Visualizing and Analyzing 10 years of Wetland Habitat Monitoring Data in Tableau

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Columbia River Estuary Conference

Lower Columbia Estuary Partnership

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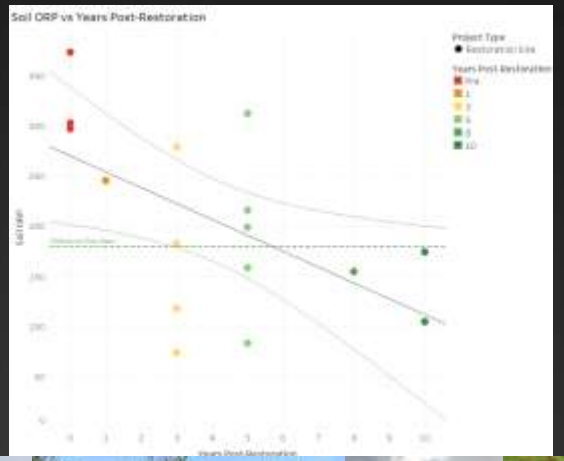
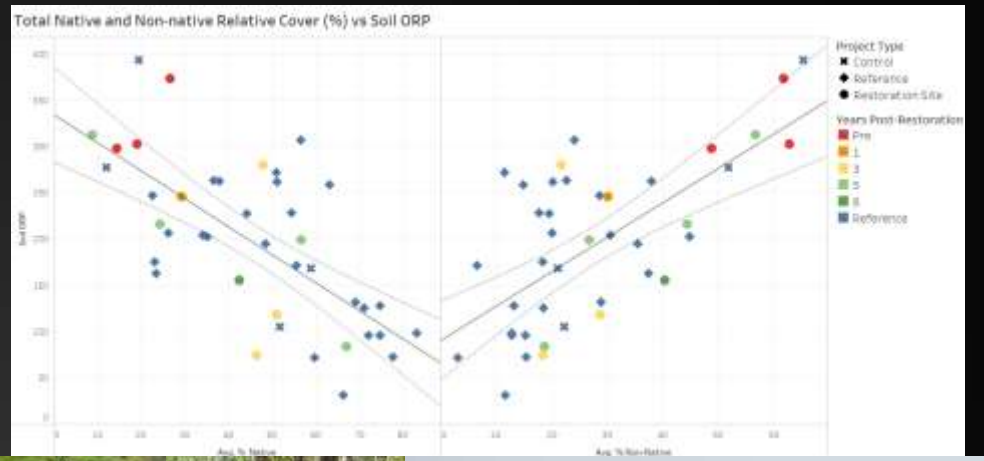
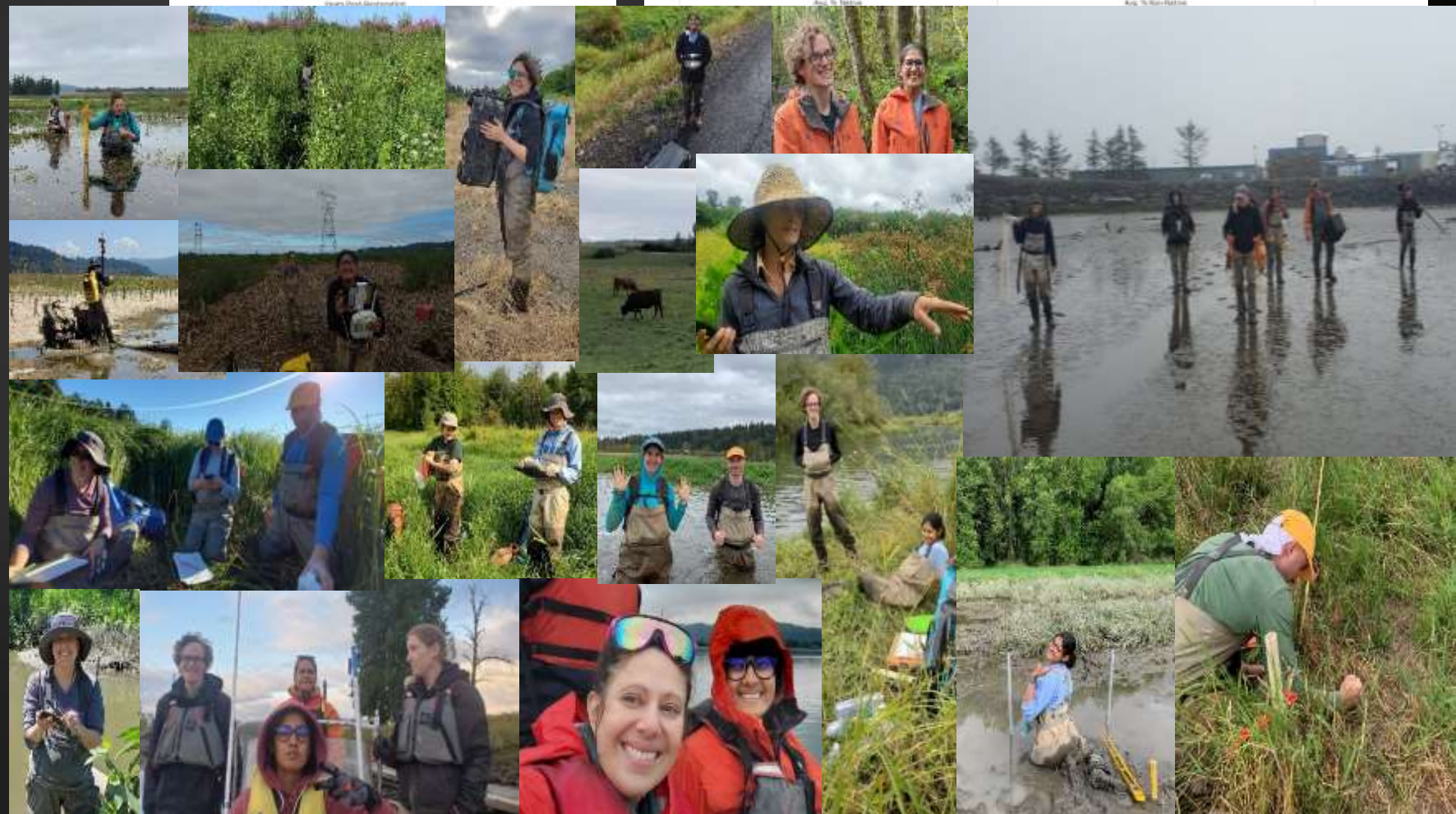






Outline of Talk

- What Data do we have?
- Background Behind Tableau
- Overview of Tableau as a Data management Platform
- Transitioning into Tableau
- Next Steps

Two Monitoring Programs

Ecosystem Monitoring Program (EMP)

- Status and trends monitoring of ecosystem condition
- Provides basic understanding, fills knowledge gaps on estuarine - tidal freshwater section of lower river
- Provides suite of reference sites for AEM

Action Effectiveness Monitoring & Research Program (AEMR)

- Allows evaluation of whether restoration actions achieved the goals of the project
- Provides understanding of benefits of restoration actions
- Depends on EMP for evaluation of results

Ecosystem Monitoring Program

Salmonid Habitat Monitoring Programs

EMP = Ecosystem Monitoring Program - ***Methods here***

- ✓ Mainstem and Abiotic Site Conditions - **Joe Needoba (OHSU)**
- ✓ Habitat Structure, Hydrology, Soils, Sediment Accretion, Detritus - **Sarah Kidd, Sneha Rao, Ian Edgar (LCEP)**
- ✓ Food Web, e.g., Planktonic and Macrophyte contributions to Juvenile Salmon Food Web - **Tawnya Peterson (OHSU)**
- ✓ Fish Prey and Macroinvertebrate Community - **Jeff Cordell, Jason Toft, Kerry Accola (UW)**
- ✓ Fish Community and Occurrence - **Curtis Roegner, Regan McNatt, Susan Hinton, Jeff Grote, Paul Chittaro, Dan Lomax (NOAA)**
- ✓ Critical Field, Lab Support, UAV pilot - **April Silva, Narayan Elasmar (CREST)**

Action Effectiveness Monitoring Research Program

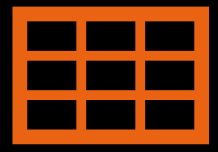
AEMR = Selected sites (Level 2) receive Full Habitat surveys – Pre, 1, 3, 5 and 10 yrs. post-restoration – *Methods* here
All sites (Level 3) receive Basic Hydrology and Sediment Accretion Monitoring Years 1-5, 10 yrs. post-restoration

- ✓ **Habitat Structure, Hydrology, Soils, Sediment Accretion** - Sarah Kidd, Sneha Rao, Ian Edgar (LCEP)
- ✓ *Spot Check of* **Macroinvertebrate Community** - Jeff Cordell, Jason Toft, Kerry Accola (UW)
- ✓ *Spot Checks at Year 5 and 10 Post* - **Fish Community and Occurrence** - Curtis Roegner, Regan McNatt, Susan Hinton, Jeff Grote, Paul Chittaro, Dan Lomax (NOAA)
- ✓ Critical Field, Lab Support, UAV pilot - April Silva, Narayan Elasmar (CREST)

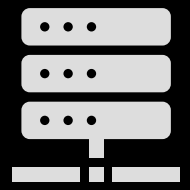
Need for a proper Data Management System

75+ Sites with over a decade of data	Excluding drone datasets, over 10gb of raw data. >1tb of drone data
Habitat	**Hydrology** •10+ million datapoints **Sediment Accretion** •8000+ datapoints
Food Web	**Vegetation and Soil** •60,000+ datapoints **Biomass** •20,000+ datapoints
Drone	Each flight >1000 photos •<50cm pixels •Veg classifications, habitat opportunity, etc
Animals	**Macroinvertebrates** •10,000+ datapoints **Fish** •40,000+ datapoints
Others	**Zooplankton** **Isotope analyses** **Nutrients**

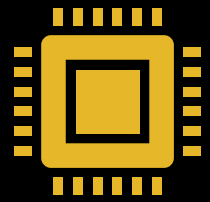
Software Options and Considerations



Excel



MS Access, SQL, ArcPro, ArcCatalog - etc.



R, Python, MATLAB, SASS, Exploratory, etc.

Tableau

- **Data Limits** – What data limits are imposed (such as Excel's row limits)
- **Database Capacity** – Does it provide a structure for storing and connecting data?
- **Accessibility and Ease of Use** – How hard is it for someone to use?
- **QA/QC, Analysis, Visualization Capacity** – Can you edit/analyze/graph your data?
- **Mapping and Geospatial Analysis** – Can you make maps and geolocate your data?
- **Collaboration** – Easy to share with others? (Proprietary data formats? Software requirements?)
- **Online/Desktop Data Sharing** – How easy is it to access and present data – online data hosting?
- **Costs** - How expensive is the software? Does everyone need to purchase the software to collaborate?

Tableau

Data Visualization Software with advanced **analysis** capabilities

Primarily used by finance sector; however, rapidly being adopted by the **scientific** communities

Emphasizes **seeing** and **understanding** data insights for both the analyst and the audience

The "**Next Step**" in the world of visualization

More info: https://www.tableau.com/why-tableau/what-is-tableau

Transitioning into Tableau

- Data Structure and Database Connections
- Tableau Prep
- Tableau Basics
- Tableau Georeferencing
- Tableau End Points

Data Structure (Relational Tables) or Database Connections

- Partial database structure
  - We use relational tables
  - Mixture of CSV files, Excel files, and shapefiles
  - Publish to Tableau Online server
- Options to connect to servers
  - Tableau Online servers
  - Any other 'industry' server
    - Redshift, Presto, MySQL, Oracle, Esri, Snowflake, etc

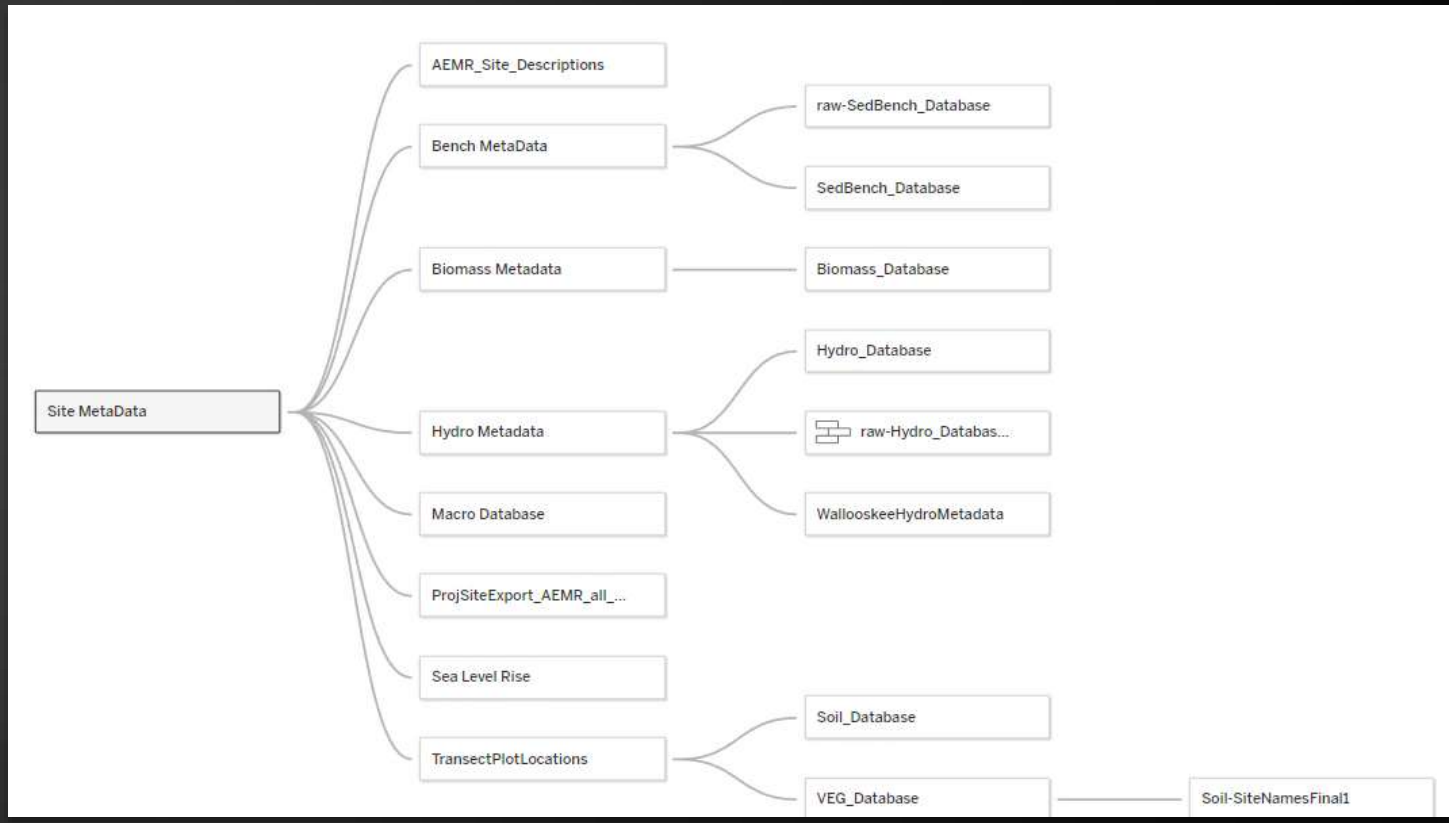
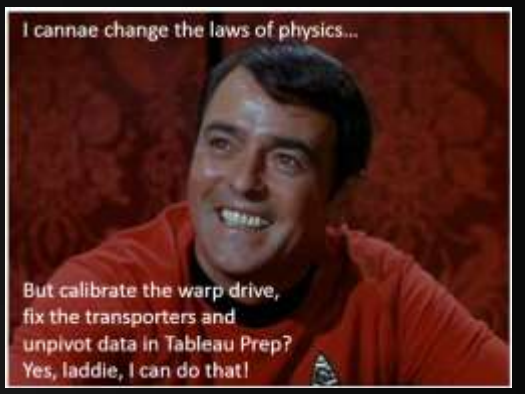
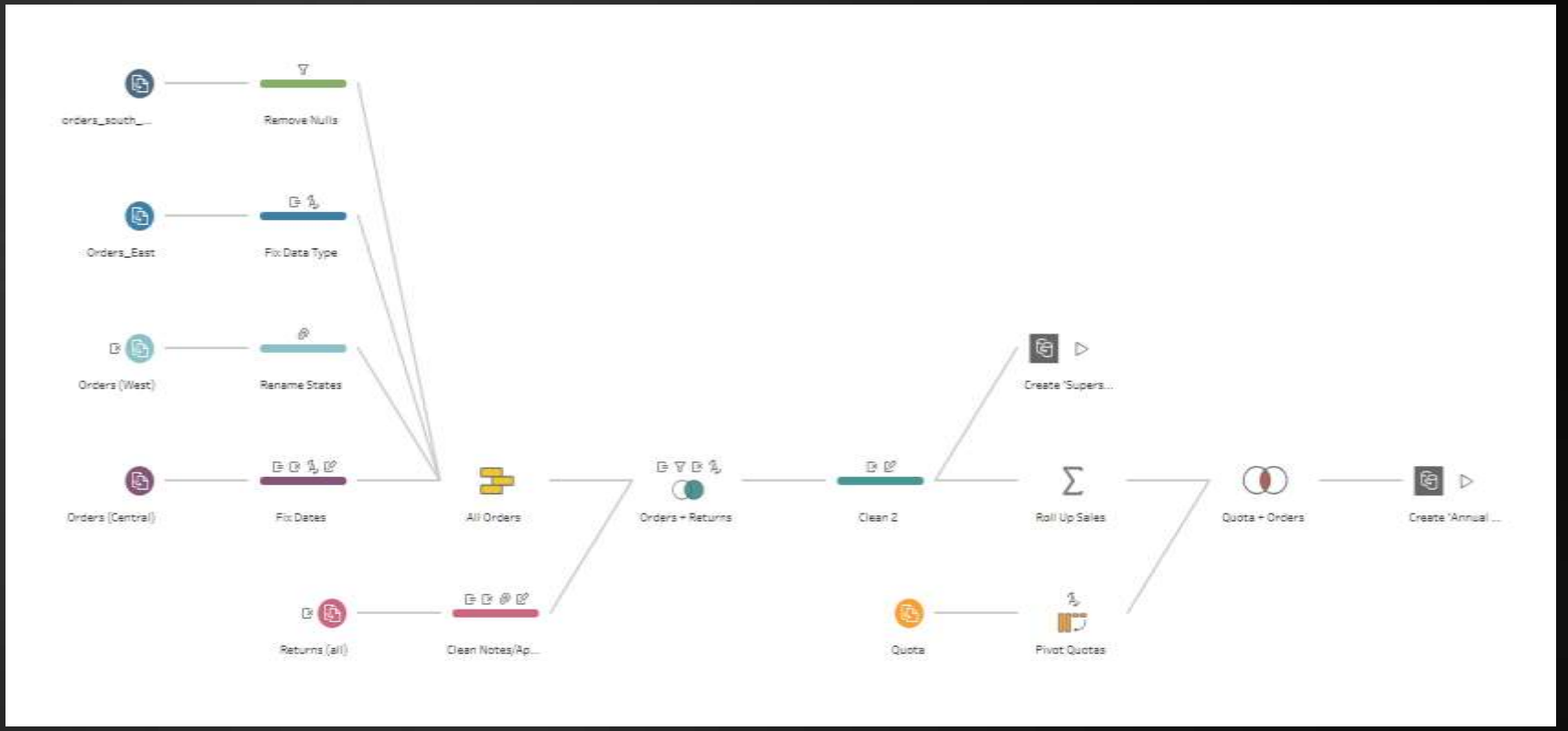


Tableau Prep

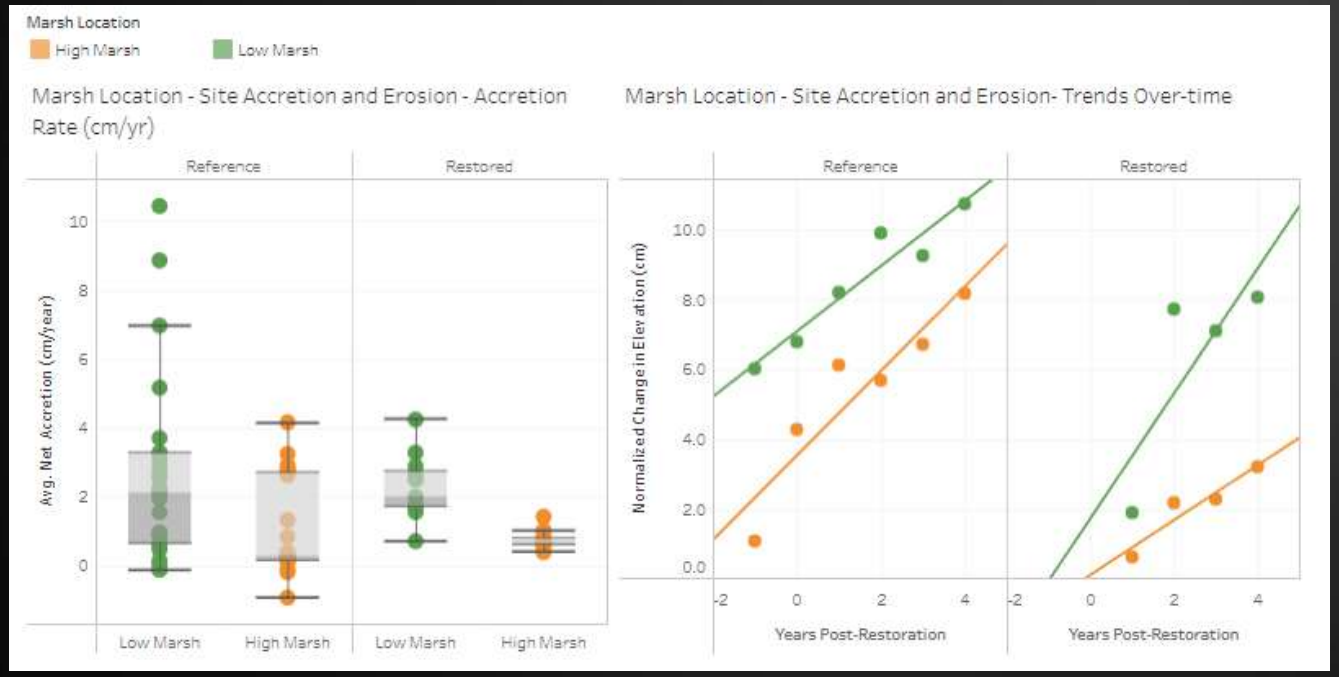


- Performance Improvements
- Creates a hyper file
  - Tableau's database system
  - Built on PostgreSQL
- As complex or simple as desired
  - Contains cleaning, unions, joins, pivots, aggregations, scripts, predictions, and exporting to several formats



Tableau

- Tableau combined georeferencing with visualization
- Simple graphs are trivial to create
- One can control the level of aggregation
- Full coding integration with R and python



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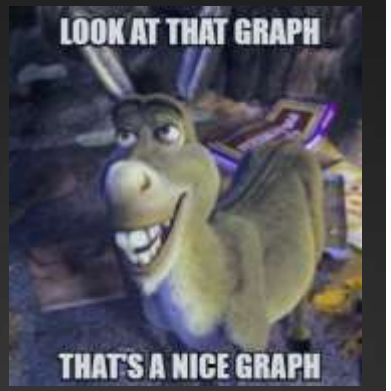
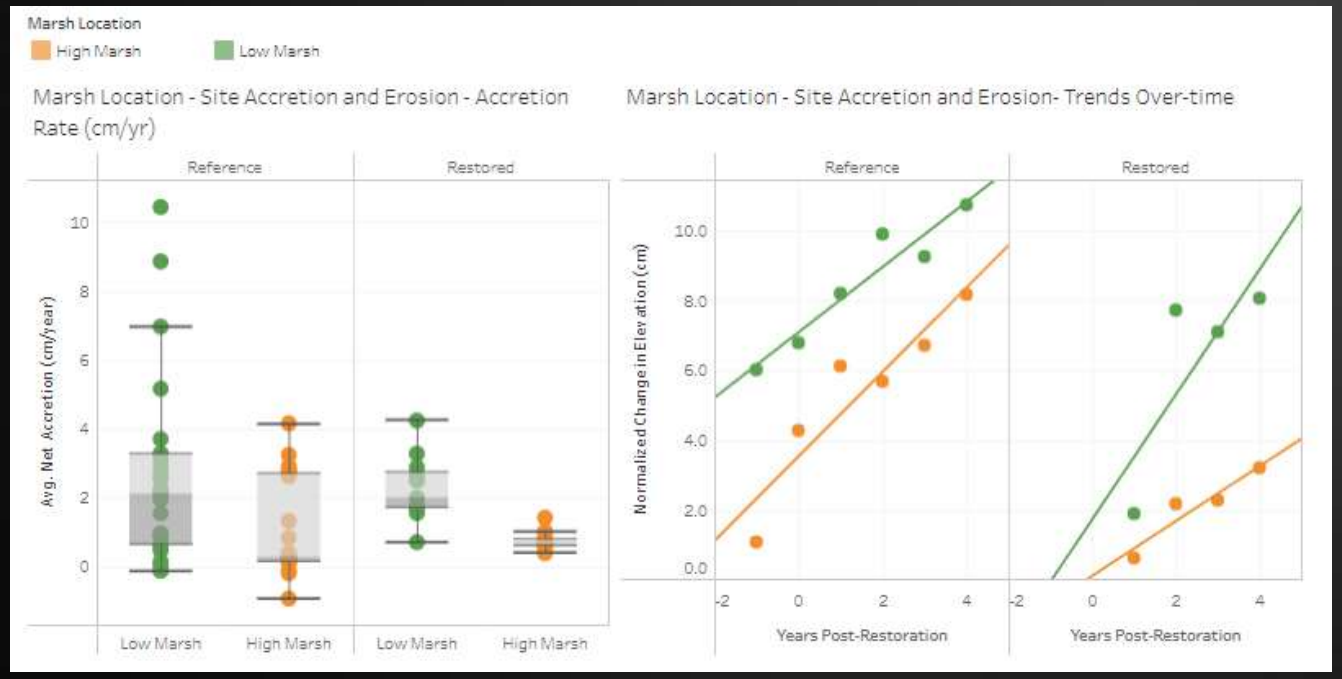
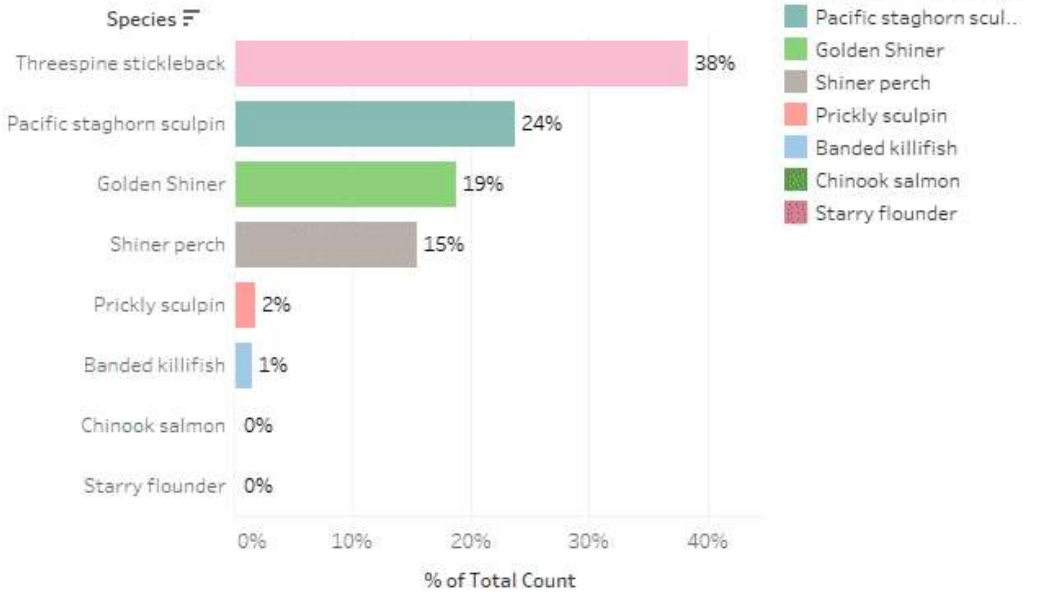




Fish Community Composition

Fish Sampling Map - Wallacut Slough

Fish Community Composition at Year 5 Post-restoration



Georeferenced Analyses

- Custom mapping using Mapbox and ArcGIS
- Full Support with shapefiles and rasters
- And more – the sky is the limit

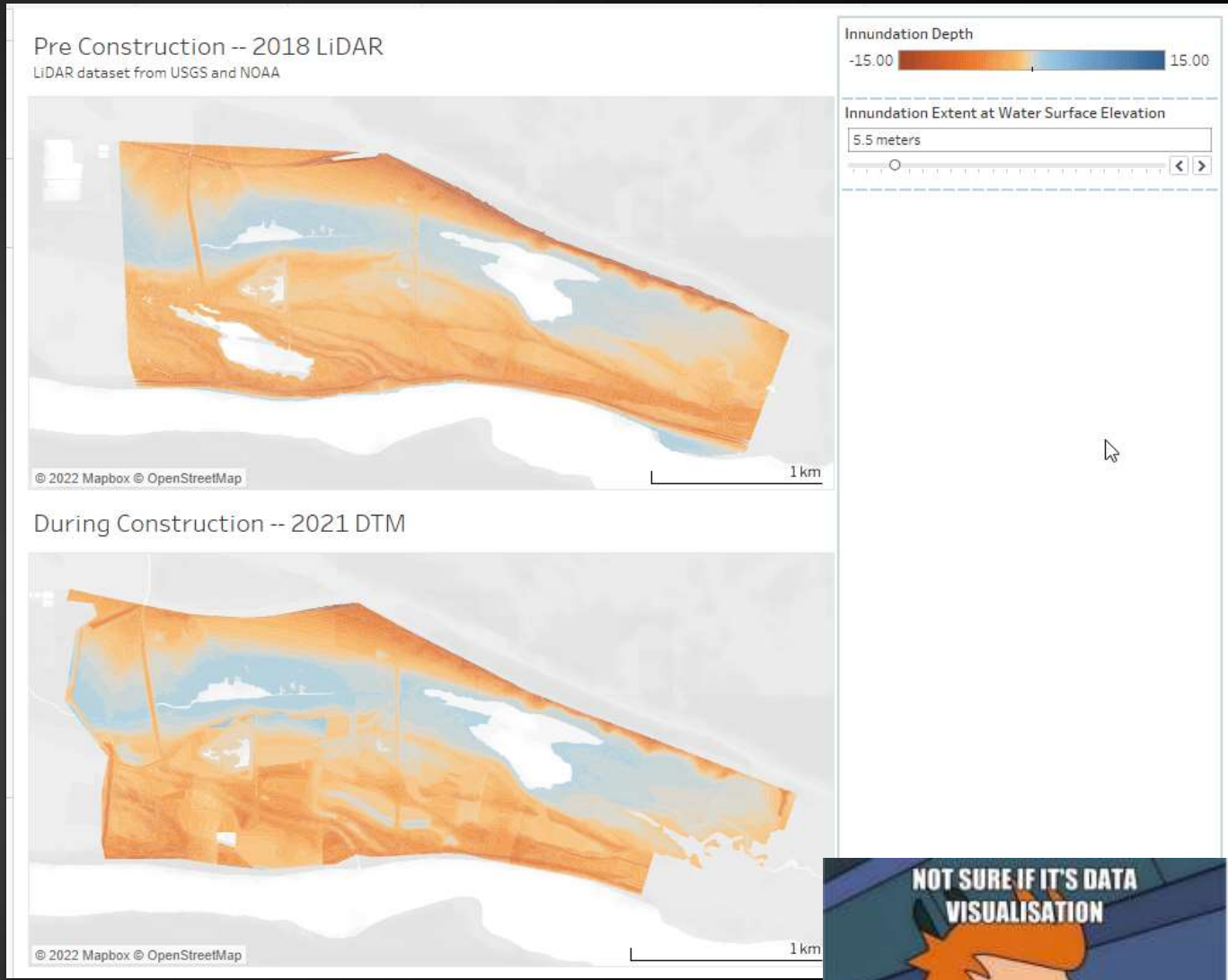


Tableau End Points

- Online Dashboards to compliment reports and share data
  - See 2022 AEMR Report
- Private or public status
- Allows sharing of data
- Tableau Public has a thriving ecosystem of visionaries

Tableau Example:
AEMR Hybrid Report

- **Executive Summary**, **Methods**, and **background** remain in a **separate**, **traditional** document
- Stand-alone tableau dashboards with **results** and **discussions**
- **Executive summary** remains in both
- Circular links in both the document and the dashboards

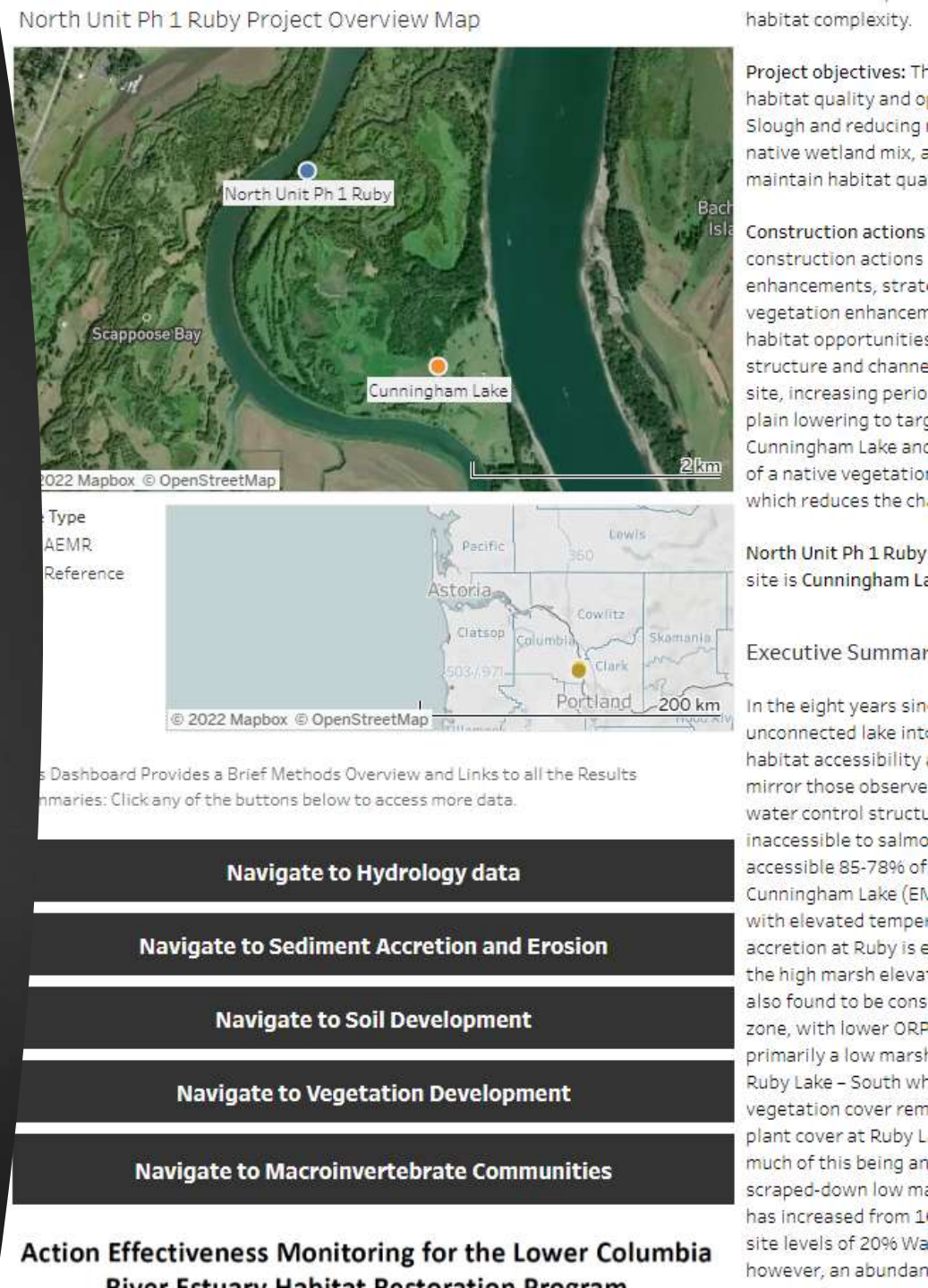


Tableau Example:

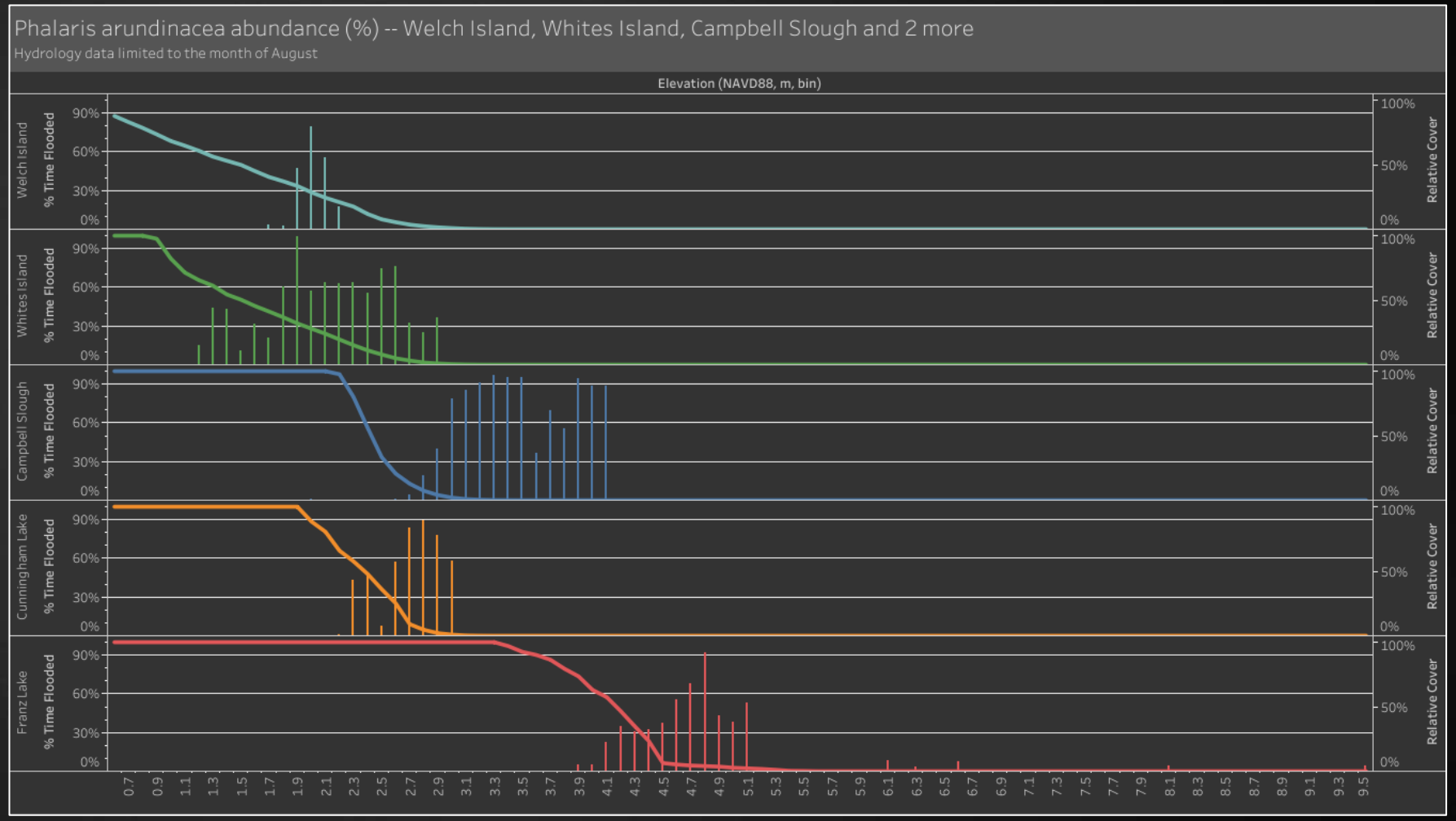
Trends in sediment accretion and erosion and Implications of SLR in tidal wetlands of the LCRE

- Net Accretion/Erosion rates of trend sites were compared to Sea Level Rise Scenarios.
- USACE's 2020 Lower Columbia River Adaptive Hydraulics (AdH) Model Scenarios
- Each site, except for Franz Lake, is accreting slower than the most extreme forecasted sea level rise scenarios.

Tableau Example:

Ecological drivers of Reed canarygrass dominance across in the lower Columbia river estuary

- EMP data through 2021 continues to confirm hydrology as a critical driver for Reed Canarygrass abundance.
- In addition to hydrology, soil chemistry, such as Salinity and ORP influence reed canary grass dominance across reference and restored sites.



Summary of Next Steps

Transition all datasets into Tableau

Focusing on creating quick and useable databases for all metrics

Full synthesis analysis of AEMR and EMP metrics

Habitat, Macros, Fish

Compare and analyze all metrics at the estuary wide scale, across each reach, and each site.

Drone Inclusion

Orthomosaic basemaps for each site using Mapbox

Full site wide statistics and analysis based on drone data

Full synthesis analyses of all sites and all metrics

Focus on the drivers and impact of each metric

Utilize predictive modeling to further inform upon the estuary

Look at Examples Online

- Our AEMR Report Page (With examples – no login required): https://public.tableau.com/app/profile/aemr.epmonitoring
- Our Tableau Public Page (With examples – no login required): https://public.tableau.com/app/profile/sarah.ann.kidd
- Watch April 2022 SWG introduction to Tableau Presentation: https://youtu.be/ExDxspBfsJo

- Contact us if you are having any issues or questions:
- Sarah Kidd – skidd@estuarypartnership.org
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- Sneha Rao – snehar@estuarypartnership.org

RESEARCH PARTNERS

THANK YOU

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Bonneville Power Administration

Washington Department of Fish and Wildlife

OHSU

Cowlitz Indian Tribe

Columbia Land Trust

Oregon Fish & Wildlife

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U.S. Fish & Wildlife Service

Pacific Northwest National Laboratory

Schott & Associates, Inc.

Institute for Applied Ecology

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