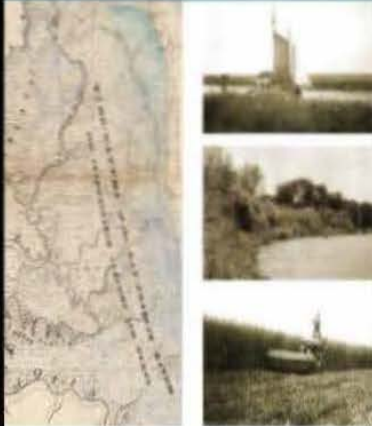


Sacramento-San Joaquin Delta Historical Ecology Investigations
EXPLORING PATTERN AND PROCESS



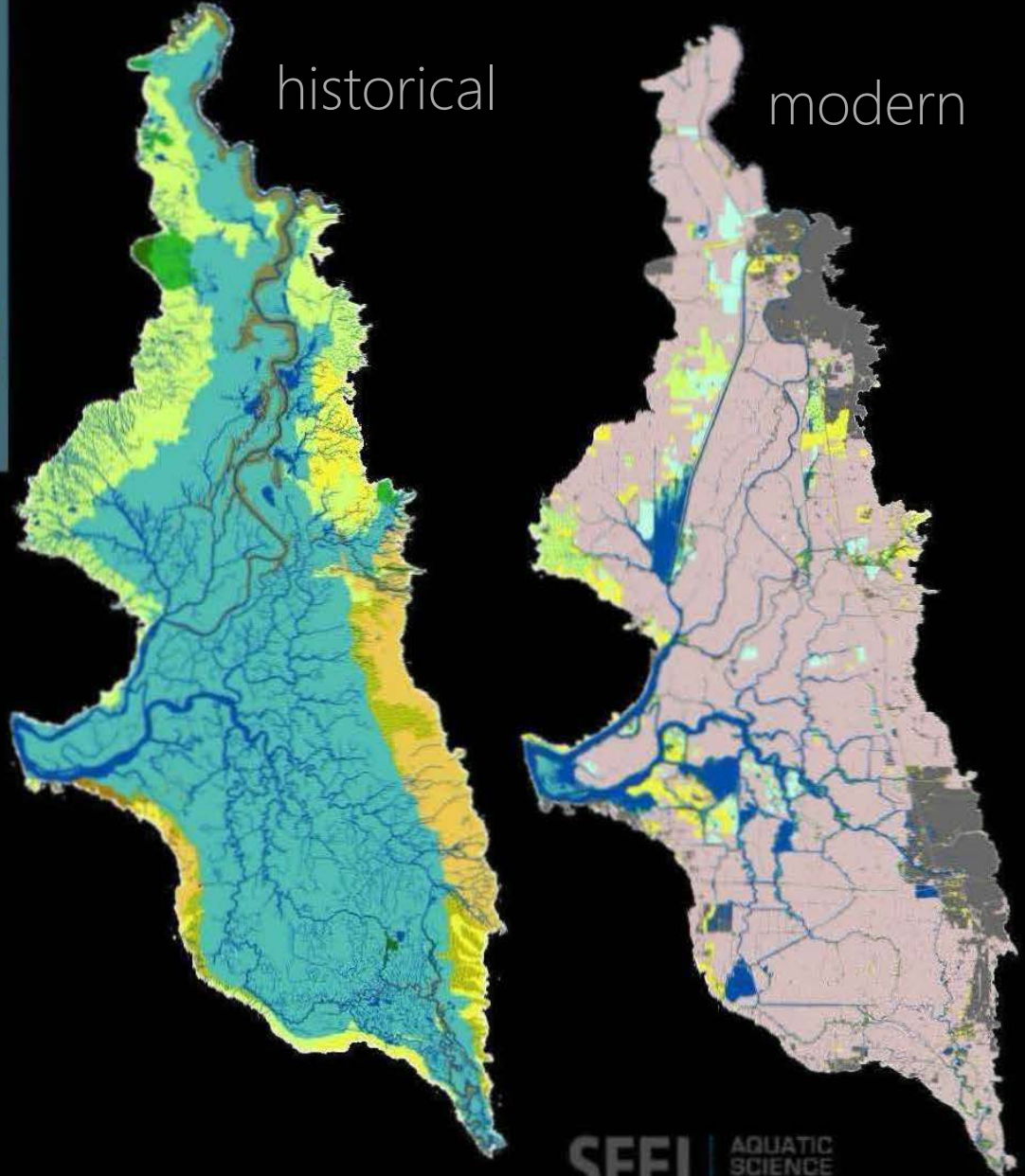
AUGUST 2011
SAN FRANCISCO ESTUARY INSTITUTE SFEI
AQUATIC SCIENCE CENTER

A DELTA TRANSFORMED
ecological functions, spatial metrics,
and landscape change
IN THE SACRAMENTO-SAN JOAQUIN DELTA

SAN FRANCISCO ESTUARY INSTITUTE SFEI
AQUATIC SCIENCE CENTER















historical

modern



SFEI | AQUATIC SCIENCE CENTER

A BREAKTHROUGH: We now have metrics of landscape change

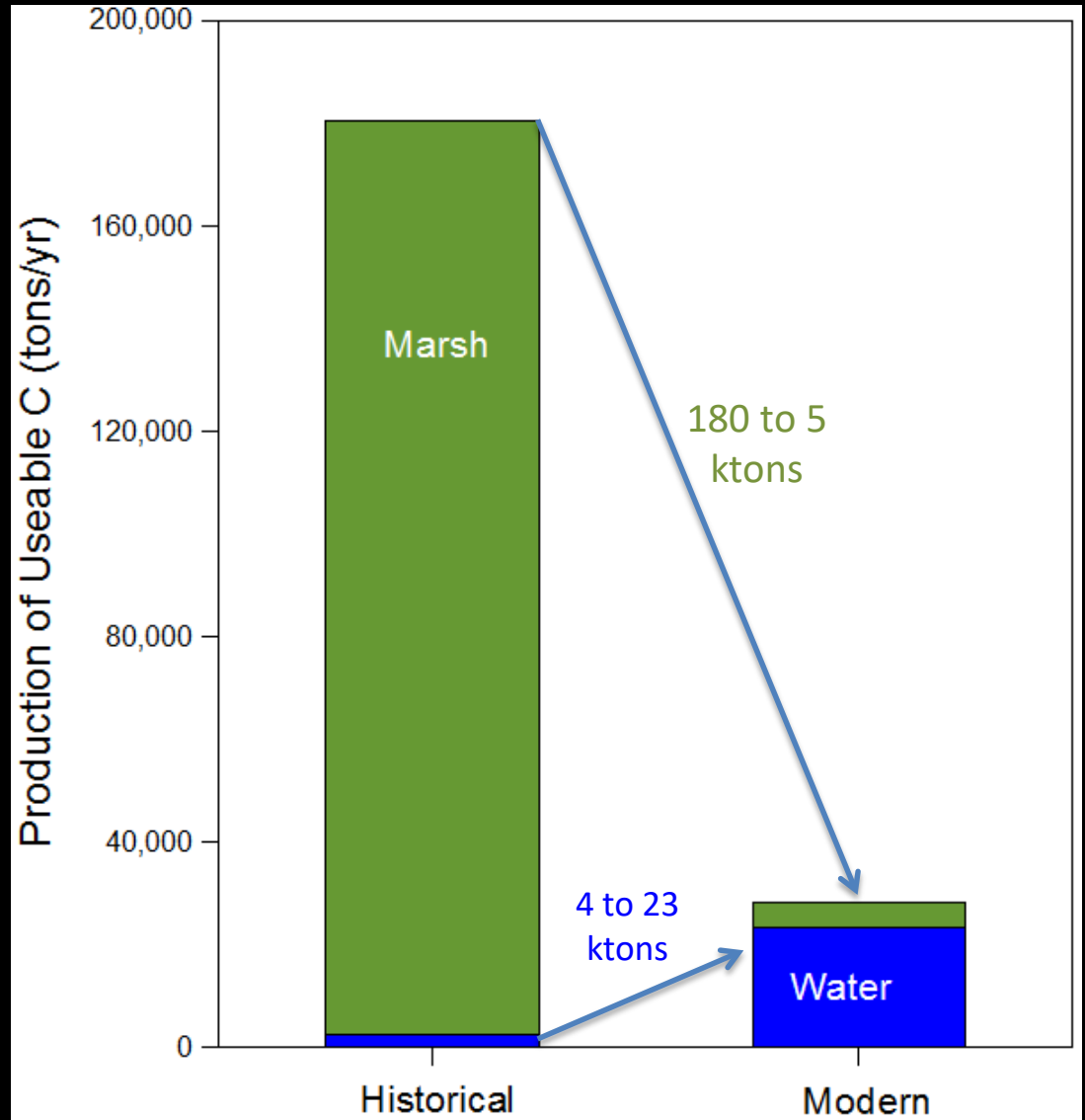
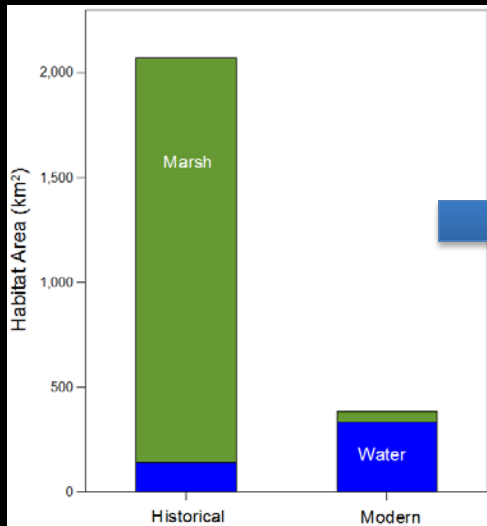
	Habitat Type	Area (ha)	
		<i>Historical</i>	<i>Modern</i>
	Managed wetlands	0	9,454
	Urban/Barren	0	35,517
	Agriculture/Non-native/Ruderal	0	216,085
	Stabilized interior dune veg.	1,032	4
	Willow riparian scrub/shrub	1,637	2,878
	Willow thicket	3,567	132
	Grassland	9,108	11,800
	Alkali seasonal wetland complex	9,193	238
	Vernal pool complex	11,262	3,007
	Water	13,772	26,530
	Valley foothill riparian	15,608	4,010
	Oak woodland/savanna	20,460	0
	Wet meadow/Seasonal wetland	37,561	2,445
	Freshwater emergent wetland	193,224	4,253

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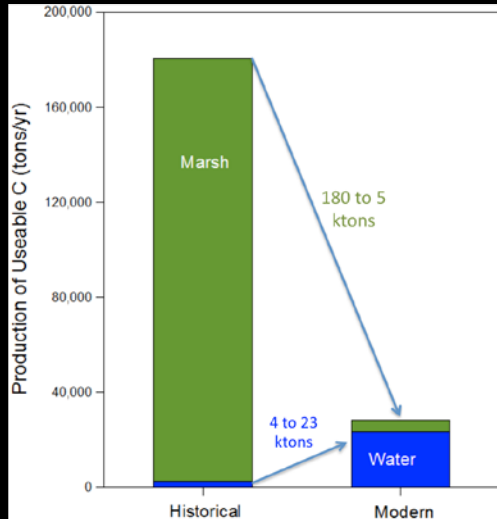
For estimating changes in ecosystem functions

For Example, Primary Production



Way Back of the Envelope Calculations

Suggestive but



Does not consider:

- 1. Other primary producers*
- 2. Food quality*
- 3. Transfer efficiency*
- 4. Habitat connectivity*
- 5. Variability*

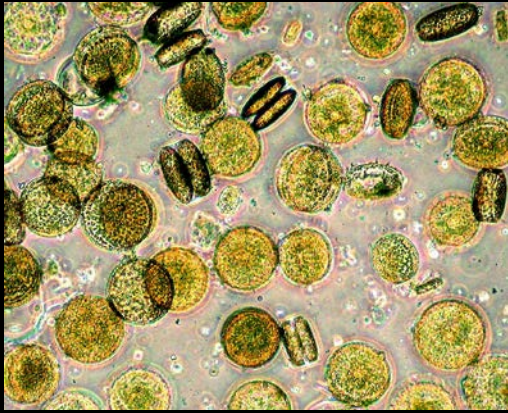
We convened a workshop

**Delta Primary Production Workshop
Agenda
October 28-30, 2015**



1. *Other primary producers*
2. *Food quality*
3. *Transfer efficiency*
4. *Habitat connectivity*
5. *Variability*

Phytoplankton



Marsh Vascular

1. OTHER PRIMARY PRODUCERS



Non-phytoplankton Microalgae

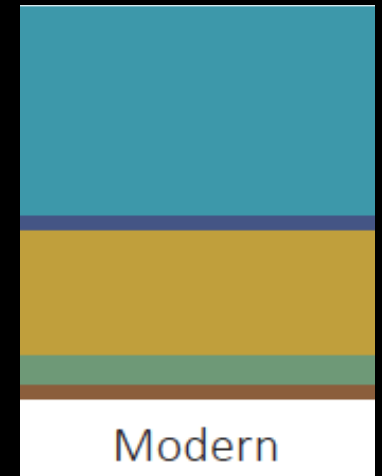
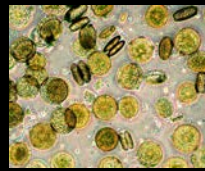


Aquatic Vascular



Riparian Vascular

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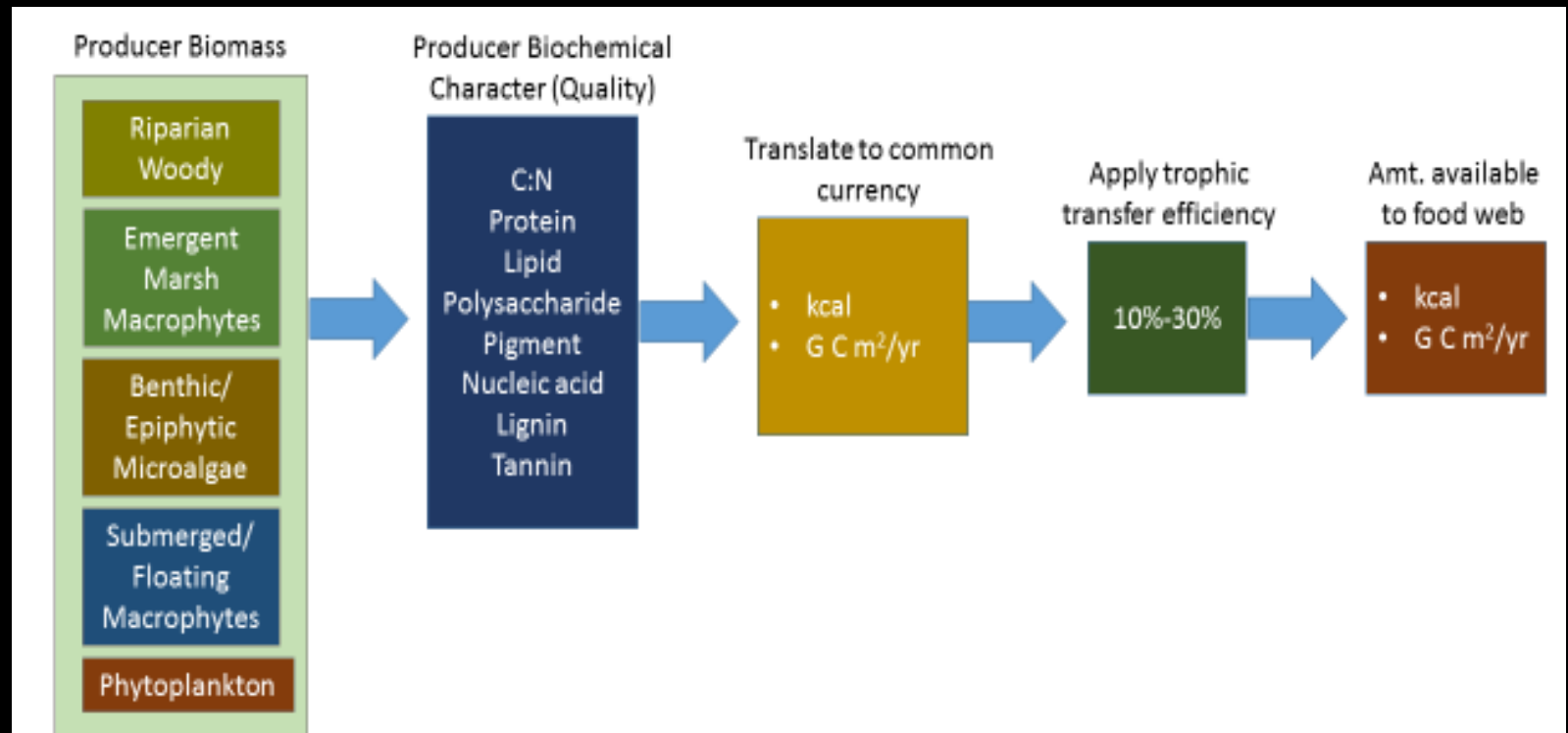


**OUTPUT = ANNUAL
PRIMARY PRODUCTION
BY FIVE GROUPS
THEN AND NOW**

2. FOOD QUALITY

Material	Protein	Polysac.	Lipid
Phytoplankton	25-50	5-50	5-20
Vascular plant	2-5	37-55	<3
Wood	<1	40-80	<3

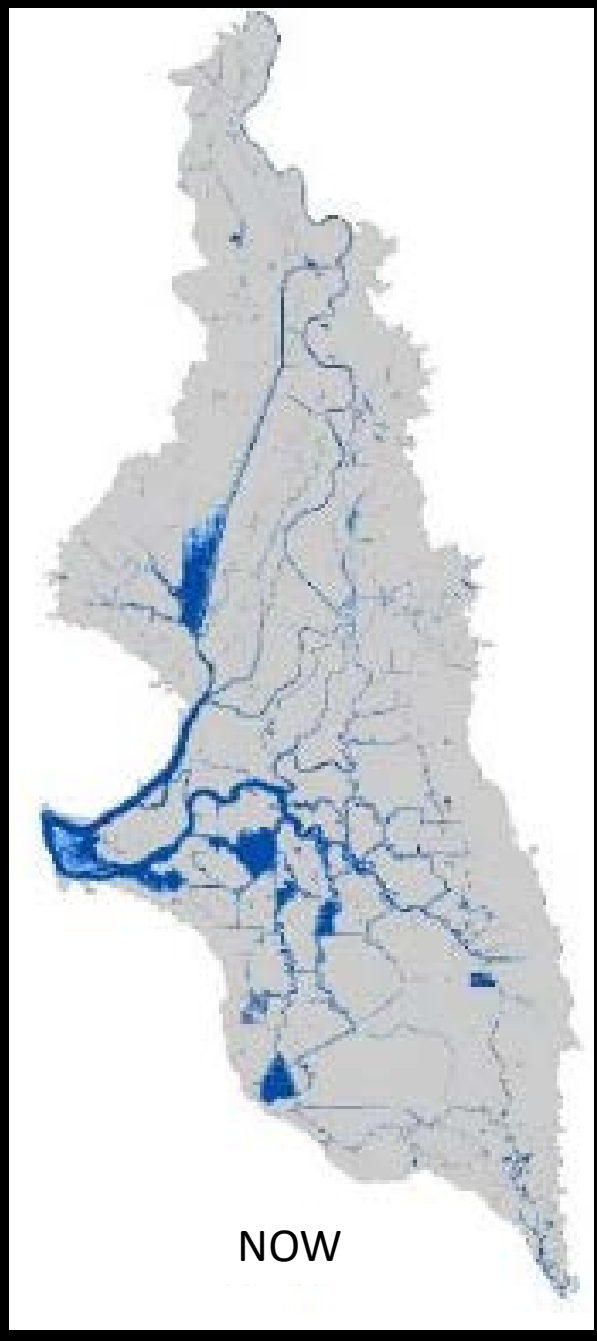
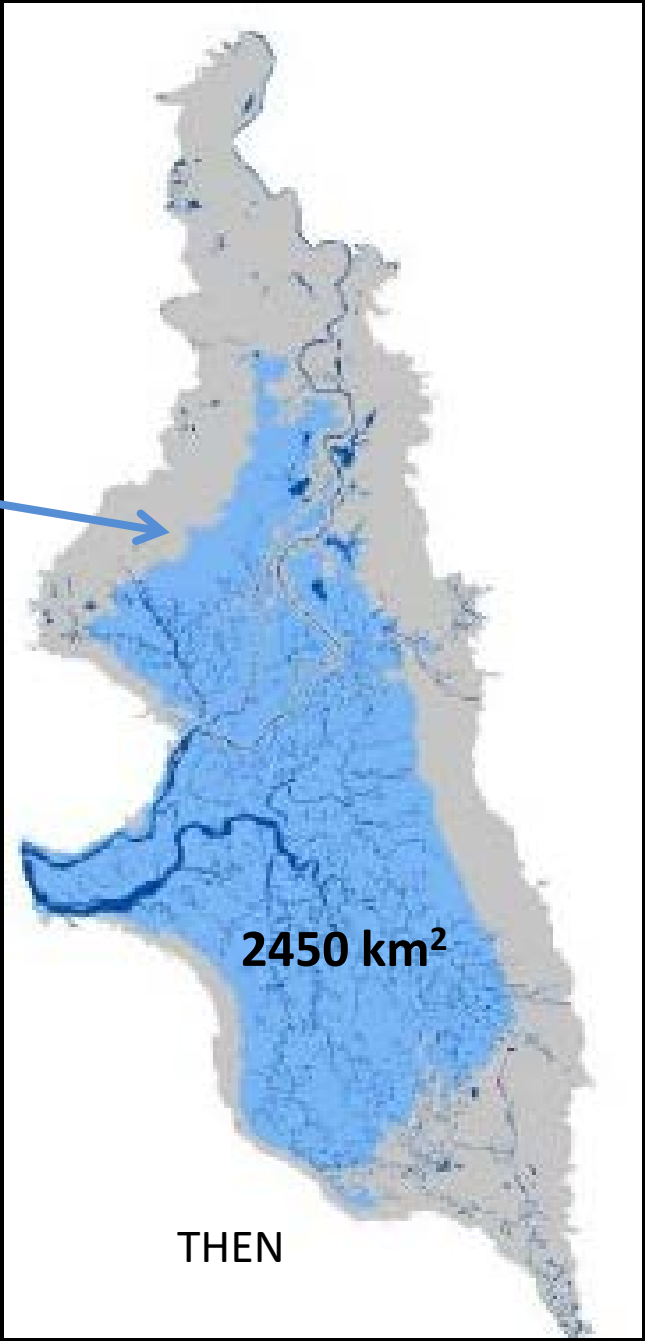
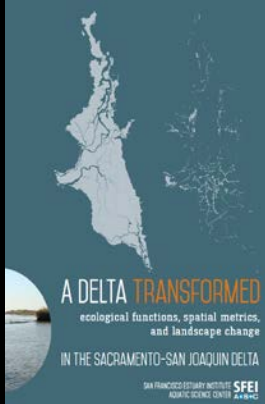
3. TRANSFER EFFICIENCY



OUTPUT = FOOD SUPPLY TO CONSUMERS BY FIVE PRODUCER GROUPS

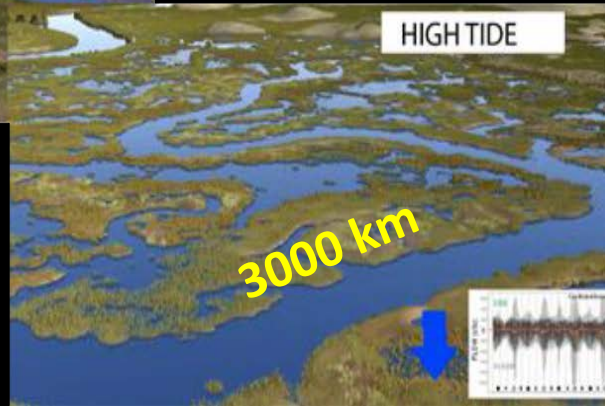
4. HABITAT CONNECTIVITY

Tidal Inundation →





Then



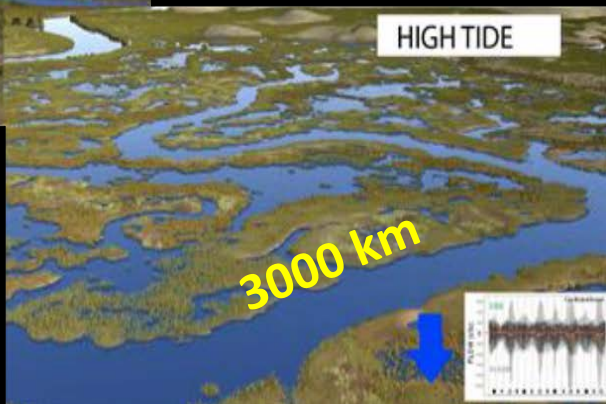
4. HABITAT CONNECTIVITY





LOW TIDE

Then



HIGH TIDE

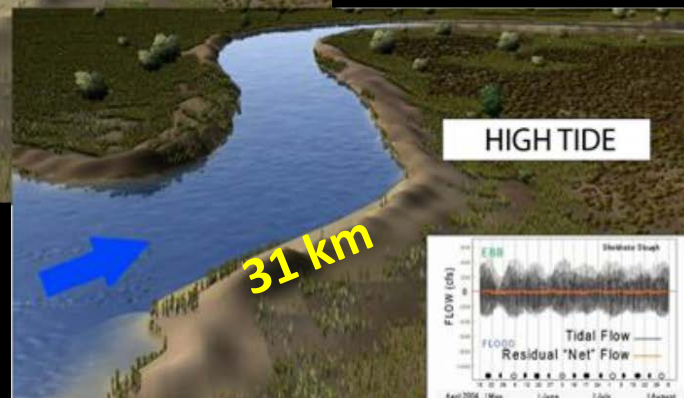
3000 km

4. HABITAT CONNECTIVITY



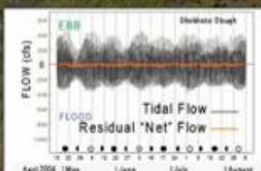
LOW TIDE

Now

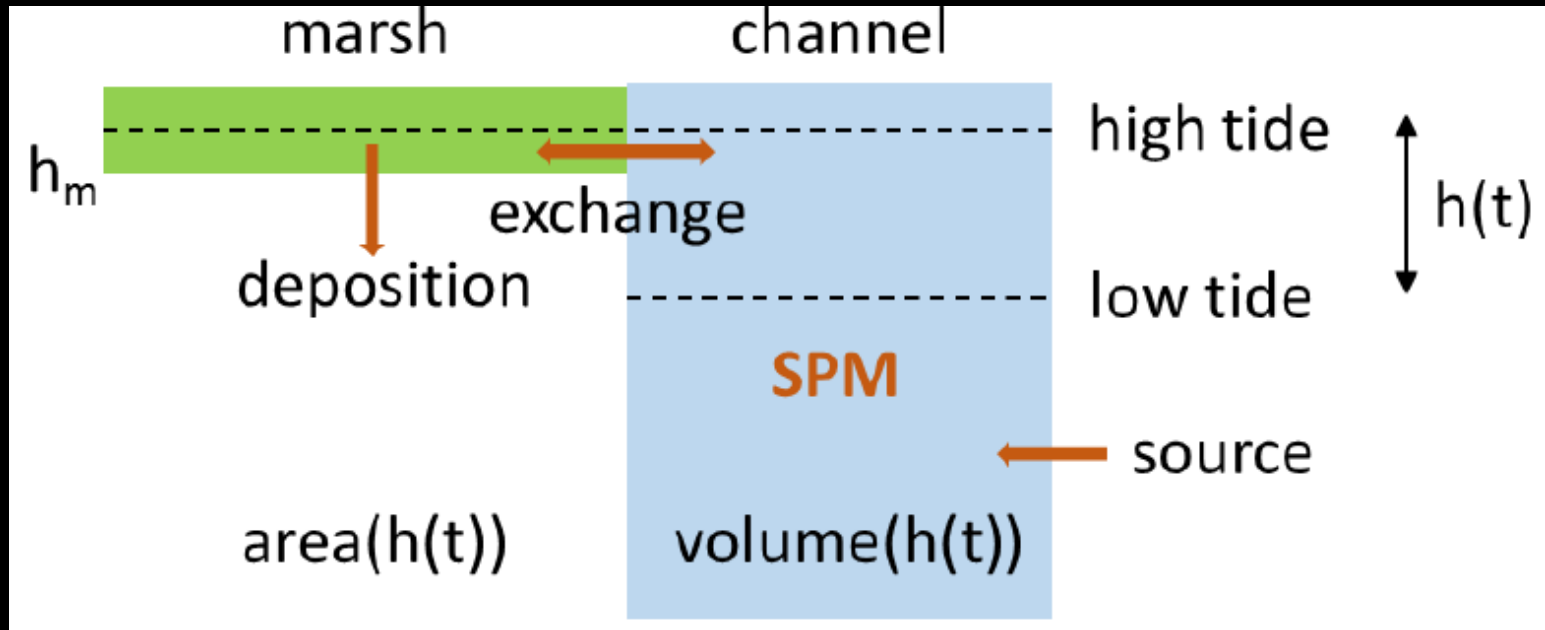


HIGH TIDE

31 km

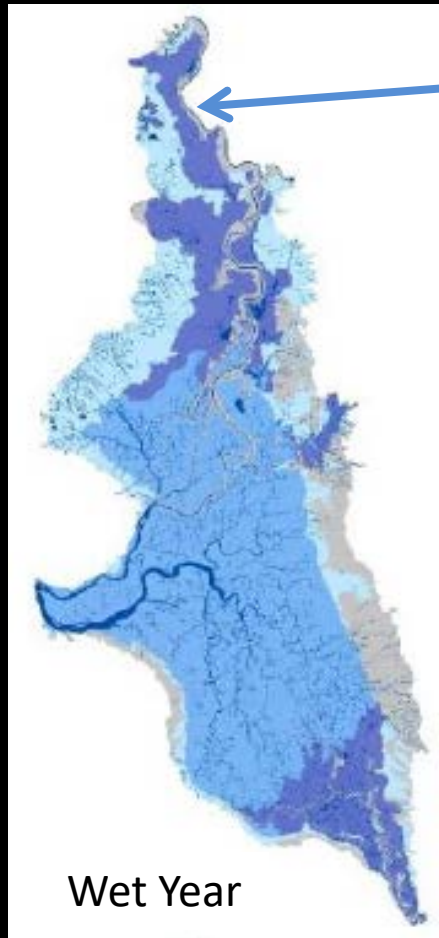
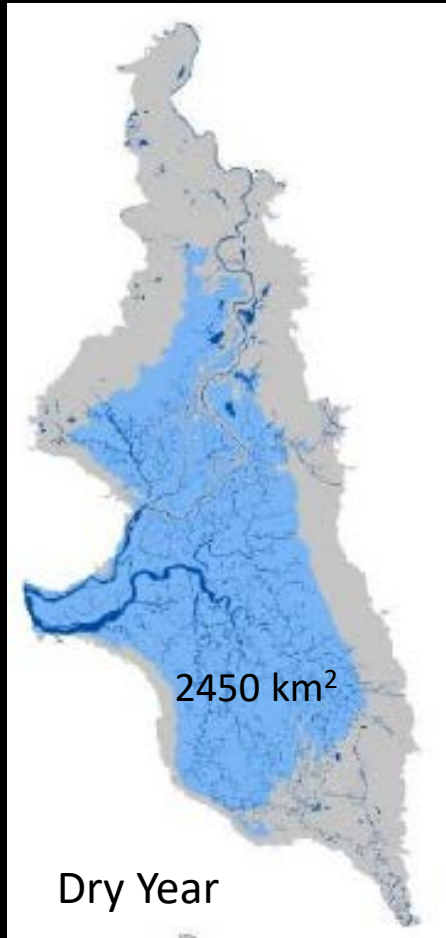


START WITH A SIMPLE MODEL



*OUTPUT = FIRST GLIMPSES OF HOW
CONNECTIVITY AFFECTS PRIMARY PRODUCTION*

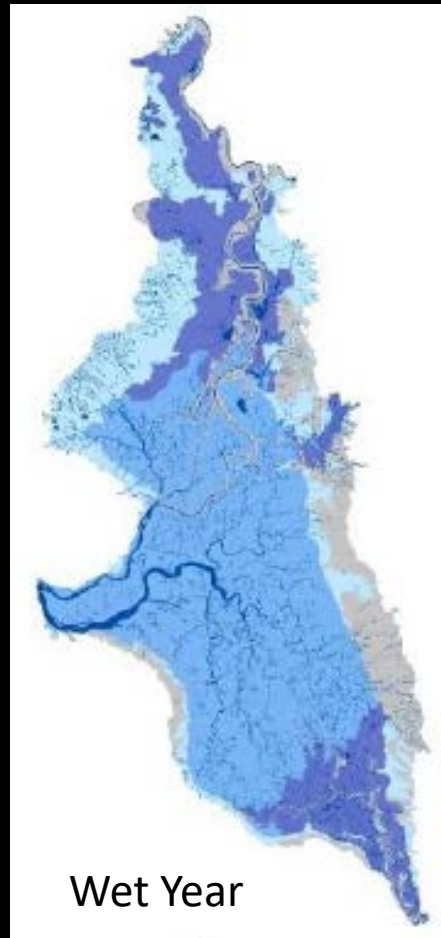
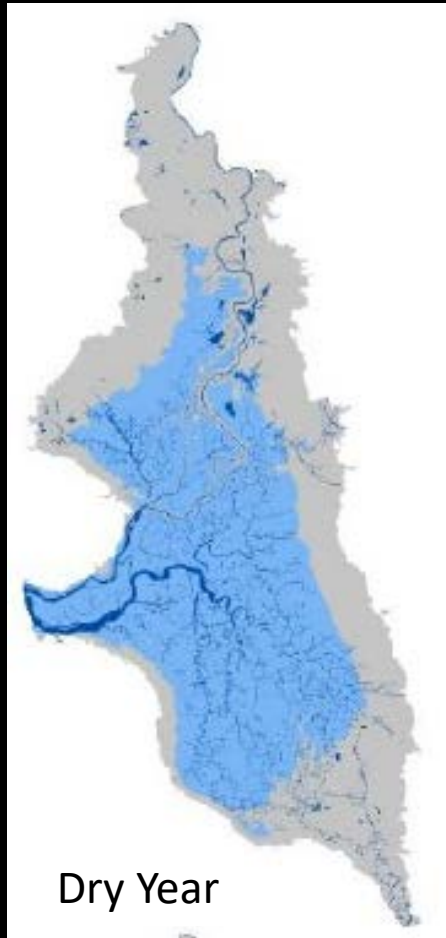
5. VARIABILITY



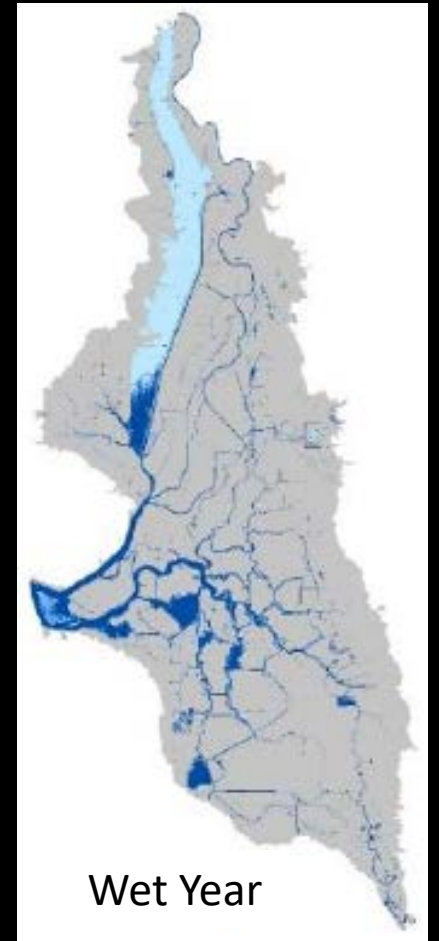
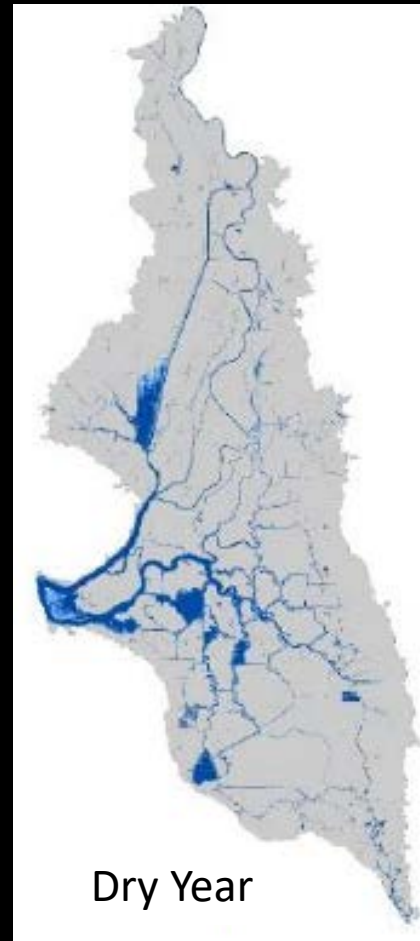
Flood Inundation >1000 km²



5. VARIABILITY

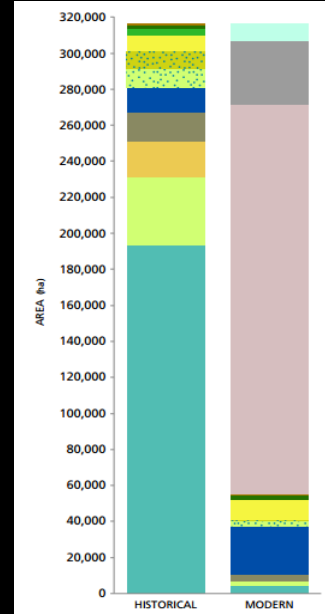
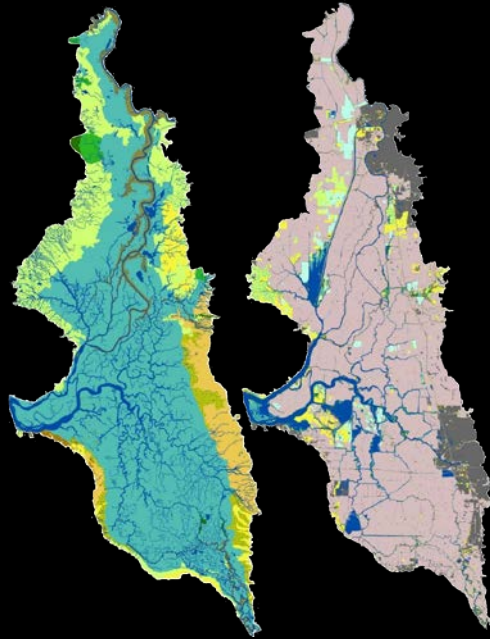


Then



Now

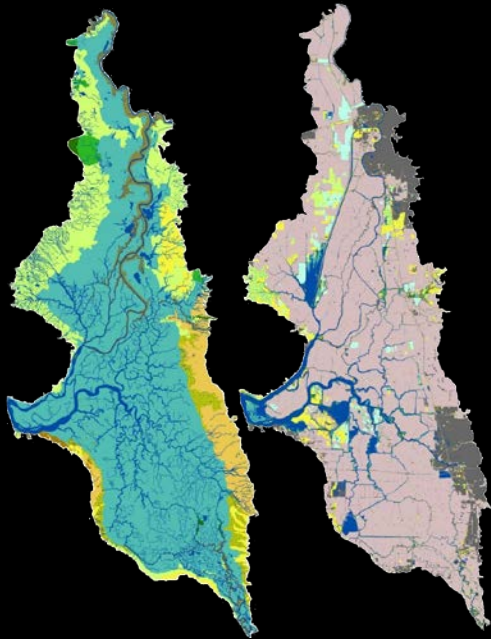
WHY DO THIS?



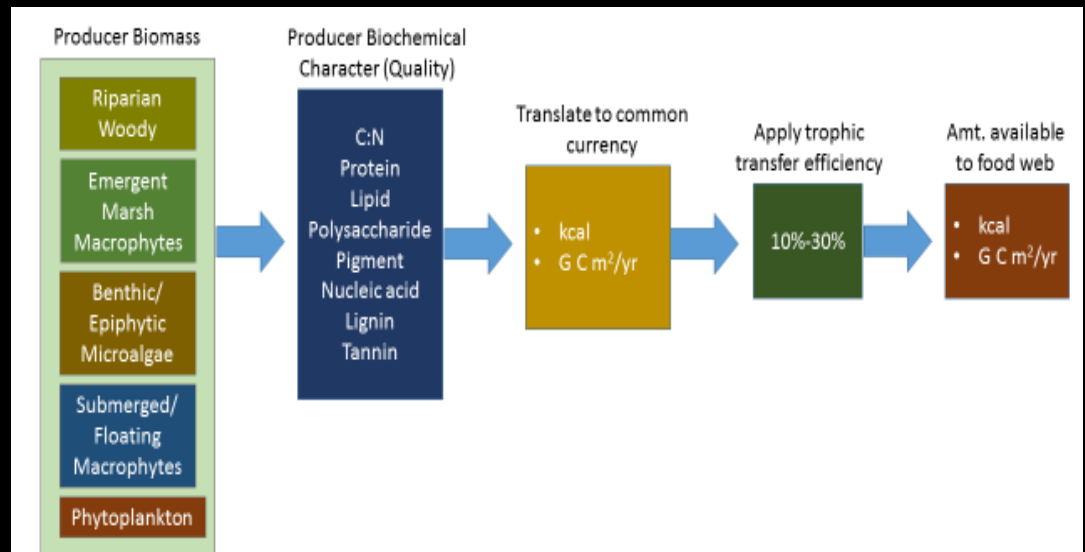
Habitat Type	Area (ha)		% Change
	Historical	Modern	
Managed wetlands	0	9,454	∞
Urban/Barren	0	35,517	∞
Agriculture/Non-native/Ruderal	0	216,085	∞
Stabilized interior dune veg.	1,032	4	-99
Willow riparian scrub/shrub	1,637	2,878	+76
Willow thicket	3,567	132	-96
Grassland	9,108	11,800	+30
Alkali seasonal wetland complex	9,193	238	-97
Vernal pool complex	11,262	3,007	-73
Water	13,772	26,530	+93
Valley foothill riparian	15,608	4,010	-74
Oak woodland/savanna	20,460	0	-100
Wet meadow/Seasonal wetland	37,561	2,445	-93
Freshwater emergent wetland	193,224	4,253	-98

A NEW OPPORTUNITY

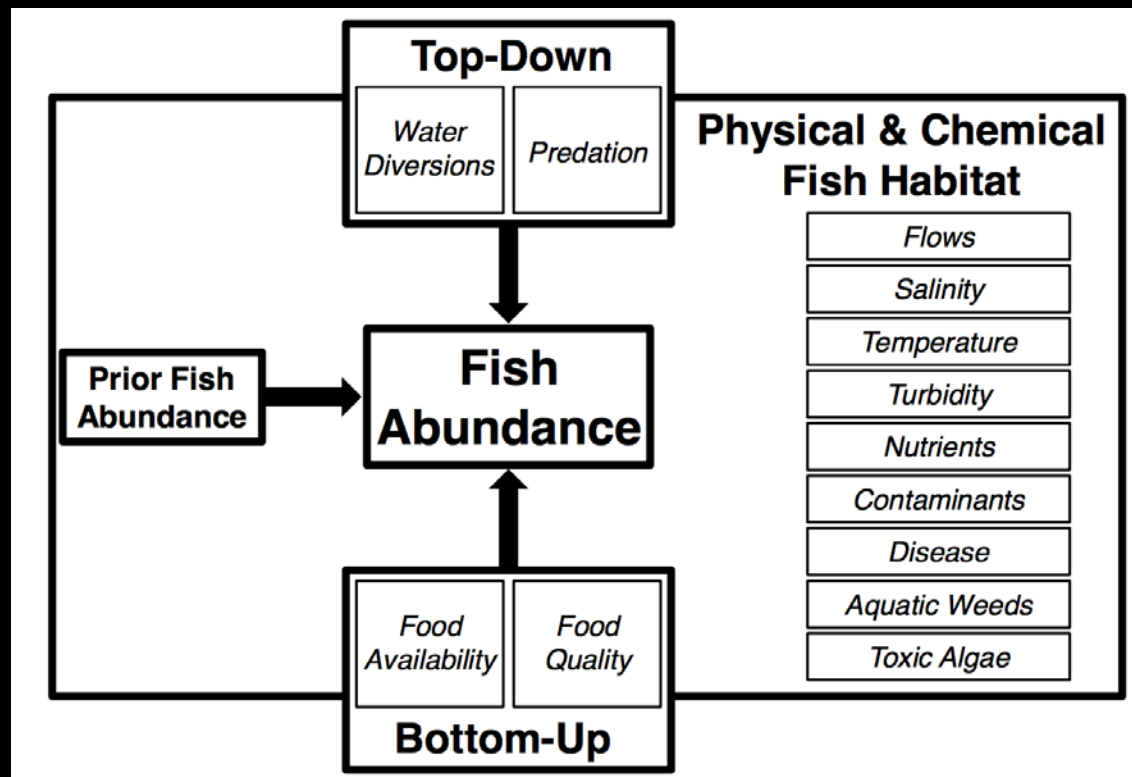
WHY DO THIS?



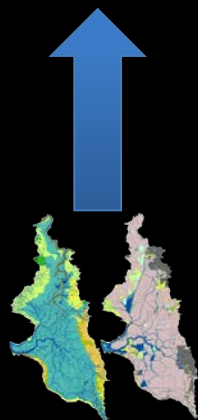
TRANSFORM HABITAT CHANGE INTO ECOSYSTEM CHANGE



WHY DO THIS?



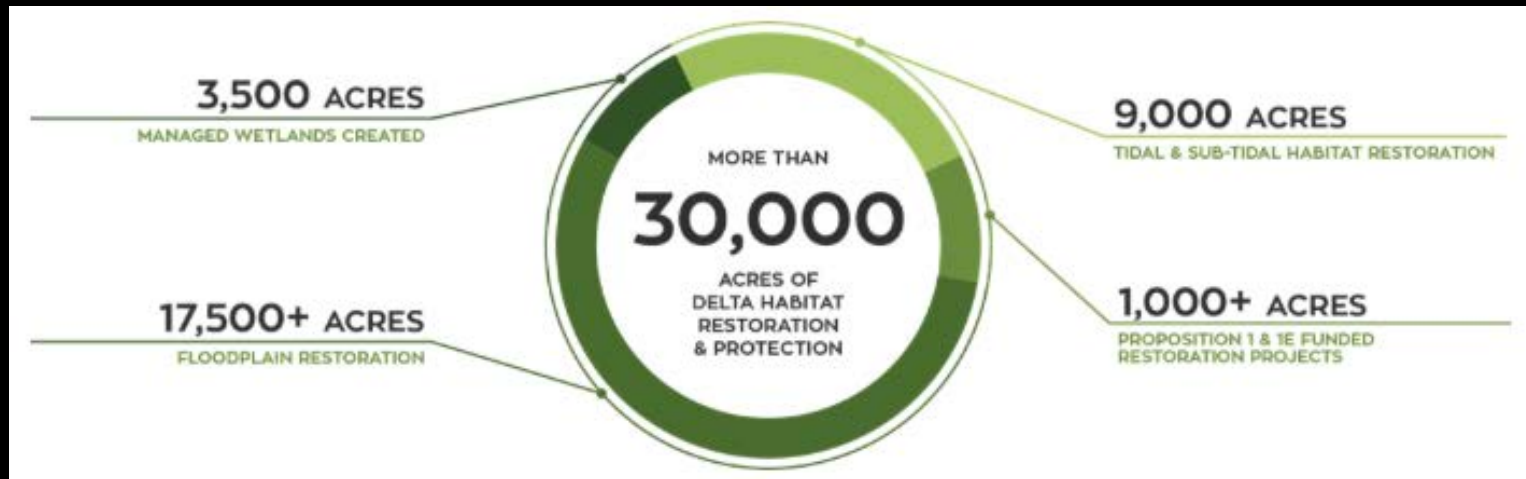
UNRAVEL THE
MULTISTRESSOR PROBLEM



WHY DO THIS?



ANTICIPATE ECOLOGICAL OUTCOMES OF
DIFFERENT RESTORATION ACTIONS



WHY DO THIS?

UNDERSTAND ECOLOGICAL IMPORTANCE OF HABITAT CONNECTIVITY

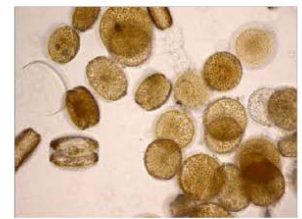


ESSAY

Primary Production in the Delta: Then and Now

James E. Cloern¹, April Robinson², Amy Richey², Letitia Grenier², Robin Grossinger², Katharyn E. Boyer³, Jon Burau⁴, Elizabeth A. Canuel⁵, John F. DeGeorge⁶, Judith Z. Drexler⁴, Chris Enright⁷, Emily R. Howe⁸, Ronald Kneib⁹, Anke Mueller-Solger⁴, Robert J. Naiman⁸, James L. Pinckney¹⁰, Samuel M. Safran², David Schoellhamer⁴, and Charles Simenstad⁸

For More
Information



PRIMARY PRODUCTION IN THE
SACRAMENTO-SAN JOAQUIN DELTA
A SCIENCE STRATEGY TO QUANTIFY CHANGE
AND IDENTIFY FUTURE POTENTIAL