# From Restoration to Optimization: Adaptive Management for Carbon Sequestration and Greenhouse Gas Reduction in DWR's restored wetland ecosystems

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## DWR's Nature-Based Climate Solutions

- DWR is leading Delta wetland restoration to:
  - Reverse subsidence
  - Sequester carbon
  - Enhance habitat
  - Protect water quality

#### KEY TO ACTIVITIES **COMPLETED SINCE 2020** Lower Elkhorn Emergency Habitat Restoration Basin Levee Supply Facility Setback Flood Control Georgiana Slough Salmonid Subsidence Reversal Sacramento Weir and Carbon Storage Migratory Barrie Yolo Bypass Fish Passage Salmonid Habitat Restoration Flood Emergency Decker Island Southport Levee Stockpile Twitchell East Improvement Water Supply **End Wetlands** Lisbon Weir Setback Levee Mayberry Farms Yolo Flyway Farms Winter Island Lower Yolo Ranch Clarksburg Antioch Lindsey Slough Desalination Plant Whale's Mouth Lookout Slough Wetlands McCormack Williamson **Dutch Slough** Smith Canal Gate Wings Landing Bradmoor Island Supply Facility Arnold Slough UNDER CONSTRUCTION 27 Chipps Island West Sacramento Levee Improvemen Whale's Belly Project Wetlands Prospect Island Lower San Joaquin River Project Grizzly Slough Floodplain BEING PLANNED 7 Tide's End Dutch Slough, Second Phase Locke Multi-Benefit Flood Project Lathrop Manteca Little Egbert Feasibility Study Twitchell Island South Delta Wetlands Operable Gates SELECT DWR DELTA PROGRAMS Isleton Flood Insurance Pilot Environmental Monitoring Delta Levee Subventions and (N) Delta Flood Emergency Management

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# Long-term research is why we are here!

- DWR led research since 1997
- Identified subsidence reversal and carbon benefit
- Eddy covariance = gold standard
- Has allowed for model and carbon market development







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Sacramento Elevation Deeper than -5m -2m Elk Grove 20m Higher than 20m Waterways Fairfield ejo Location in California Stockton Tracy Livermore 20 Kilometers Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, @ OpenStreetMap contributors, and the GIS User Community, DWR/USGS 2019



# Leveraging this a top tier nature-based climate solution

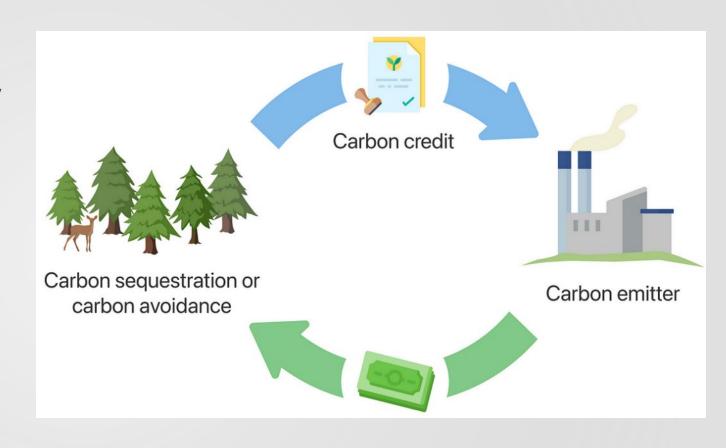
- Wetlands = climate powerhouses
  - Among most effective ecosystems for carbon sequestration & climate resilience
- Scalable, science-backed solutions
  - Integrating monitoring, modeling, & management to maximize climate benefits.





### What is a carbon credit?

- American Carbon Registry (ACR) Emissions Reduction Credits
- Credits = verified
   reductions in greenhouse
   gas emissions
- Sold to organizations to offset emissions





## Generating carbon credits at scale

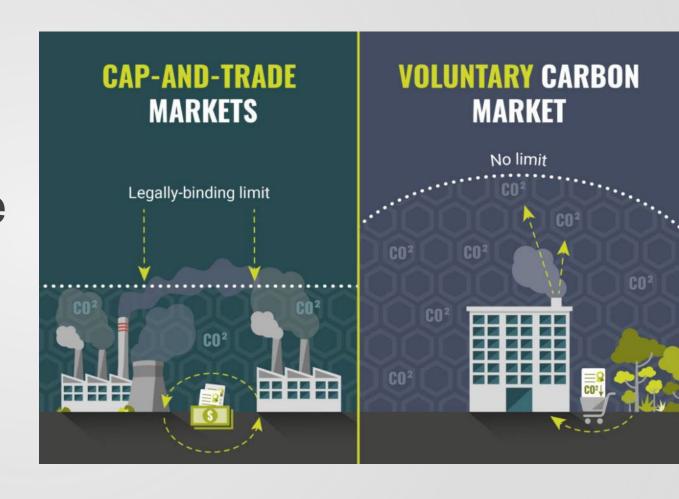
- Sherman and Twitchell subsidence reversal wetlands
- 52,000 carbon credits (tons CO<sub>2</sub>eq); ~60,000 on the way
- Translates to ~6 credits per acre annually





## Why we need to sell credits

- Potential to fund longterm management
- Highlight value of these multi-benefit credits
- What does selling look like at DWR? Across the Bay-Delta?



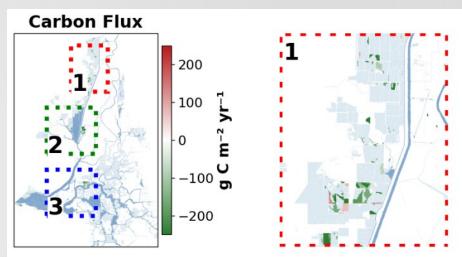


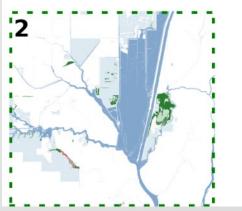
# Scaling carbon credit projects: We can't measure everywhere

- Leverage monitoring, models, remote sensing to lower costs
- Tools like:
- Mobile towers
- RegionalClimate andCarbonAnalytics Tool(RCCAT)











## The Regional Climate and Carbon Analytics Tool RCCAT

• A suite of 7 Al models ranging in complexity, using satellite (Landsat) + environmental (WLDAS) data to understand and predict patterns in CO<sub>2</sub> and CH<sub>4</sub> fluxes across vegetated landscapes.



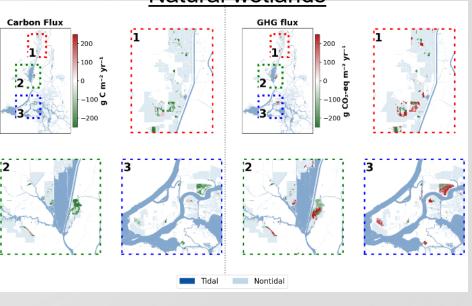


Trained & validated on decades of gold standard CO<sub>2</sub> and CH<sub>4</sub> flux data across multiple eddycovariance
 \_sites



- Trained AI models are then fused with readily-available satellite and land-surface inputs to upscale CO<sub>2</sub> and CH<sub>4</sub> fluxes to the regional scale
- Enables daily, 30m tracking of carbon burial and GHG emissions.

#### Natural wetlands





#### **DWR LAND STEWARDSHIP PROGRAM**

Leadership and Subject Matter Experts

REPORTING **DWR EXECUTIVE** OUT

**ENVIRONMENTAL** COMPLIANCE AGENCIES



#### **DWR RESOURCES**

- Division of Flood Management
- Division of Integrated Science & Engineering
- Division of Multibenefit Initiatives
- Division of Engineering-Real Estate Branch
- Division of Operations & Maintenance

#### EXTERNAL RESOURCES

- CVFPB
- Reclamation District
- Resource Conservation District
- Research Agencies
- Other Contracts/

## **Land Stewardship Program**

Multi-division effort to support maintaining DWR landscape assets through:

- Monitoring to support adaptive management, adaptation
- Research partnerships

## Adaptive Management: Needed to maintain, improve sequestration?

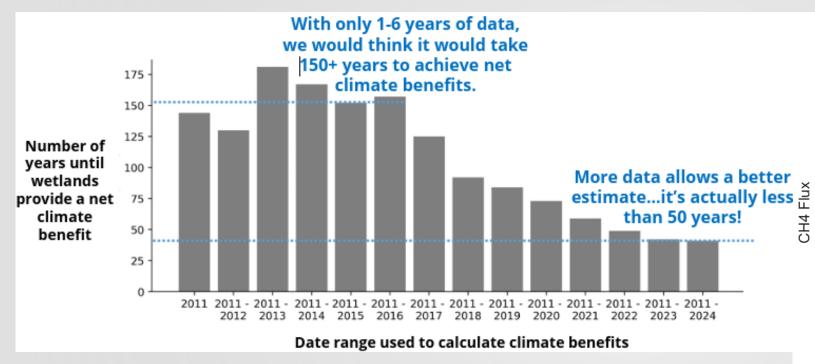
- Adaptive management guidance:
- Control invasive species
- Reduce methane, maximize sequestration →
  - Excess biomass removal?
    - Cultural fire
    - Biomass harvesting



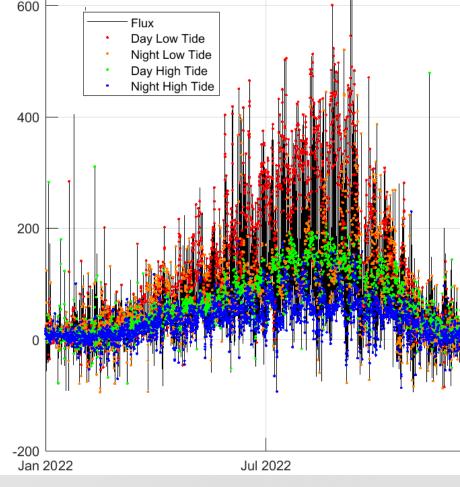


NPS Michael Gu

### Continuous data allows for actions



- Changes decision-making timescales
- Identifies potential management



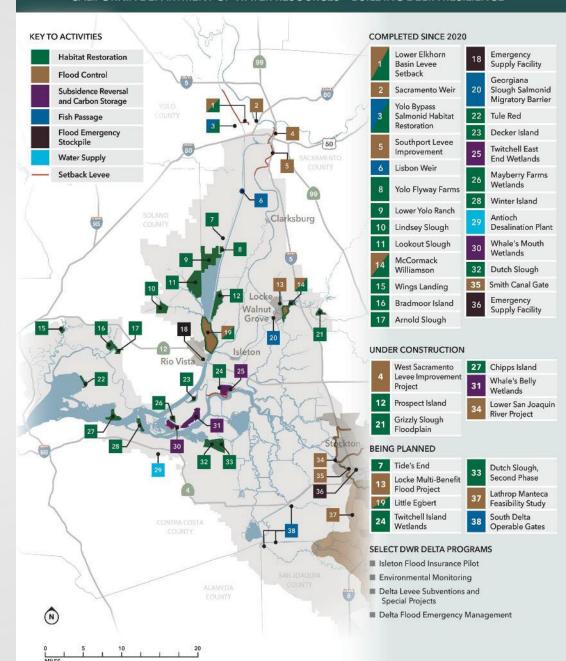


# **Key to Building Resilience**

- +60,000 acres restored habitats
   in Delta by 2050
- DWR's current commitment:
   37,000+ acres by 2030
- Ongoing efforts build resilience:
  - Future investments w/ improved climate analysis (CVFPP 2027 update, Prop 4)
  - Monitoring key to adaptation



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## Next steps to a more resilient, climatesmart Bay-Delta: Large-scale coordination

- Scaling carbon monitoring and credit projects
- Private-public partnerships
- Adaptive management guidance
- Lower investment barriers
  - Permitting
  - Assessments
  - Identifying revenue streams





### Conclusions

- DWR is leading restoration with science
- Nature-based climate solutions are working
- Adaptive management is essential
- Partnerships power progress
- Scaling up is the next frontier



## Acknowledgements



















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