



## Bay Area Ecosystems Climate Change Consortium

Thursday, May 26, 2016, 10 AM – 2 PM  
California State Coastal Conservancy  
11<sup>th</sup> Floor Conference room, 1330 Broadway, Oakland, CA 94610

### Meeting Summary

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#### Attendees:

*Marriah Abellera, <i>S USACE-IWR</i>	*Joe LaClair, <i>BCDC</i>
Louise Bedsworth, <i>Governor's Office of Planning and Research</i>	David Loeb, <i>Bay Nature</i>
Brian Benn, <i>Environmental Risk &amp; Financial Solutions</i>	Sara Moore, <i>Consultant/NBCAI</i>
*Kate Bimrose, <i>GFNMS</i>	*Elizabeth Murray, <i>USACE</i>
Louis Blumberg, <i>The Nature Conservancy</i>	Michelle Passero, <i>The Nature Conservancy</i>
Kathy Boyer, <i>Romberg Tiburon Center, SF State</i>	Isaac Pearlman, <i>BCDC</i>
*Ellie Cohen, <i>Point Blue Conservation Science</i>	Laura Prickett, <i>Horizon Water &amp; Environment</i>
Andy Gunther, <i>BAECCC</i>	Veronica Pearson, <i>Marin County Parks</i>
Maya Hayden, <i>Point Blue Conservation Science</i>	Cynthia Powell, <i>Calflora</i>
*Sara Hutto, <i>Gulf of the Farallones NMS</i>	Linda Tandle, <i>CEMAR</i>
Jenna Judge, <i>SF Sentinel Site Cooperative</i>	*Luisa Valiela, <i>US EPA</i>
Marilyn Latta, <i>CA State Coastal Conservancy</i>	Hilary Walecka, <i>CA State Coastal Conservancy</i>
	Erica Yelensky, <i>US EPA</i>

\* = via teleconference

#### 1. Introduction of participants and their BAECCC-related projects

Participants introduced themselves.

#### 2. Review Agenda. No changes were made to the agenda.

#### 3. Living shorelines in San Francisco Bay: results of a pilot study and implications for adaptation to sea level rise.

Marilyn Latta of the Coastal Conservancy and Professor Kathy Boyer of San Francisco State University gave a presentation and led a discussion regarding the latest findings of the San Francisco Bay Living Shorelines Project ([www.sfbaylivingshorelines.org](http://www.sfbaylivingshorelines.org)).

There are many potential benefits from adopting nature-based infrastructure: enhanced habitat values, functions and services; increased species support and connectivity; erosion control and shoreline protection; climate adaptation and habitat resilience, improved cost effectiveness, increased sustainability, and reduced maintenance.

Recently there a variety of state and national policies have been adopted that encourage the use of nature infrastructure, including: President's Climate Action Plan (seeks to protect biodiversity, conserve natural resources in the face of climate change, and manage public/private lands to store carbon), Army Corps of Engineers policy (Dec. 2013) for considering sea level rise, Safeguarding California Plan, State Coastal Commission Local Coastal Program, and BCDC policy development regarding fill and sea level rise. Marilyn mentioned the 2008 Maryland Living Shorelines Protection Act as a model for shoreline protection ([http://mlis.state.md.us/2008rs/chapters\\_noln/Ch\\_304\\_hb0973E.pdf](http://mlis.state.md.us/2008rs/chapters_noln/Ch_304_hb0973E.pdf)), where landowners must demonstrate why natural infrastructure is insufficient before they can get approval to build a seawall and harden the shoreline.

A new element of the Conservancy's Living Shorelines Project is a focus on the tidal marsh edge in addition to oyster and eelgrass reefs offshore. The goal of a future "phase two" living shoreline project is to demonstrate the integration of subtidal and supra-tidal habitat restoration into a complete tidal wetland system to achieve cumulative benefits (test plots are underway of four species: oysters, eelgrass, marsh gumplant, Pacific cordgrass at seven sites around the bay). The project seeks to implement recommendations from the SF Bay Subtidal Habitat Goals and the Baylands Goals Science Update on a pilot scale, using an experimental approach to document effective techniques that can be applied in larger projects.

The existing project constructed in 2012 is using two native species, Olympia oysters and eelgrass, in different designs to achieve:

- Ecosystem Function goals, including, increased food resources, improved rearing/nesting support, improved linkages and connectivity between habitat types, with an assessment of interactions between habitat types that influence restoration success.
- Ecosystem Services goals, including sediment accretion, wave attenuation, minimization of shoreline erosion, promotion of potential physical synergistic effects between habitats, testing of alternatives to traditional shoreline armoring.

There are two sites: one in San Rafael and one in Hayward. The basic design is to install large plots (10 x 32 meters) of oyster settlement substrate, eelgrass plantings alone, both together, or a control with no manipulation. These are aligned along the shore in order to measure the effect of shoreline processes both inshore and offshore of the project. Mounds of bagged Pacific oyster half shells (shellbag mounds) are being used at the largest scale, but other oyster settlement substrates are being tested. They are testing a variety of designs for "baycrete" structures. Baycrete is a custom concrete mixture that includes materials mined from the bay, including oyster shell deposits.

Preliminary results from the San Rafael location (established in July 2012) include the following.

### **Oysters**

- Early and large recruitment of oysters...over 3 million at height of recruitment. Current abundance is approximately 750,000 oysters:
  - Fewer oysters now due to recruitment fluctuations. Some years have lower recruitment at the project and at control plots on the shoreline, and recruitment has decreased over time.

- Food resources for many species have been enhanced by the structures.
- A comparison of shellbag mounds to the baycrete structures showed more native oyster recruitment on the shellbags, probably due to the greater surface area of the shellbags. A “layer cake” baycrete structure with a lot of horizontal surfaces demonstrated the poorest oyster recruitment and physical integrity.
- In general, oyster abundance was greater on (1) vertical surfaces than horizontal surfaces, (2) north side of elements than the south sides, and (3) portions the structures at lower tidal elevations (except in Hayward where the abundance of non-native oyster drills influenced oyster abundance).

### **Eelgrass**

- Eelgrass density expanded significantly through the summer of 2015.
- Point Molate donor was more successful than Point San Pablo; suggests site matching could be important.
- No benefit was seen to eelgrass from oyster shell reef mounds in close proximity, but this does maximize invertebrate and fish diversity to have both habitats adjacent.
- There was a significant loss of eelgrass at the San Rafael location between December 23, 2016 and February 8, 2016. The site was replanted in May 2016. The causes of this decline are currently unknown, and this loss affected test plots that had been present for 9 years in addition to the current project’s test locations. Possible explanations include one or a combination of increased wave energy and turbidity during El Niño, a large algal bloom in the fall months, or intense grazing by Canadian geese. Deeper test plots survived, so perhaps something is going on in the shallower depths? Losses of this type have been documented before, including the disappearance of eelgrass at Point Molate in 2006.
- Natural eelgrass beds seem to be adversely affected by warmer spring/summer temperatures. The documented disappearance of natural beds suggests that these could be normal responses to temperature or other perturbations.

### **Fish, invertebrates, birds**

- Native fish and invertebrates are associated with the physical structures, including juvenile Dungeness crabs, Bay Shrimp, Red Crabs, California Rock Crabs, Bay Pipefish, White and Green Sturgeon, Leopard Sharks, and Steelhead.
- Lots of species are reproducing at the project sites, as indicated by gravid shrimp, Goby eggs on oyster shell, oyster brooding, and nudibranch egg casings.
- The project has documented increased abundance of wading birds including Great Egrets and Great Blue Herons, Forster’s Terns, and Black Oystercatchers. Increased number of unique invertebrate taxa has also been recorded.

### **Physical Changes**

- 15 cm sediment accretion has been measured along the physical structures.
- The structures extract 30-50% more wave energy compared to control sites at mean sea level.

### **Recommendations to Date**

- Add habitat structure on mudflat to quickly attract many species, including rare and valuable taxa (Black Oystercatchers, Dungeness Crab).

- Co-locate eelgrass and oyster reefs to maximize invertebrate/fish diversity.
- Use shell bag mounds to maximize native oyster recruitment (high surface area and complexity, low desiccation and heat stress).
- Continue to experiment with Baycrete designs as oyster shell is less plentiful than in the past (due to closing of Drakes Bay Oyster Company), but can eliminate layer cake and small reef ball stack designs.
- Expect sediment accretion around reefs in future designs – don't waste valuable shell at base where it will likely be covered.
- Don't be concerned about reef subsidence, even in unconsolidated sediment, as this does not appear to impact performance.
- Test more locations, additional designs, to further evaluate wave attenuation potential.
- Increased institutional capacity is needed for design, permitting, and implementation for more pilot projects.
- Important project characteristics include landowner access, more sites in the marine central bay, testing at soft shorelines. It is tricky to find appropriate sites and physical access to sites can be problematic.

For more information, contact Marilyn Latta ([marilyn.latta@scc.gov](mailto:marilyn.latta@scc.gov)) or Kathy Boyer ([katboyer@sfsu.edu](mailto:katboyer@sfsu.edu)).

#### 4. Planning for climate change in Bolinas Lagoon

Veronica Pearson, Bolinas Lagoon Restoration Project Manager with Marin County Parks, gave a presentation on *The North End Wetlands Enhancement and Sea Level Rise Adaptation Project*.

##### **Background**

The North End Project is the result of a 15-year collaboration between Coastal Conservancy, GFNMS, Marin County Parks, National Park Service, and the communities of Stinson Beach and Bolinas. The project was initiated in part due to community and agency reaction to a proposal from the Army Corps to dredge over 1.4 MCY of sediment from the lagoon. There was interest in having an alternative solution that did not involve dredging, and that focused on addressing historic human impacts to Bolinas Lagoon by restoring ecological and hydrological processes. The project objectives (Phase I and Phase II) are to alleviate flooding of roadways, improve the function of Lewis Gulch and Wilkins Gulch Creek, enhance riparian and wetlands habitats, and allow for future expansion of Bolinas Lagoon as sea level rises.

Phase I is a site conditions report (recently completed) that reviewed hydrology and geomorphology, biological and cultural resources, traffic, regulatory environment, land ownership, and utilities. The second phase builds on this report by identifying additional studies required and developing conceptual designs for the project.

##### **Location**

The project is taking a watershed approach and is looking at all the tributaries that flow into Lewis and Wilkins Gulch Creeks, Salt Creek, and Wharf Creek, along with projections for

sea level rise, and the pattern of human development since the mid -1800s. A map of flooding that would be produced by 5.5 feet of sea level rise by the end of the century has been developed. A number of faults in the area create a complex geology with an expectation of seismic activity. The landscape hydrology and vegetation reflect the impact of human settlement. This area has seen farming, logging, mining and has experienced devastating fires. LiDAR imagery, historical maps and photos were used to develop a picture of how humans have manipulated the area and how it may have looked prior to European settlement.

Alluvial fans in the area support sub-surface seepage that has allowed for the development and maintenance of a freshwater/tidal brackish marsh edge unique within the lagoon. Freshwater seepage provides wetland resilience to sea level rise as fresh water marsh can grow despite seawater exposure because the marsh root zone remains in fresh water.

### **Conceptual Designs**

The next phase of the project will be developing conceptual designs that emphasize connecting streams and riparian corridors to the lagoon, water and sediment conveyance, and habitat restoration. Removal of stream migration barriers and changes in channel geometry are being considered: possible designs include elevating roadways above inundation area, constructing levees, or allowing levees to form through natural processes. A key challenge is to determine how much intervention is required as opposed to counting on natural processes.

Next steps include identifying the opportunities and constraints in conjunction with partners to guide concept development, and determine key additional research required to further inform decision-making. Veronica noted that there has already been a lot of outreach conducted in the community, in conjunction with the GFNMS (Marin County Parks owns land in the project area and shares management with the Sanctuary). A periodic bulletin goes to landowners and there have been a number of public meetings.

## **5. Presentation/discussion: Climate Action through Conservation**

Michelle Passero, Senior Climate Policy Advisor at The Nature Conservancy (TNC) made a presentation on the Climate Action through Conservation project in Sonoma County. The goal of the project is to achieve greenhouse gas (GHG) emission reductions at the county scale through changes in land use, management and conservation. The project has quantified the GHG reduction potential of land use changes that enhance and maintain carbon sequestration including avoiding urban sprawl, growing urban forest, and changes in land management. The project enjoyed support from the Gordon and Betty Moore Foundation and the San Francisco Foundation.

The project developed a method to estimate GHG reductions at the county scale, while also documenting other environmental benefits. The project integrated two analytical elements, a land-based carbon accounting framework and a conservation values assessment (habitats and ecosystem services).

The carbon accounting framework used a countywide carbon inventory to produce a GHG baseline scenario for the county, then looked at the interventions/activities that would reduce emissions as alternative future scenarios for GHG reductions. A Landfire dataset (land cover

change at scale of 30 meters) along with Forest Service data sets were used. The project did not consider changes in carbon storage that could occur in wetlands, nor changes that might be brought about through alternative rangeland or agricultural management practices. Soil carbon was included in scenarios that reduced conversion of land to more intensified uses.

The results demonstrate that for Sonoma County there has been a net increase in carbon stock over time (1990 to 2010) of 15 million tons CO<sub>2</sub>e (750,000 tons CO<sub>2</sub>e per year). This increase reflects carbon accumulation in forests, shrubs, and grasses, even after accounting for losses due to major fires. Much of the gain was in the coastal redwoods, and in other forests that are re-growing after being cut back in the 20th century.

The project also has developed a Conservation Carbon Accounting Tool (CCAT) that models how changes in land use, land management and restoration might affect carbon sequestration and conservation values. CCAT forecasts county-wide GHG reduction potential (compared to a GHG baseline scenario), including factors such as extent of land development, reforestation (including urban forestry), and land management practices. Reviewing different scenarios suggests there is a strong potential for enhancing carbon storage in the lands of Sonoma County and other areas as well. TNC will be working to integrate this analysis into a variety of local and state plans for GHG mitigation.

## **6. Presentation/discussion: State Policy developments related to climate adaptation and ecosystems.**

Louise Bedsworth, Deputy Director of the Governor's Office of Planning and Research, reviewed recently adopted state-level climate change adaptation and resilience policies.

Governor Brown's [Executive Order B-30-15](#) laid out GHG reduction goals for 2030 and 2050. It includes incorporating climate change impacts into all State planning and investment, including the state's Five-Year Infrastructure Plan. The Executive Order also requires regular updates to the Safeguarding California Plan (the state climate adaptation strategy) to identify how climate change will affect California infrastructure and industry and what actions the state can take to reduce vulnerability.

OPR has established a Technical Advisory Group (TAG) of approximately 50 people to help state agencies incorporate climate change impacts into planning and investment decisions. The TAG is focused on specific directions in EO B-30-15 and will result in a foundational guidance document for State agencies. They are using the California Adaptation Forum to broaden the discussion, in an effort to create a process to update and incorporate new information into state government planning and implementation.

The Governor signed three bills that build upon the Executive Order. [SB 379](#) directs all local governmental entities to address climate change in the Safety Element of their General Plan. [AB 1482](#) requires resource agencies to update Safeguarding California Plan. [SB 246](#) establishes the Integrated Climate Adaptation and Resiliency Program (ICARP) within OPR by January 1, 2017. ICARP will coordinate regional and local efforts on climate adaptation strategies. In doing so they recognize that this is a two-way street: OPR can provide information but also learn from the regions. This program will include climate equity

considerations across sectors and regions and strategies that benefit both GHG reductions and adaptation efforts. The program will be administered by OPR.

7. **Update: Measure AA.** David Loeb urged everyone to get out the vote in favor of Measure AA. The measure, **San Francisco Bay Clean Water, Pollution Prevention and Habitat Restoration Program**, would authorize a parcel tax of \$12 per year to help protect San Francisco Bay by reducing trash, pollution and harmful toxins, improving water quality, restoring habitat for fish, birds and wildlife, protecting communities from floods, and increasing shoreline public access.

*(Editor's note: Measure AA was passed by the voters of the Bay Area on June 7, 2016!)*

8. **Adjourn.** The meeting was adjourned at 2 p.m.