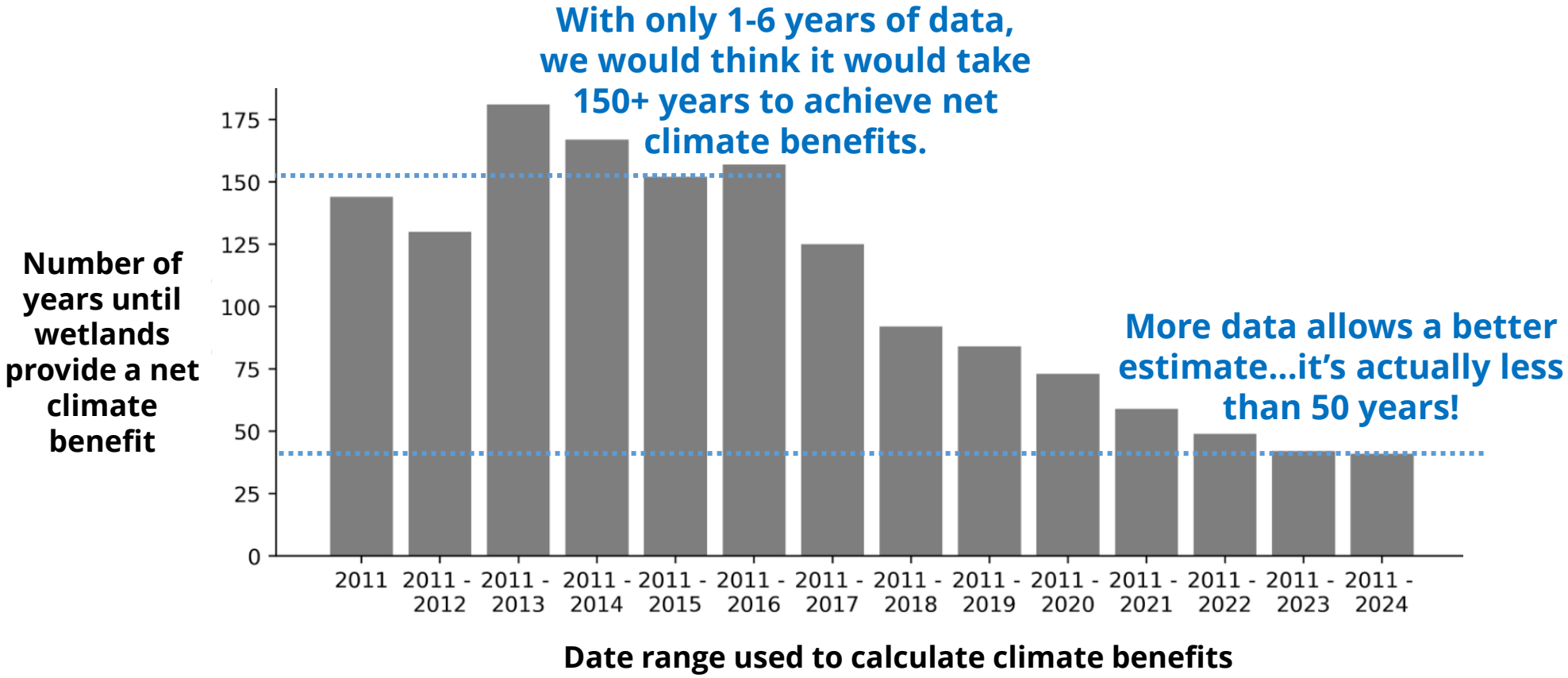
Methane emissions in a restored wetland highlight the value of long-term data



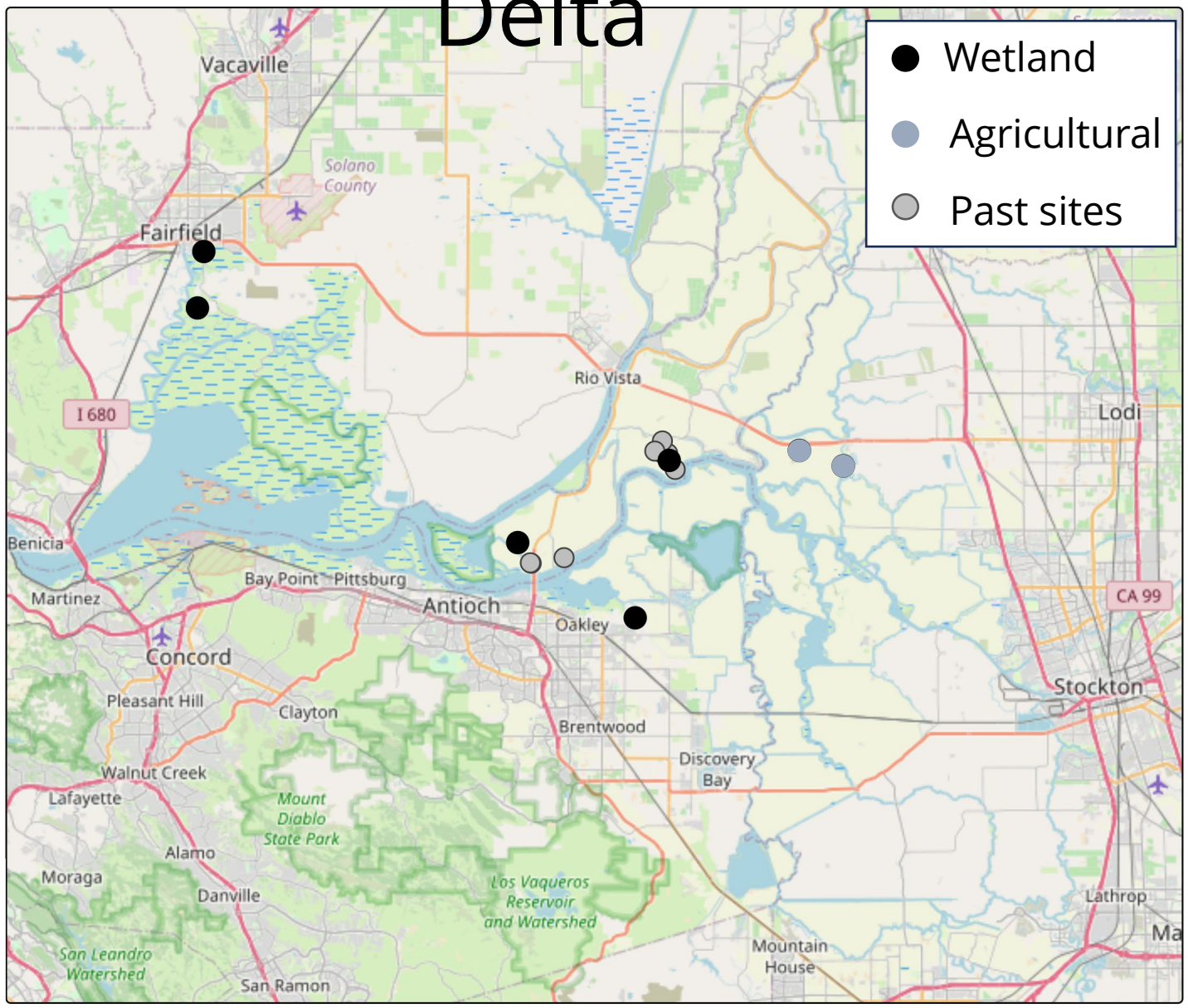
Delwiche et al. (2025), *Agricultural and Forest Meteorology*
https://doi.org/10.1016/j.agrformet.2025.110735

Carbon Monitoring in the California Delta

Kyle Delwiche

Research Scientist, UC Berkeley

Carbon Flux Monitoring in the California Delta



Monitoring sites

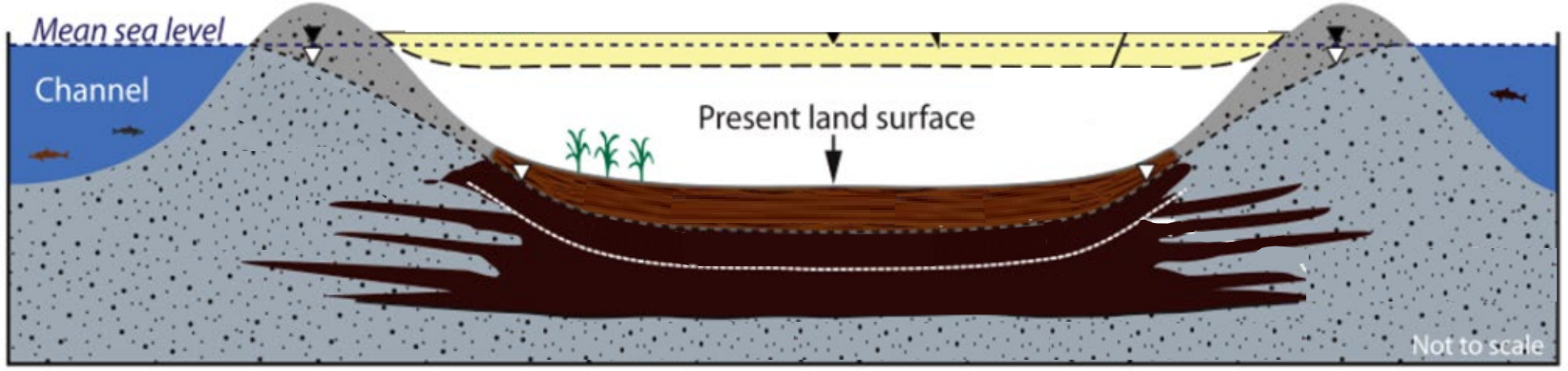
Patty Oikawa

Dennis Baldocchi

Joe Verfaillie

Daphne Szutu

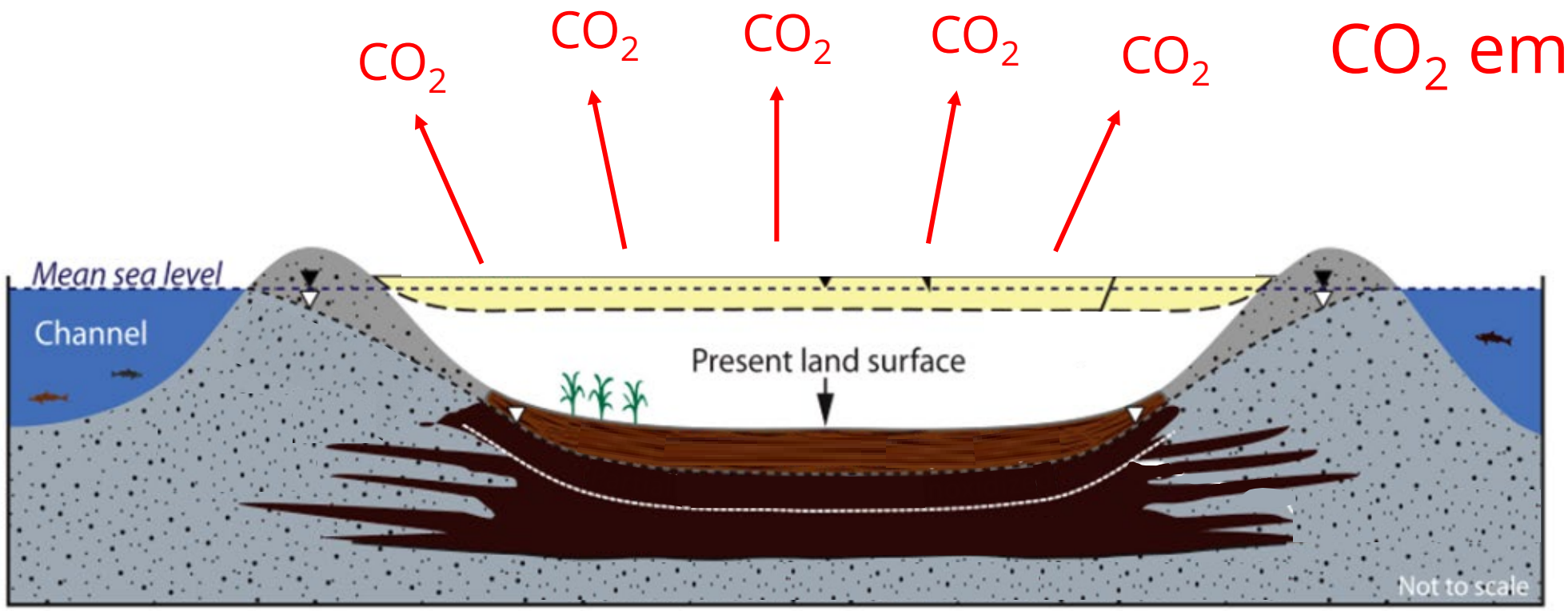
Background info: wetland drainage leads to organic carbon loss, and subsidence



Modified from USGS

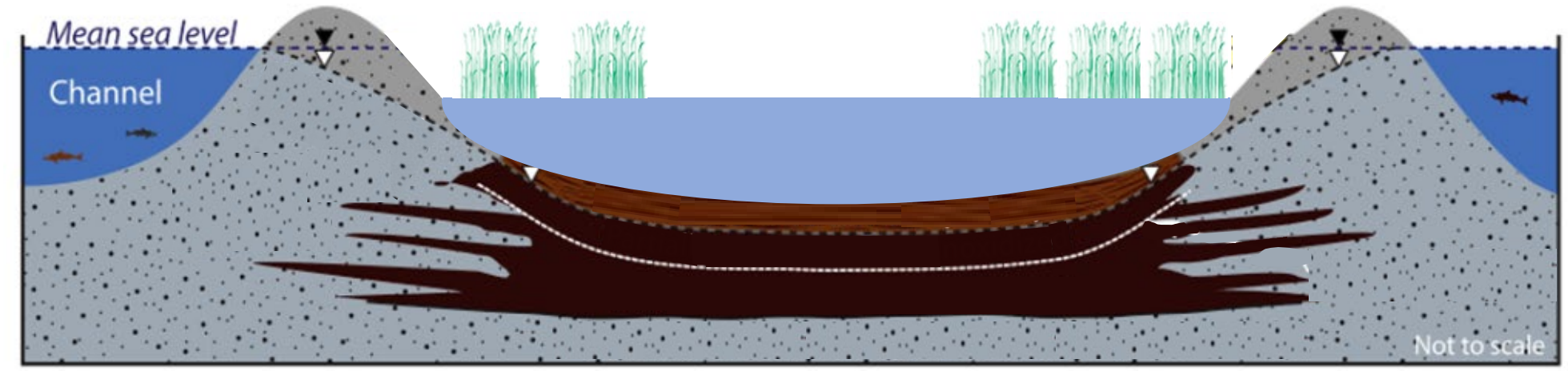
Background info: wetland drainage leads to organic carbon loss, and subsidence

Organic carbon loss = CO_2 emission!



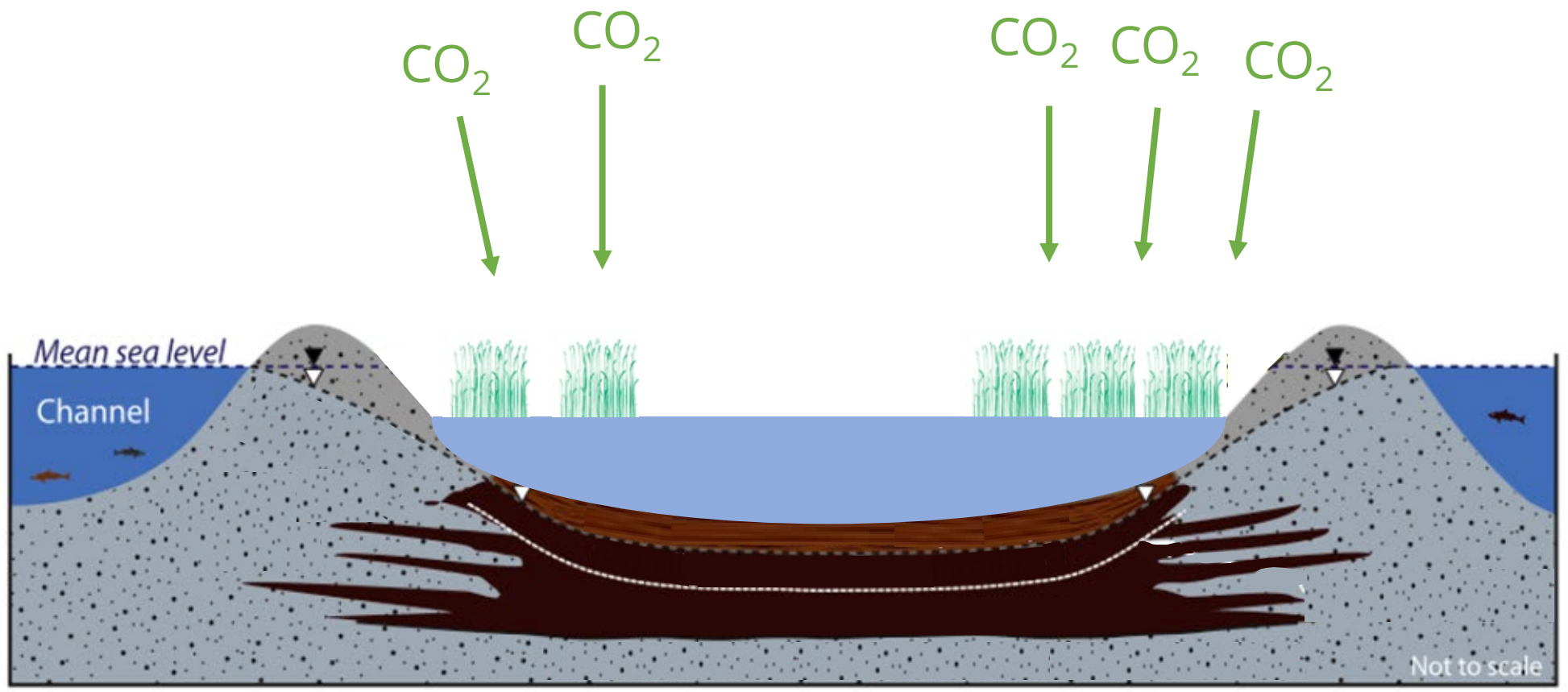
Modified from USGS

Wetland restoration stops carbon loss and reverses subsidence



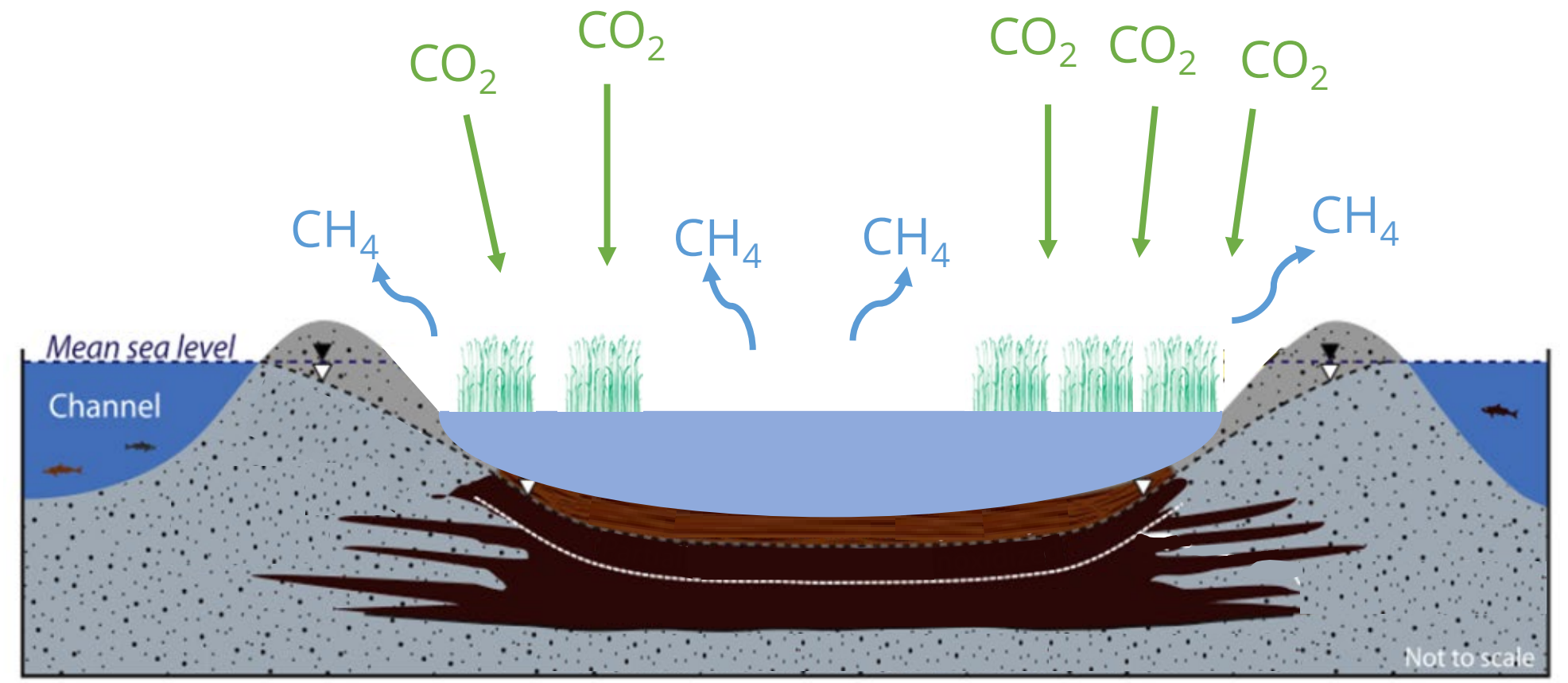
Modified from USGS

Wetland becomes net carbon sink



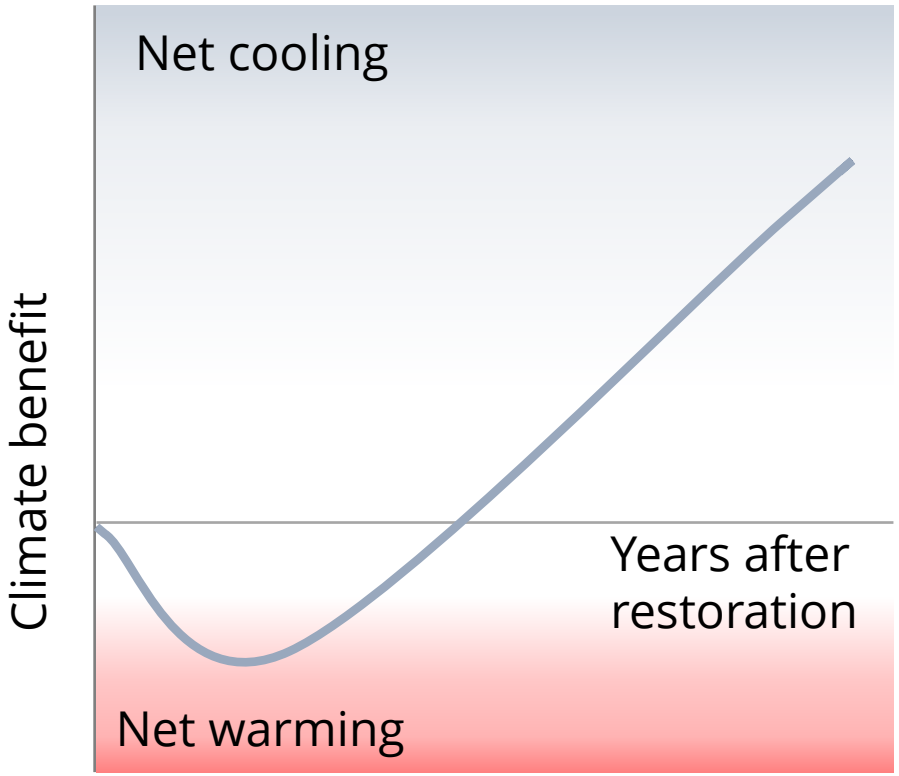
Modified from USGS

With one caveat: wetlands emit carbon as methane



Modified from USGS

Wetland climate benefit = Avoided CO_2 loss + CO_2 sequestration – CH_4 emissions



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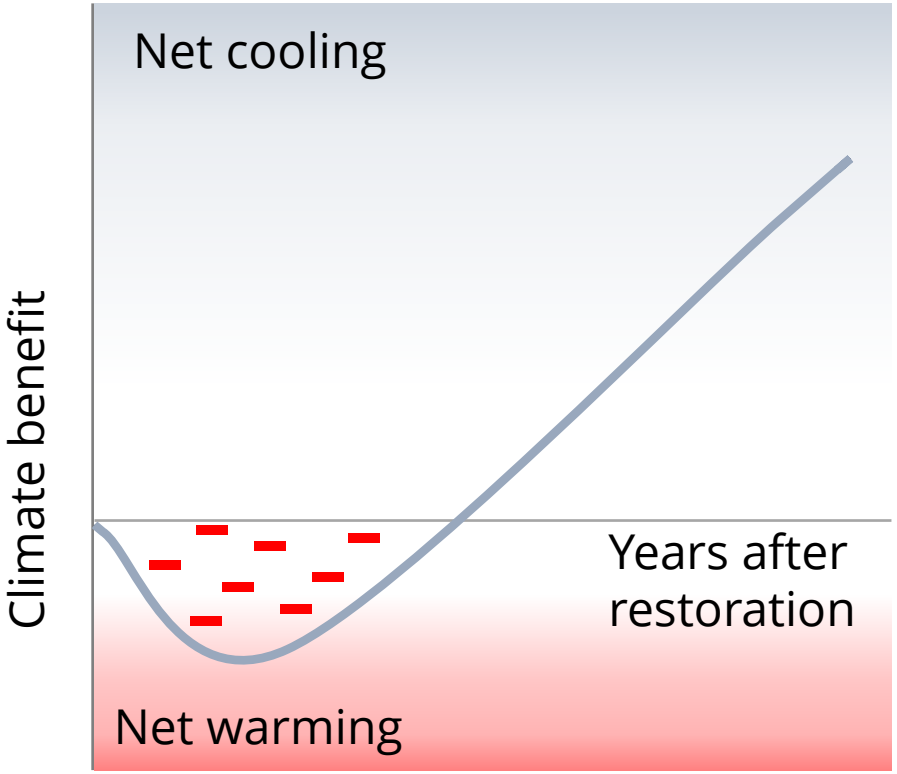

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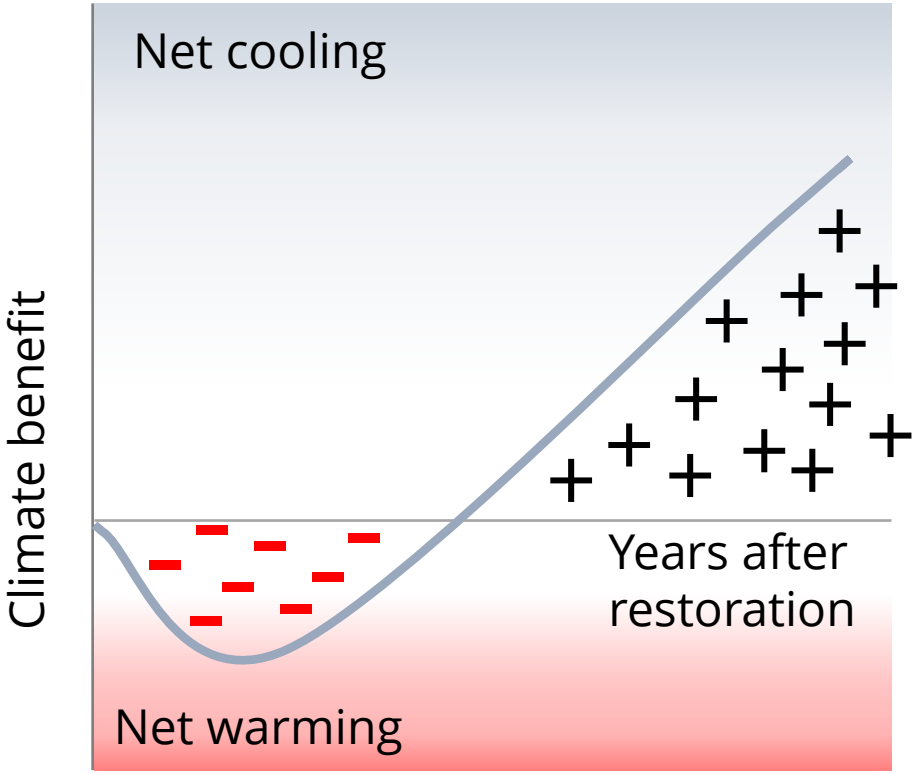

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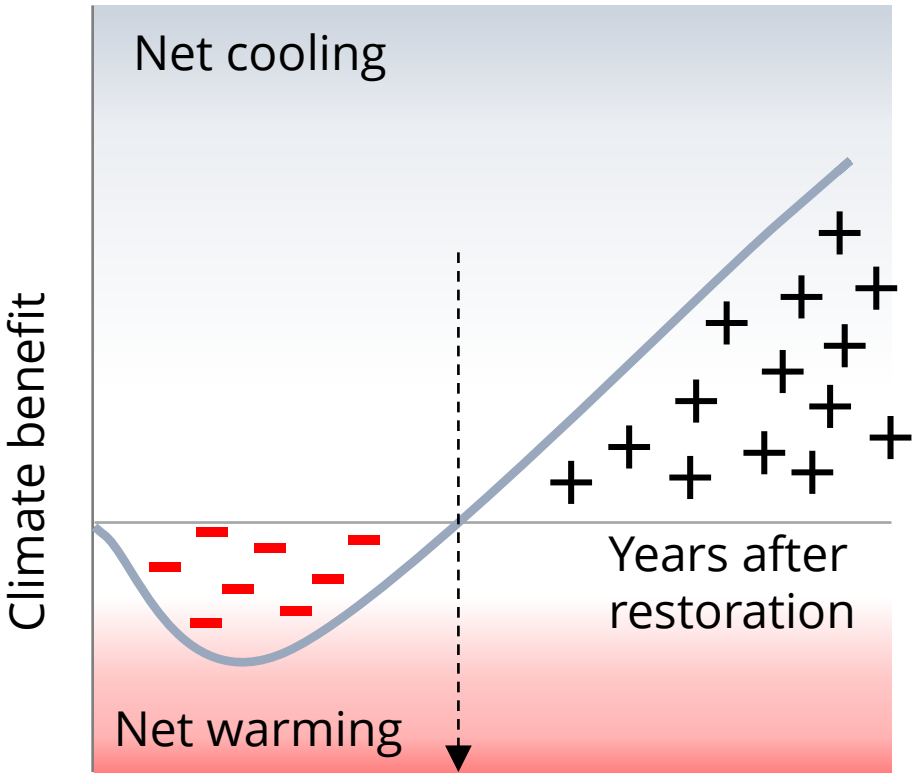
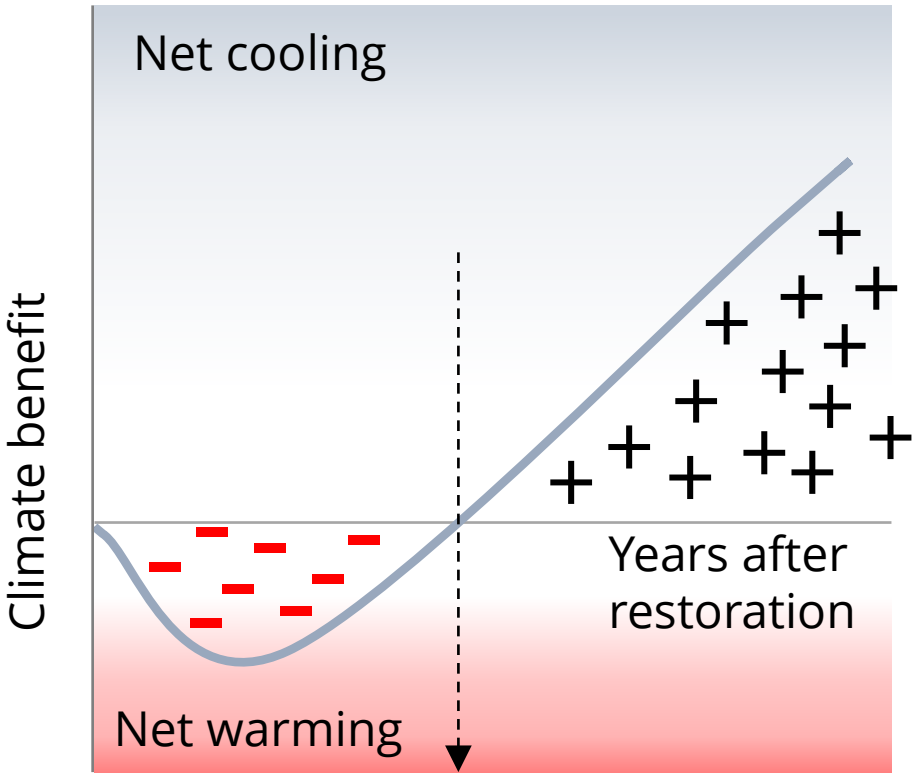
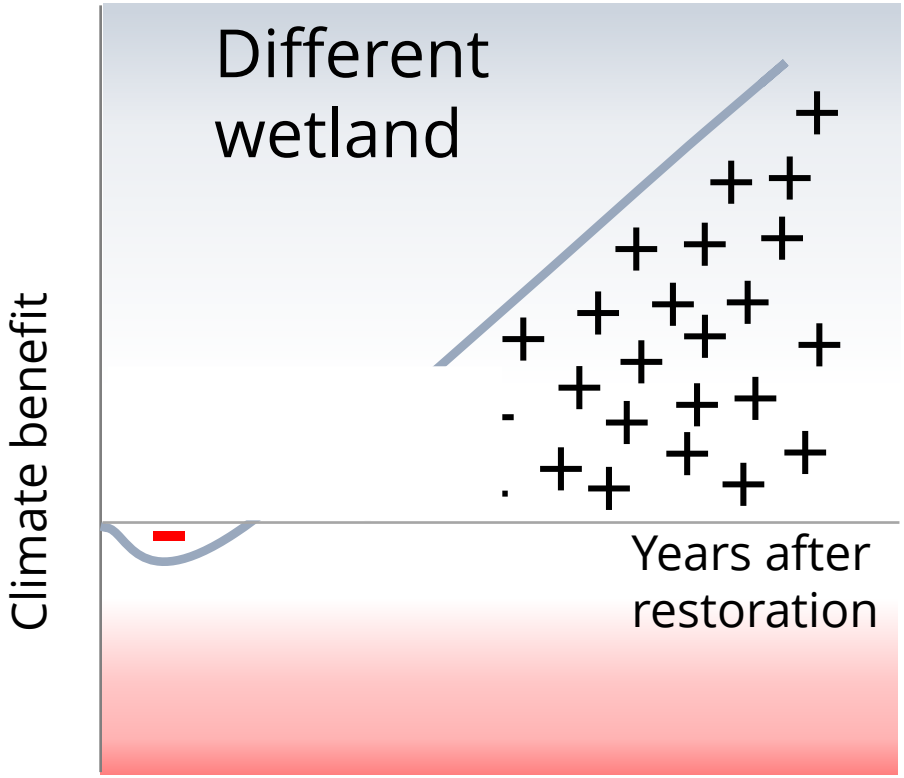


Break-even point

Wetland climate benefit = Avoided CO_2 loss + CO_2 sequestration – CH_4 emissions



Break-even point



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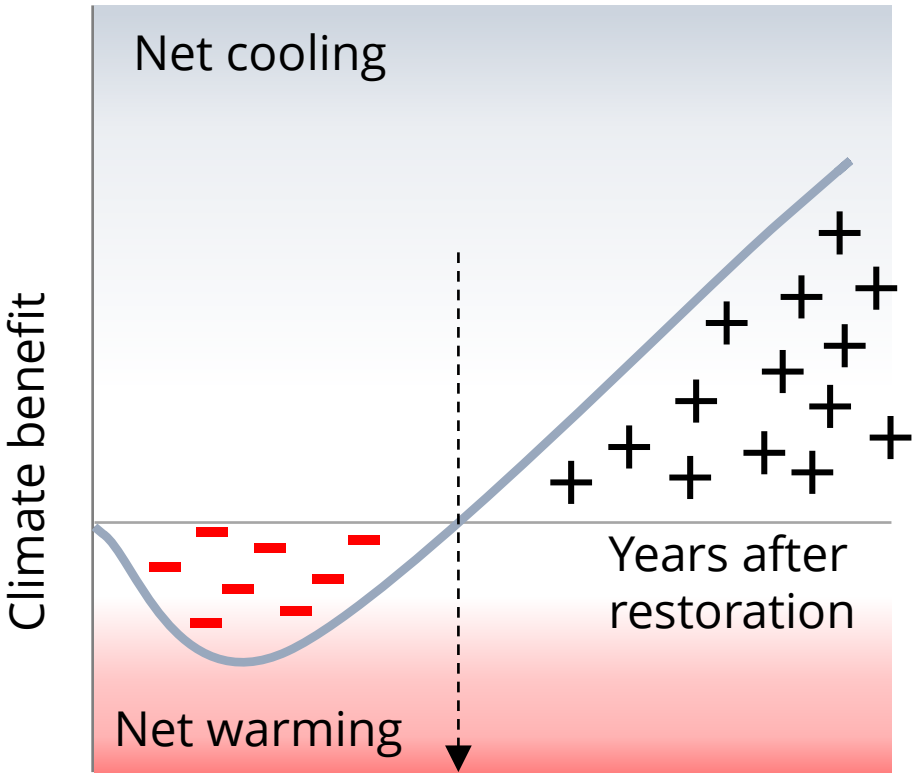
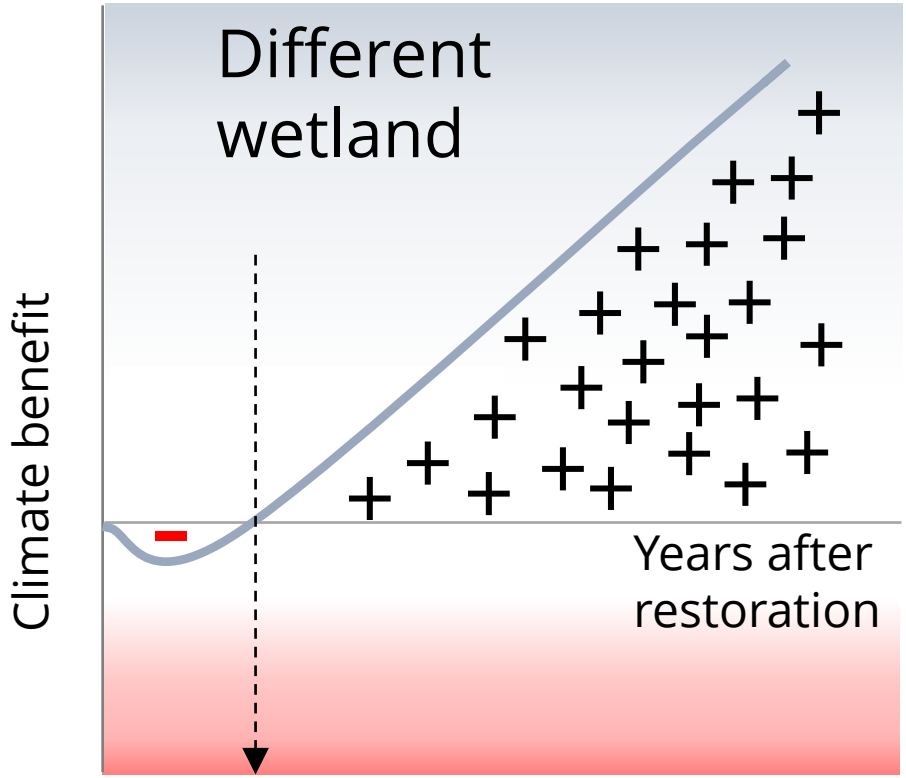
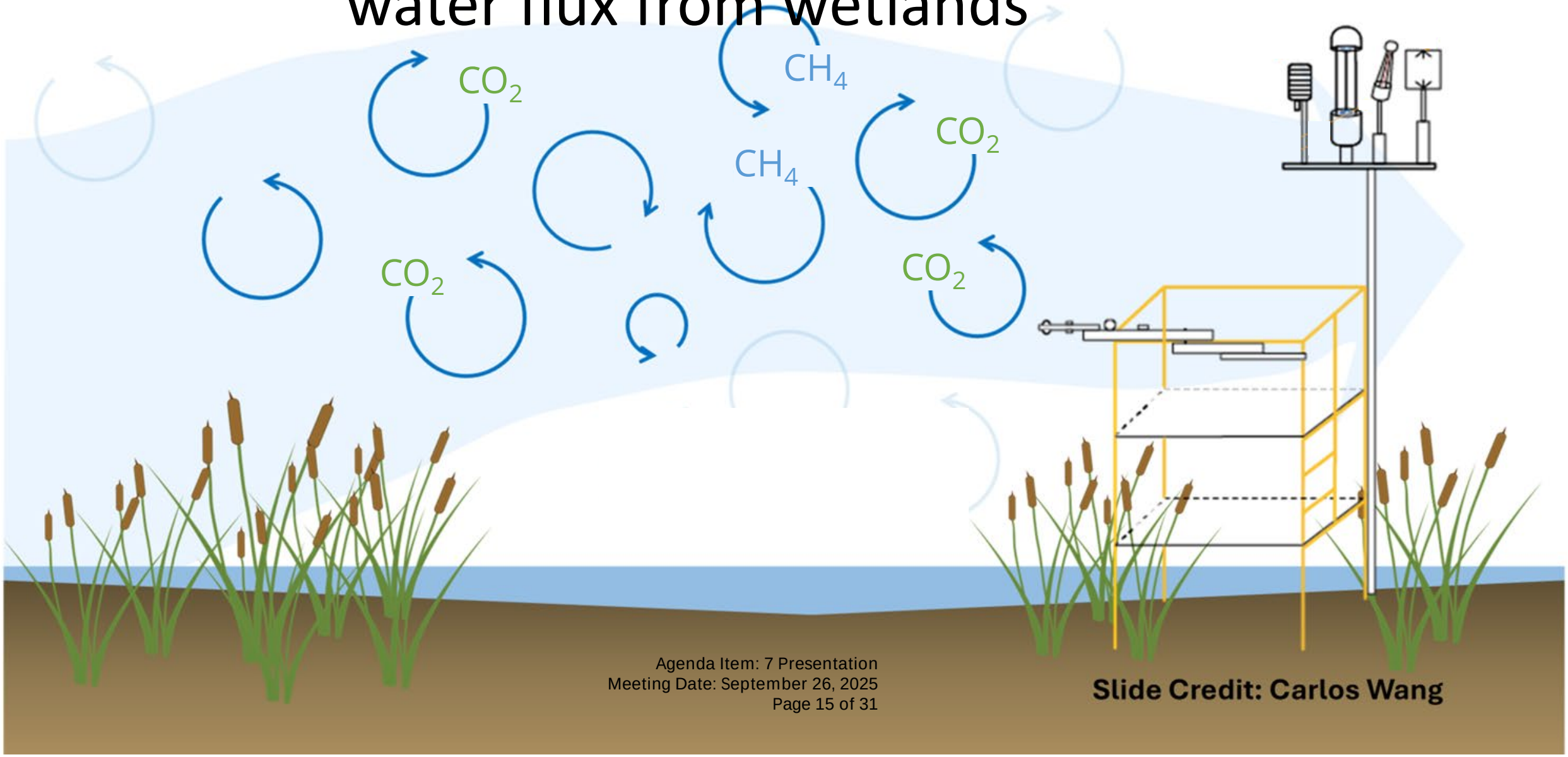


Break-even point



Break-even point changes as balance of CO_2 and CH_4 change

We use eddy covariance to measure carbon and water flux from wetlands



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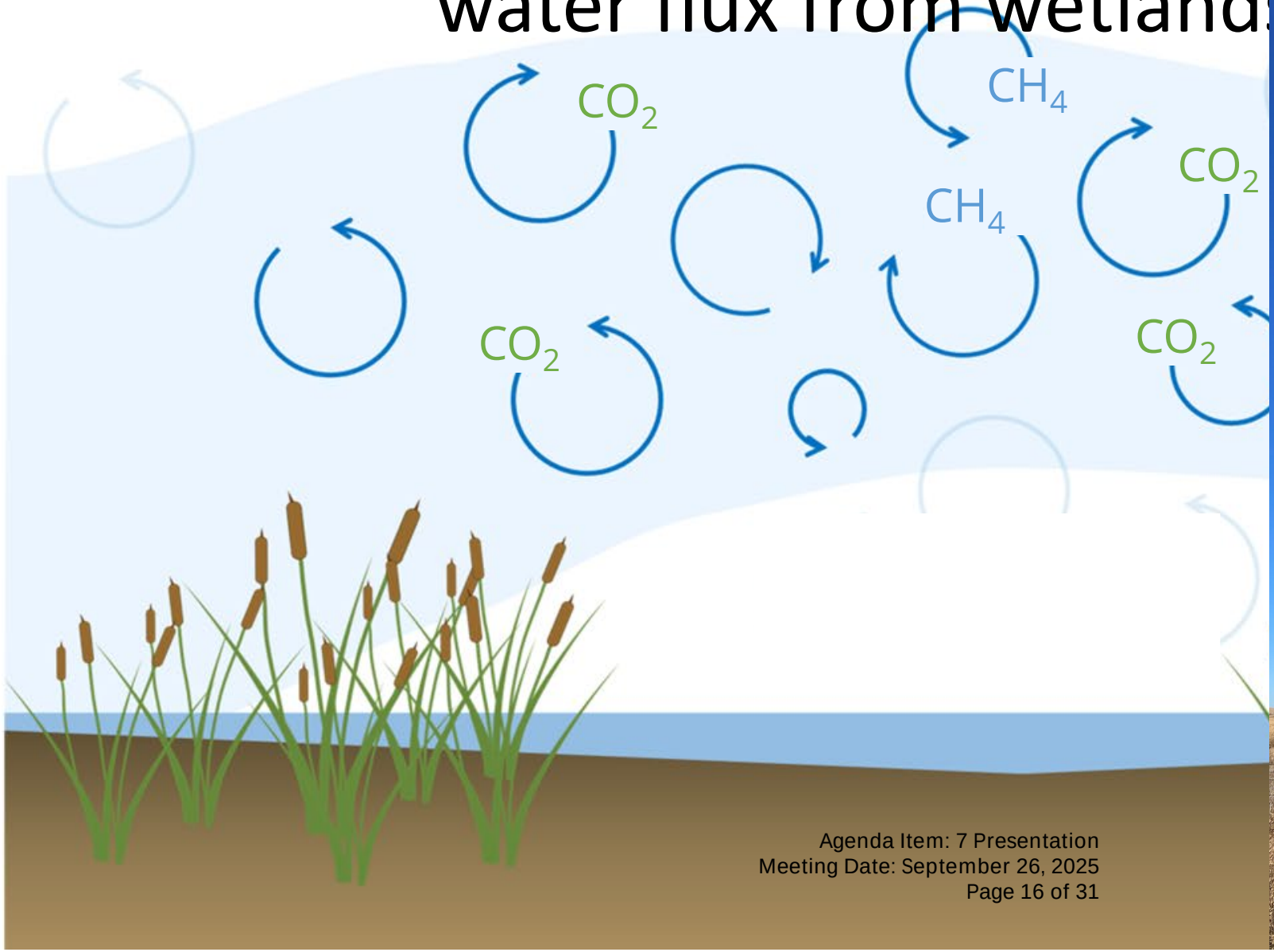
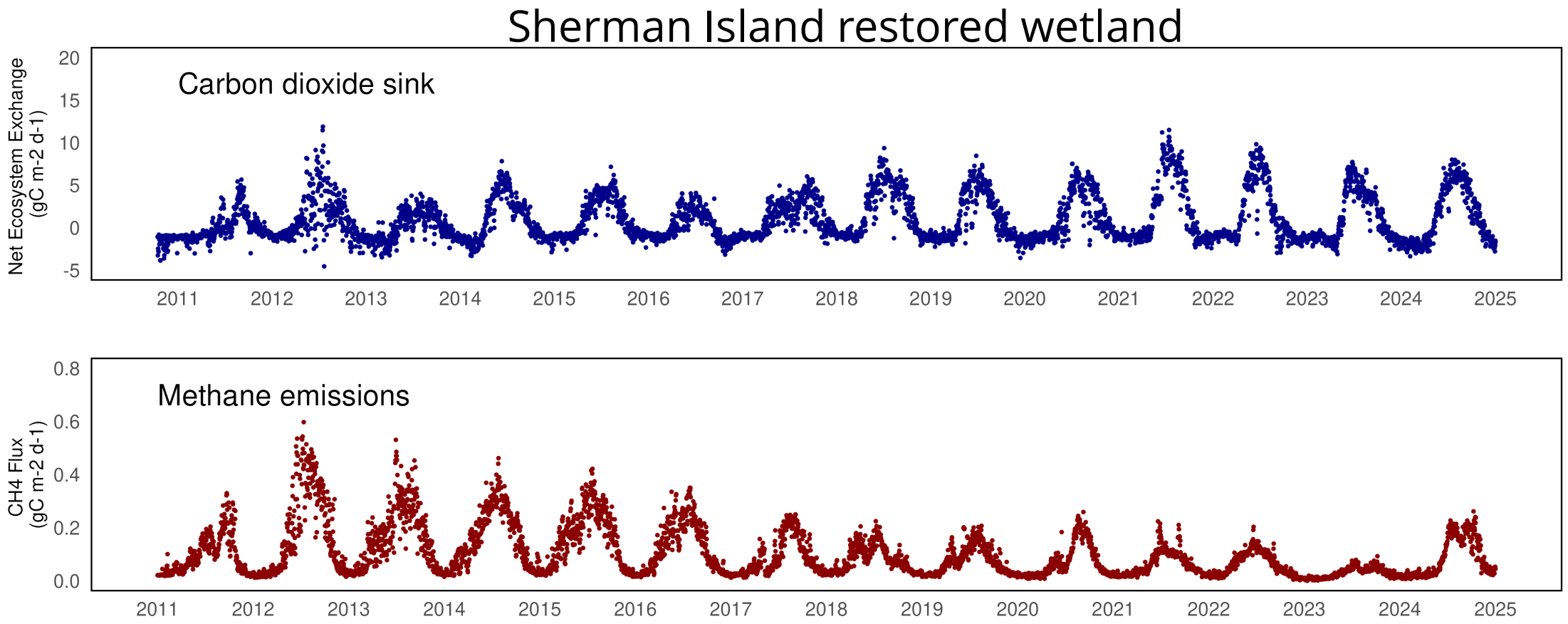


Long-term data crucial for showing long-term patterns



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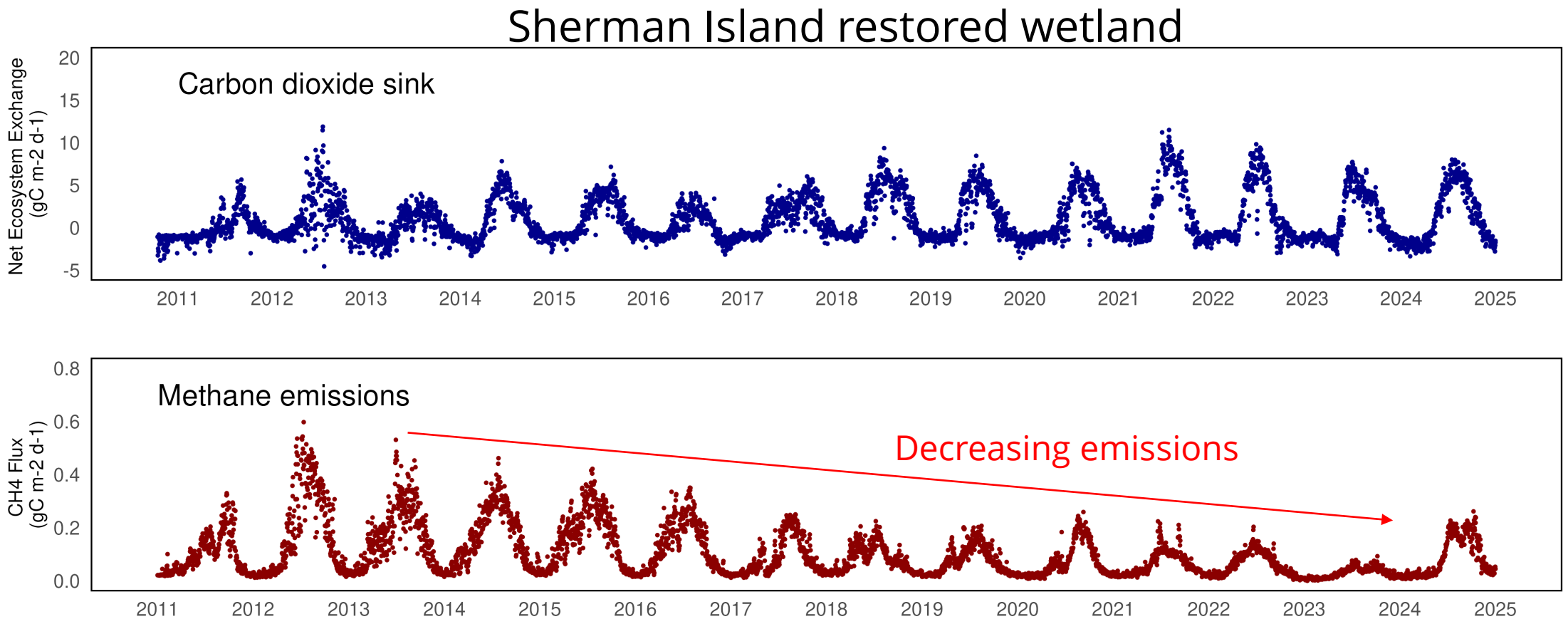
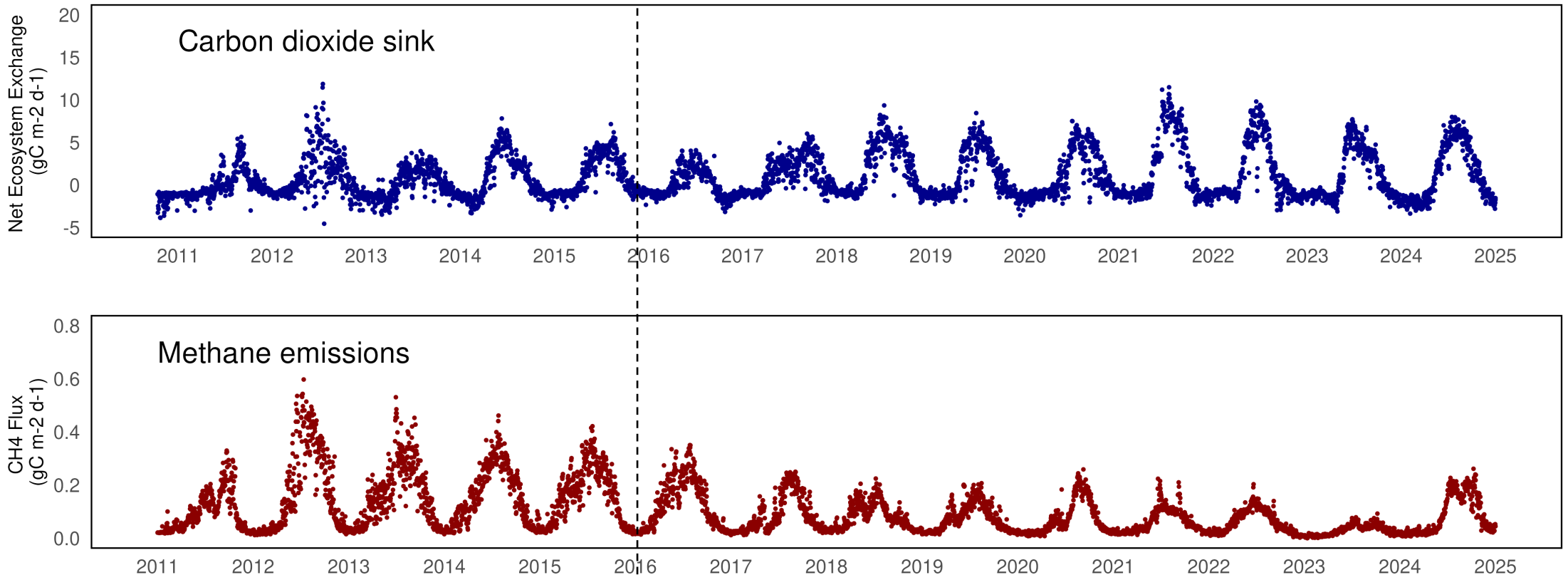


Calculated time until net climate benefit changes as flux changes

Sherman Island restored wetland



Time until net climate benefit

150 years

Calculated time until net climate benefit changes as flux changes

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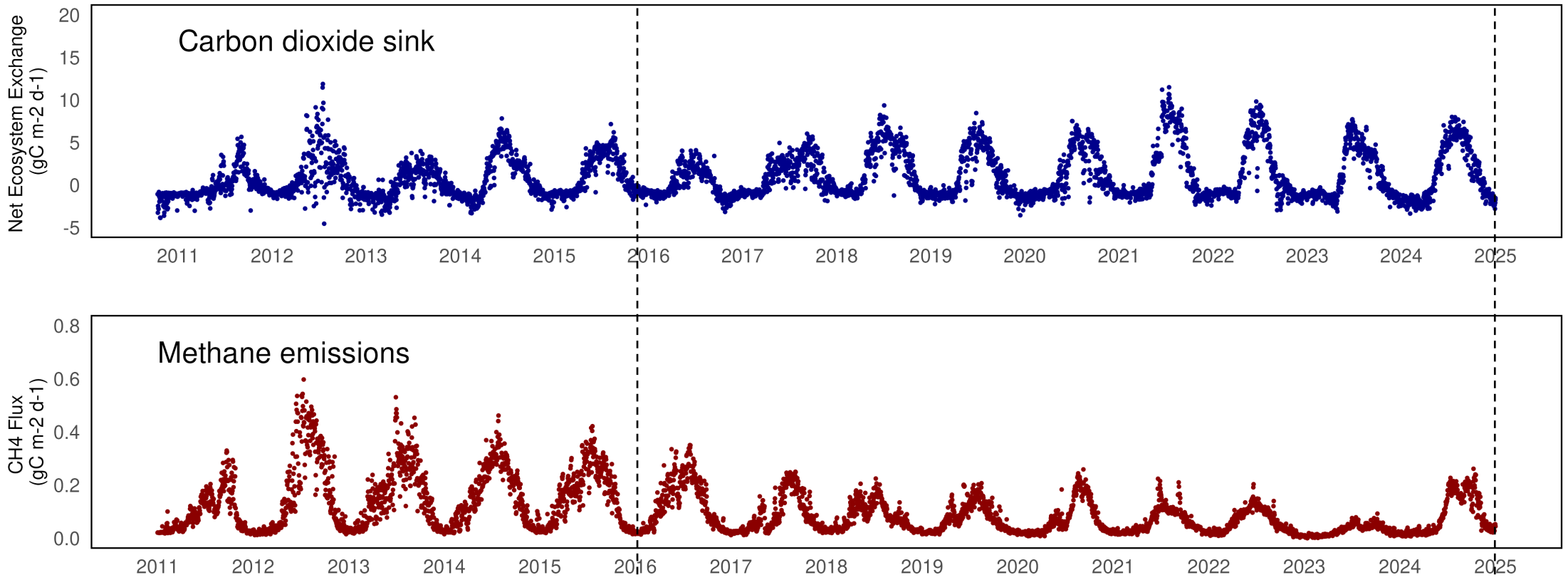


Time until net climate benefit

150 years

40 years

Delta wetlands are some of the largest carbon sinks in the world

Dutch Slough (Oakley)

Rush Ranch (Suisun City)

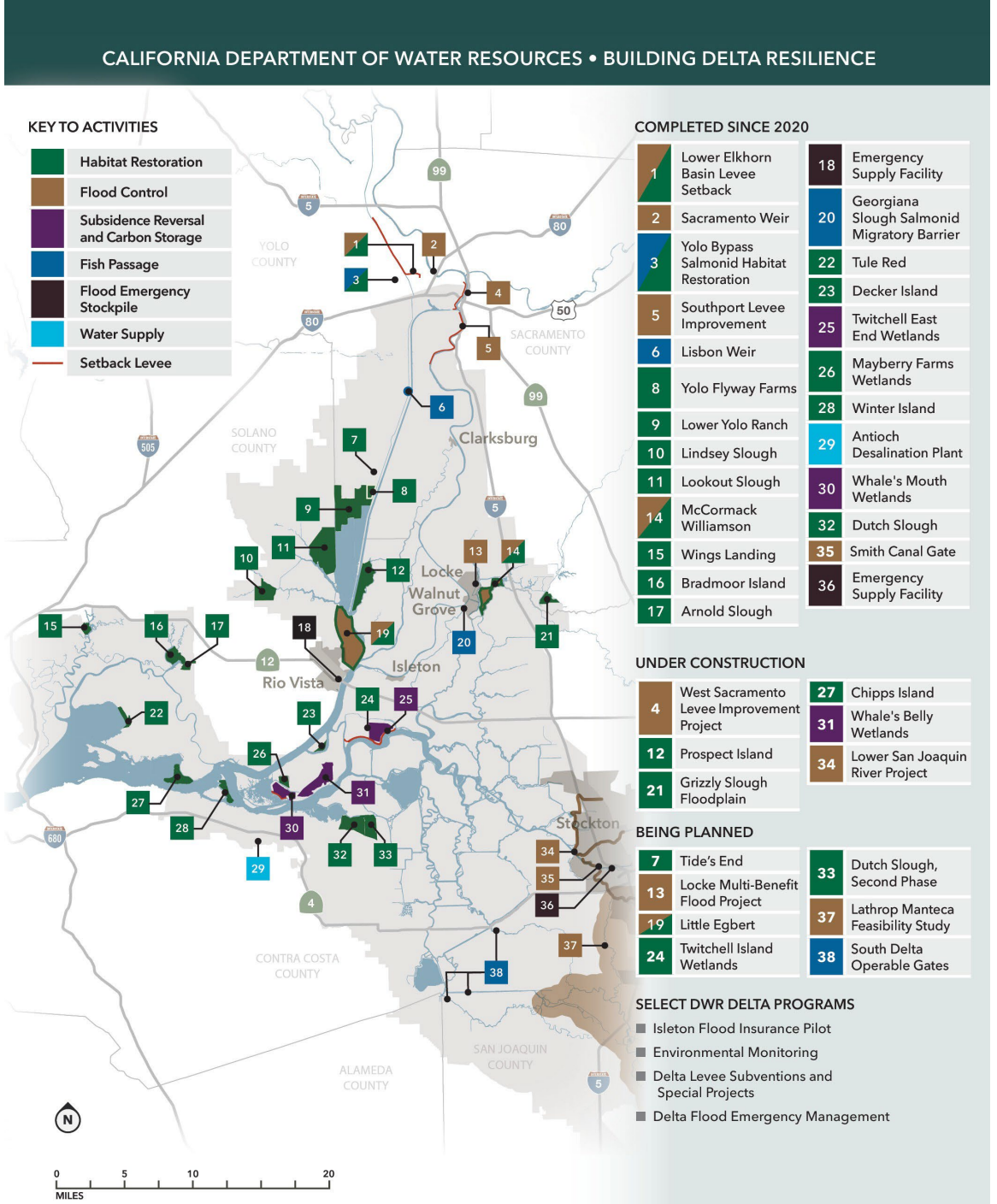
DWR's Nature-Based Climate Solutions: Carbon Credits from Delta Wetland Restoration

Tyler Anthony, PhD - Senior Environmental Scientist (Specialist)
Division of Multibenefit Initiatives – Department of Water Resources

DWR's Nature-Based Climate Solutions

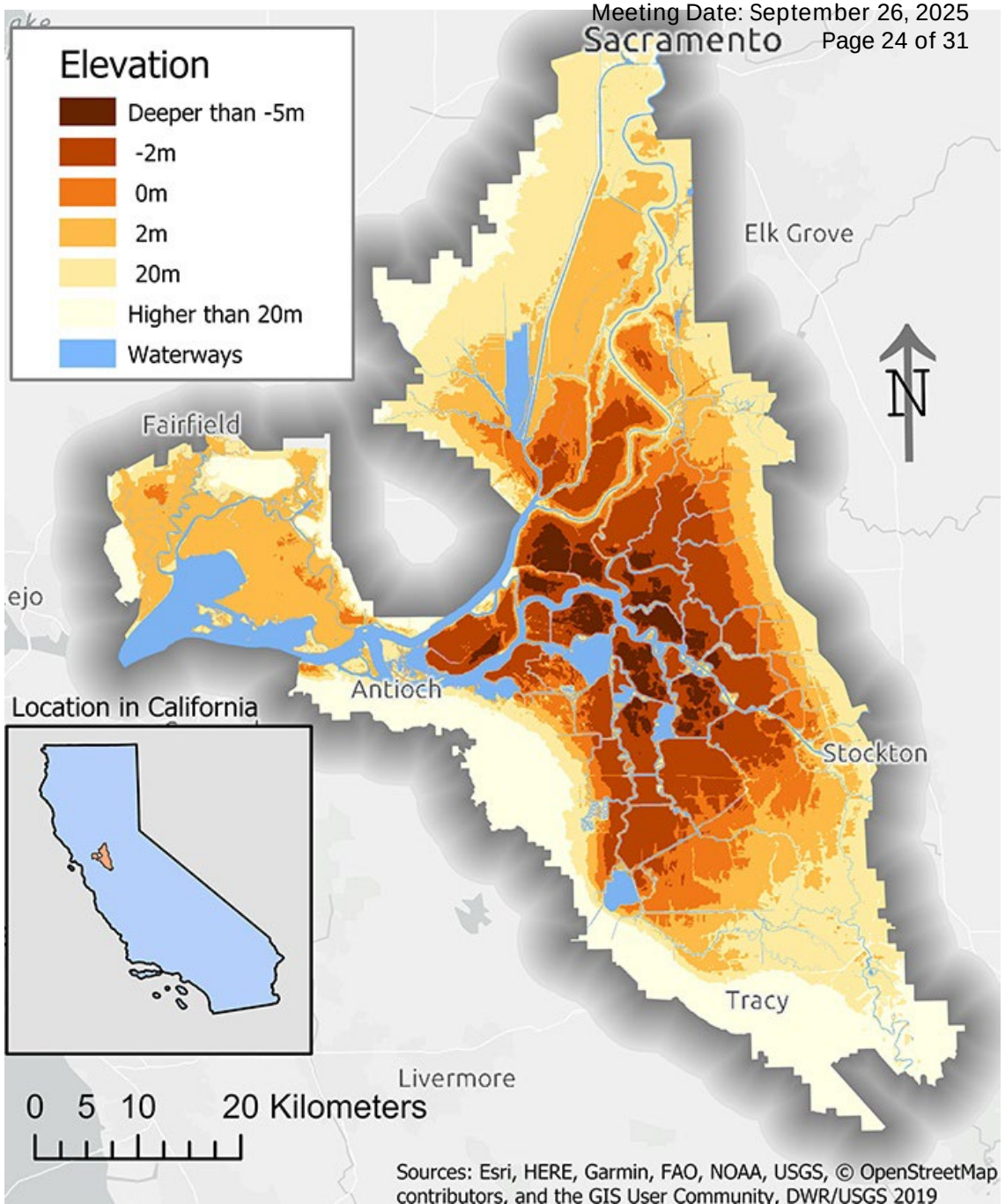
- DWR is leading Delta wetland restoration to:
  - Reverse subsidence
  - Sequester carbon and
  - Enhance habitat
  - Protect water quality

Aligns with the Council's two coequal goals



Long term research *is why we are here!*

- **DWR support of subsidence, carbon research since 1997**
- **Eddy covariance = gold standard**
- **Allowed for model and carbon market development**



Delta Stewardship Council
A CALIFORNIA STATE AGENCY

USGS science for a changing world

DUCKS UNLIMITED

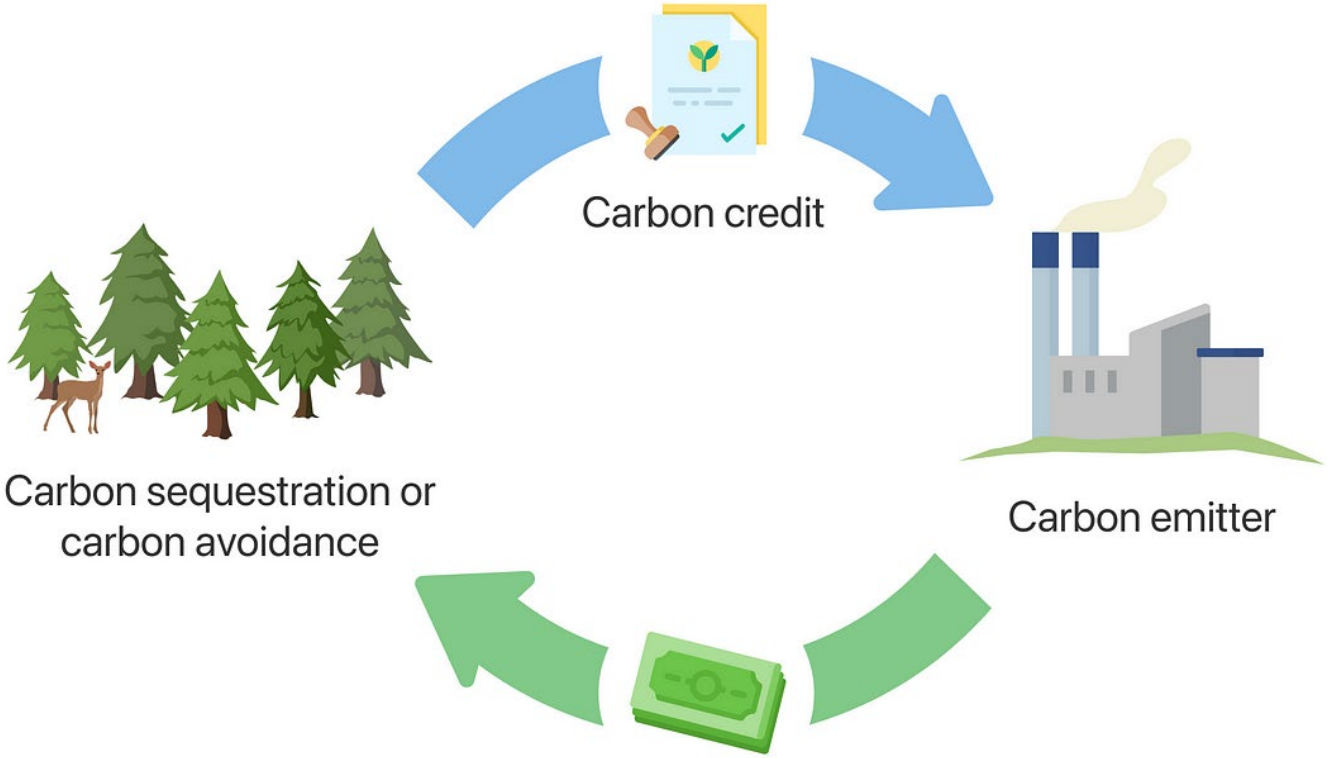
CALIFORNIA CLIMATE INVESTMENTS

UNIVERSITY OF CALIFORNIA

CALIFORNIA DEPARTMENT OF WATER RESOURCES

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

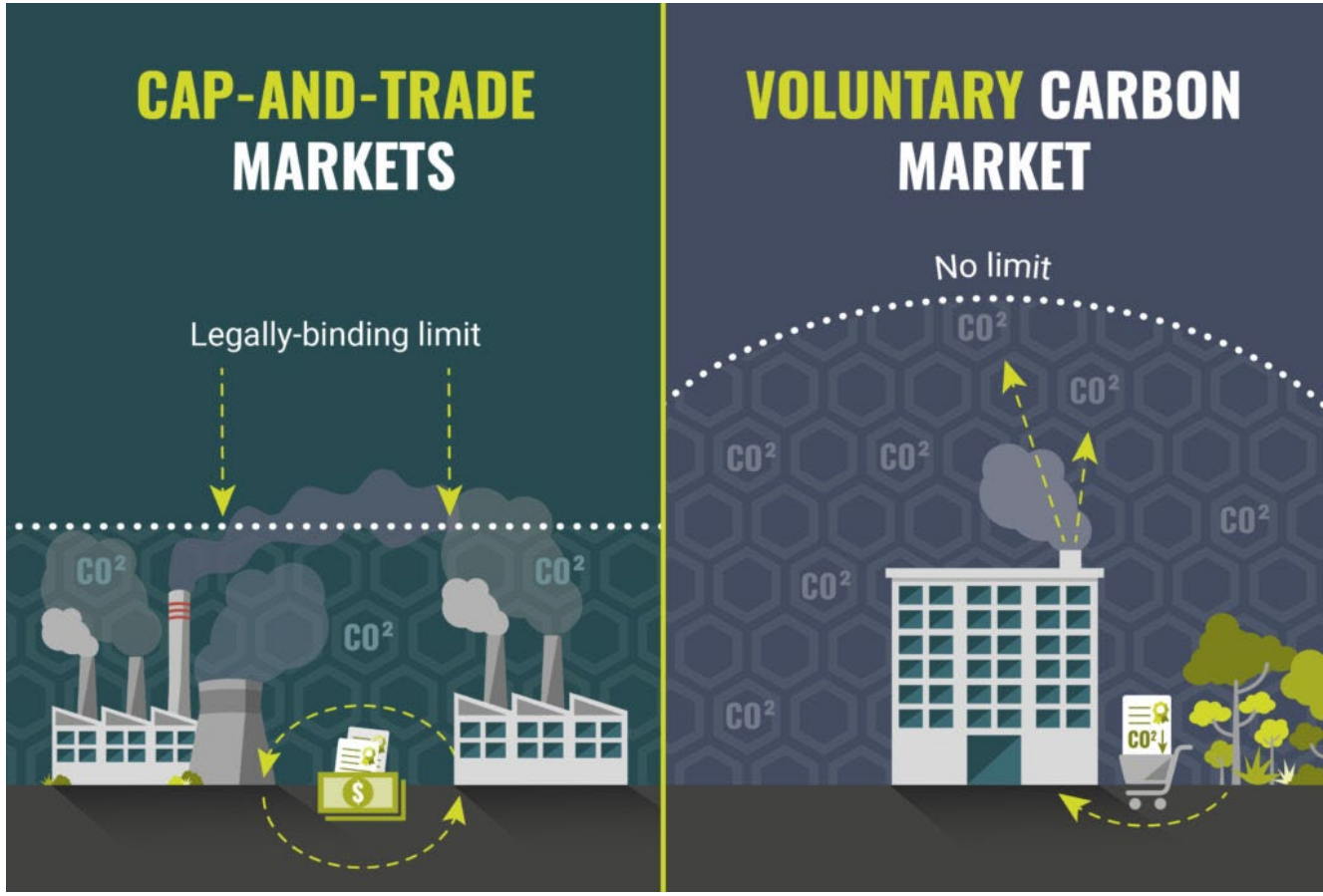


Generating carbon credits at scale

- Sherman and Twitchell subsidence reversal wetlands
- 52,000 carbon credits (tons CO_2eq); ~60,000 on the way
- Translates to ~6 credits per acre annually

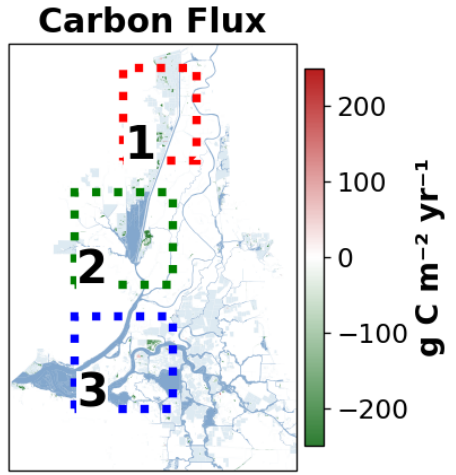
Exploring the sale of credits

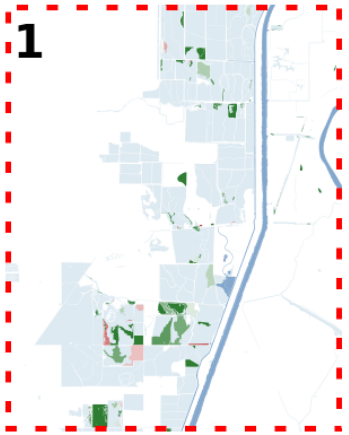
- Potential to fund long-term management
- Value of credits is uncertain
- What does selling look like at DWR?

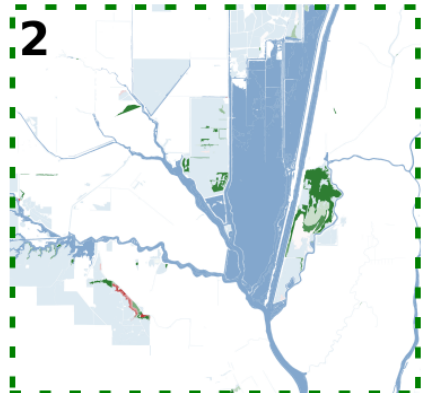


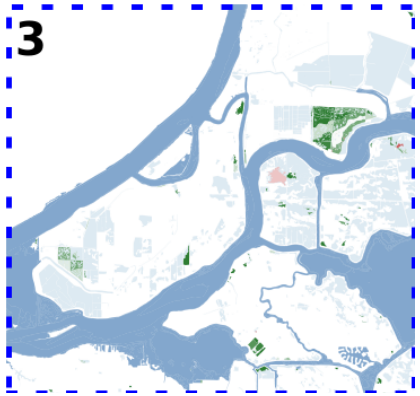
Scaling carbon credit projects: We can't measure everywhere

- Leverage monitoring, models, remote sensing to lower costs
- Tools like:
  - Mobile towers
  - **R**egional **C**limate and **C**arbon **A**nalytics **T**ool (**RCCAT)**









Next steps to a more resilient, climate-smart Delta: Delta-wide coordination

- **Scaling carbon monitoring**
- **Targeted restoration**
- **Explore:**
  - **Carbon farming as ag**
  - **Private-public partnerships**
  - **Lower barriers to investments**

Delta Science Program Activities

- **2025 Delta Research Awards** kick-off meeting
- **California Sea Grant Matching Workshop**

On Your Radar

- **DPIIC Restoration Subcommittee** meeting (August 7, 2025)
- Registration open: **Adaptive Management Forum (Oct 14–15, 2025)**
- **CNRA Secretary Speaker Series** panel on Delta climate science **(Oct 27, 2025)**
- Registration open: **State of the Estuary Conference (Oct 28–29, 2025)**

Delta Science Program
DELTA STEWARDSHIP COUNCIL

By the Numbers

09/26/2025

Agenda Item 7
Attachment 2

Precipitation[1,2]

Percent average to 09/24

Northern Sierra

56.5” 106%

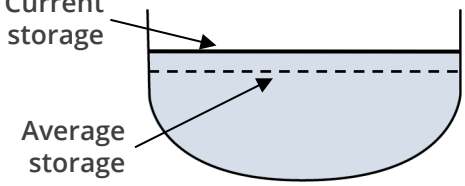
Central Sierra

32.3” 81%

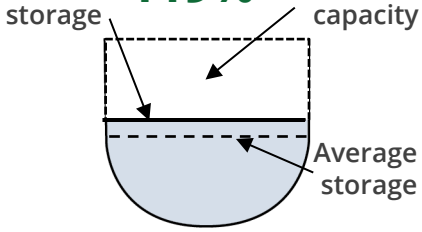
Reservoir Storage [4]

ercent average to 09/24

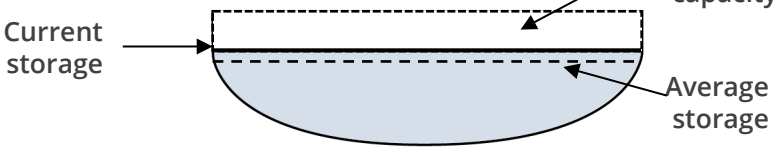
Oroville 110%



San Luis 119%



Shasta 105%



Water Temperature [3]

In degrees Fahrenheit

Average to 09/24

Clear Creek

57° 57°

Collinsville

71° 69°

Clifton Court Forebay

75° 74°

Water Flow and Quality [4,5,6]

Sacramento River - Freeport

17,875 cfs | 120% 162 µS/cm |89 ppm

San Joaquin River - Vernalis

714 cfs | 50% 405 µS/cm | 223 ppm

Combined CVP + SWP - Diversion

11,547 cfs | 139% 424 µS/cm | 233 ppm

[1] https://go.usa.gov/xQsUc
[2] https://go.usa.gov/xQsUa
[3] https://go.usa.gov/xURFU
[4] https://go.usa.gov/xQsUr
[5] https://go.usa.gov/xQsU2
[6] https://go.usa.gov/xQsUT

<50% 50–74.9% 75–90% >90%