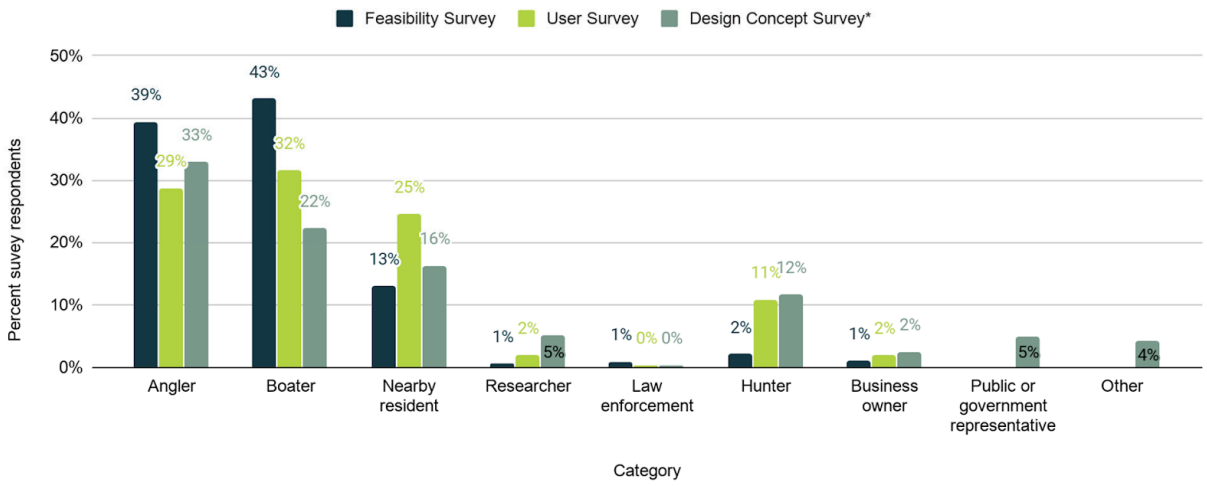


Figure 2.17. Comparing participant categories across surveys.

These surveys were some of our primary means of co-creating knowledge with a very broad public, and were combined with public and stakeholder meetings, design workshops, social media and other forms of stakeholder engagement. Echoing Kahila-Tani et al., these map-based surveys [50] were an important tool for the deliberative phase of a sensitive and complex planning project. Making the collected data visible allows for and catalyzes collective analysis and debate, during which for all involved, planners and the public alike, assumptions can be questioned, and perceptions can shift.

To our knowledge, no prior survey has been performed targeting those who live, work and play in and around Franks Tract. What little information exists from past surveys indicates that those who responded to our survey are quantitatively distinct from the average Delta recreationalist. Past engagement with Franks Tract users indicates a concern with safety, conservation, and recreation that resonates with the concerns of our survey respondents [10,58]. Our response numbers were substantial compared to other surveys conducted in the region. Whereas past surveys focused on regional boating and recreation [62–64], ours were more geographically specific and sought to identify broader use trends as well as perspectives related to landscape change.

We recognize we have no way of knowing whether we surveyed a representative sample of those who live, work or play in Franks Tract currently or may be inclined to do so in the future. We used an aggressive, multi-pronged approach to dissemination that included local and regional canvassing, social and conventional media, duck hunting forums and direct emails to hunting permit holders. Yet based on comments on social media and responses to the draft report, there remained some people who are unaware of the project or its particulars. Additional follow-up approaches to reach these people were not attempted due to time, limited financial resources and COVID-19 restrictions on attempting in-person survey methods.

Given our dissemination approach, we cannot discern a response rate. However, we did see decreasing participation numbers from survey 1 through survey 3. This decrease could be attributed to a variety of factors, including the length of time the surveys were open, which also decreased from survey 1 through survey 3, as well as accessibility associated with the map-based surveys (2,3). We also note the possibility that the decrease in participation could also be attributed to increased acceptance, or at least decreased outrage about the design of the project.

Looking across the sequence of surveys, we can observe a measurable shift in perspective away from a no-action alternative. The first survey unintentionally captured initial reactions to a remarkably unpopular State plan prepared without public input. When asked, “Are there any suggestions you have for the future design and management of Franks Tract/Little Franks Tract?” roughly 45% of participants responded that Franks Tract should be left alone. The second survey was launched at the beginning of a new round of public engagement and co-design. When asked, “What are your other concerns related to Franks Tract?” approximately 40% either expressed concern with a potential project or a desire for Franks Tract to be kept or left as it is. However, this survey also revealed more diversity in user opinions, as revealed when asked how Franks Tract could be improved or modified according to their desires, which resulted in a wide range of suggestions, some common and some not, and dissatisfaction with the status quo. The third survey asked participants to rank three design concepts and the NAA. Results showed nearly equal support across both the design concepts as well as the NAA. Though it is difficult to empirically draw firm conclusions from the surveys regarding increased acceptance of the project’s ecological and water quality goals specifically, comments at project meetings and project presentations with stakeholders, the public and the advisory committee highly support this conclusion as being expressed in the final survey responses. Specific to ecological goals, as these were expanded beyond the state’s initial focus on Delta Smelt to a broader and equal support for additional threatened species (with commercial value) and sport fish, as well as upland species, like waterfowl for hunting, ecological goals gained more acceptance.

While the three surveys empirically showed demonstrable shifts in attitudes and movement towards proactive design interventions for Franks Tract (in contrast to the NAA) what we also consistently read across the surveys was ontological diversity-a plurality of realities and notions of what Franks Tract currently is to various persons and constituencies. Those plural views configured themselves around proposed changes to the landscape. There remains a strongly voiced contingency that rejects any intervention on multiple grounds, ranging from the conspiratorial who see a “water grab”, whereby

Delta exporters are seeking to take more water (through the improved water quality the project would provide), to the skeptics who want examples of similar successful projects before they can support a project in the place they love. There remains a contingency that sees Franks Tract as Nature and intervention as hubristic and doomed to fail.

There were certain features that were identified in the user survey and design charrettes that prompted considerable design effort, with input from the advisory committee members and technical support from project team members. One example is a particularly dangerous blind corner located in the Southeast corner of Franks Tract, where multiple navigation routes intersect and wave and wind action are prevalent. The results from the concept design survey indicate recognition of efforts to make this corner safer as well as unresolved issues. We bring this up as an example of the benefits of and need for sustained and iterative co-design as well as the importance of humility. Rather than seeing persistent concern as a failure, we embrace it as an indication of engagement.

There appears to be a growing contingency that sees the FTF project as a way to advance or enhance their interests, or at the least, arrest an undesirable decline. We see in the growth of this contingency evidence of what Seijger et al. refer to as the affective and informal "soft implementation" related to shifting prospects for change that precedes the "hard implementation" of more formal and detailed project plans [65]. If our observation is correct, this in itself would constitute a success based on the objectives and expectations for the planning process.

We feel it is important to emphasize that the learning and knowledge creation involved in this "soft implementation" was in no way exclusive to the public. The placement of the surveys throughout the planning process exemplify different approaches to knowledge mobilization that provide lessons for the project team and the agencies involved. The flaws of the feasibility study were clear in the results of the feasibility survey and provided the impetus for the more participatory approach of the user survey. The

design concept survey reaffirmed a commitment to co-design and the results validate its efficacy. Each survey alone would have had limited influence. However, cumulatively the surveys created, mobilized and applied knowledge, in what we hope will continue to be an iterative cycle of reflexive co-design.

In this way, the sequence of surveys informed and contributed to an iterative co-design process. Although the surveys were not the only means of collecting information that informed the design, they were the most inclusive of a broader stakeholder public. Additional information was solicited from an advisory and stakeholder committee and consultation with biologists, recreation consultants, economists, engineers and hydrologic modelers. In line with Brown and others, we recognize these methods of engagement as critical irrespective of the PPGIS [45].

Conclusions

In their review of two decades of PPGIS application, Brown et al. argue that "the mapping of place values will need to become more than a spatial technology enhancement to public participation, but a political force that can compete against powerful interests that currently dominate land-use decision processes at multiple levels of government [47].

Our role in the Franks Tract project was to use co-design research methods to inform multi-value project design in a complex and contentious park landscape. We employed softGIS surveys to bridge identified gaps, related primarily to ease of use and accessibility, between many research-oriented PPGIS methodologies and the practices of meaningful participatory planning [51]. SoftGIS supported the iterative creation of relatively inexpensive surveys by members of the planning team as well as the creation of online visualization tools.

The surveys and co-mapping techniques deployed in the FTF project provided tangible, co-generated representations of Franks Tract as a contested boundary object. It did so within a larger, multi-faceted co-design process (that included meetings, design workshops, structured decision making techniques, iterative design development and modeling, etc.) that allowed for the consultant team and all involved to perform the needed work of "bridging boundaries between groups of people with differing views of what constitutes reliable or useful knowledge in a co-design process" [18,22].

Rather than suppress diverse conceptions of what Franks Tract is, ways it is inhabited, and what it may become, we sought to find ways that those realities and virtual desires could co-exist in new design configurations. The map-based surveys were strategically timed within the design process, generating spatially explicit public feedback when it was most influential and usable. These surveys co-created knowledge about what Franks Tract is becoming and could become without design intervention and

provided space for more qualitative descriptions of preference and desires, informing and being informed by categorical and spatial responses. This feedback was incorporated with input from advisor and steering committee members and technical experts into a structured decision-making framework. The concept designs that emerged sought to integrate these shared understandings in the form of desired design features.

Yet despite structured decision-making efforts to include these understandings and transparently address conflict and tradeoff, there remains some skepticism of the designs based on different understandings of what the landscape fundamentally is and how it should be used and inhabited. Rather than seeing the persistence of ontological differences or understandings not held in common (i.e., uncommons) as a failure, we recognize their inevitability in such complex and contentious planning processes. Furthermore, we advocate for the inclusion of the uncommons in this and other consensus-building processes, and exploring the degree to which the spatio-physical design of the landscape can embody and facilitate this diversity.

Questions of representation associated with survey sampling remain. Our non-probability sampling methods, which included convenience, purposive and snowball, were required based on our judgment, due to an unknown and sometimes hard to reach population. While our surveys had a diversity of participants, we cannot know whether these participants represent the diversity and distribution of those who live, work and play in Franks Tract currently or may in the future. This issue will likely occur in other applied project-based planning research.

Based on our study results (and above caveats) we conclude that the potential for a co-designed, multi-value design concept for Franks Tract that can preserve and enhance existing desirable features, while also emplacing new values, is “feasible”, and becoming more widely embraced by stakeholders [66]. For this reason, we see the combination of map-based surveys and structured decision making as a

viable approach for the co-design of multi-value landscapes, including parks and protected areas.

The FTF futures effort was a conceptual feasibility study, though a very thorough and detailed one at that. To move forward, state agencies will have to build support for the design concept and find ways to fund construction and long-term maintenance for a massive, unique type of eco-social-techno infrastructure. Also, like other feasibility and landscape planning efforts, additional rounds of more detailed planning and design will need to happen if the project does garner widespread support. How this will all be approached and whether or not there will be fidelity to the final FTF report, remains to be seen. Will all the recreational features carry through? Will long term Park maintenance remain a priority? The indeterminacy of what will happen leaves us with many questions about how co-design processes and the trust, knowledge and understanding they build can be sustained beyond conception through construction and long-term stewardship.

Author Contributions: B.M. and A.K.-P. contributed to conceptualization and methodology; A.K.-P., B.M., Y.H. contributed to formal analysis, Investigation, and writing original draft preparation; B.M. contributed to resources, supervision, project administration, funding acquisition; B.M. and A.K.-P. contributed to data curation; B.M., A.K.-P., Y.H. contributed to writing, review & editing; B.M., A.K.-P., Y.H. contributed to visualization. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

The survey appendix from the initial feasibility study can be accessed here: https://ucdavis.box.com/s/wexg2o6atl8jd6iknbbkmq3wzua244s.

Appendix B

The no longer active user survey (survey 2.) can be found here: https://app.maptionnaire.com/en/ 6547/.

Appendix C

The no longer active design concept survey (survey 3.) can be found here: https://new.maptionnaire.com/q/62k27e2783g6.

Appendix D

Concept A flyover: https://youtu.be/DEEQ9Xh0amU; Concept B flyover: https://youtu.be/T6h9FxsRFVg; Concept C flyover: https://youtu.be/xJQi7AMSQCQ.

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Chapter 3. Map-based survey affects: a critical SoftGIS case study from the Sacramento-San Joaquin Delta of California

Abstract

SoftGIS refers to a collection of web-based survey methods, tools, and foundational concepts and theories that connect planning practices with everyday life experiences (Kyttä & Kahila, 2011). While SoftGIS proponents celebrate subjective experiential qualities, there appears to be no direct engagement in the literature on how the media of the survey tool itself may affect responses and the corresponding power of planners and researchers who use the tool. Our case study from California's Sacramento-San Joaquin Delta investigates the role of Maptionnaire, the leading commercialized SoftGIS survey platform, in providing a framework to support long-term planning that constructs alternative future scenarios from the complexity of local experiential knowledge. Our objective is to understand how Maptionnaire affected survey responses, in this case, intending to see what might apply to participatory landscape planning and co-design more generally. Acknowledging the affective role of the survey, we recommend that planners and co-designers use softGIS with the specific affordances and limitations of the interface and the technology in mind. Exploring the role of the survey brought us greater awareness of mediation, aesthetics, and translation as aspects of co-design and situated creative knowledge-making.

Introduction

Despite tremendous efforts, participatory planning and co-design remains plagued by problems translating the desires of diverse publics into transformed places and spaces. While a full investigation of these problems is beyond the scope of this paper, I will investigate specific affordances and limitations of a map-based survey tool designed to support participatory planning. Participatory processes produce knowledge with varying degrees of influence on project outcomes. Our article directly addresses how power pervades knowledge (co)production, i.e., "what" in addition to potential influence, i.e., "whether."

Here “what” and “whether” are not independent. Rather, they are seen as representing distinct but connected moments in the participatory process that must be subject to equal research when assessing a participatory planning process's overall efficacy and equity.

The article begins with a background on a method called softGIS and a related map-based survey tool called Maptionnaire, which researchers and planners use to bring the everyday life experiences of affected communities into the planning process. I will provide the initial sketchings of a critical softGIS framework drawing from feminist GIS and media ecology as part of this background. Subsequently, I will outline a methodology consisting of constructing and then applying a critical softGIS evaluation apparatus to our case study, post facto. A discussion of several novel challenges that emerged from the application of our evaluation apparatus will be followed by a conclusion exploring specific takeaways for both theorists and practitioners.

Background

The emergence and expanding application of SoftGIS

SoftGIS, a variant of the more prominent method of Public Participation GIS (PPGIS), focuses on place-based “soft” experiential knowledge that is qualitative and subjective and can complement expert data (i.e., “hard” knowledge) to inform equitable and accountable planning decisions (Babelon et al., 2017; Brown & Kyttä, 2014; Rantanen & Kahila, 2009). Researchers and planners use the applied method of PPGIS to identify spatial information related to values, preferences, qualities, and experiences for planning and decision support (Brown & Kyttä, 2014). In their review of key issues and research priorities for PPGIS, Brown and Kyttä argue that a primary goal of PPGIS is to engage people in landscape planning and decision-making that will directly affect their lives (2014). The authors describe an idealistic vision of PPGIS in which “the systemic knowledge of planners and the direct personal

experience of the lay public would come together through mutual learning and interpersonal dialog about the features and future of place" (2014). While this idealistic potential for PPGIS may not be fully realized, as a method, PPGIS is growing in its variants, applications, and general acceptance (Brown & Kyttä, 2014).

SoftGIS refers to a collection of web-based survey methods and tools and foundational concepts and theories that connect planning practices with people's everyday life experiences (Kyttä & Kahila, 2011). The soft knowledge that SoftGIS collects is, according to Heli Rantanen and Maarit Kahila, "based on residents' personal experiences of their living environment, and it thereby forms a special place-based layer of memories, meanings and values" (2009). Participants provide soft knowledge with consent and in connection to a particular project, made explicit by planners and researchers employing the methodology, and can be used in addition to other layers of information in evidence-based planning (Kyttä et al., 2013).

SoftGIS is one of many virtual approaches that aim to support the intentional coevolution of people and landscapes by linking how people experience the landscape with planning for landscape transformation. As climate chaos renders well-known landscapes unrecognizable, softGIS' spatialized experiential knowledge could assist in the generation of new cultural landscapes in the ruins of the old. As mitigation and adaptation efforts expand, practitioners and communities could use softGIS to bring attention to their affective dimensions, perhaps through an evolution in the environmental impact study (EIS) process, which has mainly been the domain of experts.[23]

Coined by researchers at Aalto University in Finland in the early 2000s, SoftGIS was informed by urban planners and their use of paper maps and sticky notes as an in-person facilitation tool (De Vidovich, 2018). SoftGIS allows planners and designers to construct easy-to-use web-based surveys to ask users to map their activities and preferences for siting and quality of landscape features, access points, and

[23] The Dutch firm Royal HaskoningDHV is developing an entirely virtual EIR that would replace current paper versions: https://www.royalhaskoningdhv.com/en-gb/specials/digital-eis.

recreational amenities. Researchers and planners have also used SoftGIS for planning evaluation focused on users' or inhabitants' points of view (Kyttä, 2011; Rantanen & Kahila, 2009).

The theoretical background of softGIS lies in humanistic geography, environmental psychology, and communicative urban planning (Kahila & Kyttä, 2009). Here 'humanistic geography' emphasizes the experience, awareness, and knowledge of individuals and their conditions while attending to the places where they are embedded and interacting (Rantanen & Kahila, 2009). In this way, softGIS orients towards a "new wave" of humanistic geography concerned with the relationships between the material and the social, which are not seen as separated.

SoftGIS draws from the transactive framework of environmental psychology, where people's relationship to the environment is dynamic, interactive, and non-dualistic (Kyttä, 2003). From this framework, softGIS researchers use the concept of affordance to describe a relational conception of suitability that depends on both the environment and the intentions and capabilities of the observer or inhabitants ((Gibson, 1979; Heft, 2001; Rantanen & Kahila, 2009)). Together environmental qualities and human capabilities and intentions can create "emotional, social and socio-cultural opportunities and restrictions" (Gibson, 1979; Heft, 2001; Rantanen & Kahila, 2009). In theory, awareness of affordance can support planning and designing that recognizes that what a landscapes offers people is tempered by who those people are.

SoftGIS developed from the communicative or collaborative turn in urban planning (Innes, 1998; Kahila & Kyttä, n.d., 2009; Rantanen & Kahila, 2009; Staffans et al., 2020). SoftGIS facilitates the Habermasian "flow of communicative actions" central to communicative planning (Staffans et al., 2020), providing information beyond the "objective" but in the same spatial medium. The "objective" often includes quantitative data such as transit routes and traffic patterns in the urban planning context but may also include biophysical or infrastructural processes. The softGIS approach assumes that communication

between planners and the public benefits from the experiential knowledge of how the planned (and unplanned) affect people in their everyday life and how everyday life can affect planning and design.

While there is a broad theoretical basis for softGIS, primary proponents openly admit that "serious development of the methods and their theoretical basis is needed" (Kahila & Kyttä, 2009). In their foundational chapter, *SoftGIS as a Bridge-Builder in Collaborative Urban Planning,* Maarit Kahila and Marketta Kyttä identify several particular spaces for development, including visualization, analysis, and assimilation into planning processes (Kahila & Kyttä, 2009). Underlying technical concerns are complex moral questions, such as those raised by (Kyttä et al., 2013) et al. in their case study of urban densification in Helsinki, regarding what information planners provide to survey participants and how it is conveyed (Kyttä et al., 2013). Their case study illuminates the moral dilemma related to the information asymmetry between planners and participants. According to the researchers, this dilemma was addressed using "neutral terms" and conducting the survey in an early phase of the planning process before developing initial plans.

This article actively investigates the neutrality of soft GIS surveys, even when deployed early in the planning process.[24] We will also question the duality between 'hard' objective knowledge and 'soft' subjective knowledge within a planning context where attributions to the latter often remain inferior and less powerful. In line with several key PPGIS and softGIS thinkers, we see this as one of several constraints on the practical and equitable implementation of softGIS, which resist deep democratic planning that is place-based and people-centered (Brown, 2012; Brown & Kyttä, 2014; Rantanen & Kahila, 2009). Dominant cultural, political, and economic systems maintain these constraints through legal and regulatory processes that elevate expert knowledge and demote the lay and local.

[24] While much emphasis has been placed on using PPGIS early in the planning process, softGIS proponents, such as Maarit Kahila argue that it can be used throughout the lifecycle of planning. Ian Babelon notes in his thesis how how a lifecycle approach applies both within and across projects, for example in central Helsinki where the data collected for one project became part of the urban data available to inform other projects in the area (2021).

Efforts by planners and designers to shift the balance of power show the promise and peril of Antitiroiko's "facilitated integration of citizen input into democratic planning system" (2021). We see SoftGIS in light of a pragmatic push, heralded by Archon Fung and John Forester, to bring the public back into public participation. The agonistic planning rationality attributed to Chantal Mouffe, Erik Swyngedouw, Bent Flyvbjerg, and others is of far less influence. While a fuller conceptual genealogy is outside the scope of this paper, it is important to note the relatively low-conflict Finnish planning context in which SoftGIS emerged.

SoftGIS is one of many approaches that can play an active role in transforming society by providing a framework to support long-term planning that constructs alternative futures from the complexity of local experiential knowledge (Brown & Kyttä, 2014).[25] That said, purported participatory processes have led to tyrannical outcomes (Cooke et al., 2001), and maps are noted representations of power (Harley, 1989). Something is lost when assimilation is a prerequisite for participation. However, preserving different ways of perceiving the world challenges the drive towards the interoperability and universality of platforms (Reid & Sieber, 2020), which market forces may prompt. Maps can be persuasive programmatic devices that bring people closer to the planning process but perhaps further from their local knowledge base (Van Herzele & van Woerkum, 2011, 2008). A critical framework is needed to identify those areas of productive tension and those tensions that may erode equitable outcomes.

A critical framework for SoftGIS

[25] These approaches include sociotope mapping an important but often overlooked mapping approach developed by Alexander Ståhle which focuses on common "use values", in the Marxist sense, of urban public open space (2006). The sociotope approach is inspired by Lefebvre and similar to Whyte's direct observational data (Whyte & Others, 1980). Ståhle's argument for the sociotope approach is based on the proposition that, "[a] society which is turning increasingly postmodern, globalized and individualized can hardly plan, develop or grow without knowledge of the common use values of space of place" (2006).

As a more recent variant of PPGIS, softGIS has yet to be subject to the same critical turn that has been referred to elsewhere as "critical PPGIS" (Ekbia & Schuurman, 2009), an extension of the more established critical GIS discourse which emerged in the 1990s and gained traction in the 2000s (Harvey et al., 2005; O'Sullivan, 2006; Pavlovskaya, 2018; Sheppard, 2005). While critical GIS has illuminated the role of power in producing "hard" GIS knowledge, the role of power in producing "soft" knowledge remains less understood, even though the softGIS methodology was developed with an awareness of critical GIS, mainly related to access, privacy, and ethics (Kahila & Kyttä, 2009). Critical GIS brings attention to the socio-ecological and political relations that contextualize the development and implementation of GIS and the impact GIS has upon those relations. A critical PPGIS extends that field of attention onto PPGIS and its variants, including softGIS.[26]

A dynamic conversation is emerging from a constructive and, at times, abrasive tension within GIS between a positivist and techno-utopian mapping of everything and counter-mapping as part of progressive geographic imaginations that see GIS as becoming a tool for social transformation (Pavlovskaya, 2018). Critical GIS continues to evolve through ongoing conversation between researchers informed by science and technology studies (STS), feminism, and scholar-activism who engage in dynamic mapping technologies and those using similar theories to critically explore their history and ongoing development (Dillon, 2020; Harvey et al., 2005; Kwan, 2002; O'Sullivan, 2006).

PPGIS has not proven to be a silver bullet for participatory planning, due in part to "participatory processes that are superficial, obligatory, or token" (Brown, 2012), and in part to "inherent limitations related to the GIS technology which cannot be overcome with improved functionality or digital access"

[26] In their article on the argumentative work of map-based visualization, Van Herzele and van Woerkum conclude that "assessing how maps 'work' is a prerequisite for understanding the dynamics of a map-based interactional process and its consequences, which can in turn help participants in such a process (planners, citizens and others) to critically reflect on and, where appropriate, change the conditions of communication" (2011). Our critical framework for SoftGIS seeks to illuminate the similar agency of a particular platform to the same ends. However, where the power of maps has been widely discussed (Chambers, 2006; Harley, 2011), a critical framework for SoftGIS must be newly constructed, drawing from and integrating extant critiques.

(Babelon et al., 2017). PPGIS, with its explicit orientation towards public participation, is seen as a promising development that opens new areas for critique (Dunn, 2007; R. Sieber, 2006) or concerns regarding co-optation (R. E. Sieber, 2000). Simultaneously, researchers seek to co-produce "effective" PPGIS projects and showcase lessons learned from success and failure (Brown & Kyttä, 2014). The result appears to be a tension between a push for efficacy and wariness that broadening impact does not come by sacrificing foundational, progressive values.

Our critical framework for softGIS (critical softGIS) continues several established critical GIS conversations, including the role of power in producing knowledge. It draws on situated knowledge from feminist new materialism, criticizing and redefining objectivity. Insights from media ecology also inform us about the "co-creative relationships between technology, humans and environments" (Milligan, 2019). Our critical softGIS focuses on the web-based survey methods and tools central to the approach for this article. Following Brown and Chin's distinction between process and outcome, we emphasize the process of tool employment (i.e., "what") rather than the outcomes of their implementation (i.e., the "whether") (2013).[27]

Our methodology consists of constructing and then applying a critical softGIS evaluation apparatus to our case study, post facto. Our apparatus will build on prior evaluations of softGIS and PPGIS conducted by Maarit Kahila & Marketta Kyttä (2009), Kahila-Tani et al. (2019), Garcia et al. (2020), and Greg Brown & Chin (2013). The first three of these articles represent the primary evaluations of softGIS to date and the evaluation criteria formulated by researchers and practitioners. The fourth evaluation by Brown and Chin is focused on PPGIS more broadly. It includes a situated reflection on evaluation in general, including the distinction mentioned above between evaluations of process and outcome.

[27] Drawing from (Rowe & Frewer, 2004), the authors distinguish between process criteria, referring to the construction and implementation of a procedure and *ex-post* outcome criteria (Brown & Chin, 2013).

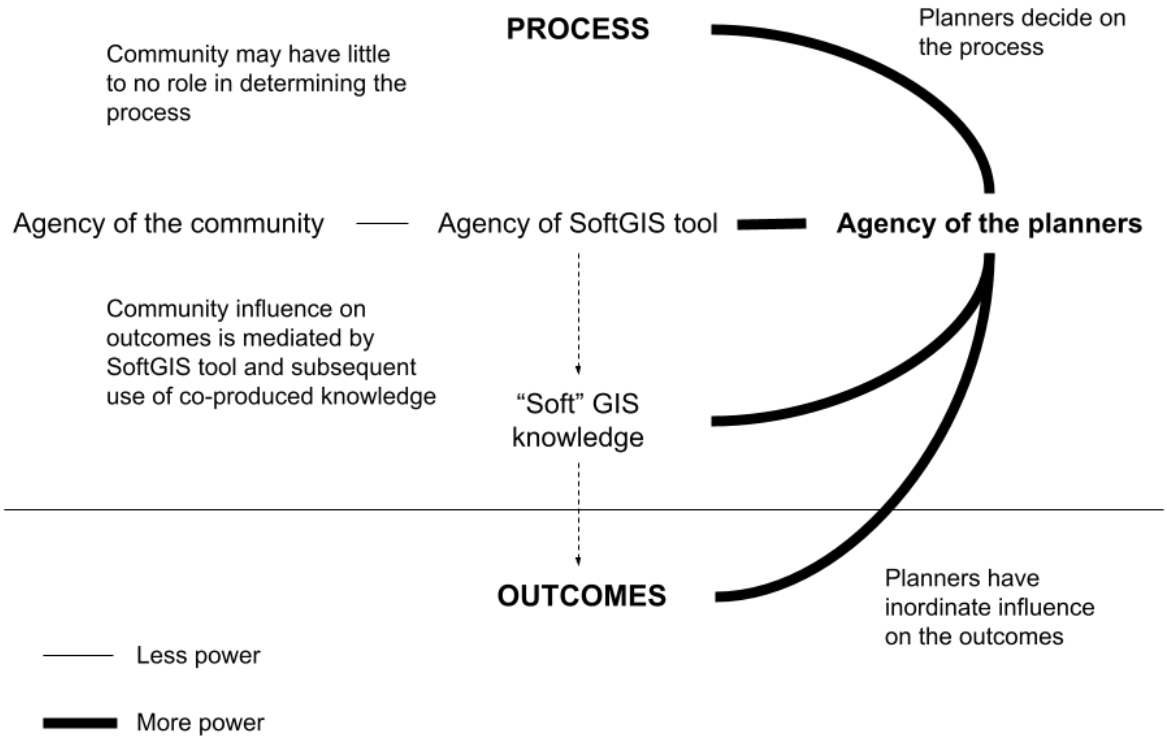

Figure 3.1. Power asymmetries in the process affect outcomes

Together, these evaluation criteria encapsulate well the promise of softGIS and the PPGIS process to support more inclusive planning efforts that are more responsive to the everyday experience of affected communities. However, they neglect to adequately address the possible ways in which softGIS tools may affect participants, landscapes, and their relations. These prior evaluations provide a comprehensive overview of most softGIS proponents, researchers, and practitioners' intentions and underscore the novel contribution of softGIS's place-based experiential knowledge within the larger PPGIS area of practice. However, these evaluations omit direct engagement with the softGIS interface's agency and thus the power of the planners and researchers who construct and implement the tool (Figure 3.2.). Due to this omission, we feel they are leaving untroubled the notion of the platform as a neutral interface or

intermediary between people's everyday life experiences and planners and researchers. Recognizing that the platform is not neutral, we are compelled to look at its peculiar capacities.

Drawing on feminist GIS and media ecology, we seek to augment these evaluation criteria based on an overlooked relation, explicitly drawing attention to the capacity of softGIS tools to affect responses and, in turn, transform people's perceptions, the landscape, and their relations. Below we present a summary of the evaluations followed by a more in-depth discussion of media ecology and situated knowledge, a key concept in feminist GIS, which we use to inform our questioning of the agency of the platform itself in the surveying process.[28]

In their 2009 chapter on SoftGIS as a Bridge-Builder in Collaborative Urban Planning, softGIS innovators Maarit Kahila and Marketa Kyttä evaluate softGIS on the following three themes (2009):

1. Supports laypersons' and communities' capabilities to utilize GIS in their everyday life
2. Completes and enriches GIS with the details of everyday life
3. Conducive to the flow of information between different actors, a critical part of collaborative/communicative planning

In their 2019 article *Does mapping improve public participation? Exploring the pros and cons of using public participation GIS in urban planning practices* in the journal Landscape and Urban Planning, Maarit Kahila, Marketa (Kahila & Kyttä, 2009), and Stan Geertman evaluate softGIS on the following three themes and identify the pros and cons associated with using softGIS (2019):

1. Enhance effective arrangements of public participation
2. Reach a broad spectrum of people
3. Produce high-quality and versatile knowledge(s)

[28] Van Herzele and van Woerkum have written extensively about local knowledge and the "visually mediated practice" of participatory mapping. The authors reference situated knowledges and Haraway's notion of position (2011, 2008). They have found that local knowledge can be conditioned by the mapping tool and the way of looking imposed by map-based representation (Van Herzele & van Woerkum, 2008).

In their 2020 article *Evaluating a web-based PPGIS for the rehabilitation of urban riparian corridors* in the journal Applied Geography, Garcia et al. evaluate softGIS on the following three useability criteria[29] (2020):

1. Efficiency - based on average response time
2. Effectiveness - based on ease of use, response rate, and data volume
3. Satisfaction - based on positive emotion associated with the tool

Greg Brown & Sean Yeong Wei Chin derive a comprehensive set of 30 evaluation criteria (variables) for public participation (2013).

Their condensed *process* criteria include

- Representativeness - a measure of the degree to which participants represent the community's interests in question.
- Accessibility - a measure of the sufficiency of the provided information
- Transparency - a measure of the extent to which the process is political

To understand better how softGIS may affect the production of local experiential knowledge and the flow of that knowledge within evidence-based, communicative planning processes, we needed to go outside of the existing evaluative frameworks for softGIS and the theoretical perspectives from which they emerged. Exploring the larger fields of feminist GIS and media ecology, we could locate relevant concepts and analyses of power missing from existing evaluations.

[29] These usability criteria are based on the ISO (International Organization for Standardization) Ergonomic requirements for office work with visual display terminals (VDTs) (for Standardization, 2000).

We consider softGIS a hybrid socio-technical system reliant on intertwined technical, governance, and institutional capacities inspired by Babelon et al.'s theorization of “cyborg PPGIS" (2017). By drawing attention to the softGIS system, this theorization augments the theoretical framework centered on humanistic geography, environmental psychology, and communicative urban planning previously described. Heeding and extending Schuurman’s call for a “cyborg manifesto for GIS" (2002), Babelon et al. apply Donna Haraway’s work on the cyborg (D. Haraway, 2006; D. J. Haraway, 2013) to PPGIS systems to speak to transgressions of established dualities (ontological complexity) and a plurality of ways of knowing from “expert” to “resident” (epistemological hybridity) (2017). As the authors note, “[a]n ontology and epistemology of web-based PPGIS as cyborgs requires further development” (Babelon et al., 2017). To contribute to this development, we apply the concept of situated knowledge and the inquiries of media ecology to our critical evaluation of a softGIS case study.

Specifically, we will be applying situated knowledge to draw attention to the particular conditions under which soft knowledge is produced, in this case, the Maptionnaire survey. We further apply the concept of mediation from media ecology to understand how the operation of the survey tool affects the translation of everyday experience into planner and designer legible soft data, which can interact with hard data layers.

Knowledge collected by online map-based surveys reflexively affects that knowledge. Central to our argument is the paradox of the expert-designed web-based survey as a tool for capturing plural knowledge (ontologies) based on multiple ways of knowing (epistemologies) without biasing results. Can any single survey tool sufficiently represent the full spectrum of embodied experience? We contend that these are tools for limited co-production rather than limitless unaffected capture. Here, our argument is not entirely dissimilar to established discussions related to survey design. However, given the novel capacities of online map-based surveys and the participatory planning contexts in which they are applied, we feel

special attention should be given to how people's experiential place-based knowledge is affected by participation in a virtual map-based survey, often completed out-of-place.

Donna Haraway's concept of "situated knowledge" (1988), a seed idea in feminist new materialisms (van der Tuin, 2014), has already informed feminist GIS (Elwood, 2008; Schuurman, 2002; Sheppard, 2005) and is central to our critical softGIS framework.[30] Based on our position, we interpret the concept of situated knowledge as positing that all forms of knowledge reflect the particular and dynamic conditions of active knowledge producers. In the context of softGIS, these conditions include the social identity, position, location of survey participants, and, importantly, the survey tool itself. Drawing from Haraway, Rogowska-Stangret (2018) describes situated knowledge as an apparatus for producing "a more adequate, richer, better account of a world, in order to live in it well and in critical, reflexive relation to our own as well as others' practices of domination and the unequal parts of privilege and oppression that make up all positions" (1988). We hope to align softGIS with that aspiration through the construction and use of our critical evaluation apparatus.

While much has been written about the capacity for softGIS to collect experiential knowledge, we see a significant void regarding how web-based surveys affect what is shared and the effects of the resultant map. Media ecology investigates the way technologies as "infrastructure" or "intermediary" affect how humans relate to environments (Peters, 2015). Media ecology can be seen as a particular application of situated knowledge to media. In this way, media ecology suggests that these virtual survey and mapping technologies produce situated knowledge and are never passive or neutral actors. "Neutral" language has an affect, as does any map of graphical representation (Harvey & Chrisman, 1998; Movik et al., 2021; Van Herzele & van Woerkum, 2011).

[30] While the "soft" knowledge of SoftGIS has elsewhere been connected to the Polanyian concept "tacit knowledge," we have seen only one reference (Rantanen & Kahila, 2009) to the soft knowledge as situated and a follow up conversation with the author indicates that the term was not used in reference to Haraway's work.

There is an emerging conversation amongst scholars from a variety of disciplines informed by media ecology regarding how the rapid expansion of remote sensing and monitoring media inform our engagements with environmental processes and politics (Milligan, 2019). To our knowledge, these conversations have yet to include the forms of sensing that softGIS enables. As a hybrid socio-technical system, softGIS surveys are part of the expanding range of landscape sensors, yet distinct in relying on people's experience. We think these commonalities and differences warrant further investigation. However, for this article, we note that remote sensing and 'softGIS sensing' create different knowledge, both mediated by operations of technologies, which has important implications for the planning context. Both create new affective relationships between site and (co)designers (Milligan, 2019). While softGIS may make planners feel closer to a site and its inhabitants, we would be wise to challenge that assumption. Others have challenged the assumption that all digital technologies for landscape sensing are inherently distancing (Walliss & Rahmann, 2016).

The concepts of situated knowledge and media ecology inform a critical understanding of softGIS that recognizes that participant position and survey form shape "soft" knowledge. As with other landscape sensors, such as drones, softGIS surveys afford a situated perspective on the landscape increasingly used by planners and designers, with implications for power relations, identities, and the ecology in which these are relationally embedded. As Jennifer Gabrys writes regarding in-situ sensors, including citizen science, "[e]nvironment is not the ground or fundamental condition against which sensor technologies form, but rather develops with and through sensor technologies as they take hold and concresce in these contexts" (2016). This insight prompts the question: what environments might develop as softGIS and soft knowledge supplement the hard knowledge of established sensor technologies as sources of knowledge informing landscape planning and design?

Methods

To move from prior evaluations to our critical softGIS evaluation apparatus, we added dimensions of power that we saw as missing, based on our experience and a broader reading of the literature on feminist GIS and media ecology. Generally, we felt that prior evaluations did not adequately encompass underlying tensions that we see as emerging from a desire to incorporate multiple situated positions, including those of heterogeneous "users," "researchers," and "planners." Rather than viewing these positions as static and distinct in the assemblage of soft knowledge, we elect to explore the messy co-production process wherein positions can shift and the softGIS platform as an affective assembler.

As the basis of our apparatus, we identify three broad and interrelated evaluation criteria: representation, specificity, and power. Although existing evaluations allude to representation and specificity, they do not adequately question the role of power. While these criteria can be applied to a critical evaluation of softGIS, they also relate to larger ongoing critical GIS discourse.

> ***Representation*** refers to the capacity to involve people, including those who have historically been over-represented, under-represented, and non-represented in participatory planning and the media of engagement. Representation, therefore, raises questions not only about access and who is represented but also about how the data can be transparently represented and accessed. By combining two uses of the word representation, one often related to visualization and the other with reach, we seek to challenge the idea that representativeness—in terms of people, media, and data—is inherently good and create space to discuss the nuances.
>
> ***Specificity*** refers to the unique capacity of softGIS to infuse planning processes with multi-dimensional (quantitative, qualitative, and spatial) perspectives. Specificity speaks to the moment of situated knowledge co-production where a participant's perceived relationship with a

landscape, mediated by a web-based survey tool, becomes data. Specificity further highlights the capacity of qualitative and spatial analysis methods to produce data that converse with biophysical knowledge (also situated) and are compatible with evolving planning support systems (Geertman & Stillwell, 2004) and planning support tools such as structured decision-making.

Power refers to the power relations that affect the systematic co-production of situated knowledge and how or if planners use that knowledge. Planning is a political activity, whether speculative scenario planning, urban planning, adaptation planning, or a general plan (Lennie, 1999; Peel, 1993). Power relations permeate all phases of knowledge co-production, analysis, translation, dissemination, and utilization. Power relations are often long-established before the planning project starts and may remain unchanged after a project ends (Flyvbjerg, 1996). Concerns with power raise questions about access, agenda-setting, the terms of consensus, and conflict rather than consensus as a frame of reference (Flyvbjerg, 1996; McGuirk, 2001).[31] Power also encourages reflection on position and raises questions about the pursuit of transparency. Again, by speaking to multiple deployments of the word power, we intentionally introduce conflicting uses, which we hope will prompt a more transparent discussion. We should also note that while we use power to refer in part to impact or outcome, we will not be exploring that component in our case study of an ongoing project where there is no clear outcome to evaluate.

The order in which we have presented the above criteria is arbitrary, given their interrelationships. However, while power and representation relate to all aspects of the iterative softGIS process, specificity speaks directly to the actual data and its collection, from implementation to results sharing.

Power affects the softGIS process in myriad ways. The power (or impotence) of a study is often judged upon its statistical representativeness, which is, in these cases, required to claim inferences legitimately

[31] These concerns have been raised by some of the critics of communicative planning, in particular, Bent Flyvbjerg.

(Brown, 2012). However, the obsession with representativeness can be based on narrow presumptions of its value that may not consider the complex social realities, including histories of marginalization and bias, unknown or unknowable populations, and the role of purposive sampling to redress underrepresentation. Similarly, the historical power relations between a more qualitative-oriented human geography and a more quantitative physical geography directly affect the legitimacy of softGIS data. Another example of the role of power is the gap between those with access to the internet and those without it, often referred to as the digital divide. The digital divide can reproduce those relations in cases where outcomes privilege those with access.

Emerging from our identified themes are the following evaluative questions. Rather than functioning as a checklist, we intend these questions to support reflection and dialogue.

Representation

A. Does softGIS support laypersons' and communities' capabilities to utilize GIS in their everyday life (Kahila & Kyttä, 2009)?
    a. How does online data acquisition compare to in-person data acquisition?
    b. How do technical problems affect data collection, including trustworthiness?
B. How does accessibility affect reach?
C. How does the sampling method affect reach?
D. How do design representation and choice of media affect participants and the co-produced data?
E. How does softGIS address tradeoffs between transparency and information overload?

Specificity

A. Does SoftGIS allow users to infuse GIS with the rich details of everyday life?
    a. Can softGIS data be integrated with the expert systems and their "hard" GIS data?
B. How does softGIS navigate tradeoffs between specificity and sensitivity?

    a. Sensitivities could be related to illegal, unsanctioned, or illicit activities and non-public knowledge such as sacred sites or private activities.

C. How does softGIS navigate compromise, noted in Hansen et al., between data accuracy and data volume (2021)?

D. What are the differences between assessments of current conditions and proposed future ones?

Power

A. Is SoftGIS conducive to the flow of information between different actors, a critical part of collaborative/communicative planning (Kahila-Tani et al., 2019)?
    a. Does softGIS address issues like privacy, access, and ethics?
    b. Is softGIS a "bridge-builder" between planning practice and the everyday life experiences of affected communities, as suggested by (Kahila & Kyttä, 2009)?
    c. Does softGIS link the human experience with spatial expression in ways relevant to design and planning decision-making? (Kahila & Kyttä, 2009)

B. How does the representation of designs/scenarios/futures affect response?
    a. Who decides how futures are represented?
    b. Can visualizations create a bias imaginary?

We recognize that there are multiple approaches to evaluation and see it as necessary to be explicit about the type of evaluation and its descriptors (Brown & Chin, 2013). To structure our evaluation, we draw on Brown and Chin's (2013) methodological descriptors for evaluation derived from (Rowe & Frewer, 2004) and (Chess, 2000). Based on these descriptors, we can classify our evaluation as summative, process-based, user-based, participatory, and comparative, focusing on process effectiveness from our planner/practitioner perspective (Brown & Chin, 2013). Our evaluation process occurs after implementing the approach, culminating in the publication of a report. However, the Franks Tract restoration project

remains in the planning phase. Our process did influence the report, which concluded that stakeholder and public engagement were critical plan formulation and must be continued in future work to ensure consistency with project goals and objectives (CDFW, 2018).

Case Study

Our case study explores an application of Maptionnaire, the dominant softGIS platform, as an agent in participatory adaptation planning. Our key questions are: what did Maptionnaire "do" in this context, and (2) how did the structure and function of our online informative and evaluative web-based surveys affect respondents' ability to participate? We arrive at conclusions that can inform future participatory planning processes by exploring these questions.

Maptionnaire supports the design of map-based surveys and the collection and analysis of survey data. Planners create basemaps and overlays in the survey editor module to design the surveys. In addition to conventional quantitative and qualitative questions, Map-based questions allow survey participants to place points and draw lines and polygons. Maptionnaire's analysis module supports simple spatial visualization of survey results. Non-spatial results are also summarized in Maptionnaire's results module.

Academic/practitioners have described Maptionnaire as "an interactional trading zone where urban planners, researchers and citizens interact in a dynamic dimension…where SoftGIS is a material medium" (De Vidovich, 2018; Kahila-Tani, 2013). In our previous article, referencing Nel et al., we referred to the Maptionnaire surveys as "landscape boundary objects that facilitated the boundary work of 'bridging boundaries between groups of people with differing views of what constitutes reliable or useful knowledge in a co-design process'" (Milligan et al., 2020; Nel et al., 2016).[32] We noted that the spatial component of the surveys created common knowledge of practices. In contrast, the qualitative

[32] Our observations are preceded by the foundational work of Harvey and Chrisman on boundary objects and the social construction of GIS technology (Harvey & Chrisman, 1998).

components helped retain knowledge not held in common (i.e., uncommons), which existed before the process and may persist after (de la Cadena & Blaser, 2018; Milligan et al., 2020).

Maptionnaire was developed for non-tech-savvy users (Maptionnaire, 2020), and we developed the surveys mainly on our own, with limited input from Maptionnaire staff regarding comparative projects and technological issues. While this does indicate the accessibility of the tool, we should note that the technical issues included software bugs and interface limitations that required creative and time-consuming workarounds.[33]

Franks Tract Futures

Our case study focuses on the Franks Tract Futures (FTF) project in the Sacramento-San Joaquin Delta of California (hereafter Delta). Our previous paper, *Park, Fish, Salt and Marshes: Participatory Mapping and Design in a Watery Uncommons,* provided a background on the FTF project and the two public online map-based surveys that informed our co-design approach.[34] FTF sought to balance freshwater supply reliability concerns with ecological restoration mandates while providing community benefits, unlike previous efforts. The FTF process had to contend with multiple and divergent perspectives on what the Tract is, how it is changing, and what it could become. The FTF effort "highlights an innovative application of SoftGIS (in the form of map-based surveys), choreographed into a mixed-methods SDM [Structured Decision Making] process to create diverse knowledge for the co-design of a complex and politically fraught park landscape" (Milligan et al., 2020). The evolution of this landscape may be a litmus test for both the future of adaptation planning and public participation in the Delta and beyond.

[33] The Maptionnaire platform had a major update during survey development and implementation, which included the resolution of several known bugs and limitations, a revamped user interface, and the addition of new features.
[34] Franks Tract which while part of a larger urban infrastructure (Milligan & Kraus-Polk, 2017), differs from the "city" context in which SoftGIS first emerged and where the majority of its applications focus.

Franks Tract Futures Surveys

We conducted three surveys of people concerned about possible futures at Franks Tract. Our surveys were one component of a multiway communication between planners, scientists, facilitators, designers, agency staff, and the heterogeneous, affected publics. The first was a feasibility study survey. The second was a user survey, and the third was a design concept survey. The feasibility study survey provided an initial view of the demographics and landscape values of people who live, work, and play in and around Franks Tract. The user survey, informed by the first, collected geospatial information about the type and location of recreational activities, launching, berthing, and areas of Franks Tract in need of improvement and optimal (or least detrimental) locations for tidal marsh restoration. The design concept survey assisted in evaluating three plans developed with input from the previous survey and the FTF advisory and steering committees. For this article, we will be focusing on the user survey and design concept surveys, which used Maptionnaire. We will focus on the map-based questions that generate softGIS data within these surveys.

Franks Tract User Survey

We used a maptionnaire-based softGIS to provide a means for more widely accessible geospatially explicit participation in the planning and design process. We selected Maptionnaire as a relatively easy-to-use, mobile-compatible survey platform. In addition to map-based questions, we posed demographic questions informed by a previous survey conducted in the Franks Tract Feasibility Study. Map-based questions were informed by a more extensive mixed-methods approach, described in detail in (Milligan et al., 2020)0, including research on previous outreach efforts and stakeholder discussions.

Map-based questions concerned recreation types, boating routes, launching and berthing, areas of improvement, and new tidal marsh locations. Topics raised in the feasibility study and continued stakeholder engagement informed these questions. We collected responses through the Maptionnaire

platform, which supported rudimentary in-browser spatial analysis and .csv data exports. Exported .csv data were cleaned, largely consisting of the deletion of unsolicited personal information, and analyzed in Google Sheets and Microsoft Excel. Cleaned geospatial data were imported into ArcGIS Pro for spatial analysis and visualization. Statistical analysis was used to explore relationships between variables. Spatial visualization was used to discern trends that informed an iterative design process. Survey results are available for public viewing and exploration using the ESRI map-viewer on the project website: https://franks-tract-futures-ucdavis.hub.arcgis.com/pages/franks-tract-user-survey-results

Our survey was intended for those who currently live, work, or play in and around Franks Tract or may in the future. This is an unknown population with no sampling frame, so we opted for non-probability self-selection (voluntary) sampling. As Brown et al. have shown, sampling effects are associated with voluntary participation instead of random samples (2013). We recognize these sampling effects and understand that they could be mitigated by creating an arbitrary sampling frame, for example, adjacent zip codes. However, we feel that our non-probability sampling was justified given our objective of reaching a heretofore unknown constituency of current and prospective users. As a result, our survey dissemination approach was intended to reach diverse Franks Tract user groups but not to reflect the predominance of any of these groups statistically.

We engaged target user groups identified from the first feasibility study, such as residents, boaters, anglers, and hunters, with direct emails, canvassing, social media, and a project website. The survey was released immediately before the project kickoff public meetings, and flyers with a survey link and Quick Response (QR) code were made available at that meeting. People participated in the survey, which ran from August 10, 2019, through September 13, 2019, on a variety of devices including phones, tablets, and computers. Several local and regional blogs and news outlets that covered the kickoff meeting included links to the survey. We are aware that relying on self-selection for a web-based survey creates bias and that our results cannot be seen as statistically representative of a population. If a follow-up survey

intended to obtain an accurate assessment of population characteristics is conducted in the future, it would have to use probability sampling. It could not replicate our purposive self-selection web survey.

Franks Tract Design Concept Survey

The public and stakeholder design survey was designed to appeal to those familiar with the project and those new to the project and process. Photographs, rendered images, flyover videos, and links to previous survey results were embedded within the survey to provide project background and communicate proposed concepts. The survey was designed to allow participants to indicate in space what they liked, did not like, and ask concept-specific questions. Sub-questions related to location and access were asked to discern reasons for liking or disliking a feature more clearly.

Survey development involved considerable effort to translate map-based scenarios to a format compatible with the Maptionnaire platform. We attribute some issues to the geographic size of the design concepts, which are much larger than the urban master plans for which Maptionnaire was developed. Informed by feedback from the previous survey, critical considerations in the development of the design survey were loading time and mobile compatibility.

The design survey was beta-tested by advisory and steering committee members in response to feedback from the previous user survey asking for greater involvement in survey development. The finalized survey was launched during the second public meeting on June 9th 2020, which, due to COVID-19 precautions, was an online webinar. The survey closed on September 1st, 2020. Follow-up reminders to complete the survey were sent to webinar participants. A survey link was posted on the project website and reposted on social media (Facebook, Twitter, Instagram). Targeted messages were sent to relevant Facebook groups, expanding on those identified in the previous survey dissemination process.

The survey included two parts, feedback solicitation and scenario ranking. The first part introduced four scenarios, including a no-action alternative and three design concepts. Scenarios were presented with interactive maps showing locations of key features and flyover videos illustrating design concepts to provide a sense of scale. For each of the four scenarios, respondents were asked to drop pins on places and features they liked, disliked, or had questions about. A follow-up multiple-choice question asked respondents to consider the feature, location, access, and other positives or negatives for the like and dislike pins. The question pin prompted an open answer to follow-up questions. The second part of the survey asked respondents to rank scenarios relative to one another. Each scenario could be ranked from one to four, the highest and the lowest. A summary image that contained all four scenarios was included.

Analysis

Drawing on Fagerholm et al.'s recent methodological framework for analysis of PPGIS, we categorize our softGIS analysis methods as exploratory, which the authors define as descriptive and univariate analysis and the generation of visual outputs (2021). Initial exploratory analysis was conducted using Maptionnaire's visualization capabilities (Figure 3.2.). More refined descriptive analysis and visualization were conducted after migrating data into ArcGIS Pro and Adobe Illustrator (Figure 3.3.). Shareable interactive mapping tools were developed using ArcGIS online and embedded in the project website (Figure 3.4.).

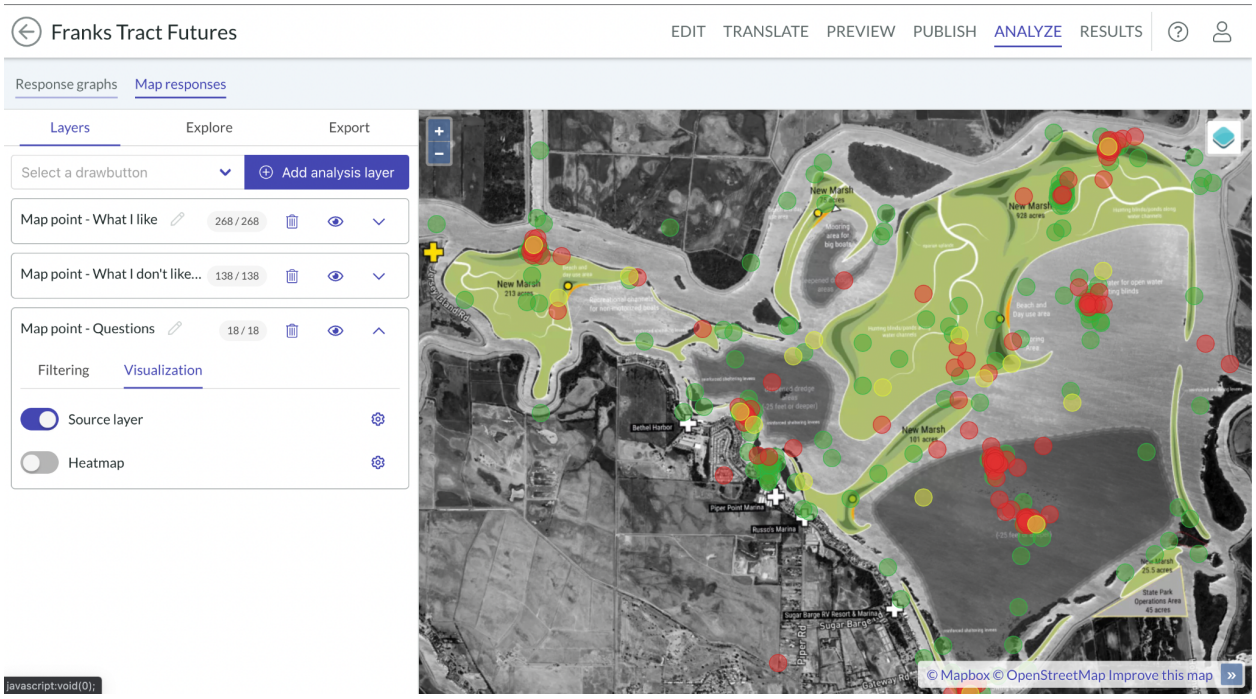

Figure 3.2. Screenshot of the Maptionnaire visualization tool.

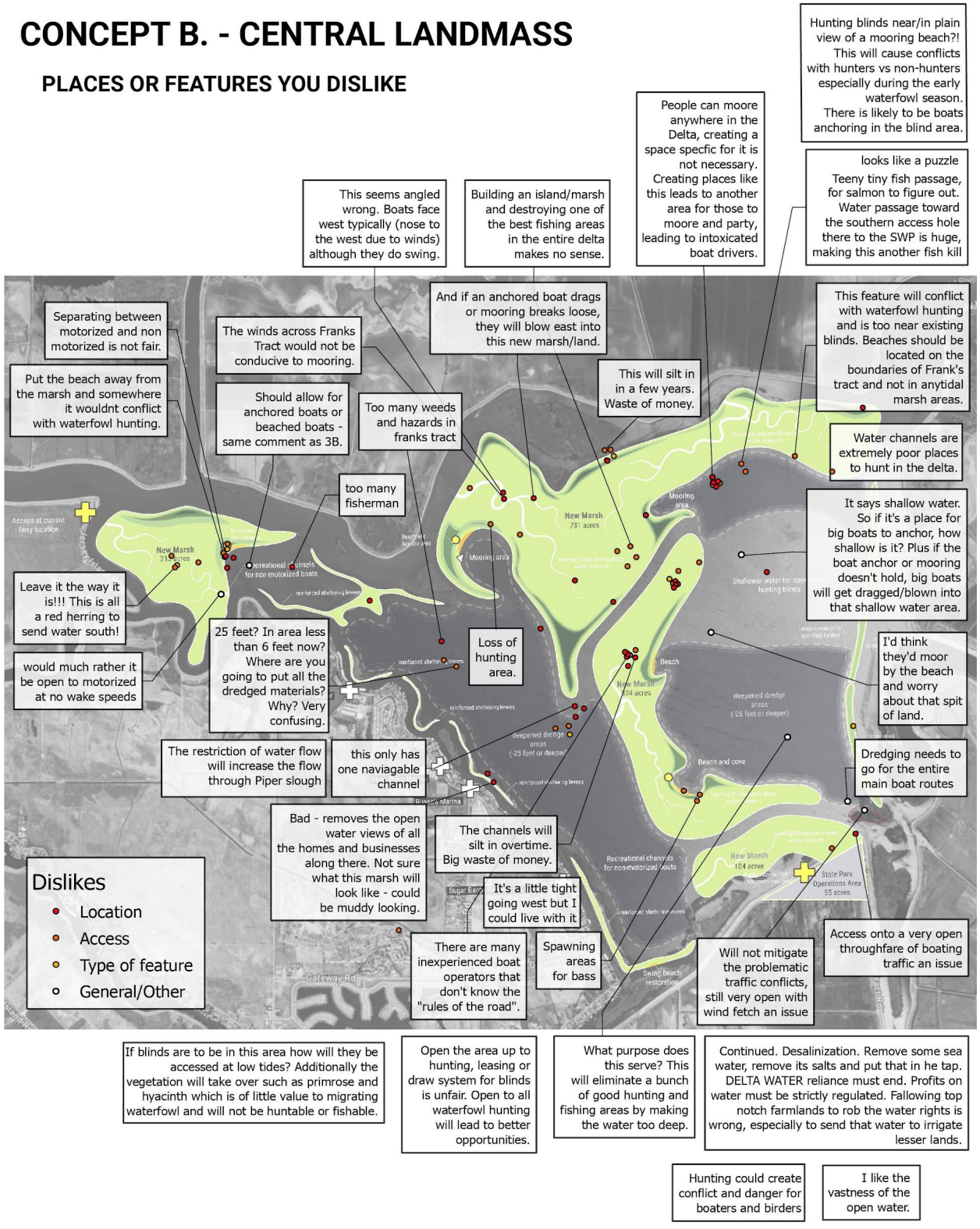

Figure 3.3. Refined visualization produced in arcGIS pro and Adobe Illustrator.

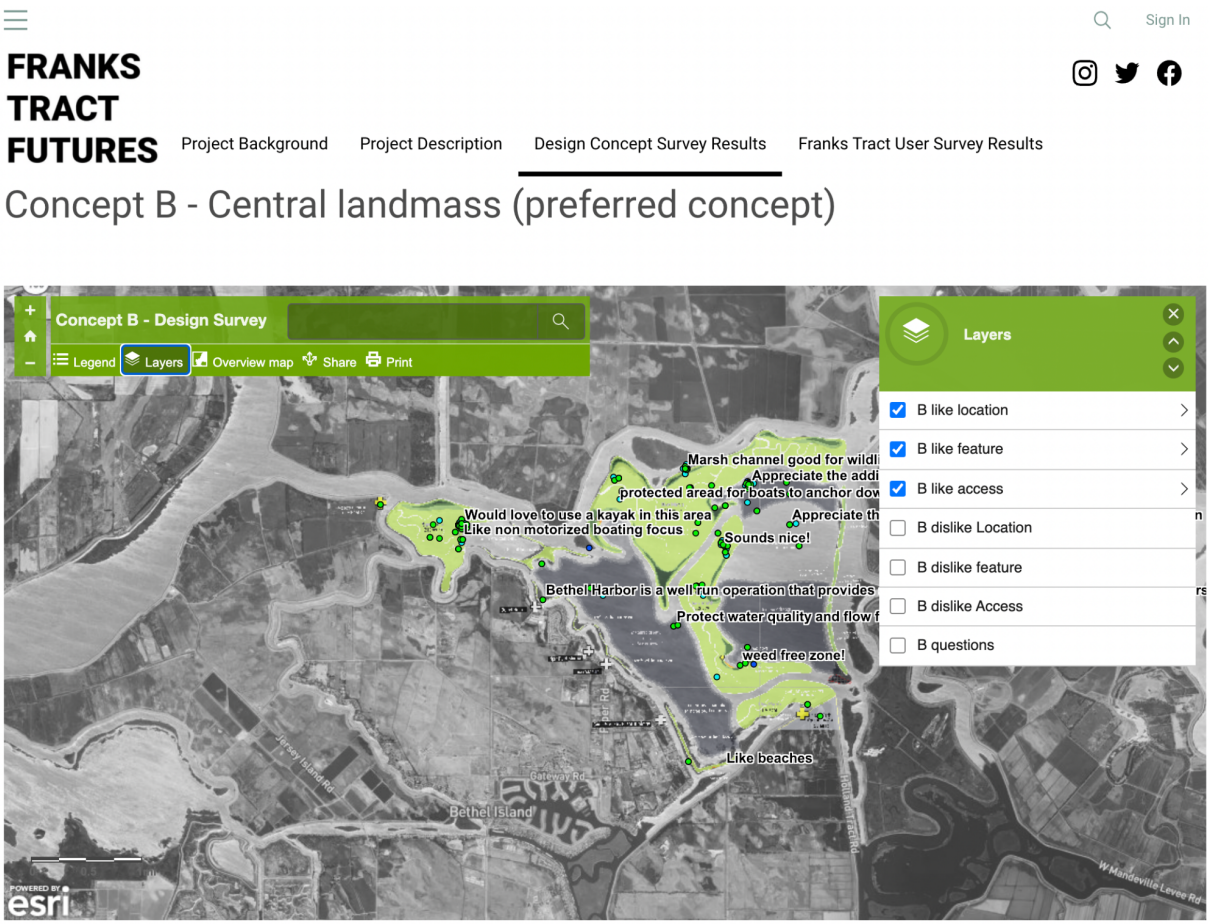

Figure 3.4. Screenshot of shareable interactive mapping tool on the arcGIS hub website: https://franks-tract-futures-ucdavis.hub.arcgis.com/pages/design-concept-survey-results

Results

Our results are composed of applying our evaluative criteria and questions to our case study. The table below provides a synopsis and is followed by a more in-depth reflexive self-evaluation.

Representation	
Evaluation Questions	**Results**
Does softGIS support laypersons' and communities' capabilities to utilize GIS in their everyday life (Maarit Kahila & Kyttä, 2009)?	Yes, in this case.
a. How does online data acquisition compare to in-person data acquisition?	Each has benefits and drawbacks
b. How do technical problems affect data collection, including trustworthiness?	Technical problems can reduce trustworthiness.
How does accessibility affect reach?	Accessibility may expand reach but not necessarily homogeneously across all demographics.
How does the sampling method affect reach?	It depends on what is known or unknown about the sample population.
How do design representation and choice of media affect participants and the co-produced data?	Aesthetics affect participants and their responses.
How does softGIS address tradeoffs between transparency and information overload?	Both too much and too little information can affect responses. The appropriate amount of information may always be context-dependent.
Specificity	
Evaluation Questions	**Results**
Does SoftGIS allow users to infuse GIS with the rich details of everyday life?	Yes.
a. Can softGIS data be integrated with the expert systems and their "hard" GIS data?	Yes.
How does softGIS navigate tradeoffs between specificity and sensitivity? Sensitivities could be related to illegal, unsanctioned, or illicit activities and non-public knowledge such as sacred sites or private activities.	The inaccuracy of the tool, due to map-scale, can protect sensitive information. Sensitivity was not an issue in this case.
a. How does softGIS navigate compromise, noted in Hansen et al., between data accuracy and data volume (2021)?	We feel we struck a good balance but recognize that we are affecting responses by including some information and not others.
What are the differences between assessments of current conditions and proposed future ones?	Temporal representation affects responses.

Power		
Evaluation Questions		**Results**
Is SoftGIS conducive to the flow of information between different actors, a critical part of collaborative/communicative planning (Kahila-Tani et al. 2019)?		The survey enabled the communication of spatially explicit information that was legible to both the project team and potential proponents.
	a. Does softGIS address issues like privacy, access, and ethics?	Surveys can be made anonymous and conducted voluntarily.
	b. Is softGIS a "bridge-builder" between planning practice and the everyday life experiences of affected communities as suggested by (Maarit Kahila & Kyttä, 2009)?	SoftGIS functions as a bridge-builder, but the crossing affects the information.
	c. Does softGIS link the human experience with spatial expression in ways relevant to design and planning decision-making? (Maarit Kahila & Kyttä, 2009)	Surveys co-produce soft data relevant to ongoing design and planning decision-making processes as they exist now.
How does the representation of designs/scenarios/futures affect response?		
	a. Who decides how futures are represented?	Given that representation affects responses in currently unknowable ways, it is necessary to question who decides how futures are represented.
	b. Can visualizations create a bias imaginary?	Further research on scenario planning is needed. We could imagine a survey study where multiple no-action representations, including current and future renderings based on the best available knowledge projections, are provided and responses compared.

Table 3.1 Synopsis of results by theme and evaluation question.

Representation

> *Does SoftGIS support laypersons' and communities' capabilities to utilize GIS in their everyday life (Kahila & Kyttä, 2009)?*

Yes, in the context of the Franks Tract Futures (FTF) case study, SoftGIS connected users' growing familiarity with GIS and online mapping tools to a detailed planning and design objective. Planners and designers will continue to utilize GIS for landscape-scale projects. Whether they know it or not, most

people are regularly engaging GIS on their phones, cars, and computers. Layperson and community GIS use will likely expand as technologies become more accessible and available.

a. How does online data acquisition compare to in-person data acquisition?

The FTF process included both in-person and online map-based data acquisition. In-person data was gathered during design charrettes and meetings with groups and individuals and differed from the softGIS approach of online map-based data acquisition through the maptionnaire survey. The process could be presented for in-person data acquisition, and questions fielded. Our softGIS survey provided some background information. However, it had several weaknesses: it was not as comprehensive, and information could not be tailored to the audience, nor could participant questions be answered.

In-person data were not precisely georeferenced, whereas softGIS data were. This lack of spatially explicit detail with in-person data may allow participants to represent general or dynamic trends better.[35] In contrast, the cartesian coordinates are well suited for more static occurrences. SoftGIS survey data were restricted to lines, points, polygons, and associated qualitative and quantitative questions. In-person data included loosely drawn lines, points, polygons, text, and sketches. In-person data acquisition occurred as part of a conversation in which information could be added, modified, or redacted at any time. In-person data acquisition may be biased by the planners, designers, and researchers whose presence may coerce self-censorship or tamer responses.

b. How do technical problems affect data collection, including trustworthiness?

We understand trustworthiness as hinging on transparency and fidelity. While our survey did not have any technical problems related to the map-based questions, we did see many places in the analysis process where problems may arise that would distort the collected data. Such technical problems would obscure the transparency of a process by introducing problems that might be addressed without participant input.

[35] We did use paper maps for in person interviews, having them out to either take notes ourselves or to have interviewees draw directly. Some of these findings were later formalized on digital maps.

Technical problems impact fidelity by distorting submissions and thus creating differences between responses and data output. The softGIS approach is subject to technical problems that do not exist with the in-person acquisition. Slow loading times and lags can create issues for users attempting to draw on maps. Frustrations can lead to inaccuracy or abandonment of the survey altogether.

We took great lengths to minimize the possible frustrations of our survey participants, by providing detailed instructions and doing walkthoughs at public meetings. While we still had some participants who were confused by certain parts of the survey, the ease of use contributed to the growth in trust in the project and the commitment of its proponents to transparent community engagement.

How does accessibility affect reach?

Our surveys were designed to be accessible to a broad range of participants with varying degrees of computer literacy and online mapping proficiency to expand the survey's reach. Accessibility may expand reach but not necessarily homogeneously across all demographics. There may also be tradeoffs where increased accessibility comes at the cost of decreasing accessibility for others. A potential tradeoff between data richness and accessibility related to information overload is also discussed below.

How does the sampling method affect reach?

We employed a non-probabilistic targeted survey approach to reach specific demographics that are historically underrepresented and hard to reach. Brown et al. have shown that sampling effects are associated with non-random samples (2013). We recognize these sampling effects and understand that they could be mitigated by creating an arbitrary sampling frame, for example, adjacent zip codes. However, we feel that non-probability sampling was justified given our objective of reaching a heretofore unknown constituency of current and prospective users. As a result, our dissemination approach was intended to reach diverse Franks Tract user groups. However, we did not intend to statistically reflect the predominance of any of these groups, which is unknown, as stated previously.

How do design representation and choice of media affect participants and the co-produced data?

Initial designs for tidal marsh restoration in Franks Tract depicted the tidal marsh in a brown-tan color. Many members of the public associated this color with tidal mudflats, which were understood to be aesthetically unpleasing due to their sight and smell. We avoided these colors when developing the designs used in the final concept design survey. Instead, we selected brighter, perhaps unrealistic green colors that would not be subject to the same associations. While we may have avoided negative associations, we did not at the time consider colorblindness. We suggest that efforts be made to bring more attention to this issue and provide colorblind accessibility palettes.

Perceptions of channel width were also a significant issue with participants concerned with navigability and boating. We attempted several strategies to assuage concerns, including adding channel dimensions and comparing the width of design channels with existing known and well-traveled channels.

The interactive 2D, bird's-eye view of the site and design plans provided a context in a format likely familiar to many participants. However, the omission of a third dimension created some confusion regarding the height of the designed features and concerns that tidal marsh might create a boating hazard, especially at high tide when it might be partially or fully inundated. While the designed marsh would contain plants that would be visible even at high tide, a 3D map would likely have ameliorated these concerns. Related to the previous point on color, we depicted the "complete design" as it might appear at some point after construction when the marsh plants had become established. Had we shown multiple design renderings at various stages of construction, concerns related to navigability and aesthetics might have more validity.

How does softGIS address tradeoffs between transparency and information overload?

Related to the points above, we chose to limit the depictions that we included in our survey. We felt compelled to make this choice because of the structures of the survey platform, which only allowed for static overlays on 2D maps. While we could have included more pages, we were concerned about information overload and participation fatigue resulting from a lengthy survey. As Maptionnaire and SoftGIS develop, we can imagine enhanced 3D capabilities and a time dimension that would allow users to explore site evolution over time, which would be very helpful in communicating the construction process and sea-level rise impacts. However, more capacities will likely not solve the issues of information overload and may perhaps add to them.

Specificity

Does SoftGIS allow users to infuse GIS with the rich details of everyday life?

Yes, our survey co-produced GIS data on user activities and preferences emerging from everyday experience. However, the GIS data provides limited insight into the broader "affective ecology" (Kraus-Polk & Milligan, 2019; Singh, 2018). While data sheds light on the location of activities, other emotional dimensions related to sense of place are not present. There are details of everyday life available to ethnographic methods that are not available to SoftGIS. However, the limitations of SoftGIS are unknown, and there is potential for continuing to expand the method's capabilities.

That said, planners can also see rich details as distracting from or irrelevant to the primary planning exercise, which brings us back to the question of scope and who decides on its delineation. Our case study data included perspectives on many issues outside of the pre-defined project scope. However, for the most part, the granular details were all relevant to informing a more comprehensive understanding of current activities and their perception.

a. *Can softGIS data be integrated with expert systems and their "hard" GIS data?*

Yes, Soft GIS data were integrated with hard GIS data related to site conditions and ecology. We also note how existing hard GIS data can influence the co-production of softGIS data through landscape representation in the context of a survey.

How does softGIS navigate tradeoffs between specificity and sensitivity? Sensitivities could be related to illegal, unsanctioned, or illicit activities and non-public knowledge such as the location of sacred sites or activities.

Our softGIS surveys provided an initial base map with a bird's-eye view of the landscape. This perspective created a default generalization due to the inaccuracies of point, line, and polygon placements at that zoom level. If users wished to zoom in to improve accuracy, they had that option.

We did not explicitly ask for sensitive information such as unsanctioned uses, sacred sites, or illicit activities. Nothing significant of this nature arose. However, we recognize its possibility and encourage vigilance.

a. *How does softGIS navigate the compromise, noted in Hansen et al., between data accuracy and data volume (2021)?*

We provided the information we thought necessary for participants to make an informed response to our survey. We were conscious of the potential to overwhelm users with the vast amount of data we could present. Nevertheless, we recognize that we are affecting responses by including some information and not others.

What are the differences between assessments of current conditions and proposed future ones?

Both "current" and future conditions can be represented as either a snapshot in time or more dynamic continuums. It was challenging to present average current or future conditions in an evolving landscape that exhibits daily tidal changes, seasonal changes, annual changes related to aquatic plants, and

longer-term epochal changes, such as sea-level rise. We expect some users only partially to understand the temporal dimensions we attempted to represent. It would be interesting to assess understanding in future studies.

Our first survey focused entirely on current conditions, contingencies, and ongoing trends, and responses likely reflect lived experiences. Our second survey included four scenarios, three design alternatives, and a no-action alternative, thus requiring participants to consider future impacts on themselves and other users. Many participants assumed that their recent experience and perspective would be valid in a future scenario based on responses. While this is a reasonable assumption, an alternative assumption might question the continuity of current preferences into the future and leave space for new positive modes of interacting with the landscape, such as new leisure, recreational, or vocational activities.

Power

> *Is SoftGIS conducive to the flow of information between different actors, a critical part of collaborative/communicative planning (Kahila-Tani et al., 2019)?*

The surveys were a way for the project team to communicate aspects of the process, proposed designs, and possible no-action futures. The surveys provided a way for the affected public to communicate their concerns about the landscape planning process and former and currently proposed scenarios. While the survey media and format shaped the contours of these concerns, the survey enabled the communication of spatially explicit information that was legible to both the project team and potential proponents.

a. *Does softGIS address issues like privacy, access, and ethics?*

Our softGIS survey was anonymous and voluntary. Individual identifying data were removed by the primary survey investigators during initial processing - prior to sharing with the public, the advisory and steering committee, and the rest of the project team.

b. *Is softGIS a "bridge-builder" between planning practice and the everyday life experiences of affected communities as suggested by (Kahila & Kyttä, 2009)?*

Our softGIS survey did function as a bridge-builder. However, to continue that metaphor, our experience questions the bridge's design itself. The survey's media dictates the terms of the bridging, allowing certain information to cross while blocking other information. Furthermore, information may be affected by the crossing. While there is no way of knowing for sure, we assume that most survey participants completed the survey in a location removed from the landscape in question. Such responses would be a reflection on prior experience and since memory is partial these responses would be partial. Furthermore the survey prompts the recollection of specific memories and experiences, rather than inviting a more general recollection of feeling. The context of the survey, including the project in which it is a part, further tempers responses based on people's preconceptions and attitudes towards the project.

The media of the map-based survey tool specifically asks for a translation of experience into a 2D plane based on a birds-eye view of the landscape. These spatio-temporal dimensions differ greatly from the dimensions that define immersion in the actual landscape. The detachment allows for certain memory triggers related to location and a certain conception of being in space while negating other senses that might elicit other knowledge. In this way the tool has intrinsic affordances and limitations that affect what is able to cross the bridge from everyday life experiences to the planning and co-design practice.

c. *Does softGIS link the human experience with spatial expression in ways relevant to design and planning decision-making? (Kahila & Kyttä, 2009)*

Our surveys co-produce soft data relevant to ongoing design and planning decision-making. However, these criteria assume the permanence and homogeneity of design and planning decision-making as written. A more pluralistic perspective would situate relevance in multiple modes of design and planning decision-making.

How does the representation of designs/scenarios/futures affect response?

This is a big question that our case study did not directly answer. However, our case study can give us the contours of some subquestions that might guide further research. These sub-questions include:

- How do designs generated without community input compare to co-created designs in terms of response?
- How does deference to expertise affect responses?
- How do abstract representations compare with realistic representations?
- How do rendered representations compare to appropriate real-life examples from other places?
- How do dynamic representations of change over time compare to static point-in-time representations?
- How could research on future representation learn from and contribute to the concept of political aesthetics (Jenkins, 2018)?

Our experience shows that the representation of designs/scenarios/futures affects responses. This effect is evident in the initial use of a tan-brown color to portray the proposed wetland area. This color looked like mudflats for many concerned residents, which they associated with foul odors.

Incorporating long-term projections and uncertainties could generate confusion as an implemented project may not remain as designed. There is growing evidence from the region that restored tidal marshes will not be able to keep up with rising sea levels (Orr et al., 2003), ultimately drowning, which in the case of Franks Tract, would reassume its characteristics of a shallow tidal lake.

a. Who decides how futures are represented?

Given that representation affects responses in currently unknowable ways, it is necessary to question who decides how futures are represented. For our project, these initial design decisions were largely made by a design team including a professor of Landscape Architecture who crafted two senior undergraduate

design studios based on the Franks Tract project. These studios allowed us to receive feedback on design representation from a limited group of community members, including a purveyor of a local marina and a resident, both highly socially connected. This feedback was incorporated into the final designs.

b. Can visualizations create a bias imaginary?

We used an unaltered base map for our second evaluative survey to represent the no-action alternative. Here we made a conscious decision to use a representation that is highly unlikely to be a good representation of a future scenario. We augmented the unaltered base map with narrative information to communicate potential changes. Given the contested nature of Franks Tract at present (Milligan et al., 2020), we saw a single representation of a future no-action scenario as a potential source of further contestation and wished to avoid stoking controversy.

At the same time, by representing a no-action future using present imagery, we may have aided the reproduction of unrealistic understandings of landscape evolution or lack thereof. This choice could have biased responses towards the no-action alternative, assuming participants are attached to things as they are. Interestingly, our survey responses indicated that while many users want the tract to remain as it is, there are also users who are dissatisfied with the present trends and features of the landscape.

Further research on scenario planning is needed. We could imagine a survey study where multiple no-action representations, including current and future renderings based on the best available knowledge projections, are provided and responses compared.

Discussion

Applying our evaluation apparatus to our case study exposes several novel challenges to the softGIS survey approach emerging from the situated knowledge and specific media ecology of soft GIS data. We

learned that while our softGIS survey did meet many of our criteria, there were caveats and unknowns which require further research and could guide the evolution of the SoftGIS approach.

The primary finding that we would like to highlight relates to the ways in which the softGIS process shapes soft data. Our case study illustrates that softGIS is a bridge-builder between planning practice and inhabitants' everyday life experiences. However, inspired by media ecology and feminist GIS, we question how bridge crossing might affect experience communication, co-production of knowledge, planning, design, and the lived-in landscape. Through our evaluation, we learned that SoftGIS, while delivering on its proponents' promise, may have an under-recognized influence on the coproduction of "soft" data.

Additional findings generally relate to the tradeoffs between the push for softGIS to play a larger role in the transformation of society and space and the recognition that no single platform or process may be sufficient to capture the richness of human experience. We noted a potential trade-off between data richness and accessibility related to information overload. We now can generate exact data for many different features of everyday life, more perhaps than can be reasonably analyzed and communicated. Increasingly, restraint may be needed to limit the amount and definition of information so as not to overwhelm planning process participants. This is an important consideration in light of the potential of enhanced 3D capabilities and a time dimension to communicate site evolution over time, including construction process and long-term landscape changes, e.g., sea-level rise impacts.

Our findings also generated some broad and open questions, which we hope might inspire conversations around the role of SoftGIS. These questions include:

- How can survey design represent or encourage participants to consider future generations' needs, desires, and perspectives?

- How can relevance to a singular planning process be situated in emerging, plural, and shifting modes of design and planning decision-making?
- How can scenario planning inform the representation of non-stationary no-action alternatives?
- How does the visual representation of designs/scenarios/futures affect response?

Despite initial reflection, there remain gaps in our understanding of how we could have constructed and deployed the survey in different ways to enable other types of analysis. We see the results of our reflexive self-evaluation as part of an extensive social learning process that connects our case study with the evolution of the softGIS approach.

Our evaluation apparatus indicates the limits of softGIS or any single approach for representing the full spectrum of human experience. Many of the constraints of SoftGIS arise from its acceptability within the dominant planning paradigms, and it may prove impossible to address these constraints without compromising its strengths in terms of acceptability. Such as conclusion indicates a need to either accept these constraints or continue pushing the boundaries of acceptability within planning practices.

Our critical evaluation apparatus provided helpful information on how Mationnaire can tangibly improve its platform and how practitioners can deploy it. Our recommendations for the evolution of the softGIS approach and Maptionnaire platform focus on involving communities in the design of surveys by giving attention to tensions regarding specificity and the power of representation. Such a process may entail forming focus groups to guide survey design and representations. On the technical side, the platform needs to develop new ways of landscape representation that can better reflect everyday life, which, while increasingly mediated by GIS technologies, contains many sensual dimensions that are not captured in a 2D, birds-eye, 2,000 ft. map. We suggest further investment in alternative representations, particularly recognizing the power of narrative and non-visual representation.

We are aware that the latest iteration of Maptionnaire has fledging 3D capacities. We also welcome compatibility with the Mapbox suite, which will allow increased customization of base maps. We encourage Maptionnaire to continue these developments to allow highly customized and context-specific survey applications.

Our recommendations related to practitioner deployment come from a critical assessment of both our perceived successes and shortcomings. We successfully built trust with a diverse constituency through a commitment to ease-of-use that considered a range of various familiarities with virtual map-based platforms. We also successfully solicited constructive feedback on design scenarios that were iteratively developed with community input. Despite our success in these areas, we failed to consider specific essential accessibility criteria such as color-blindness. Our iterative development redressed a first draft plan formulated with essential no community input.

We developed our evaluation apparatus and applied it to a case study post facto. We invariably carried biases from the case study into our evaluation. The case study made us aware of certain things that SoftGIS could do and its shortcomings, and areas of improvement. This awareness informed the selection of criteria and the construction of critical evaluation questions. Our literature review provided additional criteria and questions from which we created the thematic groupings of representation, specificity, and power. That said, we suspect that the evaluation metrics from our literature review are subject to the same selection bias in that they were created to review specific case studies.

Additional shortcomings include insufficient user input and beta testing of the survey and designed scenario maps. Application of the critical evaluation apparatus drew our attention to how survey development without user input amounts to an initial agenda setting out of step with a genuinely participatory process. That said, part of the survey's intent was to solicit feedback on designed scenarios, which exposes perhaps an inherent tension in participatory softGIS between community co-production of

the tool and its application. When taken to an extreme, seeking community input on constructing a survey tool could make its eventual application redundant.

It is important to note again that the Finish planning context in which Maptionnaire was developed is less conflictual than the US, and multi-objective environmental planning, such as our case study, is often more conflictual than urban planning, Maptionnaire's primary milieu. Thus, many of our recommendations can arise from a misplaced application. However, Maptionnaire is actively trying to gain ground in the US and non-urban planning processes.

We further recognize that the platform's agency orients an evolution towards a plurality of approaches that can be adopted and adapted, rather than a single ideal neutral softGIS approach. We feel our apparatus speaks to common themes across all contexts and can be a valuable guide for future evaluation of diverse approaches.

Conclusion

SoftGIS like PPGIS, will have limited efficacy in "participatory processes that are superficial, obligatory, or token" (Brown, 2012). Ignoring data altogether is an obvious way in which knowledge can be discounted. However, our critical SoftGIS illuminates the more subtle ways data is shaped, even prior to its use or non-use in a planning process. Hopefully, participatory processes will become less superficial, obligatory, and tokenized. However, if this happens those involved should pay attention to how data is created in the first place.

Landscape planning and design increasingly rely on spatial biophysical data from technologically advanced environmental sensors and surveying tools. SoftGIS is a participatory mapping platform that seeks to augment this swollen data river with experiential data from the everyday life of affected communities. However, like biophysical landscape sensors, soft data produced by softGIS bears an

imprint of the media through which it was produced. Recently media ecology has been used to critically assess a diversifying array of modes of landscape interpretation, such as drones (Milligan, 2019). In this article, we extend this critical assessment to softGIS as a new form of site surveying, which we foresee continuing to rise in prominence.

Our particular assessment involved constructing a critical evaluation apparatus and applying it to a case study from the Sacramento-San Joaquin Delta of California. Our results suggest how the softGIS approach co-produces situated knowledge influenced by the media in which it is delivered. We anticipate our results opening a conversation around how the softGIS approach delimits the field of subjective geographic experience as part of a larger conversation to unsettle the dominance of "hard GIS" within what Bergmann and Lally refer to as the "geographic imagination system" (2021).

Our case study and softGIS, in general, might give the impression that the nexus between participatory mapping and design can imbue processes with "more information, more options, more accessibility, more transparency, more visibility" (Willis, 2012). However, as Anne Marie Willis notes about the expansion of GIS and GPS technologies, "[t]hese limitless vistas of choice obscure that what's going on is induction into a particular way of knowing and being in the world –one that, as it gathers momentum, becomes 'indispensable,' displacing other ways of knowing and being in the world" (Willis, 2012). Some degree of displacement is likely inevitable with the increased ubiquity and capability of mapping technologies. Our case study also exhibits how new, situated ways of knowing and being in the world can be effectively, if never objectively, brought to bear in a planning and design context.

As with question-wording, participants and sponsor organizations can take the features of a map-based survey for granted. While tremendous effort has gone into studying survey wording, the decisions around map-based survey setup have received very little critical analysis. This paper focuses on a single empirical case study, providing insights into the agency of SoftGIS. Maptionnaire, the leading commercialized SoftGIS platform, is one of a growing set of powerful tools that can support public

participation in planning and design processes. These tools must be used responsibly. We posit that a critical part of their responsible use must come from recognizing their output's situated knowledge. While planners and researchers should make efforts to communicate situatedness, striving for its complete elimination will be a futile effort. SoftGIS proponents and participatory planners must reckon with this inconvenient and uncomfortable reality and take the necessary steps to identify and communicate the biases intrinsic to virtual map-based participation.

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Chapter 4. Embodied ethnography for critical infrastructural studies: A case study of a multi-benefit levee setback in the Sacramento-San Joaquin Delta of California

Abstract

Beyond their prescribed functions, infrastructures are sites that bring together multiple agents and produce new conceptions of what a landscape is and for who. This article uses first-person embodied ethnography to explore infrastructure across five interrelated domains: remaking landscapes, making new forms of sociality, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects. Our case study is the Southport Levee Improvement Project in the Sacramento-San Joaquin Delta of California, a multi-benefit infrastructural project within the larger infrastructural Delta. Our case study explores how infrastructure, such as a setback levee, changes worlds. Our findings across these five domains of change speak to the emergent properties of infrastructural landscapes. These include physical forms such as trails and unresolved questions of access, which may exceed what planners and the public expect. In conclusion, we posit that planning processes that recognize the affective and dynamic qualities of infrastructural landscapes can better address the effects and affect of infrastructural landscape change.

Introduction

In this article we use first-person embodied ethnography to explore infrastructural change across five interrelated domains: remaking landscapes, making new forms of sociality, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects. Our case study is the Southport Levee Improvement Project in the Sacramento-San Joaquin Delta of California, a multi-benefit infrastructural project within the larger infrastructural Delta. Our method

Critical infrastructural scholarship informs our theoretical framework for how infrastructure configures new worlds, and shapes ways of being, living, thinking, and associated politics. Ethnography is a

foundational method used to explore the material and metaphorical or symbolic dimensions of infrastructure. An "ethnography of infrastructure" supports asking what infrastructure is, what it does, and what that means for the various human and non-human actors involved (Star, 1999). Critical infrastructural studies further questions how infrastructure might be made differently based on the systems and circumstances exposed by ethnographic elucidation.

Jensen and Morita's concept of infrastructures as ontological experiments focuses on how infrastructure shapes people's understanding of the world as part of the "co-evolving relations of multiple agents" (2015). A central premise of this concept is that ontologies are dynamic and emergent properties of the infrastructural assemblage. Ontological experiments are world-making events that can create relations, subjects, and objects beyond those anticipated by planners, designers, or even public participants. These new relations, subjects, and objects, in turn, shape the evolution of infrastructures through use, maintenance, adaptation, or ruination. Our emphasis on ontological change foregrounds shifting human subjectivity, connected to but transcending objective landscape changes.[36]

The coevolutionary idea that we shape infrastructure, and infrastructure shapes us, is central to our understanding of critical infrastructure studies. Coevolution, more broadly refers to an understanding that social systems effect biophysical landscape evolution, which in turn affects the evolution of social systems (Norgaard, 1984). In our previous discussions of coevolution in the Delta context, we looked at the mutual influence of composite 'social' and 'ecological' conditions as part of the intentional restoration and unintentional naturalization, recognizing that humans are integral to the design, habitation, and evolution of infrastructural landscapes (2017a). Coevolution thus connects observations of changing and mutually influencing ecologies (of infrastructure) and social practices, enabling a more comprehensive

[36] Owing to its mitigatory nature we present restoration as a particular part of the ontological experiment, following Marisol de la Cadena's provocation that restoration is an ontological transformation (de la Cadena, 2016).

understanding of socioecological change than the dominant approaches that separate the biophysical from the cultural if included at all.

Through engagement with critical infrastructure studies and coevolution, we challenge the positivistic emphasis of modern science that, despite resistance, continues to bias stakeholders, policymakers, planners, designers towards minimizing and overlooking the political, ecological, and experiential dimensions of infrastructure. By joining this resistance, we align ourselves with planners and designers attempting to be sensitive to culture, politics, personal experiences of living in a place. However, we are also seeking to understand why these biases remain, despite those attempts to acknowledge and combat them. By drawing attention to the world-making work of infrastructure we show the vibrant political, ecological, and experiential dimensions of infrastructure, even if they are not registered in planning and post-planning analysis. Our focus on infrastructures of restoration and recommoning draws attention to particular shifts that accompany a transition from a private to a public and quasi-public landscape.

Infrastructural landscapes are landscapes designed and planned to perform often multiple functions. From the infrastructural landscape's complexity emerges unpredictable surprises, which are sometimes at odds with the designed functions. Our case follows a particular infrastructural landscape that has changed in form, function, and accessibility assuming new infrastructural roles while becoming something else and creating new social and political conditions.

Our embodied ethnography foregrounds our bodies as sensors, which we see as an appropriate research tool for exploring the affective and ontological dimensions of infrastructural change. Embodied landscape ethnography provides a method for exploring infrastructural landscapes as consequential places where materiality, meaning, and aesthetics meet (Anand et al., 2018). . Generally, we understand embodied landscape ethnography as based on a relational mode of embodied engagement in "the unbroken

coincidence of our being, our doing, our knowing" (Maturana & Varela, 1987).[37] Specifically, embodied landscape ethnography entails interacting with the landscape and its people, creatures, and materials.

As researchers, we are participants in coevolution, becoming documentarians of place and people affected by our presence. In this way, our embodied ethnography is an ontological experiment in its own right. As participants in the coevolution, we contribute to the emergent experiential field and associated ontologies by engaging them in our own provisional and experimental way. We are likewise affected by this engagement. However, we recognize that there is much change that we cannot detect and specific changes that are perceivable (or matter) to us because of our positionality as academic researchers trained in specific modes of landscape sensing and embodied ethnographic engagement.

GIS/GPS methods (ArcGIS Collector app) aided our embodied ethnography, allowing for spatially explicit information and photo documentation of human activities, traces of human use, and instances of ecological dynamics. This data augments research on the planning, implementation, and performance of the Southport Levee Improvement Project (SLIP) in the context of multiple overlapping State-led initiatives.[38] This article and the larger research project of which it is a part seek specifically to fill an identified void related to social dimensions of multi-benefit projects. While economists may assess economic impacts, the Delta science enterprise knows little about how such projects affect those who live, work and play within the immediate landscape (DISB, 2017).

[37] In their recent article Tilley and Cameron-Daum describe this position similarly, stating that "our perceptual senses intermingle in our embodied experience and all at once" (2017).

[38] These initiatives include the overarching Delta Plan, which aims to minimize development in flood-prone areas, and the Central Valley Flood Protection Plan (CVFPP). The CVFPP promotes multi-benefit flood designed to "reduce flood risk and enhance fish and wildlife habitat, as well as create additional public benefits such as sustaining agricultural production, improving water quality and water supply reliability, increasing groundwater recharge, supporting commercial fisheries, and providing public recreation and educational opportunities, or any combination thereof" (CVFPP).

We will begin with an overview of the concept of the Delta as an infrastructural landscape, drawing on our previous work. We will then summarize Jensen and Morita's concept of infrastructures as ontological experiments and outline the five domains of change: remaking landscapes, making new forms of sociality, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects. Having provided a general and theoretical context, we will introduce initial research questions emerging from the interplay between context and guiding concepts. With context, conceptual basis, and research questions established, we present our case study, the Southport Levee Improvement Project, as a specific infrastructure within a larger infrastructural landscape. We will outline our method of a detailed case study using embodied landscape ethnography tools and data from our case study, followed by a discussion interpreting the data guided by those research questions. The conclusion will return to the larger guiding research, focusing on how our methods can inform efforts to understand how Delta publics engage with (using and perceiving) restored Delta landscapes. We will lastly address the relevance of this understanding to the effective implementation of multi-benefit projects in this Delta context and elsewhere.

Background

Delta as infrastructural landscape

> Given the compound infrastructural character of the Delta, meaning the wholesale remaking of it through infrastructural means (dredging and levee building), followed by the "reclaiming" of that infrastructure to serve a larger globalized constituency as the state's water delivery hub, we can confidently describe the Delta as an infrastructural landscape (Milligan & Kraus-Polk, 2017a)**.**

The Delta is also a landscape, scientifically understood through unique and identified landscape-scale processes, and understood otherwise as a place where people live, recreate, call home, and revere as a sacred homeland and story place (Hankins, 2018). The Delta is connected to and embedded within other infrastructures and other ecologies as both landscape and infrastructure. Within the Delta, infrastructure

and landscape exist as component pieces or operational units (Robinson et al., 2016), including levees, pumps, gates, fish screens, roads, and bridges, generally understood as infrastructure. These are joined by restoration projects that function as mitigatory landscapes, at once part of and responding to larger infrastructural effects (Milligan & Kraus-Polk, 2017a). The result is what Jensen and Morita refer to as an "ontological palimpsest" of layered and multi-scalar infrastructures (2017). We attribute much of the "cantankerous complexity" of Delta politics to these multiple understandings (Luoma et al., 2015) and plural ways of being in the Delta.

Infrastructures as ontological experiments

Carl Bruun Jensen and Atsuro Morito have written extensively on infrastructure and ontology in a Delta context, the Chao Phraya Delta in Thailand (2017; 2017). In their work on infrastructure as ontological experiments, Jensen and Morita synthesize the recent turn towards ontology and infrastructure within anthropology and science and technology studies (STS), building from anthropologist Brian Larkin's work on the ontology *of* infrastructure (2017) towards infrastructures as experiments that produce new practical ontologies. For the authors, practical ontologies concern the concrete construction of worlds and all those diverse components that contribute. Infrastructure generates practical ontologies which may simultaneously affect the five aforementioned domains of change: remaking landscapes, making new forms of sociality, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects (2017).

Large-scale infrastructure projects remake physical landscapes to support specific functions, often emplacing new ones and displacing the existing ones. Remade landscapes take on both new physical forms and forms of description. In this way, both the landscape and the ontological terrain transform with implications for the project afterlife. While non-human actors may disregard the shift in landscape description, how a landscape is variously understood can matter significantly to who relates to a landscape and how they act within it, which has implications for how the landscape evolves. For example,

intrepid, curious bike riders may view a levee setback construction site as a playground, whereas dog-walkers and joggers may be deterred by heavy machinery.

New landscape forms, features, forms of description, and related access regimes create new forms of sociality as new and existing inhabitants relate and act differently. Penny Harvey's study of waste infrastructure development in Peru (2017) provides an example of new forms of sociality that emerge as decomposing material of some is reconfigured as a resource for others. Importantly, Harvey notes that the "recognition of infrastructural relations as categorical relations, also allows for the recognition of the spaces between categories, and the excesses, slippages, and ambiguities that in turn hold the potential for ongoing transformation" (2017). There are anticipated, sanctioned, unsanctioned, and surprising uses and users of infrastructures that do not fit neatly into predefined categories but make up the infrastructural assemblage and contribute to its evolution. In our previous study of human use of restored and naturalized landscapes, we have observed such "excesses, slippages, and ambiguities" elsewhere in the Delta. We have noted their importance in landscape evolution (Milligan & Kraus–Polk, 2017).

After infrastructure remakes a landscape and new uses and users emerge, a new politics is defined among those concerned with a project's (after)life. This politics may concern oversights from the planning process, who does and does not have access to what, and why. Jacques Rancière refers to these questions of access as the 'distribution, or redistribution of the sensible' - meaning what is and is not aesthetically made public - and, more generally, the *politics of aesthetics* (2013). For us, Rancière's point is that the everyday public experience of infrastructure is not a given. Instead, public experience is constructed through creative, institutional, and political means (2013). This construction can be contested as aesthetics are challenged and impacted by human and non-human activities. Immense amounts of energy, labor, money, and power may be required to maintain an aesthetic. Such maintenance work can be invisibilized or become part of a project's post-completion aesthetic. When maintenance work ends or is disrupted, a new feral aesthetic may emerge, ultimately leading to an aesthetic of ruin, which can have wide-ranging

political implications (Gupta, 2018). Infrastructure connects, but the connections can be strategically hidden. When infrastructure fails, (dis)connections can become sensible. There are political implications for both.

Infrastructure reorients human and more-than-human agency as people, beings, and materials form new assemblages within the landscape, with their own unplanned and emergent properties. Infrastructure can enclose, strip agency away, and liberate new actors to bring their actions to bear on the site. As Milligan notes, agency can be ascribed and conceptualized in multiple ways, with implications for how we design and act politically within a landscape (2022). As researchers and infrastructure co-designers, we strive to be open to what Pickering describes as the "dance of agency," involving such diverse entities as water, sand, plants, birds, people, and machines (1993). Many things act within an infrastructural assemblage, contributing to knowledge that does not fully recognize those actors and their actions. Different people ascribe agency differently or focus on one identified source. Our senses and thus our stories are ever partial.

Infrastructure reconfigures subjects and objects as both a thing and their relation (Larkin, 2013). Infrastructure is a thing that moves things. Infrastructure creates dependencies that can be taken for granted until that movement is disrupted. Infrastructures can also serve as objects of protection that reconfigure a thing as a threat and another thing (or people) as safeguarded, worthy of protection. Infrastructures continuously work to relate and, in doing so, redefine a heterogeneous suite of actors, making them liable to unpredictable change (Jensen & Morita, 2015). Furthermore, because infrastructures are shaped by and shape politics, society, and the environment, these unpredictable changes can have broad ramifications.

Together these interrelated five domains of change indicate the profound implications of infrastructural change, which can be felt on many registers. While certain dimensions of change appear self-evident (to

some), others may be more insidious. Part of our attempt at categorization aims to ask why this is so, à la Ranciere. Reflecting on our attempts helps reveal our own biases. Playing with our biases allows us to speculate on how we feel about infrastructural change and how we might co-design infrastructure that elicits different feelings in ourselves and others.

Research questions

Our overall research question examines the ways Delta publics engage with (use and perceive) restored Delta landscapes. This question concerns how restored Delta landscapes as infrastructural and ontological experiments create new worlds and conditions. For this article, we will empirically explore five domains of ontological change related to remaking landscapes, making new forms of sociality, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects. Our exploration method will be embodied landscape ethnography. We intend our exploration to draw awareness to the world-making work of infrastructure so that it might be planned, designed (or combatted) with a greater consciousness of its affective and indeterminate dimensions.

Method

Our method is development of a detailed case study using embodied landscape ethnography aided by photo documentation and spatial data collection using the ArcGIS Collector app. In this case, we explore the use and perception of an infrastructural landscape and the activities of people and other agents within it. In practice, our method entailed taking in the landscape through biking, walking, collecting data points, photography, talking with people, and thinking critically about how this landscape-as-infrastructure came to be and the ramifications for the affected communities and the larger adaptation agenda. Our own embodied experience in the landscape process meant that we affected the landscape as well.[39] We were seen by others and left traces of our own.

[39] We have previously discussed our concern with affective ecologies in the Delta (Kraus-Polk & Milligan, 2019).

The ArcGIS Collector app facilitated the collection of geospatial data on people, traces, and tracks. We then categorized collected data into people (angler, boater, cyclist, dog-walker, scientist, walker, worker) and traces (art, encampment, erosion, fires, other, trash). Tracks were documented as lines by starting collection at the beginning of a track and ending at the end. Qualitative descriptions and photo documentation with phone cameras augmented geospatial and categorical data. Spatially explicit data on human use was cross-referenced to biophysical information related to the site's evolution, including weather, water levels, erosion, plant growth, fish and bird presence, and general aesthetics. The aim was to bring together the social and the biophysical to inform an understanding of how people perceive the landscape with an awareness of the multiple cultural and environmental factors shaping perception and evolving human-landscape relations.

The ArcGIS Collector app data collection occurred from May 2019 through December 2021. We collected data during approximately 30 intermittent, irregularly timed site visits. Site visits were often conducted alone and occasionally with both authors. We intended to understand the seasonality and timing of specific activities and the relationship between those activities and seasonal events such as flooding.

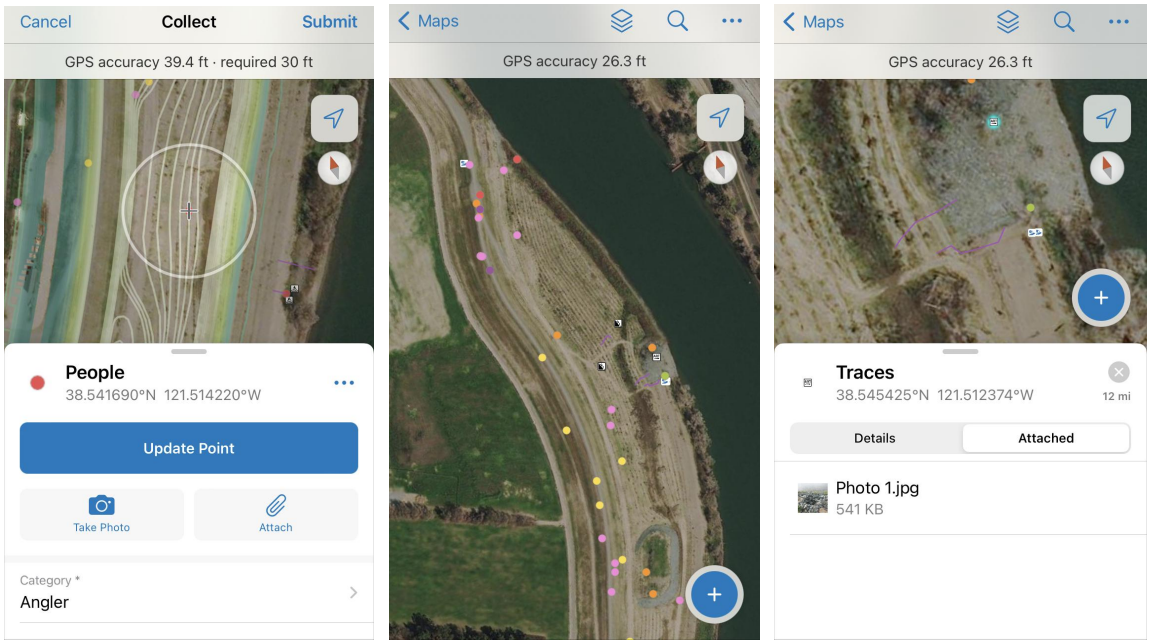


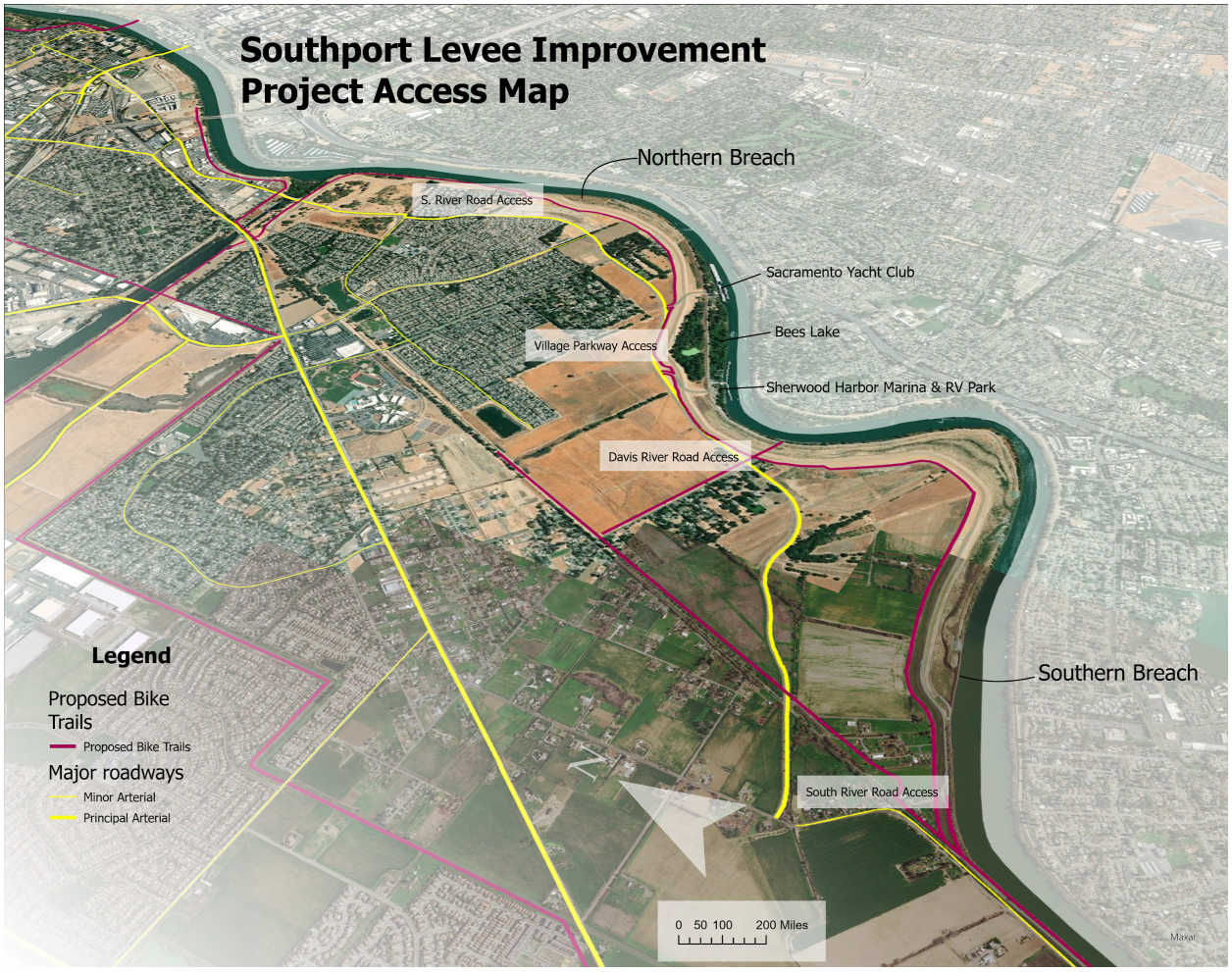
Figure 4.1. Screenshots from the ArcGIS Collector interface.

Additional photo documentation bears witness to coevolution from the construction period through the ongoing post-implementation phases. Novel assemblages and feral edges drew the attention of our senses and lenses. Human subjects are depicted engaged in sanctioned and unsanctioned activities, some of which we have observed previously on restored and naturalized Delta landscapes (Milligan & Kraus-Polk, 2017a, 2017b). We partially relied on photo documentation, which has biases and affordances as visual modes of sensing, combined with the geospatial positioning system to help memorialize and trigger our memory. We recognize that visuals provide partial and situated knowledge that conditions and delimits affective responses and their political ramifications. We have sought to expand our narrative descriptions beyond the visual for these reasons. Thus our embodied ethnography was also multi-sensory and social. We talked with the people we encountered and got our shoes muddy in the receding floodwaters.

Case Study: The Southport Levee Improvement Project

The Southport Levee Improvement Project (SLIP) included fix-in-place improvements and a new, approximately five-mile setback levee with material transported from borrow sites. Additional construction included realigned roadways, new access ramps, turnouts, cul-de-sacs, and maintenance corridors. The project involved massive earthmoving to recreate a floodplain for the Sacramento River and improved levees to contain these high floodwaters, expected to become more frequent with climate change.

Levee standards revisions after Hurricane Katrina catalyzed the SLIP. The West Sacramento Area Flood Control Agency (WSAFCA) prioritized levee improvements in this area of West Sacramento as part of an ongoing regional effort to create or restore the 200-year level of protection required for urban levees. The project protects existing and new developments currently in the advanced planning phase and under construction. However, until the entire regional effort is complete, a failure in the West Sacramento levee system during a large flood would inundate approximately all of the City, with floodwaters up to 20 feet deep. Evacuation routes would be quickly flooded, potentially contributing to a loss of life.



Map 4.1. Southport Levee Improvement Project Access.

The SLIP is multi-benefit due partly to geotechnical considerations that required setting back the levee from the river, allowing for habitat creation exceeding the mitigation requirements. The SLIP is a self-mitigating project with on-site habitat mitigation, which in this case exceeds legal requirements. The project is restoring 212 acres of habitat, with a net increase of 114 acres of habitat that did not exist before the project. In addition to the ecological benefits, the touted recreational benefits relate to connecting a growing regional trail system. Several engineering groups have recognized the SLIP as representing a new paradigm in multi-benefit flood control.[40]

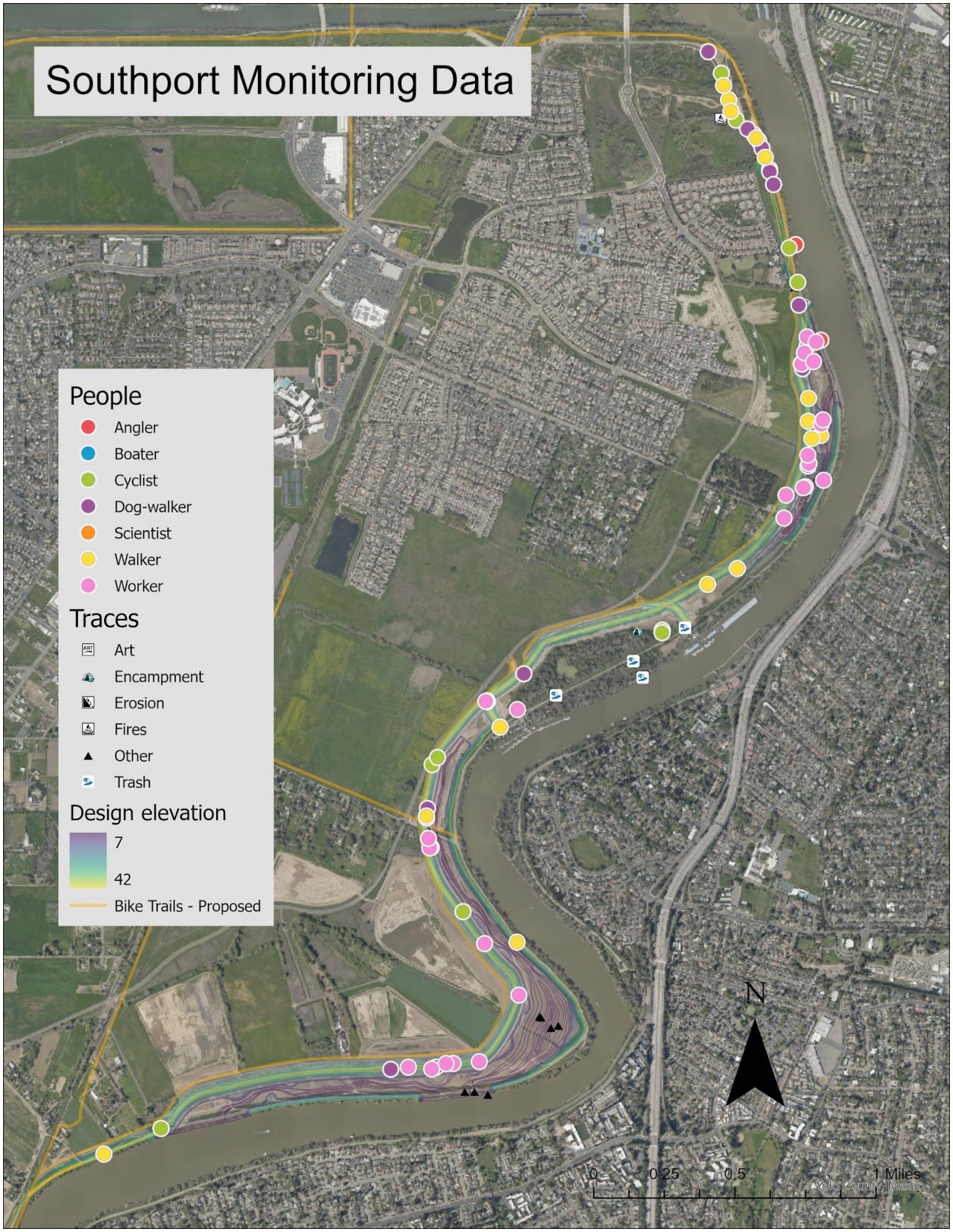
[40] The award-winning project received an honor award in 2021, a merit award in 2020 from the American Council of Engineering Companies, and an Envision Platinum Award for Sustainable Infrastructure from the Institute of Sustainable Infrastructure (ISI, 2020).

From an engineering perspective, the project appears to be functioning as designed with routine inspections by staff from the local reclamation district and flood control agency. However, no post-construction monitoring efforts exist to study the ecological functions of the projects, including designed benefits to State and Federally listed fish species. While mitigation measures exist to 'develop and implement a drainage and grading plan that minimizes losses of fish from stranding,' the assumption is that stranding will impact non-native species, as native species evolved to take advantage of ephemeral floodplains (ICF, 2014).[41] No measures exist in the Mitigation Monitoring and Reporting Program related to recreation, socioeconomics, environmental justice, and community effects (WSAFCA, 2016). The company awarded the contract to plant the setback area regularly monitors the condition of the plantings, focusing on survival and supporting irrigation infrastructure. While affected communities were involved and considered in planning and design, we are aware of no official post-construction engagement efforts.

In chronicling our embodied experience of the SLIP, we are documenting our sense of how others' relations to the landscape have changed. What the landscape is understood to be has changed dramatically, along with what it does and whom it benefits. The SLIP rendered an old levee obsolete and created a meticulously designed new levee that will be highly maintained. The old levee will degrade in time. However, the new levee will protect more lives and property than the one it replaced from floods predicted to be larger and more frequent. The plan called for the strategic breaching of the old levee to allow floodwaters to flow into the space (setback) between the old and the new. In doing so, the uniform bank of the Sacramento River, constrained by levees both up and downstream of the project site, is now punctuated by a new heterogeneous ecological and social experiment.

[41] The drainage and grading plan was informed by CBEC's two dimensional hydrodynamic model. According to CBEC, "model simulations characterize the inundation dynamics for offset areas which are helpful in characterizing the habitat quality for salmonids at flow ranges that tend to occur during critical times (i.e. outmigration / rearing) during their life cycle. The ability to use the model to optimize the habitat for target species presents a significant opportunity to design for the best possible ecological outcomes" (CBEC, 2019).

We conducted our research without any official, project-affiliated landscape or social change study. California Department of Water Resources (DWR) financially supported our research and provided a significant portion of the SLIP funding through distinct projects. While conducting our research independently, we communicated with project proponents, including staff from the West Sacramento Area Flood Control Agency (WSFCA), the West Sacramento Division of Flood Control, and the West Sacramento Division of Parks and Recreation. We also talked with staff consultants involved in modeling and design efforts, monitoring, and the staff for the contractor responsible for the post-construction planting of the setback area.



Map 4.2. Cumulative monitoring data for the entire period of study.

Results

Tracks (bird and bike) in the dry northern setback area. January 7, 2019

Data on people and their traces supplemented research on the planning, implementation, and performance, allowing insights into how the SLIP creates new conditions across five domains of ontological change related to making new forms of sociality, remaking landscapes, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects.

Purely quantitative data provides insights into some trends but cannot offer insights into others. A broader understanding of the world-making work of the SLIP requires a contextually richer narrative; however, quantitative data does show the demographic shift from a worker-dominated construction landscape to a post-construction landscape with diverse users (Figure 4.2.). The data also provides a picture of the prominence of certain types of users during the discrete periods of observation (Figure 4.3.). Trace observations appear fairly random across the sampling timeframe (Figure 4.4.).

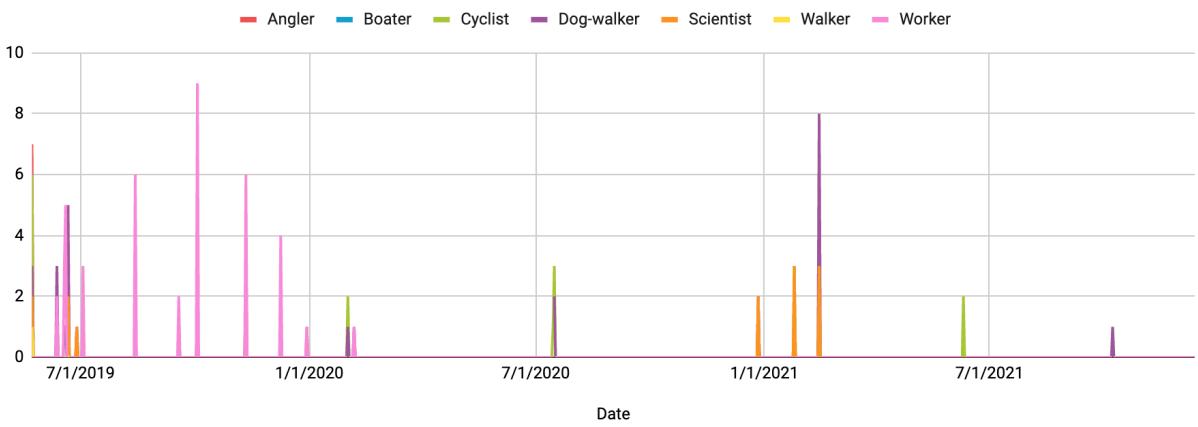


Figure 4.2. People observations over time by category

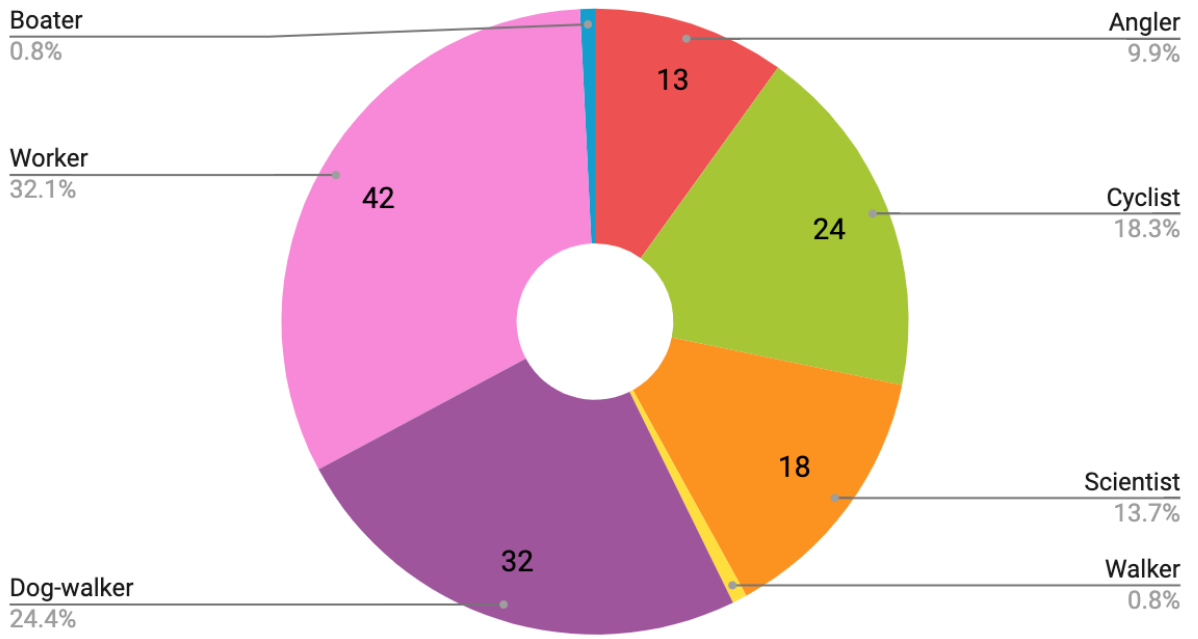


Figure 4.3. Total people observations by category

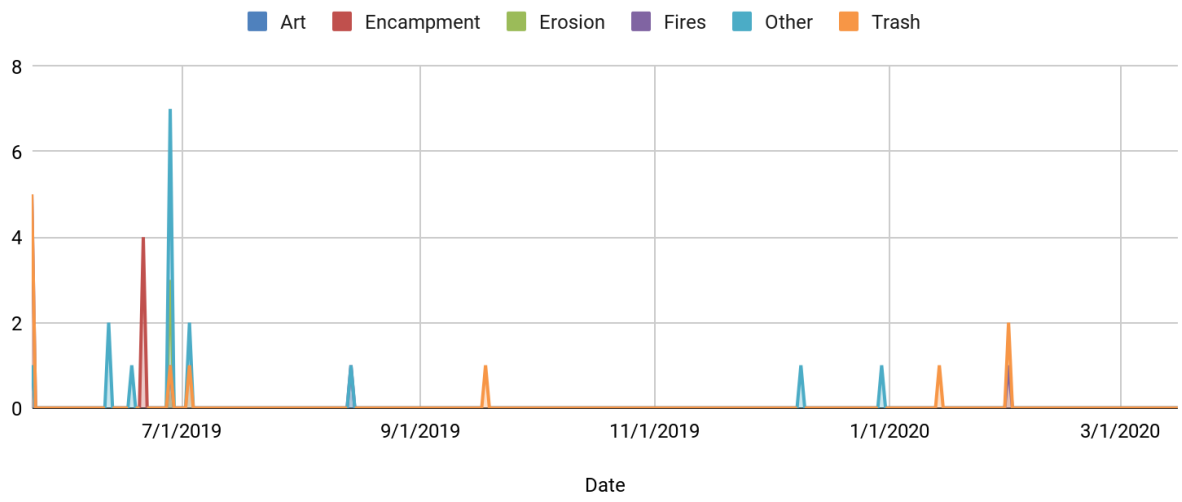


Figure 4.4. Total trace observations over time by category

remaking landscapes

The three-year project involved moving over two million cubic yards of earth, according to the Teamsters Local 150's Construction Division (Joint Council, 2019). Thirty-eight articulated dump trucks ran six days a week for several months to create a mega levee on what had been farmland. Earth was taken from adjacent borrow pits, which had to be later filled in with material imported from several miles away. The monumental terraformation was felt when biking through the construction site on off days and holidays. Earthen ramps had to be constructed to allow these massive trucks to scale the mountains of moved material which brought exhilaration to bikers used to flatlands. SUV-sized trenches were carved into new levees as part of their construction, enabling a surreal journey into the center of a levee. Large machines sculpted features based on highly engineered contours to provide flood protection while supporting floodplain habitat functions. Specific mixes of soil and cement were injected into existing levees to improve their stability.

Biking in the levee. Near northern breach site. July 22, 2018

Biking on the setback construction site. Near northern breach. July 22, 2018

Video still from a City of West Sacramento promotional video (Sacramento, 2018, pt. 3:11)

What had been part of a continuous leveed bank has become a dynamic vegetated setback area designed to flood in the winter. The breaches created new harder-to-reach peninsulas, islands emerged during floods, and a riparian forest weaned off water grows fast until the next big flood. The setback levee also exemplifies landscape urbanist Pierre Belanger's 'landscape as infrastructure' embedded and enabling new urban growth in a floodplain (2009). However, as Morita notes in his study of floating rice in the Thao Praya Delta, world-changing and landscape remaking infrastructure can be seen as a product of a changing political economy. The role of infrastructure as both catalyst and symptom speaks to its imbrication in the coevolutionary process.

Slurry injector for fixing the levee in place. Northern levee. August 7th, 2018

Slurry material. Northern levee. August 7th, 2018.

Smoky view from the construction site, looking towards existing and planned residential development. August 7, 2018

However, the project also remade landscapes on a smaller scale by creating new formal pathways and conditions for their informal generation. The formal pathways include the gravel road intended for joggers, walkers, and bicyclists. Fish are also using the inundated setback area, as evidenced by sightings of piscivorous birds (no monitoring is occurring to validate the presence of fish directly). The informal pathways forming include the ‘desire lines’ of anglers, who cut across the setback area when it is unflooded to reach the old levee and the rip-rapped outlet points. Boaters are also finding their way into the flooded setback area, either out of curiosity or by mistake.

Boat in the setback near the Northern breach. April 24, 2019

making new forms of sociality

The project has heavily affected sanctioned and unsanctioned activities, creating new forms of sociality, including bikers, anglers, workers, walkers, and boaters. The primary recreational infrastructure, a gravel trail on the new levee crown, is evident and heavily used. However, the ruins of the old levee provide paths taken by anglers to old and new fishing locations. Other unplanned ephemeral trails cross the seasonally flooded setback between the ruins of the old path and the new. The SLIP was designed to support certain sanctioned recreational activities. Preexisting unsanctioned activities may or may not have been either known or considered in the planning and design phase.

As with the SLIP, Harvey's Peruvian experts designed waste infrastructures within proscribed categorical limits. For the SLIP, these included setback, breach, trail, new levee, and old. Even though the ephemeral quality of the episodically flooded setback added a temporal complexity to the category, they remained hypothetically bound by model projections and anticipated flood recurrence intervals. The future will likely include floods exceeding model projects and necessitating updating current flood recurrence intervals. Discussing projected uses with project proponents and engineers, we heard a proscribed vision for how the project will function to support specified forms of passive and active recreation, along with possible interpretive features of the area's natural and cultural history.

However, we observed how the SLIP creates some unforeseen opportunities for new forms of sociality to emerge earlier and in unexpected places. One example of a new form of sociality created by the SLIP involves an evolving group of bicyclists. Before construction, bicyclists used the paved levee road, and an adjacent road (Village Parkway) continues to be a highly trafficked road biking route. During construction, a group of adventurous cyclists began biking within the evolving construction site, often riding on the compressed tracks of heavy machinery. These bikers would ride after work hours, on weekends/holidays, and during other breaks in construction. While perhaps not officially sanctioned,

these rides were permitted, and riders conversed with construction staff. Several of these riders we spoke with found the dynamic construction site much more appealing than the boring roadway it had replaced and the tamer gravel trail under construction.

Group bike ride near the Davis River Road access. June 20, 2019

The post-construction gravel trail has drawn a new group of bike riders, including participants in a weekly ride loosely affiliated with a local bike shop. Riding with this group on several occasions, we learned that the new route supports a more extensive social happening that includes post-ride visits to local breweries and eateries. This riding group is just one example of new activity trails that pass through the SLIP and the project's role within the larger regional context.

However, we observed that bicyclists are not a homogenous group. Near the project site is an unsanctioned bike pump track, consisting of jumps and carefully contoured slopes and curves carved out of an older levee, mainly through the intense years-long labor of a single person. While construction activities did not directly modify the track itself, the conversion of adjacent agricultural land increased the

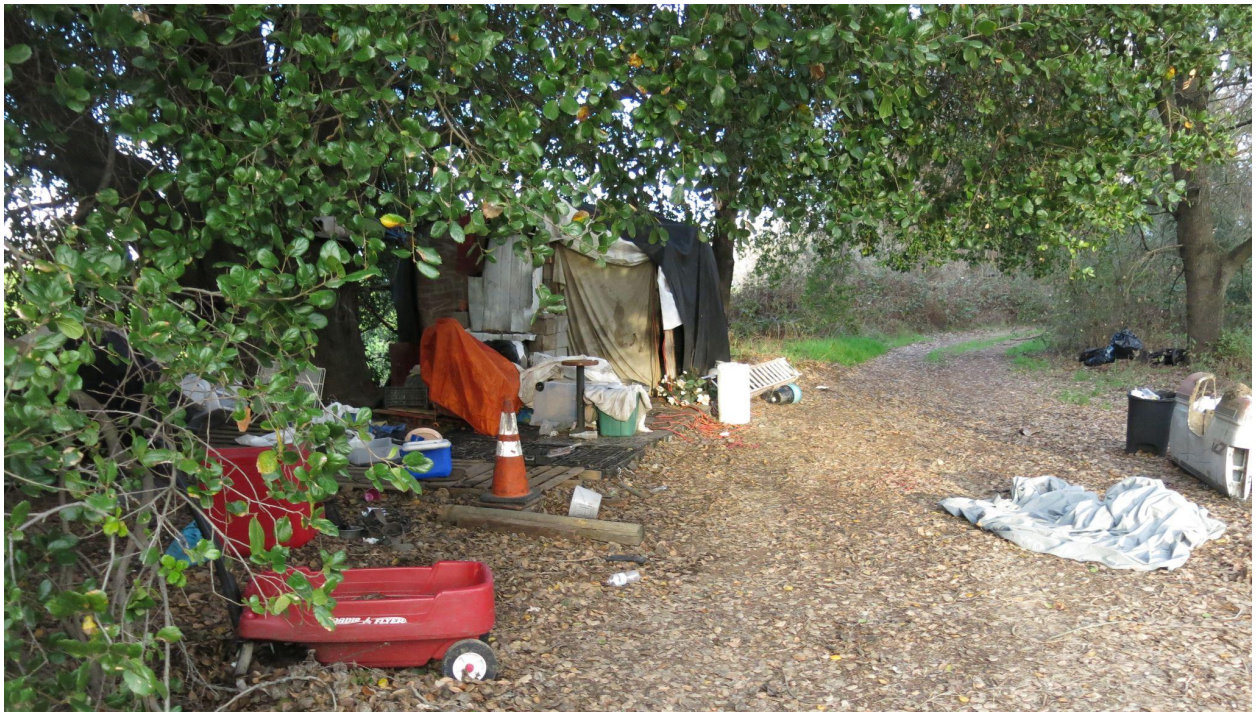
track's visibility and made access easier. Together, these changes have led new people to a previously hidden place, heretofore frequented by the single person responsible for its construction and upkeep.

Sign at the entrance to a bike pump track near the Northern part of Bees Lake. January 25, 2021

Sign at the entrance to a bike pump track. December 26, 2020

Anglers are another group whose sociality appears to have been reshaped by the project. The shaded levee bank previously had several established fishing spots. The project has created new points at the outlets where fish and fishing activities are concentrated. These new points are much further from car parking, especially when the setback floods, and have led to the use of bikes and wheeled coolers. The remoteness and lack of facilities may also contribute to illegal littering and fires.

Fishing the Southern breach from the riprap tip of the old levee. Central breach site. May 17, 2019



Encampment. Off Bees Lake setback levee. February 13, 2021

The project has reshaped the accessibility of the landscape, with implications for the unhoused. New roads have created new ways of entering remote areas. However, gated access means that car-associated camping is more challenging. Despite the challenge of negotiating gates, we observed cars in gated areas. While the bustle of construction may have deterred encampment, the completed project is beginning to become a site for unsanctioned camping. In addition, construction activities made much of the landscape visible. As vegetation grows back, new hideouts are being made, which are being occupied by people.

defining novel forms of politics

The project is a product of a particular national and regional political moment. However, it has created a local politics attuned to the ongoing coevolution of the site, its maintainers, users, and nearby inhabitants. One example of this new local politics involves a local homeowner at the end of a roadway cul-de-sac adjacent to the project. The end of this roadway was a clearly defined public access point, complete with a

pedestrian gate and a sign informing users of what uses are and are not allowed. However, there was no parking provided anywhere nearby. This homeowner was furious with people parking in the roadway or gravel expanses in front of his property, a problem he attributed to the lack of planning for recreational uses. While the planning process did identify the need for recreational amenities, such as parking, these amenities were deprioritized and unbuilt due to financial constraints.[42] We have seen many instances where the unanticipated creates problems. In this case, the planners anticipated the parking problem, but a resolution was seemingly put off in the interest of project completion.

Political perceptions must often shift or be actively shifted before transformative large-scale infrastructural projects can be constructed and thus often require a political catalyst. For the SLIP, that catalyst was Hurricane Katrina and the subsequent revaluation of flood control throughout the country, including the highly vulnerable Sacramento region.[43] The multi-million dollar project was funded by the California Department of Water Resources and the US Army Corps of Engineers, which required authorization by Congress. The project will provide 200-year flood protection for existing and future developments and is part of a larger transition from agriculture to suburbs in the Southport area of West Sacramento.[44]

[42] According to the appendix of the project environmental impact statement, landowners had informed the City that some recreational users are trespassing on private property for parking and staging. One or more official parking areas were promised to provide for safe, off-street parking and staging and reduce trespassing on private property (A-4) (ICF, 2014).

[43] According to a 2016 USACE report, a flood in the area caused by a levee breach could cause massive damages on the scale of $4.53 billion, potentially significant loss of life, as well as major disruption to transportation corridors and critical infrastructure (2016).

[44] As a multi-benefit project, the SLIP mobilized a more diverse consortium of interested stakeholders, including West Sacramento's Department of Parks and Recreation, and a multi-organizational effort supporting multi-benefit flood projects in California's Central Valley. The SLIP was also included in California's Ecorestore program, a multi-agency initiative launched in 2015 to advance at least 30,000 acres of critical habitat restoration and enhancement in the Delta. Few multi-benefit approaches at this scale exist, making the SLIP a poster child for a new paradigm. While there may be a desire to replicate its success, there is also a reality that a unique convergence of circumstances enabled this project. Funding has historically been a significant impediment.

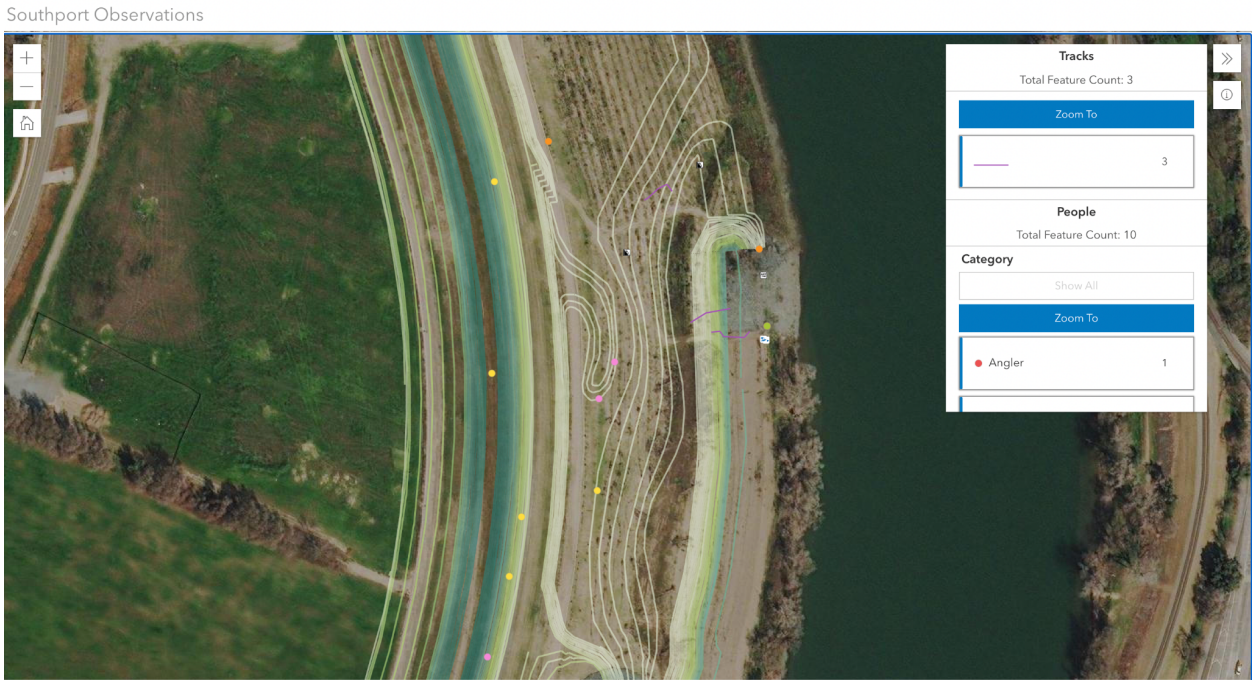


Figure 4.5. ArcGIS Collector data viewer interface showing data collected near the Northern breach.

reorienting agency

The SLIP reorients human and more-than-human agency as people, beings, and materials form new assemblages within the remade landscape. Overall the constellation of landscape actors has become more diverse. Defined by a simple levee the previous landscape was maintained by a reclamation district. The levee crown had a paved county road that provided easy fishing access and supported local transportation. Remaking the landscape enrolled diverse construction personnel, environmental monitors, and later restoration specialists. The reclamation district will still be in charge of maintenance and monitoring, but they will be joined by other city and flood control district personnel. The breaches and setbacks will also attract birds and fish, anglers, and birdwatchers.

The SLIP replaced agriculture with intensely managed habitat, with similar labor and water use regimes. However, in this case, more labor and perhaps water are required to maintain habitat than was needed for

the prior farming. Unlike the prior agricultural landscape, the setback habitat will be set free from regular maintenance after three years of careful nurturing. This new feral landscape relies on the agency of the plants and other creatures to live or die within the constructed floodplain habitat. Already we are seeing ecosystem complexity emerge as plants provide shelter and hiding places for animals, trap sediments and debris, and prevent erosion. However, periodic herbicide treatment by workers as part of levee maintenance ensures, for now, that the feral space is contained.

Infrastructure can enclose and liberate. The SLIP has elements of a recommoning, in the transition of private agricultural land with tightly controlled access to more open-access commons, including seasonally navigable waterways. This change in the access regime means “owners” no longer have the same agency to exclude people. However, there remain efforts by the new land managers to exclude other beings, such as through the aforementioned periodic herbicide treatment. Even with the shift in access regime, there remain attempts at managing access through fences, gates, and the dubiously placed no-trespassing sign at the entrance to one of two informal bike pump tracks.

We observed smaller-scale maintenance instances where entanglements between people, infrastructure, and nonhumans are evident and affect how the landscape coevolves. We observed how altered hydrology around the breach sites leads to an accumulation of sandy sediments that threaten to disconnect the new floodplain from the river for longer than designed. We suspect that sediment accumulation may trigger periodic maintenance to ensure connection at lower river stage levels. Such maintenance regimes would likely enroll people and machines to moderate sediments that will continue to accumulate.

Southern Breach. April 29, 2019

Walkers in the setback. Northern breach. May 8, 2019

Dog walker in the setback. Setback area north of southern breach. June 21, 2019

reconfiguring subjects and objects

The infrastructural landscape is maintained by the staff and contractors of several entities, visited by a diverse public, and protects a growing population in the floodplain. The SLIP is reconfiguring the 'objective' space of the Southport area, but less noticeably the "subject positions" of those who depend on the new infrastructural arrangement (Jensen, 2017). The latter is aesthetically elusive as many of these subject positions are "silent," apparent only upon infrastructural breakdown. Other "silent transformations" involve entities and activities that are hardly noticeable and beyond the pale of public debate and controversy (Jensen & Morita, 2015). Fortunately, our data collection did not include a large-scale breakdown, such as a levee breach, that would have rendered how the setback levee (object) protects dependent communities (subjects) and brought attention to the other entities at work in the production of disaster.

The transition from an agricultural to an infrastructural landscape has created new subjects and subject positions. The agricultural landscape was privately owned, farmed by a small group of people, and provided food or food inputs for a larger group of people. Monoculture agriculture was devoid of significant biodiversity. The SLIP is becoming a habitat for plants, beyond those planted by the contractor as part of the restoration, and other creatures, from hand-fed feral cats to bald eagles. The levee protected the agricultural landscape and has been replaced by the setback levee infrastructure, which protects the new houses constructed on retired farmland. In this way, the SLIP plays a role in a larger and ongoing transition in the region, away from agriculture and towards more urban land uses. However, when this transition occurs on floodplains, it comes with a reconfiguring of risk.

Our methods and data could not directly observe the new dependencies forming between the flood control infrastructure and the population and property it protects. People lived behind the old levee, and more people will live behind the new levee. Within the bounds of our project site, where we deployed our fieldwork methods, it was impossible to sense the new dependent subject positions configured as people began to move into the protected setback area. Despite the significant transformation, the reconfiguring of dependent subjects remains aesthetically elusive. There is no noticeable transformation within the project site that corresponds to the development the project has enabled. Hints might be ascertained from increased popularity, presumably connected to more people living in the area. However, we are not confident in assuming this causal relationship.

Although beyond the reach of our method to sense, the “levee effect” is a recognized phenomenon where levee construction and improvement increase flood vulnerability by creating incentives for development based on a general sense of safety (D’Angelo et al., 2020; Hutton et al., 2019). While the setback of the SLIP is a novel approach, it remains a levee project and is subject to this associated paradox. This levee effect reconfigures subjects by changing risks, perceptions of risk, and those at risk. The transition from

rural to suburban development in a floodplain increases the consequence of flooding. However, if levee upgrades enable this transition, the probability of flooding decreases. Defining risk as a product of consequence and probability, we can see how risks change with transition, recognizing that scientific understandings of all factors are governed by degrees of uncertainty.

However, understanding the risk perception of the affected community does not always abide by such a simple formula. Dr. Pamela Rittelmeyer's study of risk perception in the Delta attributes risk perception to individuals' social and cultural characteristics, emphasizing trust and values (Rittelmeyer, 2020). Rittelmeyer's study validates the position put forward by Slovic (1987) that "people who feel less control over a hazard tend to perceive a risk to be higher than those who think that they have control over it" (2020). While the development plan remains partially built, new residents already live behind and recreate on a state-of-the-art setback levee. The size, expense, and aesthetic of this new levee seemingly convey an assurance of control, which, when coupled with flood insurance, appears at least enough to promote investment and habitation. Rittelmeyer further deconstructs "social and cultural characteristics" to understand risk tolerance. Rittelmeyer's study finds that "the combination of trust, what a person values most about a place, and their perceptions of the scale of risk and adaptive capacity is a strong determinant of their tolerance for risk" (2020).

The new levee divides habitat farming (left) and conventional agriculture (right). February 13, 2021

Discussion

Being in the SLIP from construction through "completion," we observed world-making events that created relations, subjects, and objects beyond what planners, designers, or public participants anticipated. We attempted to categorize examples of these events across five domains of change. However, we recognize that the events are interrelated and defy simple, untroubled categorization. Much of our categorization relates to a provisional starting point from which we qualify change. While the SLIP is an experimental infrastructure, we did not have a control site to compare, and therefore we cannot know what would have been in the absence of the project.

Planners and designers anticipated that the social life of the landscape would change after the project's completion. Our monitoring tracked changes that began during the construction phase, where curious people were attracted to a landscape in transition amidst the earthmoving. We monitored the site during dry summer months and wet winter days, noting the choreography of water, workers, scientists, birds, cyclists, dog-walkers, anglers, and their associated materials, detritus, and traces. We saw vegetation, including carefully "farmed" habitat and feral growth. We noted how the mechanized monumental earthmoving differed from the labor and water-intensive work of horticultural restoration, each with its schedule and cultural practices.

We noted the cultural differences within various categories we had created for our monitoring plan. The pack of shop-affiliated gravel cycling enthusiasts was very different from the lone dirt jump biker on his hand-hewn pump track. Both were in the bike category but represented a very different form of sociality. Similar distinctions were evident within the angler category, where depending on the season, different groups would fish for different fish in entirely distinct locations.

The contours of these differences emerged throughout many visits spread out over two and a half years. While more intensive monitoring may have yielded specific insights, we see value in a more prolonged engagement. We can imagine a more refined approach that balances rigor and consistency with a timeframe befitting some of the multi-annual cycles present with such a project. We also recognize the value of trace observation to avoid possible observer effects. Seeing traces of activities may not directly affect those activities in the ways that witnessing them firsthand might.

As participants, we bring our own biases, which affect our perceptions as we perform the labor of monitoring. Our embodied ethnography included sensing that was a mix of first-person and technology-mediated. Through the former, we understood the site as an affective landscape. However, the latter, specifically the arcGIS collector map, presents the landscape as a passive object. The internal

tensions that arise from reconciling two disparate understandings inform our composite perspective on changes over space and time. Having looked at maps, we situated ourselves in the landscape in a particular way, attentive to features and histories beyond our immediate senses. Later, when looking at a map, our understanding of the 2D space was deepened by our previous presence.

Just as different site maps convey different information about the project, our particular experiences brought unique affordances. An obvious example would be biking, our predominant mode of mobility while on the site. While biking allowed us to perceive certain things, such as the view from the back of a dusty peloton, we also missed things that we might have sensed had we been walking, boating, or lying still. The site's large size, time constraints, and protocol called for surveying the entire site every time we monitored, limiting any extended presence at a single site or the more leisurely pace at which some activities occur. However, biking also allowed us to stop and talk or look at things that caught our eye. Visiting the entire site did provide a sense of coherence to the project, which is already becoming enfolded in the surrounding landscape.

We were afforded opportunities as academics and researchers to connect with people involved in the project, which informed our understanding of the scale of the project. These connections also begat more connections that tied us into a community of people who knew the project well as designers, planners, and active users. In addition to the legitimacy afforded by our academic positionality, we were also financially supported to engage in this research as part of a larger initiative to explore how people relate to restored Delta landscapes.

We also brought our political perspective to the project, which we variably understand as part of larger movements toward nature-based solutions to climate change and associated infrastructural breakdown and buildup. The coevolution between people, the project, and the ecosystem in which they are embedded will occur in the context of climate chaos. Already the project has seen drought and flood, which have affected

coevolution. Vegetation will continue to respond to these cycles. Water in the setback will continue to mediate human and fish access, attracting various birds and perhaps bird watchers. The predicted high variability and extremes may benefit and be conducive to certain activities while detrimental to others. A longer-term perspective must also consider sea-level rise, impacting the new project and adjacent levees.

At this point, we can only speculate on the coevolution of the site based on what we have seen so far. Human presence may change as residents occupy new developments, but it is too early to tell what these changes will be. If new residents flock to the recreational amenities offered by the project site, we could see a marked increase in sanctioned activities. However, the nearby American River Parkway shows a case with high levels of unsanctioned uses, especially illegal encampments. Many encampments already exist North of the project site and may expand if local social service offerings expand.

Climate change affects the coevolution of the site by changing what the project is protecting from and whom it is protecting. The 200-year flood may be reevaluated again by the USACE to reflect shifting recurrence intervals. Planners may consider the prospect of managed retreat or resilient relocation in the region, policymakers, and the affected community. Even if the project withstands larger and more frequent floods, the region will be as vulnerable as the weakest link in the levee protection system. There is a long way to go before the entire system is consistently protected.

Conclusion

From the beginning, our methods were experimental and part of a pilot study that could inform future approaches to studying landscape change. Our data shows a transition from a construction site dominated by workers and scientific monitors to an open access landscape becoming known to various people at play. New recreational affordances are evident through new uses, users, and activity trails. These include cyclists and dog walkers on the gravel trail on the levee crown, anglers fishing from the riprap, and people

exploring the setback on foot when dry and by boat when flooded. Our observations track a shift in the composition of bikers (including ourselves) and where they biked.

In the course of this research, we have been part of the coevolution of the project: observers of landscape change, participants in new forms of sociality, considering at a distance (here) novel forms of politics, reconfigured from curious interloper on a construction site to post-implementation recreators, all the while maintaining our positionality as academic researchers. We have noticed ourselves foregrounding or backgrounding different infrastructural aspects of the multi-benefit project. Seeing others do the same, we recognize this as part of the experience of navigating infrastructures, which is part of cultural practice (Edwards, 2003).

Using the five interrelated categories of change was a helpful approach to organizing observations from our embodied ethnography of infrastructure field method. Having organized our observations around these five categories, we would in the future be more attentive to those five interrelated changes, in effect categorizing "in the field." However, we recognize the irony of categorizing those things that escaped prior categorization and understand that most of our observations could fit into any of the five domains of change.

Based on observations, we think future multi-benefit planning and design efforts could place more consideration on co-evolution beyond project completion. In the messy assemblage exists the potential to advance or negate initial project objectives and the opportunity for new unforeseen desires to emerge. Recognizing this, planners and designers could have made explicit accommodations for people in the ongoing site evolution. Even the project's plan for active recreation does not anticipate that these activities will greatly impact the site. What would it mean for planners to plan for the public, i.e., non-planners, to develop and implement future site designs that advance initial and emerging site objectives?

Our research also shows us how infrastructural landscape management dovetails with the distribution of the sensible as part of a political aesthetic. The political and social implications of how large-scale multi-benefit or green infrastructure are managed or moderated warrant further study. We hope that these kinds of infrastructure will increasingly grow in scale and distribution, replacing prior forms. However, if and as they do, we believe that planners, designers, and managers should be aware of the implications of actions that may hide or reveal certain functions. Daylighting a creek reveals infrastructure and can be done in ways that invite engagement and create learning opportunities. Dam removals are an example of a high-profile infrastructural fix with wide-ranging implications. Setback levees are akin to partial dam removals as they provide limited horizontal connectivity while maintaining or even increasing flood protection.

In conclusion, we posit that planning processes that recognize the affective and dynamic qualities of infrastructural landscapes can better address the effects and affect of infrastructural landscape change. Climate change adaptation will increasingly take the form of large infrastructural landscape interventions. Embodied landscape ethnography affords unique insights into the coevolution between people, projects, and the ecosystem in which they are embedded, which will occur in the context of climate chaos that has interrelated social and biophysical components. We hope planners and designers will continue to develop the method in other contexts.

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