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### South Bay Salt Pond Restoration Project: Dream or Nightmare?

Along the shoreline and tidal marshlands of the Pacific coast live tiny white shorebirds approximately 5-6 inches, weighing less than two ounces with patches of grey and brown that allow them to blend in with the environment. They dash back and forth, dodging waves one minute and chasing them the next, stopping to quickly poke their little pointed beaks in the wet sand to search for a meager morsel. Named after their bright white feathers, the Western Snowy Plover (*Charadrius alexandrinus nivosus*) has been on the Endangered Species list since 1993. A combination of commercial development and human activity in their habitat during their breeding season (the summer months), as well as non-native predators, have made it difficult for them to successfully reproduce; they remain among the most vulnerable species, with an ever-declining population. They are the casualty of another kind of species, albeit a native one-- humans.

Growing concern for endangered species like the Snowy Plover has evolved from merely protecting species to a broader ecosystem perspective, thanks to increasing awareness of the importance of how interconnected life is on our precious planet. Renowned Pulitzer Prize winning scientist and author Edward O. Wilson helps us better understand the significance of this concept in his book, *The Future of Life*: "If the extinction of a species is a sniper shot, then the destruction of a habitat containing multiple unique species is a war against nature" (57-58). His war analogy is exemplified by Hawaii, long considered a tropical dream destination for

many people within the western portion of the United States. Wilson dispels the idealized image of Hawaii when he asserts, “In actuality it is a killing field of biological diversity” (43). Humans are to blame for the dramatic decline in ecosystems worldwide, from freshwater to marine to tropical rainforests; we have become masterful killers due to “overpopulation and environmentally ignorant development” (Wilson 42-43). Central to Wilson’s eye-opening book is the importance of developing an understanding that we are inextricably linked to our planetary ecosystems and all life on Earth. This guiding principle for our species is the only way we can transcend the short-term anthropocentrism that threatens our own existence, he argues. What is desperately needed before it’s too late is a universal environmental ethic (Wilson pp. 40-41).

Northern California is a prime example of both environmental assault and environmental ethos. When gold was discovered in California in 1848, the largest migration in U.S. History occurred, resulting in a severe impact on the biodiversity of the *Golden State*. Natural wetlands and related habitats in the San Francisco Bay area that had been in place for thousands of years were devastated by human activity over the following century. These activities included gold and mercury mining; creation of artificial dikes and levees for agriculture; retention of saline bay water for salt ponds; and filling in marshland areas for commercial development. By most estimates, between 80% and 90% of the original natural habitat in this area has been wiped out, completely lost to the frenzy of human ignorance.

Scientists’ dire warnings have not been completely ignored in California, as state policymakers began to address the damage inflicted by human development. In 1993, Governor Pete Wilson signed Executive Order W-59-93, California’s *no-net-loss* policy, placing a figurative stake in the ground against continued destruction of wetlands by development in the San Francisco Bay area. This legislation essentially set into motion a policy of mitigating habitat

losses through regulatory compliance. The environmental ethics of Californians support more than just mitigation, however. Environmental groups and state leadership rallied together to do more by supporting projects not just aimed at conservation, but restoration. Initial studies began to evaluate the feasibility of restoring the large commercial salt ponds in the Bay Area to their former tidal marsh ecosystem of wetlands, and by 2008 the South Bay Salt Pond (SBSP) Restoration project began. The SBSP Restoration website announced the project's impetus:

South Bay Salt Ponds were acquired in 2003 from privately owned Cargill Inc. Funds for the acquisition were provided by federal and state resource agencies and several private foundations. The 15,100-acre property transfer represents the largest single acquisition in a larger campaign to restore 40,000 acres of lost tidal wetlands to San Francisco Bay.

The project includes goals of flood management; and public access to wildlife and recreation. ([southbayrestoration.org](http://southbayrestoration.org))

A project of this size makes it one of the largest in the US and the largest tidal wetland restoration project on the West Coast, spanning a 50-year timeline. Its colossal size and ambitious goals beg the question as to who will pay for it and where the funding will come from. This question is answered on The San Francisco Bay Restoration Authority's website:

"The Restoration Authority was created by the California Legislature in 2008 to find solutions to the need for new, local funding, due to reduced funding from other sources" ([sfbayrestore.org](http://sfbayrestore.org)).

The agency subsequently proposed a \$12 per year parcel tax for wetlands restoration projects on the June, 2016 ballot (Measure AA). This funding source would raise \$25 million per year for twenty years, totaling \$500 million. Opponents to the parcel tax cited no requirement for a scientific advisory board to approve or evaluate proposed projects or accomplishments and concerns that contracts would be awarded based on politics, not science. However, California

voters across nine counties showed their support with 70% in favor of the tax ([sfbayrestore.org](http://sfbayrestore.org)). In a land of high-technology make-believe where firms like Apple and Google and Facebook literally changed the world, money is no object. The voters seemed to say, *we can make this happen, too*. The cost for returning their prized ecosystem to an idyllic condition drew few naysayers and even fewer questions as to whether or not it can actually be achieved.

Environmental impact studies and ecological methodologies were conducted and reviewed by multiple consultants, environmental experts and research agencies. Published research by experts as early as 2004 led credence to the optimism of such a project yet cited uncertainty for its outcome. Guidelines and recommendations included the need for additional studies, empirical data and expert analysis of findings. For example, in the *Journal of Environment Management's* published study, "Wetland Ecological and Compliance Assessment in the San Francisco Bay Region, California, USA," multiple sage recommendations were made, including: setting aside a minimum of 30% of funding for accurate monitoring and assessment; quality control of data collection in the field and in a centralized database; region-wide guidance for removal of non-native invasive, aggressive species; water quality metrics; 5-year monitoring; and testing the validity of assessment methods (Breaux et al. 229-230).

Given the level of uncertainty and in keeping with the experts' recommendations, the SBSP Restoration Project managers have incorporated an Adaptive Management planning process. Several uncertainties to be managed were identified in the "Phase 1 Science Summary, Tracking Adaptive Management" document related to the project (Trulio 1-8). Additionally, U.S. Geological Survey's lead scientist, Laura Valoppi, brings the uncertainty to the attention of the public in her 2018 published "Phase 1 Studies Summary of Major Findings of the South Bay Salt Restoration Project, South San Francisco Bay, California:"

Significant uncertainties remain with a project of this geographic and temporal scale of an estimated 50 years to complete the restoration. . . . The Adaptive Management Plan identifies specific restoration targets for multiple aspects of the Project and defines triggers that would necessitate some type of management action if a particular aspect is trending negatively. (Valoppi, 1)

While this Adaptive Management Plan strategy sounds reasonable for incorporating flexibility into a project, the key uncertainties hint at a broader question which has not been asked nor answered in the scope of this project: Will restoration work? There have been studies that raise questions about the success of wetlands restoration.

A 2012 publication by PLoS Biology of a meta-analysis of 621 wetland sites across the globe show that “current restoration practice fails to recover original levels of wetland ecosystem functions, even after many decades” (Moreno et al. 1). Another more recent publication from The Royal Society reports that “the meta-analysis of 400 sites worldwide show that active restoration was not associated with more complete recovery or faster recovery than passively recovering [eco]systems” (Jones et al. 5). The results of this published study suggest setting aside areas of a restoration project for passive recovery as a means of comparison (Jones et al. 6). Most importantly, the study notes that “restoration can sometimes be ineffective or even hinder recovery. . . . Letting ecosystems repair themselves may be the most effective restoration strategy, a counterintuitive yet critical finding that could help society allocate restoration funds more effectively” (Jones et al. 6).

These studies, if even reviewed by the SBSP Restoration Project managers, weigh lightly against the enthusiasm for the project moving forward, despite the enormous projected costs. As reported by the San Francisco Bay Restoration Authority’s website, proposed funding for Phase

2 comes to a grand total of \$243,701,649 with a mere 3.6% of the total spend on Adaptive Management and applied studies, which does not include the cost of annual monitoring of endangered species (sfbayrestore.org). This allocation is a mere fraction of the industry recommended minimum of 30% for monitoring and assessment (Breux et al. 229-230).

Valoppi's publication about the findings of Phase 1 is informative in terms of educating the public about the scope and progress of the project since its inception a decade ago. The findings frame the project as a group of uncertainties and provide a stoplight methodology (red, yellow, green) to report the status of each one. The Appendices of this publication reveal many details about the researchers' and managers' concerns, the individuals *on the front lines*. These Appendices include a summary of their March 15, 2016 meeting and subsequent surveys of each group. The surveys are very telling and provide the most accurate evaluation of Phase 1 of the project from the individuals who are operationally the closest. Survey questions covering the eighteen identified uncertainties provide an area for elaboration on each response. Feedback from the managers and researchers indicate concerns for funding cuts for monitoring and science studies related to wildlife habitat in the project areas; concerns for management of invasive predators; concerns about having specific data to use for baseline measurements for mercury levels and water quality monitoring; concerns over sea level rise and incorporating that into the planning; and concerns that more time, studies and data are needed to better understand the impact of what's been done so far, as a way to incorporate that into the next phase of the project (Valoppi Appendices 2-3).

The summary of the annual managers and researchers meeting, Appendix 1, included in the USGS publication, defines the targets and triggers for each of the areas of uncertainty and generally reflects the concerns raised in the survey questionnaires. This summary provides more

details about the discussions and action items from the meeting. The closing statements recommend that management action be “based on trends, not specific triggers; and that a working database group be established to ensure data not be lost, although this can be very expensive” (Valoppi Appendix 1). Basing a decision on a trend, however, can be tricky, if the trend is over a short period of time and used as a basis for projection over a long period of time. For example, if an endangered species like the Snowy Plover, has an improvement in breeding in one site over a period of one year, and that data is projected forward as a trend out toward the project end of 50 years, it may look like it is trending well. The possible advantage to such an approach is in reporting, as a way to smooth out the ups and downs during years of habitat disruption caused by continued project work in their nesting site areas.

Balancing protection of wildlife while restoring ecosystems is a complex challenge. A published study from *Ecology and Society* makes clear the problems that can arise when one non-native species is introduced to improve native habitat, with undesirable results. In the late 1990s, a non-native cordgrass (*Spartina alterniflora*) was introduced by USGS to help recover tidal marshes in the San Francisco Bay estuary. This non-native hybridized with the native species of cordgrass, providing extra protection for the nearly extinct California’s Ridgway’s Rail (*Rallus obsoletus obsoletus*). However, the hybrid plant became highly invasive and crowded out other native tidal marsh plants, negatively impacting the underlying tidal marsh composition. Herbicide treatment to address the invasive species had a negative effect on the then flourishing Ridgway Rail (Casazza et al.). Good intentions don’t always bring good results. Lessons learned from this were presented in the research publication, with a specific emphasis on sharing data. In this instance, decisions were made without knowing what impact removing the invasive species would have on the Rail population; nor what would happen to the tidal marsh



ecosystem if nothing were done to remove the invasive plant (Casazza et al.). This example underscores the importance of collecting, sharing and accurately analyzing data across a wide, complex project with often conflicting desired outcomes. Perhaps the lack of a shared information database is reflected in the concerns of the managers and researchers working on this highly ambitious and complex project. Or perhaps there is a concern over baseline information.

The most significant uncertainty that could undermine the entire SBSP Restoration Project and all wetland projects in the San Francisco estuary is sea-level rise caused by climate change. A research publication from *Science Advances* in February of this year based on predictive modeling brings a focused attention to the importance of taking climate change seriously. Titled “U.S. Pacific Coastal Wetland Resilience and Vulnerability to Sea-Level Rise,” through predictive modeling it warns that “tidal wetlands are highly vulnerable to end-of-century submergence, with extensive loss of habitat. . . . at imminent risk of submergence with projected rates of rapid sea-level rise” (Thorne et al. 1-10). The USGS “Phase 1 Study Summary of Major Findings” addresses climate change toward the end of the Introduction with a one sentence acknowledgement: “Additionally, climate change and associated sea-level rise, although not specifically identified in the AMP as an uncertainty, have been the focus of research . . .” (Valoppi 13). Later in the publication, a section about sea-level rise is included after the identified uncertainties have been addressed as follows:

Although one of the major goals of the Project is to restore former salt ponds to tidal marsh, managers are also concerned that predicted changes in climate, particularly increased rates of sea-level rise, would result in flooding the restored marshes and thereby undo the benefits of tidal marsh restoration for wildlife and people. (Valoppi 53-56)

Valoppi's response to the managers' concerns is addressed by identifying the need for additional studies during Phase 2 of the project in a text box at the end of her publication. However, what is not stated is whether it should be or will be added to the list of identified uncertainties that form the nexus of the operational monitoring of the project. Should this predictive model of sea-level rise impact the San Francisco wetlands as reported in *Science Advances*, could the entire SBSP Restoration project effort be all for naught? Is this \$500 million Phase 2 project train barreling down the tracks without concern for climate change as a potential derailing?

The "Final Environmental Impact Statement/Report, Phase 2," however, attempts to address sea-level rise by proposing "habitat transition zones" or what is often called "horizontal levees." There is no natural gradation of upward sloping land from the bay bottom to higher ground where wildlife could seek refuge from storm surge and elevated tides from sea-level rise. The proposal to build these zones as described is quite challenging, as most of the adjacent property that is most feasible for this is already commercially developed and outside the boundaries of the purchased project land. The only option available is to build these horizontal levees inside the salt ponds (US Fish and Wildlife Service). While acknowledging there are limited options to address sea-level rise within the boundaries of the project area, it would obviously have an impact on adjacent developed properties all around the San Francisco Bay.

Restoration of the beloved San Francisco Bay estuary is a noble undertaking, supported by taxpayers and businesses, and politically correct, at least for now. One of the identified goals of the SBSP Restoration Project is flood management, but due to sea-level rise it could become a political hot potato. The funding of the project included a parcel tax on businesses as well, yet the ones that surround the Bay area's wetlands are not likely to benefit from the proposed

horizontal levees that can only be placed in the salt ponds. The managers' concerns regarding sea-level rise may be justified when viewed from this angle.

Despite concerns of those closest to the problems, Phase 2 planning continues and funding is likely to be approved with no opposition. As the oversight arm of the Restoration Authority the Advisory Committee members are in the best position to raise questions about the operational challenges and action items identified in public documents. The feedback from managers and researchers following Phase 1 completion, such as concerns raised about lack of central information database, funding for ongoing studies and field research, invasive species management and sea-level rise, represent opportunities for committee members to do this. Additionally, the Advisory Committee has responsibility for doing so, to ensure maximum benefit of the project and as a watchdog for public tax dollars. Phase 1 of the SBSP Restoration project has been completed and the planning for Phase 2 has proceeded without taking the necessary time to evaluate how these uncertainties will impact its overall success. As a result, the reported progress has been overstated for political and economic reasons. Instead of rushing forward into Phase 2 because the funding is available, now is the time to pause and ask some hard questions that would be easier to avoid but are necessary to accurately evaluate the merits of the project as a whole.

It's been said that *As California goes, so goes the nation*. This project size and scope ensure that all eyes are on California as this project unfolds. Let us lead with integrity and realism about the complex challenges resulting from the havoc we have wreaked on nature. Let us not continue with our Gold Rush mentality of chasing the money and the glory; let us stop and think about consequences.

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