The NOAA Sentinel Site Cooperative: Partnering to Meet the Challenges of Sea Level Rise in the Bay Area

Maya Hayden, California Sea Grant / NOAA Sentinel Site Cooperative, maya.hayden@noaa.gov
Maria Brown, Greater Farallones National Marine Sanctuary, maria.brown@noaa.gov
Jim Eckman, California Sea Grant, jeckman@ucsd.edu
Wendy Goodfriend, San Francisco Bay Conservation and Development Commission, wendy.goodfriend@bcdc.ca.gov
Kelley Higgason, Greater Farallones National Marine Sanctuary, kelley.higgason@noaa.gov
Sara Hutto, Greater Farallones National Marine Sanctuary, sara.hutto@noaa.gov
Becky Lunde, NOAA Office for Coastal Management, rebecca.lunde@noaa.gov
Heidi Nutters, San Francisco Bay National Estuarine Research Reserve, heidin@sfsu.edu
Becky Smyth, NOAA Office for Coastal Management, rebecca.smyth@noaa.gov
Mike Vasey, San Francisco Bay National Estuarine Research Reserve, mvasey@sfsu.edu

Planning for and adapting to changing coastal flood conditions requires regional collaboration to translate and focus available science, identify vulnerabilities, and consider feasible adaptation options. The San Francisco Bay and Outer Coast Sentinel Site Cooperative is one of five cooperatives in the nation participating in a NOAA program focused on fostering regional resilience to sea level rise. The Cooperative Management Team is made up of representatives from the San Francisco Bay Conservation and Development Commission, NOAA's Office for Coastal Management, NOAA's Greater Farallones National Marine Sanctuary, the San Francisco Bay National Estuarine Research Reserve, and California Sea Grant. The Cooperative aims to (1) improve the capacity of coastal decision-makers to use sea level rise and coastal flooding models and tools, (2) support on-the-ground efforts of partners engaged in adaptation planning in the region and facilitate sharing of lessons-learned, (3) bridge adaptation work focused on natural resources and built communities, (4) foster a regional coastal intelligence network to allow for early detection and forecasting of changes to critical marsh ecosystems, and (5) facilitate integration of science and management at the ocean-bay interface. The Cooperative is currently working to improve collaboration and build new partnerships that connect local- and regional-scale NOAA programs and partners to national NOAA resources. Toward this end, we showcase several Management Team efforts in the San Francisco Bay Region, including Adapting to Rising Tides, the Climate-Smart Adaptation Project for the North-Central Coast and Ocean, and the collaborative "Lifting the Fog" workshop series focused on sea level rise models and tools. We highlight the freely available information and decision-support tools that underlie these projects, as well as project-specific products that can be used to initiate or strengthen adaptation planning efforts throughout the region.

Keywords: sea level rise, resilience, vulnerability, adaptation, climate change, decision-support tools

Poster Topic: Data/Tools: Monitoring the Bay

Watershed Based Ecosystem Condition Profiles in Santa Clara County

Sarah Lowe, San Francisco Estuary Institute - Aquatic Science Center, sarahl@sfei.org
Doug Titus, Santa Clara Valley Water District, dtitus@valleywater.org
Lisa Porcella, Santa Clara Valley Water District, lporcella@valleywater.org
Sarah Pearce, San Francisco Estuary Institute - Aquatic Science Center, sarahp@sfei.org
April Robinson, San Francisco Estuary Institute - Aquatic Science Center, april@sfei.org
Micha Salomon, San Francisco Estuary Institute - Aquatic Science Center, micha@sfei.org
Josh Collins, San Francisco Estuary Institute - Aquatic Science Center, josh@sfei.org
Cristina Grosso, San Francisco Estuary Institute - Aquatic Science Center, cristina@sfei.org

The Santa Clara Valley Water District's (District) Safe, Clean Water and Natural Flood Protection Program is a voter approved program with five, broad-sweeping priorities. Priority D – Restore Wildlife Habitat and Provide Open Space is a countywide effort to restore and protect wildlife habitat, and provide opportunities for increased access to open space. The Ecological Data Collection and Analysis project (Priority D5) focuses on establishing a comprehensive, watershed approach to monitoring and assessment, improving the District's and other organizations' capabilities to make informed watershed and asset management decisions.

SFEI's Wetlands Science team is working with District staff to implement their Ecological Monitoring and Assessment Framework (Framework) in five watersheds within Santa Clara County. The District's Framework employs the science tools developed to support California's Wetland and Riparian Protection Policy, and Wetland and Riparian Area Monitoring Plan (WRAMP). WRAMP recommends the USEPA's three-level approach to wetlands assessment: (1) Mapping – to characterize the distribution and abundance of aquatic resources; (2) Rapid Condition Assessment – to conduct probability-based rapid field surveys assessing the overall ecological condition of target resources; and (3) Intensive Assessment – to conduct focused monitoring techniques to better understand potential causes of poor ecological condition. The watershed approach with quantitative measures is consistent with the USACE and USEPA compensatory mitigation for losses of aquatic resources final rule, and regulatory guidance.

SFEI has been working with the District to characterize and track the distribution and abundance of the aquatic resources based on the Bay Area Aquatic Resources Inventory (BAARI) and District's ArcGIS inventory, and assess the overall ecological condition of streams based on the California Rapid Assessment Method (CRAM). SFEI developed probability based sampling designs and is supporting the District in assessing and reporting on stream and watershed conditions using CRAM in five watersheds within Santa Clara County.

Keywords: Ecological Monitoring and Assessment Framework, CRAM, watershed approach

Poster Topic: Data/Tools: Monitoring the Bay

Innovative Visualization Tool for Water Quality Data

Cristina Grosso, San Francisco Estuary Institute - Aquatic Science Center, cristina@sfei.org
Gemma Shusterman, San Francisco Estuary Institute - Aquatic Science Center, gemma@sfei.org
Shira Bezalel, San Francisco Estuary Institute - Aquatic Science Center, shira@sfei.org
Michael Weaver, San Francisco Estuary Institute - Aquatic Science Center, michaelw@sfei.org
John Ross, San Francisco Estuary Institute - Aquatic Science Center, johnr@sfei.org
Amy Franz, San Francisco Estuary Institute - Aquatic Science Center, amy@sfei.org
Adam Wong, San Francisco Estuary Institute - Aquatic Science Center, adamw@sfei.org
Donald Yee, San Francisco Estuary Institute - Aquatic Science Center, donald@sfei.org
Rebecca Sutton, San Francisco Estuary Institute - Aquatic Science Center, rebeccas@sfei.org
Todd Featherston, San Francisco Estuary Institute - Aquatic Science Center, todd@sfei.org
Tony Hale, San Francisco Estuary Institute - Aquatic Science Center, tonyh@sfei.org
Philip Trowbridge, San Francisco Estuary Institute - Aquatic Science Center, philt@sfei.org

The Contaminant Data Display and Download Tool or CD3 (cd3.sfei.org) is an innovative visualization tool for accessing water quality data for the San Francisco Bay-Delta and northern montane regions. It is the primary tool for accessing and downloading the San Francisco Bay Regional Monitoring Program's (RMP) long-term dataset and other project data stored in the San Francisco Estuary Institute's (SFEI) Regional Data Center (RDC). Data stored in SFEI's RDC are comparable with the state's data management business rules and are regularly exchanged with the California Environmental Data Exchange Network (CEDEN).

CD3 was recently redesigned to leverage SFEI's other interactive mapping efforts. It debuts impressive new functionality, including enhanced spatial querying and dynamic statistical summaries. Other key benefits of the redesigned tool include aggregating data from different projects and sampling events for an analyte; accessing all data collected across multiple years for a project; spatial querying by county, Water Board, hydrologic region, or user-defined area of interest; generating surface model maps for RMP data; selecting among several chart types for data analysis (e.g., mean and error; box and whiskers, histogram); downloading data as a tabular or spatially displayed dataset; and customizing and downloading charts for use in reports and presentations. The tool is updated regularly with new datasets and has the flexibility to display all public data stored in SFEI's Regional Data Center database.

The data stored in CD3 comprise the informational base of the RMP. By providing dynamic and transparent access to one of the most rigorously vetted and significant data collections in California, CD3 inspires confidence in the RMP's scientific analyses, findings, and recommendations.

Keywords: data visualization, water quality

Poster Topic: Data/Tools: Monitoring the Bay

Remote and In Situ Observing -- San Francisco Bay Ecosystem (RIO-SFE) 2: Model Validation with In Situ and Satellite Data

Yi Chao, Remote Sensing Solutions, Inc., ychao001@gmail.com
Fei Chai, University of Maine, fchai@maine.edu
Curtiss Davis, Oregon State University, cdavis@coas.oregonstate.edu
Nicholas Tufillaro, Oregon State University, nbt@coas.oregonstate.edu
Frances Wilkerson, Romberg Tiburon Center San Francisco State University, fwilkers@sfsu.edu
Richard Dugdale, Romberg Tiburon Center San Francisco State University, rdugdale@sfsu.edu
Steve Ackleson, Naval Research Laboratory, steve.ackleson@nrl.navy.mil

One challenge facing Earth system science is to understand and quantify the impacts and feedbacks of human influences on rivers, estuaries, and coastal zone ecology especially in regions of high population density like the San Francisco Bay and Delta Ecosystem (SFE). The goal of our NASA Interdisciplinary science project is to put in place a modeling framework to inform stewardship of freshwater and marine resources within the SFE and adjacent ocean ecosystems. Our SFE project combines four components: (1) satellite observations, (MERIS, HICO, Landsat-8, and in the future Sentinel-3); (2) field observations (nutrients, phytoplankton, suspended sediments, CDOM, and optical properties); (3) the CoSiNE ecological model integrated with (4) a SCHISM hydrological model of the SFE.

The unstructured grid model known as SCHISM (Semi-implicit Crossscale Hydroscience Integrated System Model) is used to model the San Francisco Bay/Estuary with a variable spatial resolution from 1 km at the ocean boundary to 10 meters inside the estuary. The lateral boundary conditions outside the Golden Gate are provided by the Regional Ocean Modeling System (ROMS) model covering the entire California coast. Both SCHISM and ROMS are coupled with the CoSiNE biogeochemical model with 13 components. Here we present initial results of coupled SCHISM and CoSiNE model validation results with *in situ* and remote sensing. Results from a 10-year model hindcast/reanalysis will be validated against in situ and remote sensing data to compare drought and non-drought years.

Keywords: San Francisco Bay, modeling, in situ, remote sensing data

Poster Topic: Data/Tools: Monitoring the Bay

Remote and In Situ Observing -- San Francisco Bay Ecosystem (RIO-SFE) 1: Remote Sensing and In Situ Data

Curtiss Davis, Oregon State University, cdavis@coas.oregonstate.edu
Nicholas Tufillaro, Oregon State University, nbt@coas.oregonstate.edu
Frances Wilkerson, San Francisco State University, fwilkers@sfsu.edu
Richard Dugdale, San Francisco State University, rdugdale@sfsu.edu
Alex Parker, San Francisco State University, aparker@sfsu.edu
Steven Ackelson, Naval Research Laboratory, steve.ackleson@nrl.navy.mil

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Keywords: remote sensing, water quality measurements, ecosystem modeling

Poster Topic: Data/Tools: Monitoring the Bay

Automated Tool for Generating Recurrent Storm Events of Different Durations from Raw Precipitation Data

Thomas Burke, Hydrologic Systems, office@hydrologic-systems.com

PRECIP is an automated tool for developing recurrent storm event hydrographs from raw precipitation data. The model can read in raw precipitation data at any time step, in incremental or cumulative format from a text or spreadsheet file. The data is evaluated and the peak annual precipitation for each year is computed for any duration from 5 minutes through 96 hours. From this annual data, the return frequency for each duration is computed using a Log Pearson Type III analysis. These return frequencies are then used to develop balanced storm hydrographs with a specified return frequency of 1-year through 500-year event. The duration of each event hydrograph can be set by the user from a 1-hour to a 96-duration. The hydrographs can be saved to a text file for pasting input into any hydrologic model.

The full time series of the precipitation data can be used in the analysis, or specific time periods from the data can be used to evaluate changes in precipitation patterns over the time period of the data collected by the gage. The data is displayed graphically and can be exported into a report. All the computed data results, frequency summary, and outlier analysis is summarized in an output file for each gage.

Keywords: Precipitation, Hydrograph, Stormwater, Frequency Analysis, Rainfall, Log Pearson

Poster Topic: Data/Tools: Monitoring the Bay