



U.S. Department of the Interior
U.S. Geological Survey



ENVIRONMENTAL
DEFENSE FUND™

Finding the ways that work



CARBON-CAPTURE WETLAND FARMING



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California Department of
Water Resources

RAE Conference November 2010

The Scientific and Economic Viability of Carbon-Capture Wetland Farming in the Sacramento-San Joaquin Delta

EDF

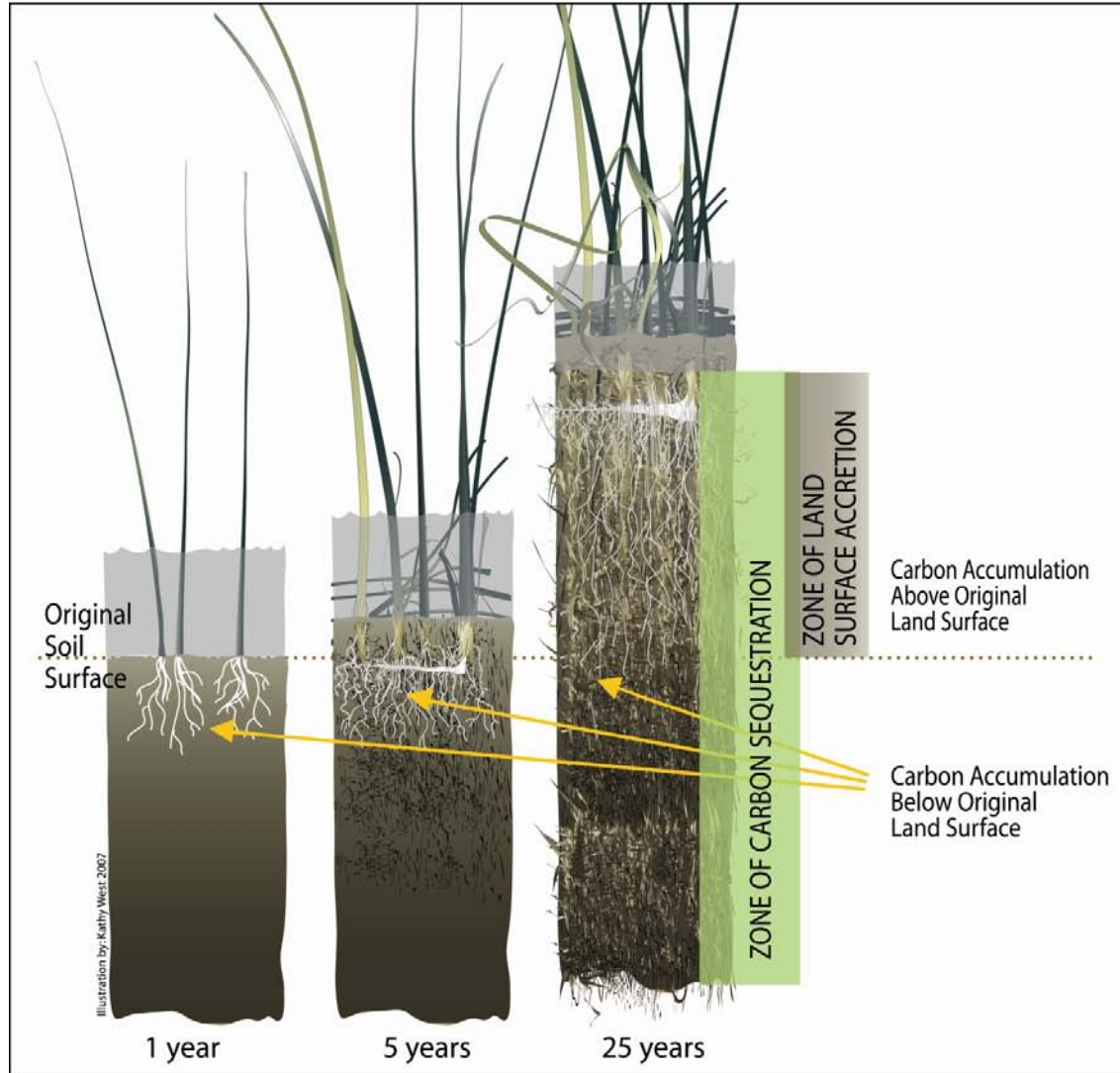
Belinda Morris

USGS

Brian Bergamaschi,
Roger Fujii,
Robin Miller

and the

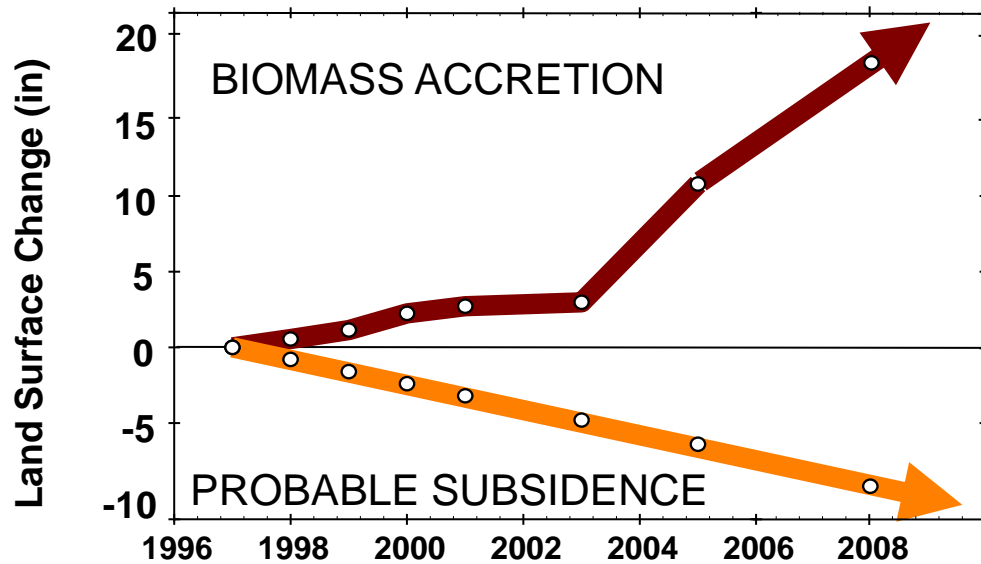
Organic Carbon
Research Group



U.S. Department of the Interior
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Wetland Performance

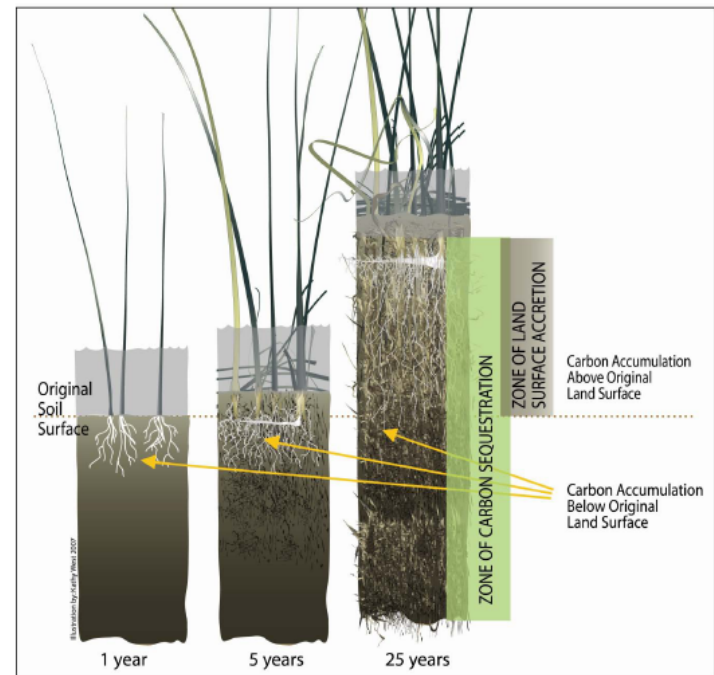


Submerged about 1 ft
Low oxygen conditions
Balance between plant growth and reduced decomposition

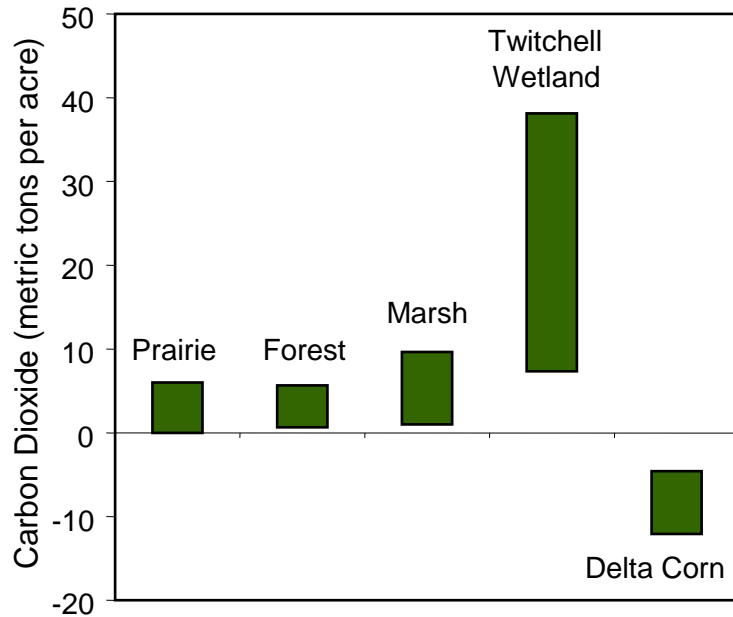
Wetlands **replace lost peat soils**,
reversing subsidence,
rebuilding land surface

Wetlands **eliminate current GHG emissions** of CO₂ and N₂O.

~25 metric tons of CO₂ per acre-year are captured by plant growth and preserved



Wetland Farms?



Is it possible to place GHG benefits in **Carbon Offset programs?**

Could yield benefits *better than existing bio-sequestration programs.*

Multiple Benefits

MAJOR

- Reduces current GHG emissions
- Large bio-sequestration potential
- Potentially provides income to landowner through Carbon Market

ANCILLARY

- Preserves agricultural communities
- Improves water quality by trapping nutrients
- Stabilizes levees by reducing hydrostatic pressure
- Provides habitat
- May permit reopening of these wetlands in the future to tidal action.

Major Unknowns

- Baseline emissions
- Wetland emissions - lifetime
- Variability
- How to verify performance

Problems

- Methyl mercury production
- Dissolved organic carbon release

wetland construction costs



WETLAND ELEMENT	WETLAND PER-ACRE COST SCENARIO		
	LOW	MEDIUM	HIGH
Economy of scale / wetland size	Large	Medium	Small
Engineering Costs (%)	10%	12.5%	15%
Wetland shape	Square	1.5:1 rectangle	2:1 rectangle
Complexity of installation on landscape:			
Extent of leveling	Minimal	Some	Most
Extent of perimeter berms	None	1 side	4 sides
Extent of plumbing infrastructure	Moderate	Moderate	High
Extent of island infrastructure protection	Least	Moderate	Most
Annual O&M			
Periodic raising of berms	Least	Moderate	Most
Irrigation	Moderate	Moderate	High
Contingency	10%	20%	35%

wetland production



COST CATEGORY	WETLAND PRODUCTION PERIOD AND WETLAND COST SCENARIO					
	20-YR.			10-YR.		
	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
TOTAL CARBON CREDITS PRODUCED PER ACRE IN AMORTIZATION PERIOD (Mt CO₂e) ¹						
Establishment, yr 1	0	0	0	0	0	0
Emission reductions: 100%, yr 2-5	50	50	50	50	50	50
Ramping-up production, yr 2-5	25	25	25	25	25	25
Full production, yr 6+	375	375	375	125	125	125
TOTAL CARBON CREDITS	450	450	450	200	200	200
PRODUCTION COSTS PER CARBON CREDIT (\$/Mt CO₂e) ²						
Establishment costs	\$1.35	\$1.72	\$3.00	\$3.03	\$3.86	\$6.74
Annual operations costs (discounted to 2010)	\$7.57	\$7.97	\$8.67	\$8.87	\$9.33	\$10.15
TOTAL COST PER CARBON CREDIT	\$8.92	\$9.68	\$11.66	\$11.90	\$13.19	\$16.89
TOTAL PER ACRE COST/YEAR	\$201	\$218	\$262	\$238	\$264	\$338

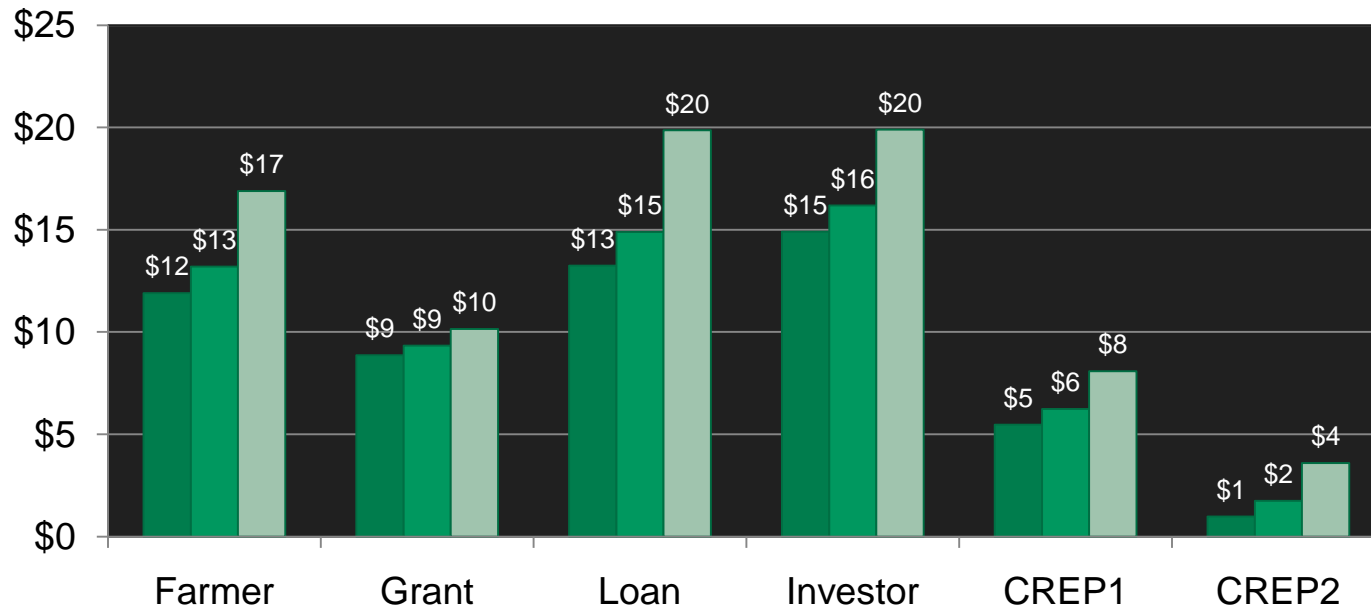
1. Assumes zero carbon credits year 0-1, avoided emissions reductions begin year 1+
2. Carbon verification costs not included

breakeven carbon price



Breakeven Price of Carbon over 10-year Production Period

■ low cost ■ medium cost ■ high cost

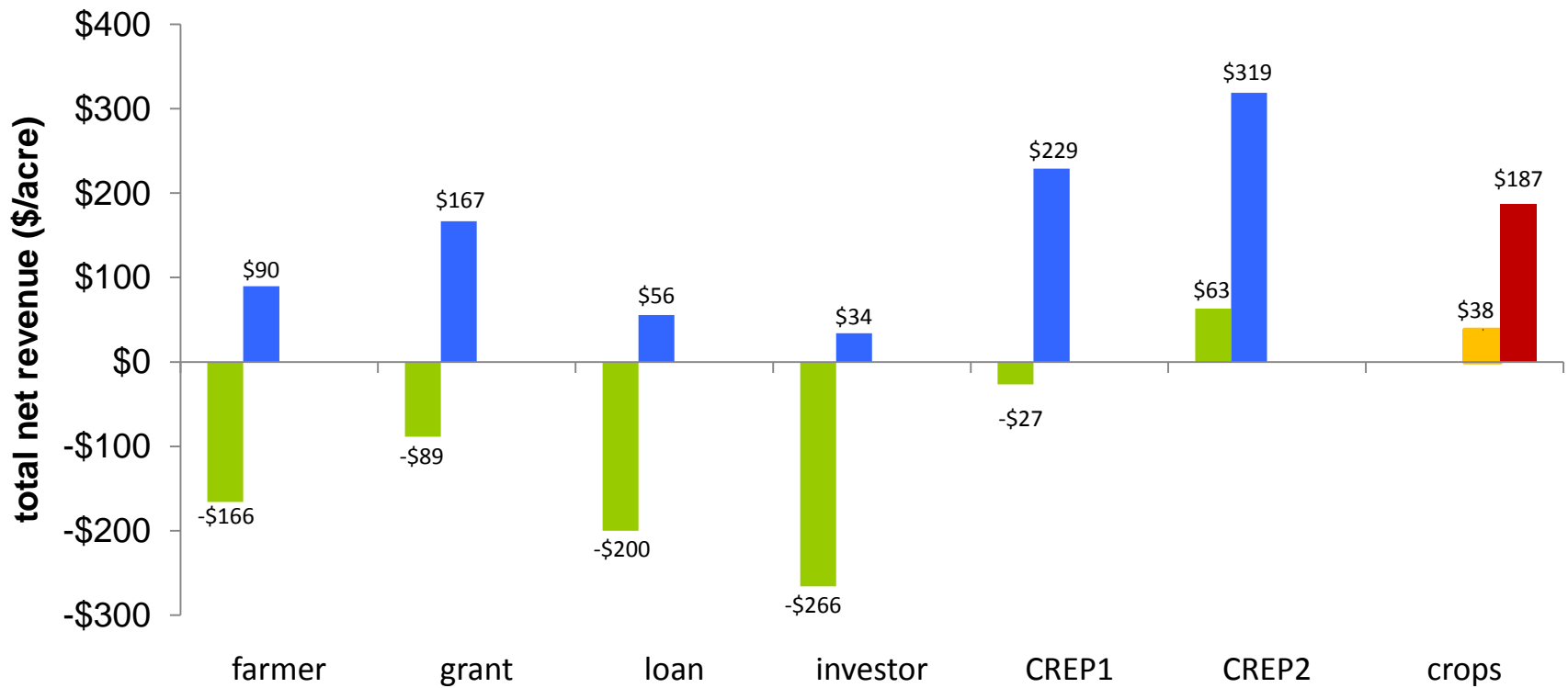


carbon vs. crops



Medium Cost Wetland Scenario

■ \$5/tCO₂e ■ \$20/tCO₂e ■ corn ■ tomatoes



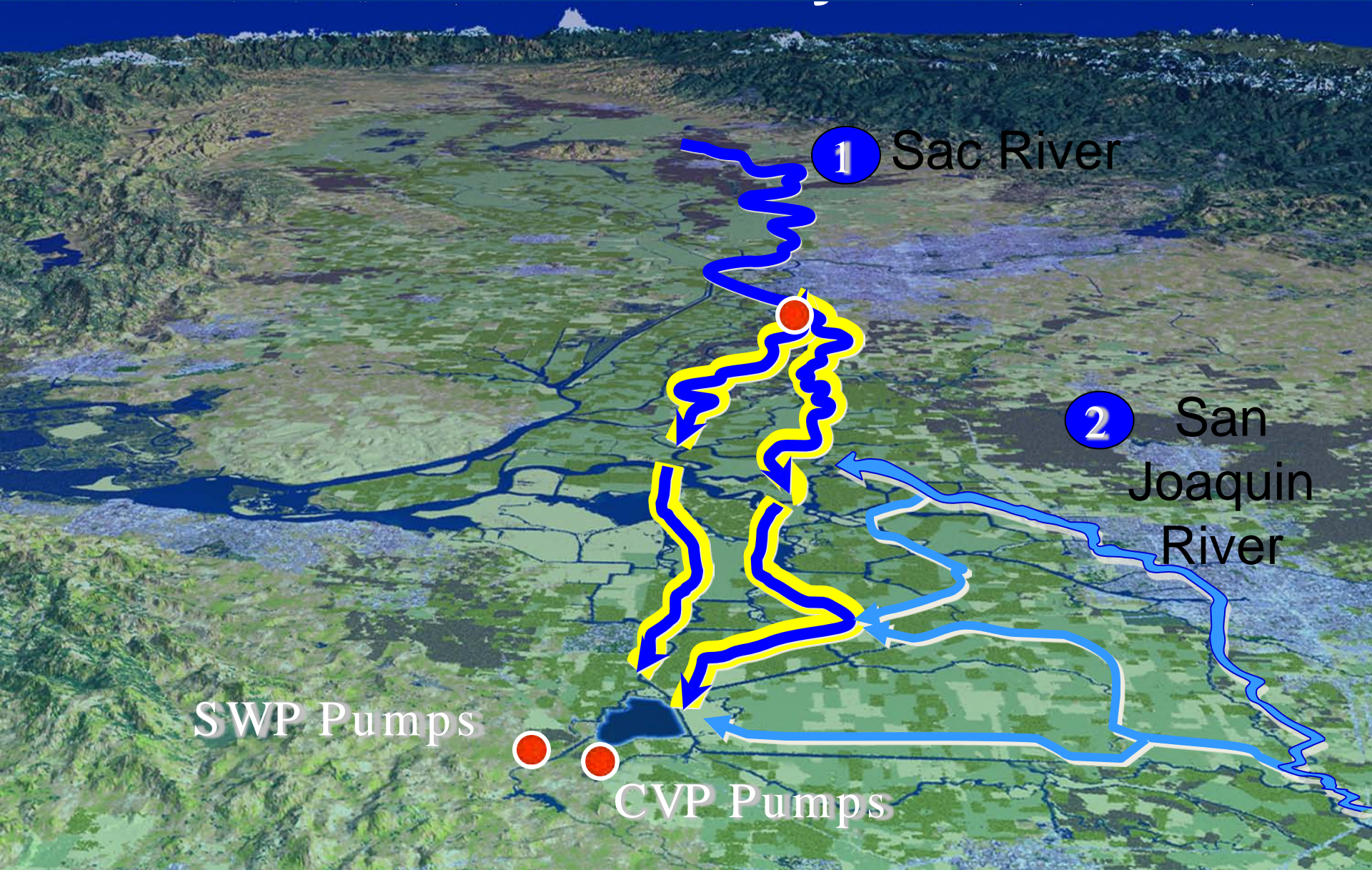
multiple benefits



- Land accretion
- Climate mitigation/adaptation
- Water supply security
- Habitat



Sacramento-San Joaquin Delta



1 Sac River

2 San Joaquin River

SWP Pumps

CVP Pumps

Thank you

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