

Mapping Marshes and Mudflats from Space: 2021/2019 Preliminary Results Habitat Evolution Mapping Project 2.0



CALIPPC



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Methods – Habitat Classifications (19)



Habitat Type		Mapped Habitats (19) (Alliances and Associations)
Salt Marsh (7)	Salt Marsh – low (MTL-MHW)	Cordgrass
		Cordgrass /- Pickleweed
	Salt Marsh – “mid” (MHW-MHHW)	Pickleweed
		Saltgrass
		Pickleweed /- Jaumea
	Salt Marsh – high (MHHW)	Alkali Heath
		Pickleweed /- Gumplant
Brackish Marsh (2)		Alkali Bulrush
		Spearscale
		Pepperweed*
Freshwater Marsh (2)		Freshwater Bulrush
		Cattails
Upland (3)		Alkali Grasses
		Ruderal
		Mudflat
Non-Vegetated (5)		Mudflat with Biofilm
		Wrack
		Bare Earth
		Water

*Pepperweed was not included in the 'Brackish Marsh' habitat category when acreages were calculated.



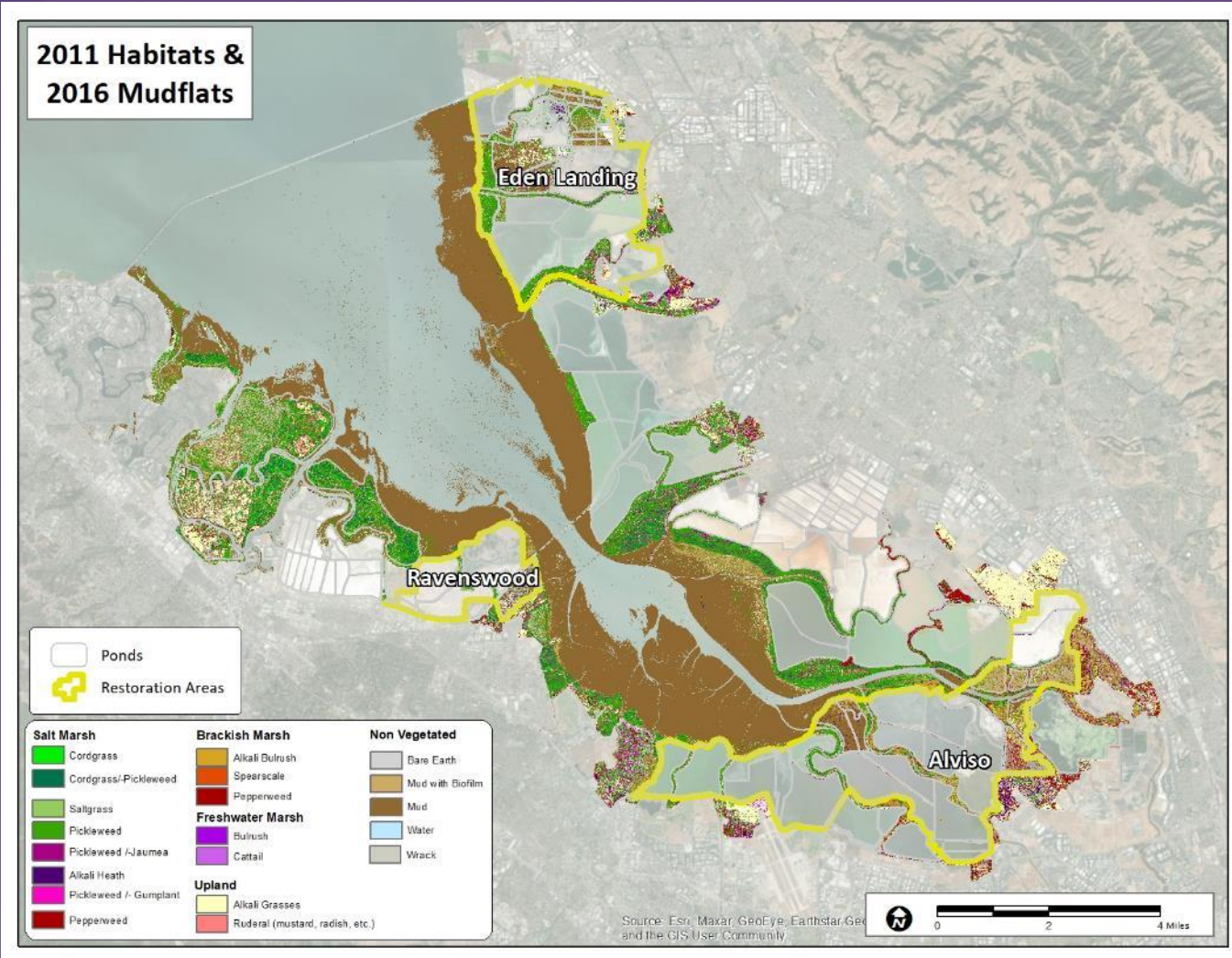
Habitat Evolution Mapping Project 1.0 (2009-2011)

2009-2011

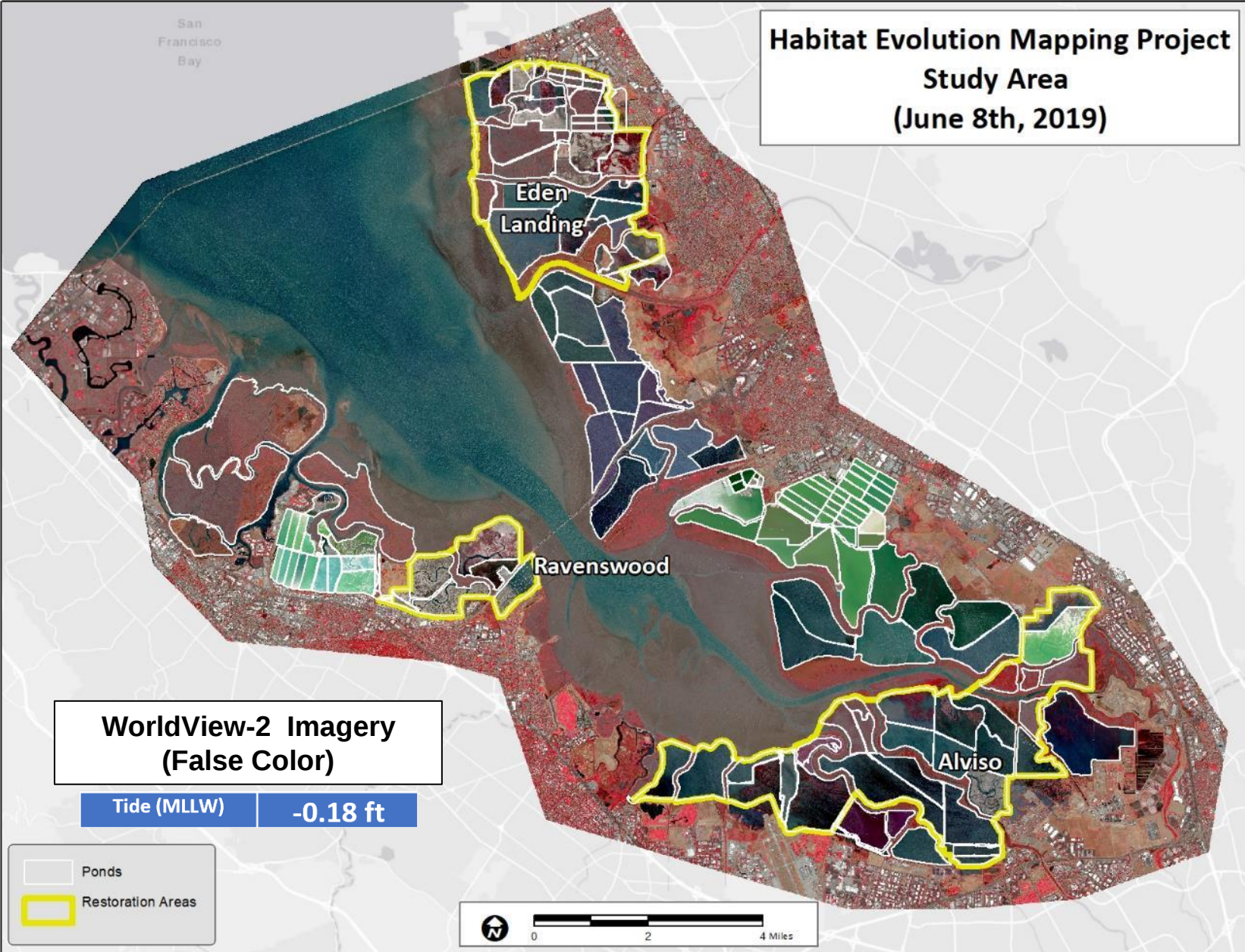
~15,000 acres of tidal salt, brackish, and freshwater marsh vegetation mapped

2016

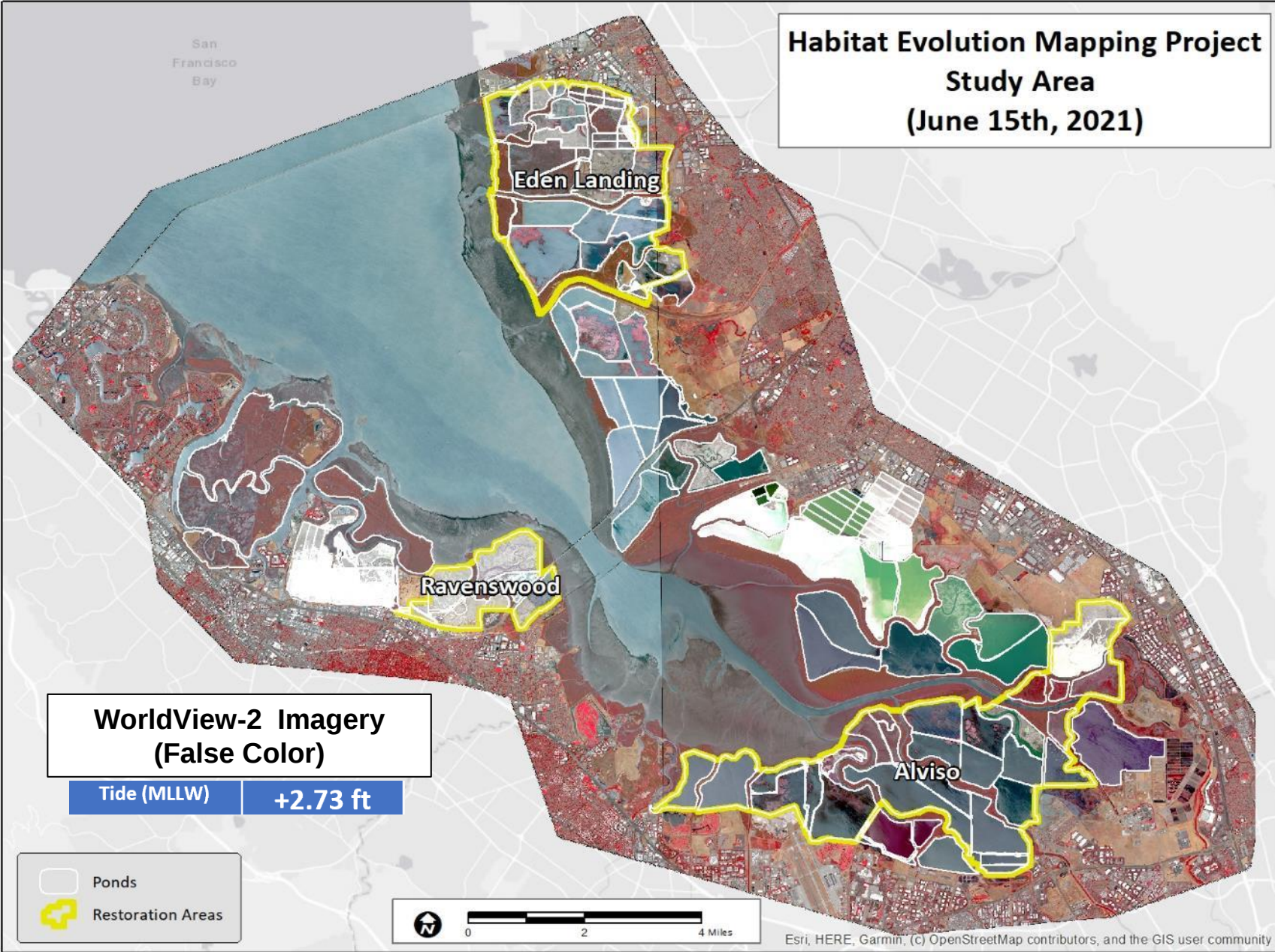
~18,000 acres of tidal **mudflats** mapped



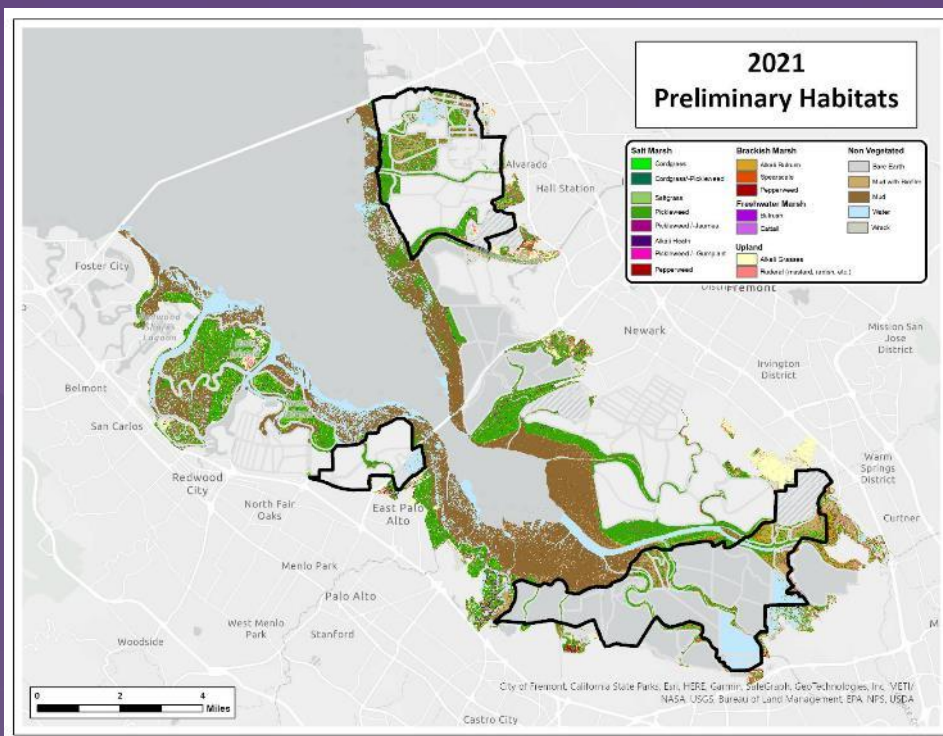
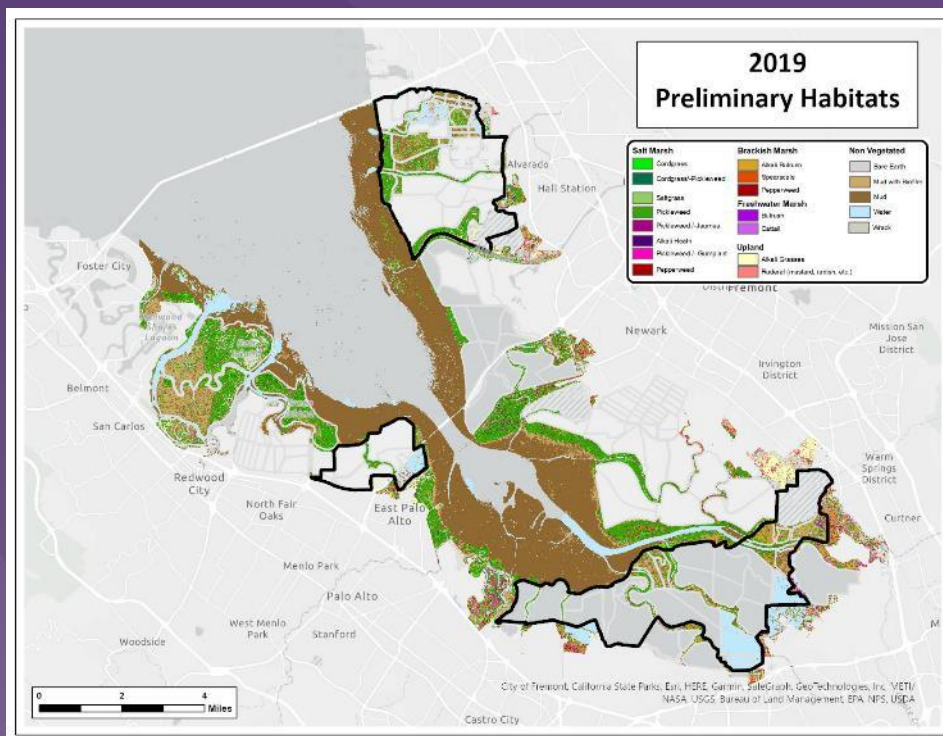
Habitat Evolution Mapping Project 2.0 (2019) – Imagery and Ground Truthing



Habitat Evolution Mapping Project 2.0 (2021) – Imagery and Ground Truthing



Habitat Evolution Mapping Project 2.0 (2019-2021) –Status Update



- ☐ Finalizing 2021 (and 2019) Habitats and Mudflat datasets
- ☐ Final QC on Ground Truthing dataset for Validation

Results (HEMP 1.0 & 2.0) – Accuracy Assessment

Overall Accuracy (dominant habitat alliance)

2019 (preliminary): 82% (*Kappa 0.78*)

2011: 76%

2010: 70%

2009: 70%

Overall Accuracy (sub-dominance habitat association)

2019 (preliminary): 73% (*Kappa 0.68*)

2011: 61 %

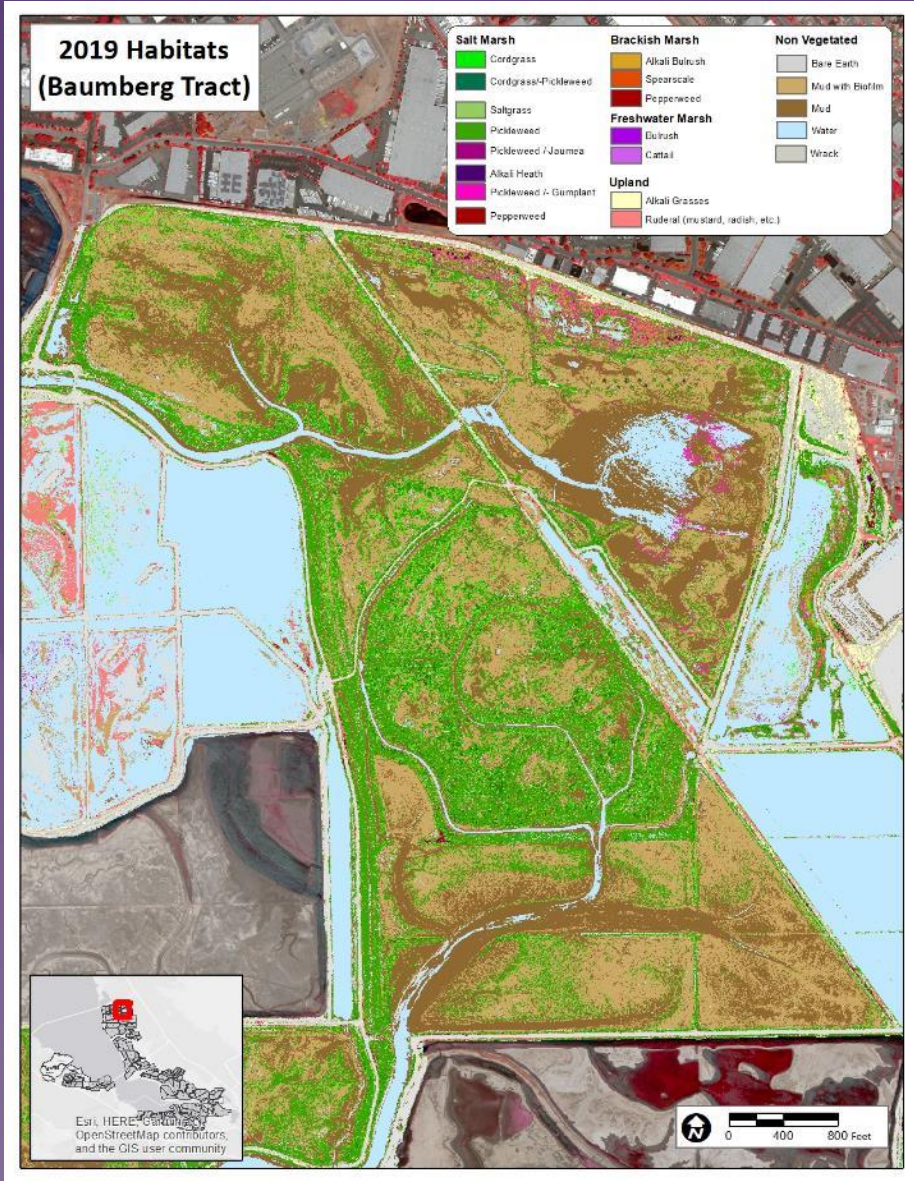
2010: 67 %

2009: 56 %

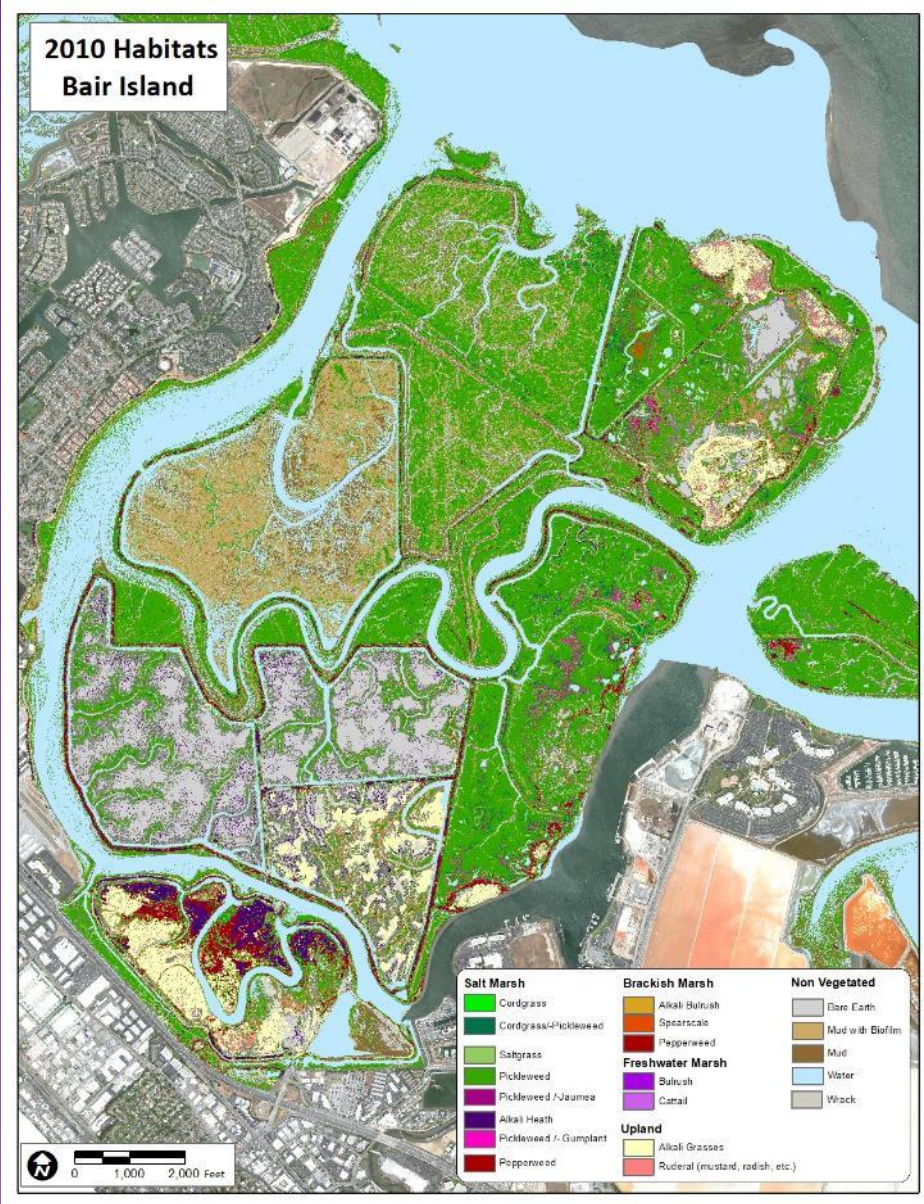
Habitat Evolution Mapping Project 2 – 2021/2019 Preliminary Results (E9/E8A)



Habitat Evolution Mapping Project 2–2019 Prelim Results (Mt Eden & North Creek Marsh)



Habitat Evolution Mapping Project 2.0 – 2021/2019 Preliminary Results (Bair Island)



Habitat Evolution Mapping Project 2.0 – 2021/2019 Preliminary Results (Inner Bair)



Habitat Evolution Mapping Project 2.0 – 2021 Preliminary Results (A6)



Habitat Evolution Mapping Project 2.0 – 2021 Preliminary Results (above A6)

2011

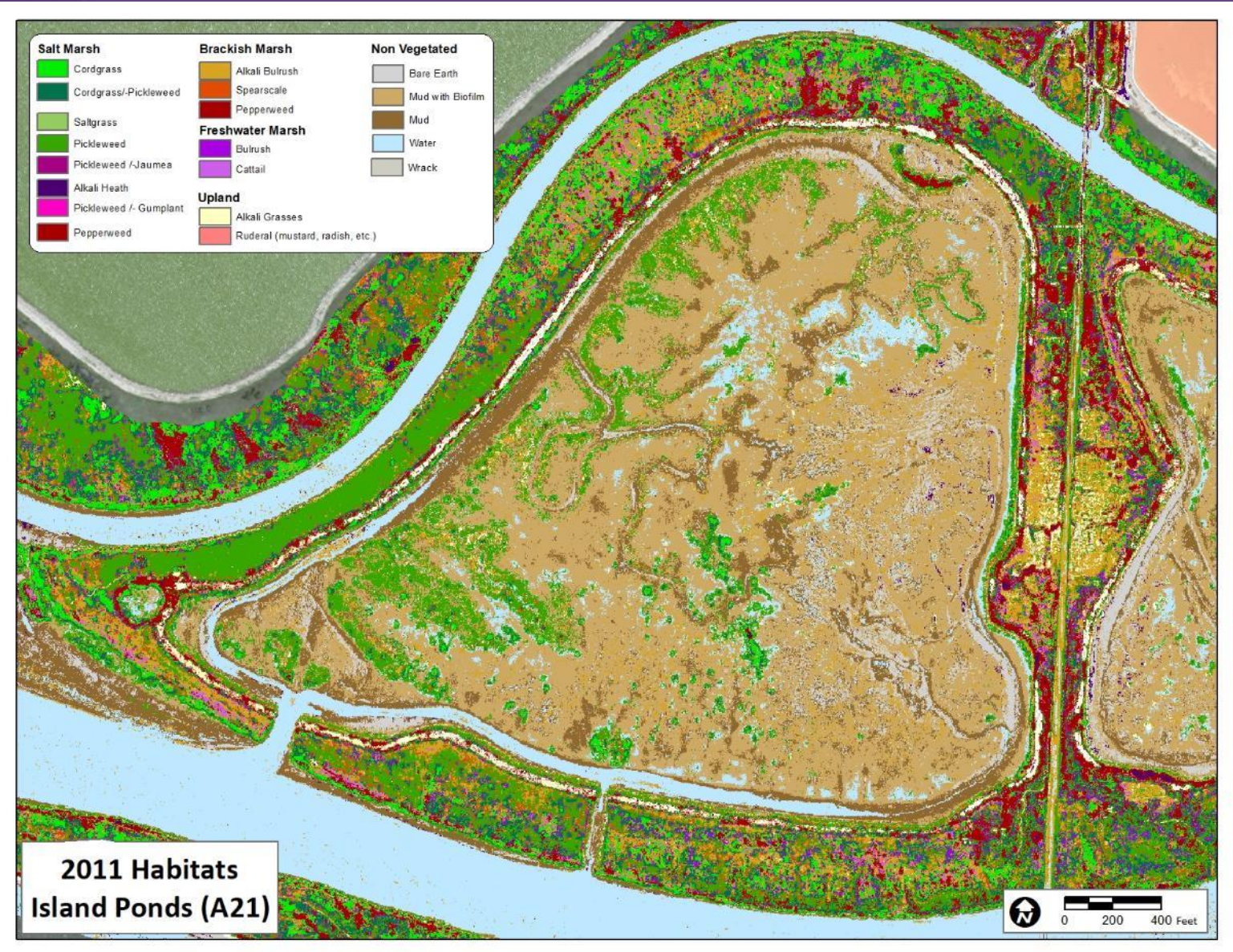


2021

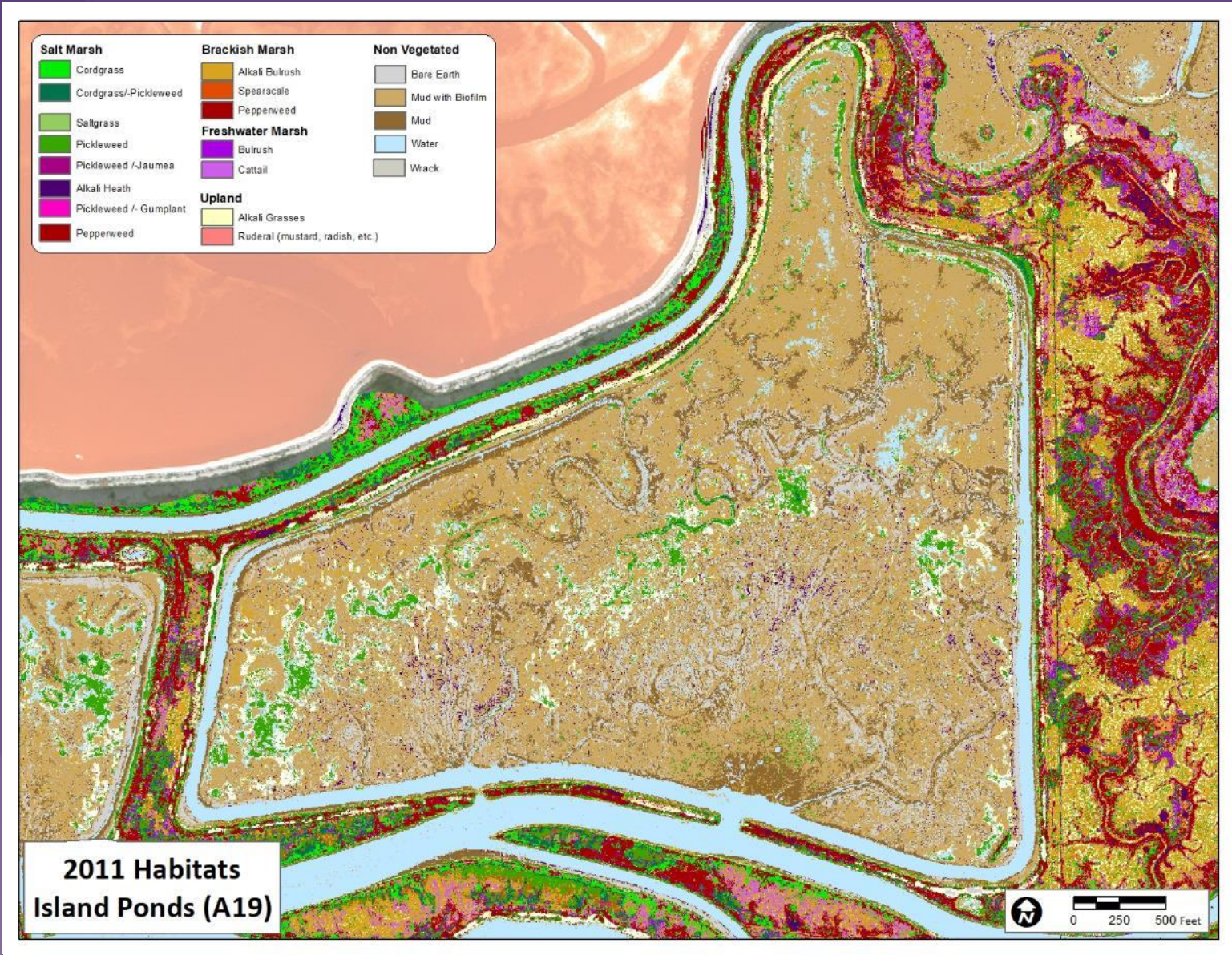


~ 30 meters
growth of
low marsh
(2011-2021)

Habitat Evolution Mapping Project 2 – 2021/2019 Preliminary Results (A21)

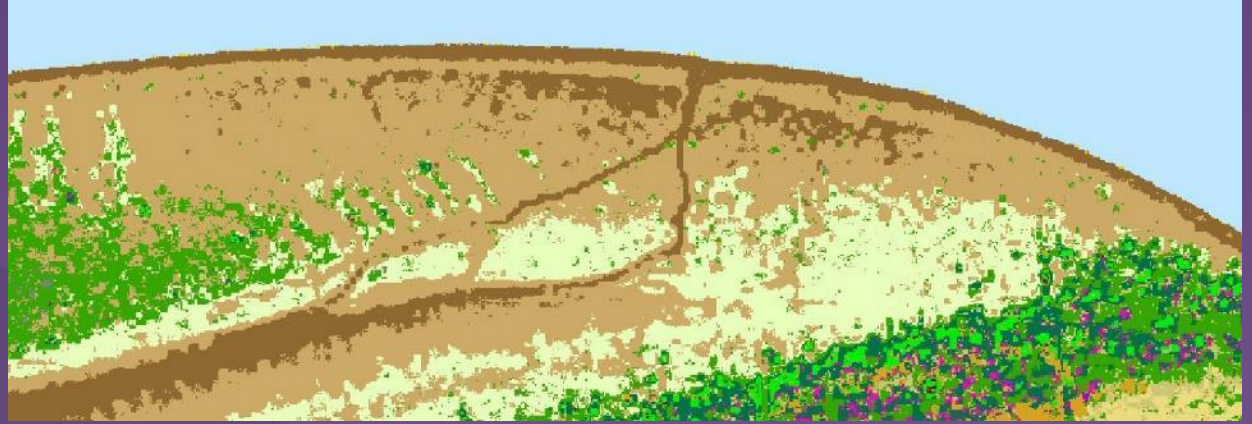


Habitat Evolution Mapping Project 2 – 2021/2019 Preliminary Results (A19)

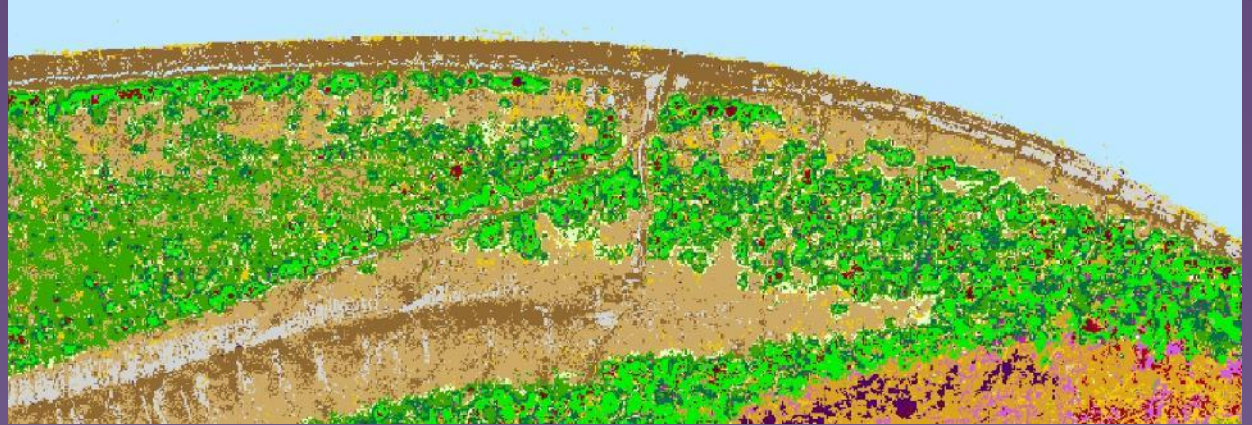


Habitat Evolution Mapping Project 2 – 2019 Preliminary Results (Ogilvie Island)

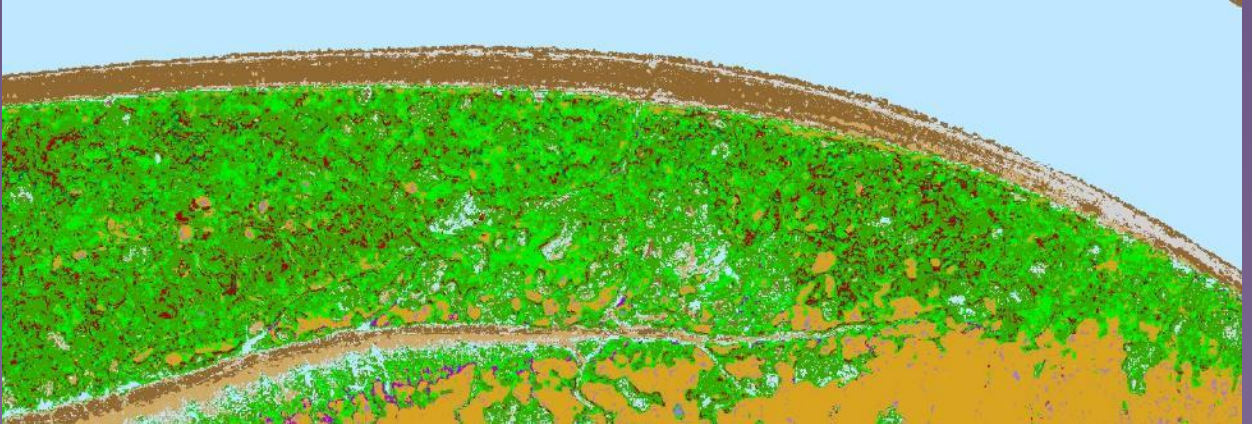
2009



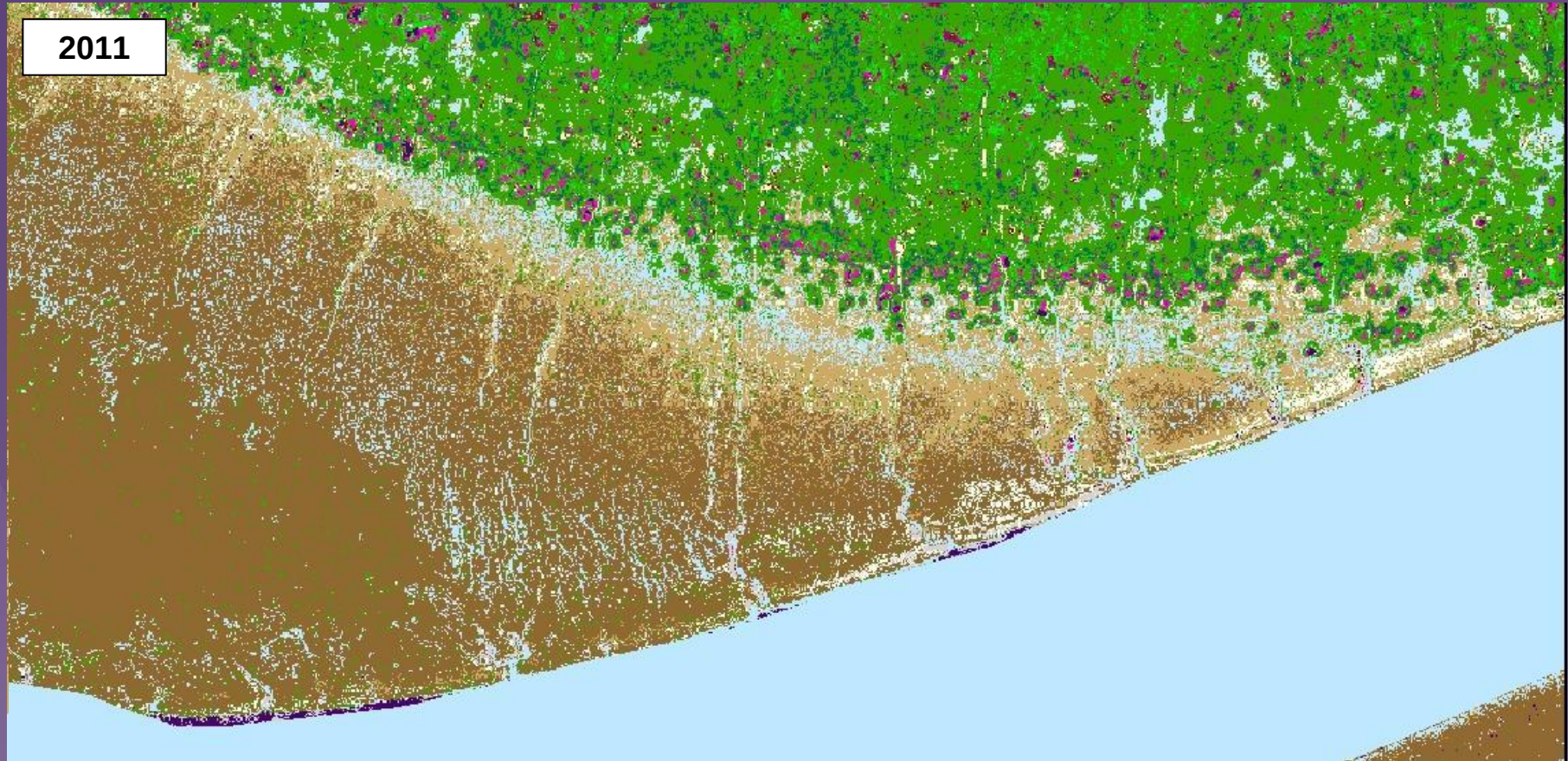
2011



2019



Habitat Evolution Mapping Project 2 – 2021 Preliminary Results (Calavares)



~ 40 meters growth of low marsh

Habitat Evolution Mapping Project 2 – 2021/ 2019 Preliminary Results (Faber/Laumesiter)

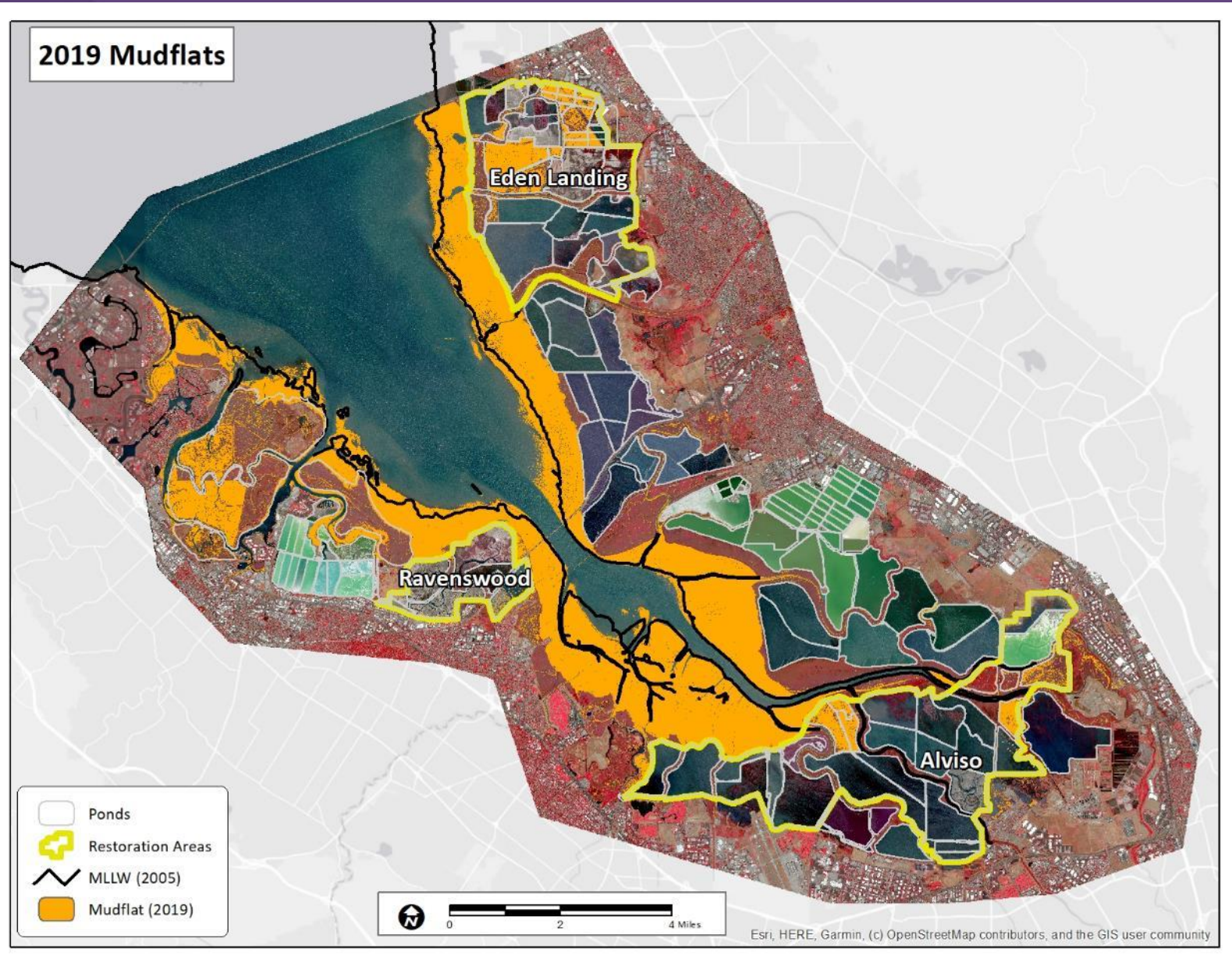
2011



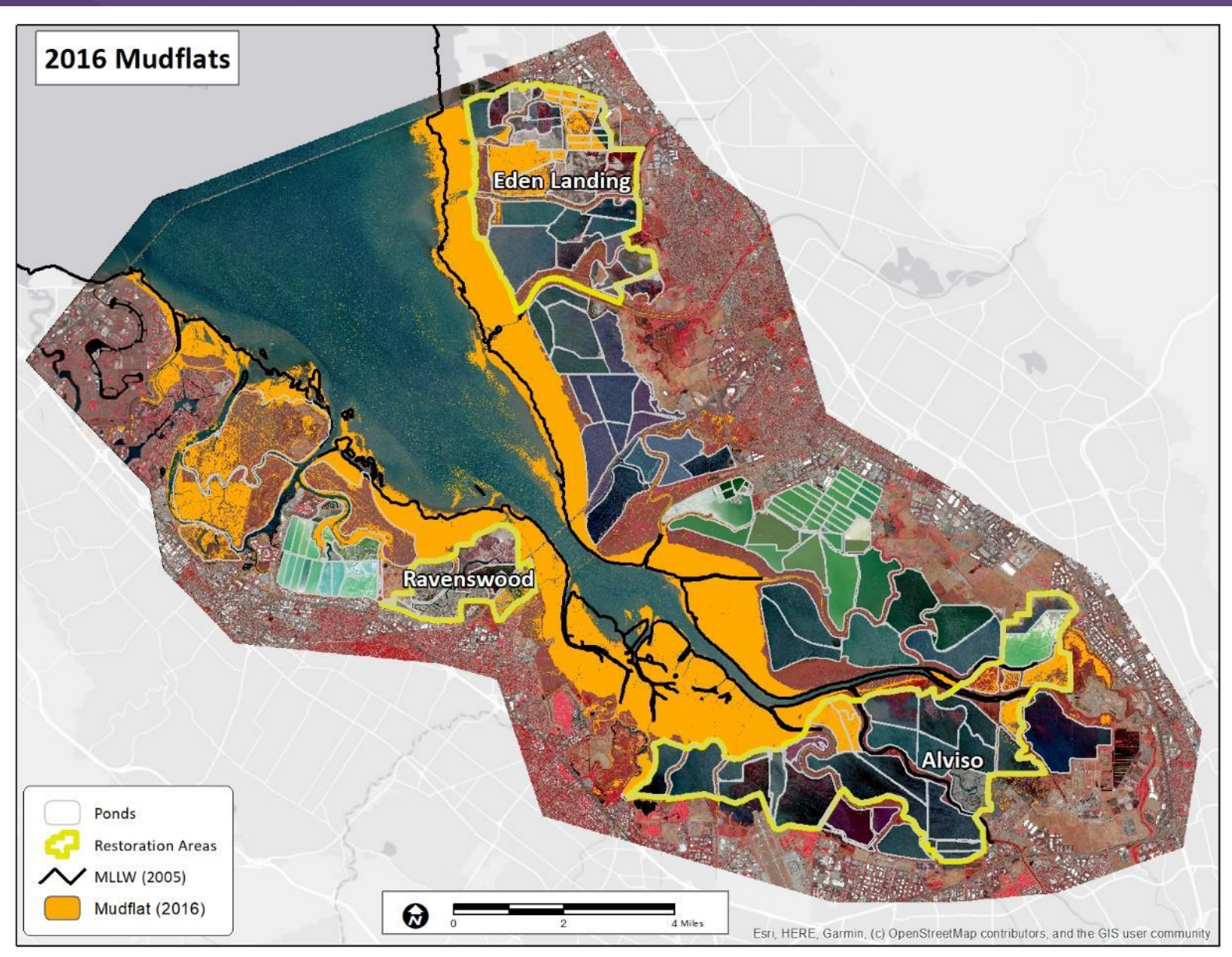
2019



Preliminary Results (2019) - Mudflat



2016 Mudflats



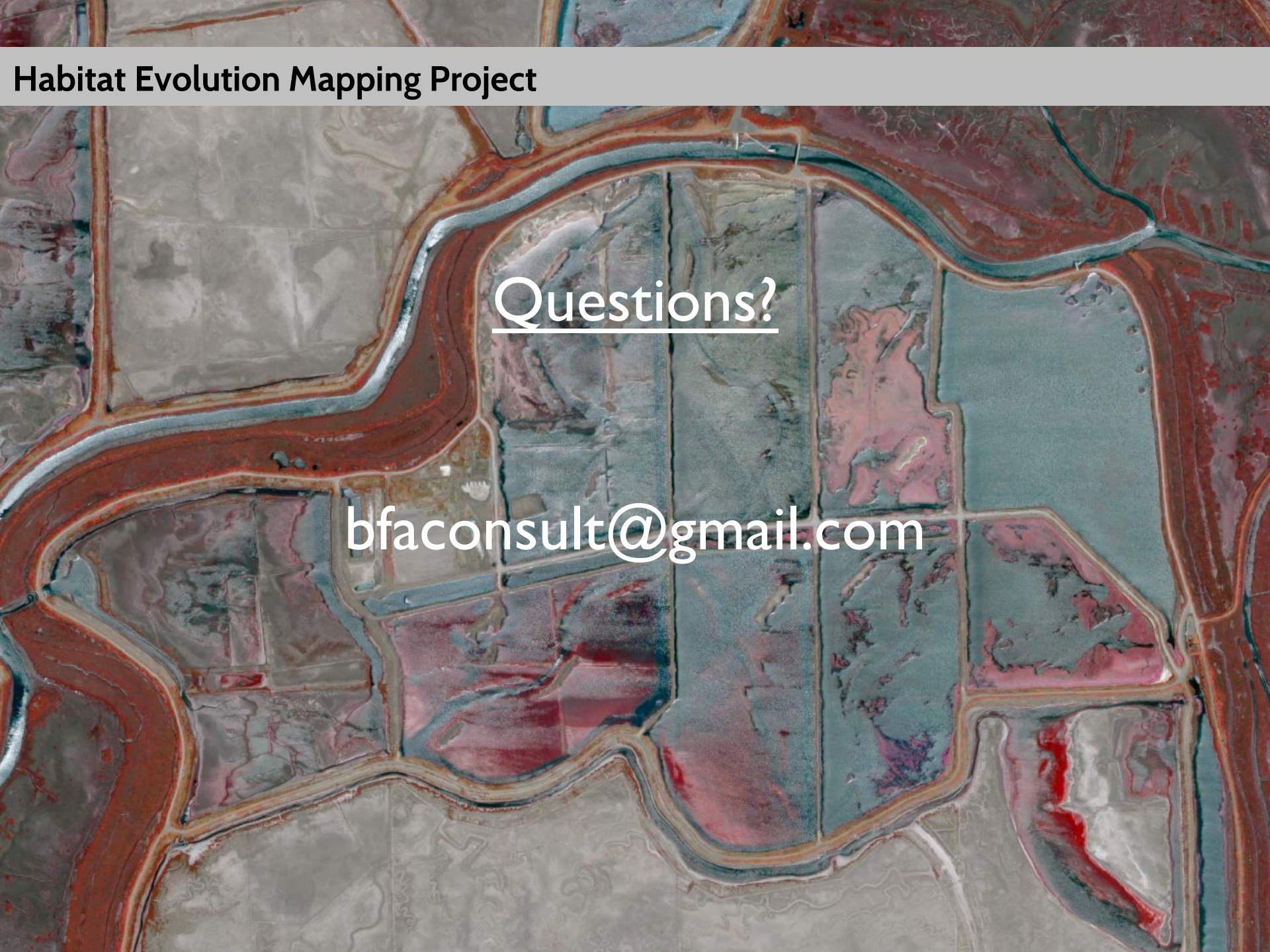
Habitat Evolution Mapping Project 2.0 –Final Steps and Deliverables

May – August, 2022

- Final 2019 and 2021 Habitat and Mudflat Datasets
- Final 2019 and 2021 Data Validation
- Final Habitat and Mudflat Change Analysis (2021/2019 to 2009-11)
- Final Invasive vs Native Spartina Results

Final Deliverables (August, 2022)

- (1) **HEMP 2.0 Final Report (with change analysis)**
- (2) **Final Datasets:**
 - Final GIS habitat (2019 & 2021) and mudflat (2019) datasets
 - 0.5 meter multispectral imagery of study area (2019 & 2021)
 - Ground Truthing (2019-2021) geodatabase
 - Interactive Map of GIS datasets (Data Basin & BIOS) and Imagery (WMS)
 - Native vs Invasive Cordgrass (2019/2021)
- (3) **Presentation (PDF) and Webinar (available online) on Final Results**

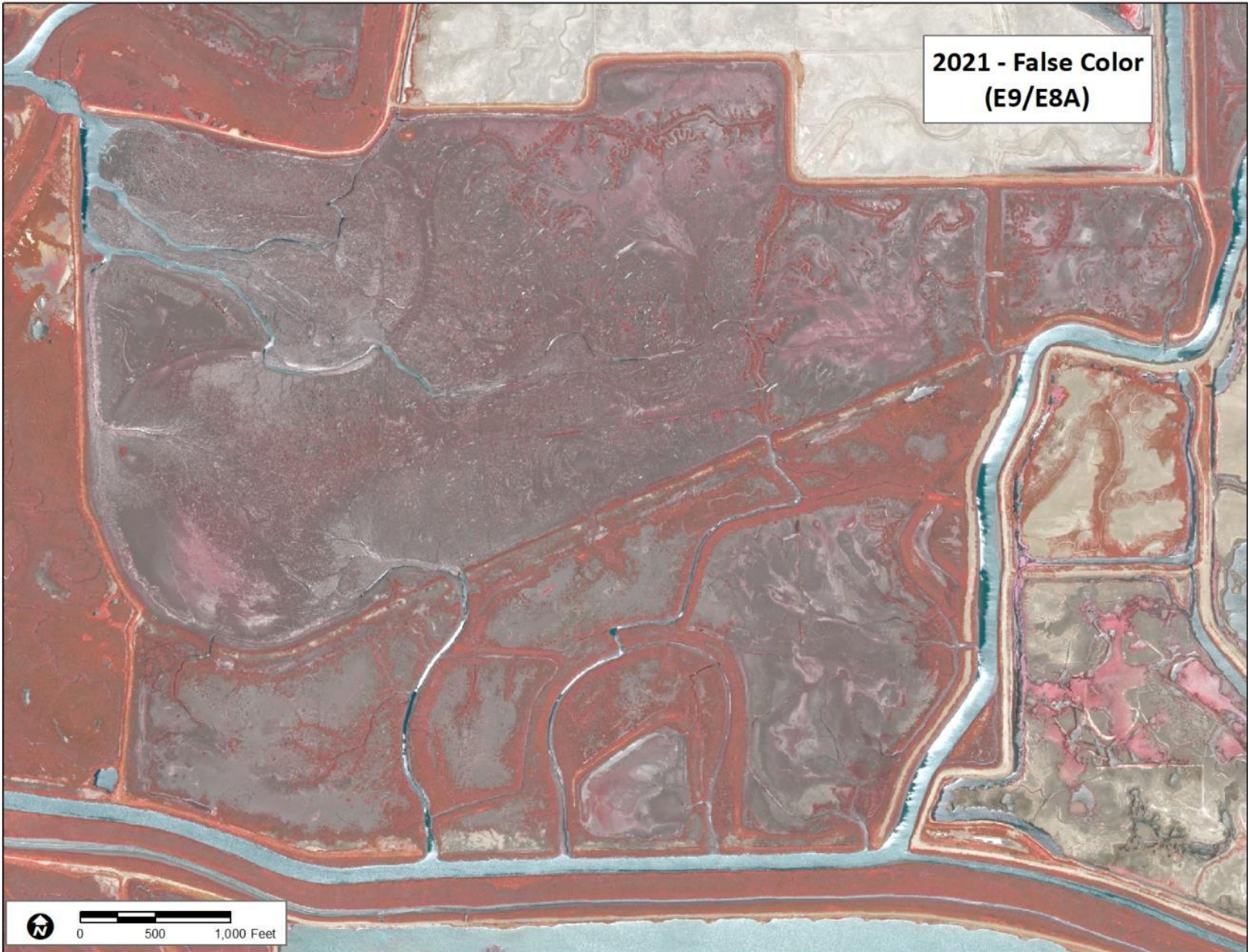


Habitat Evolution Mapping Project

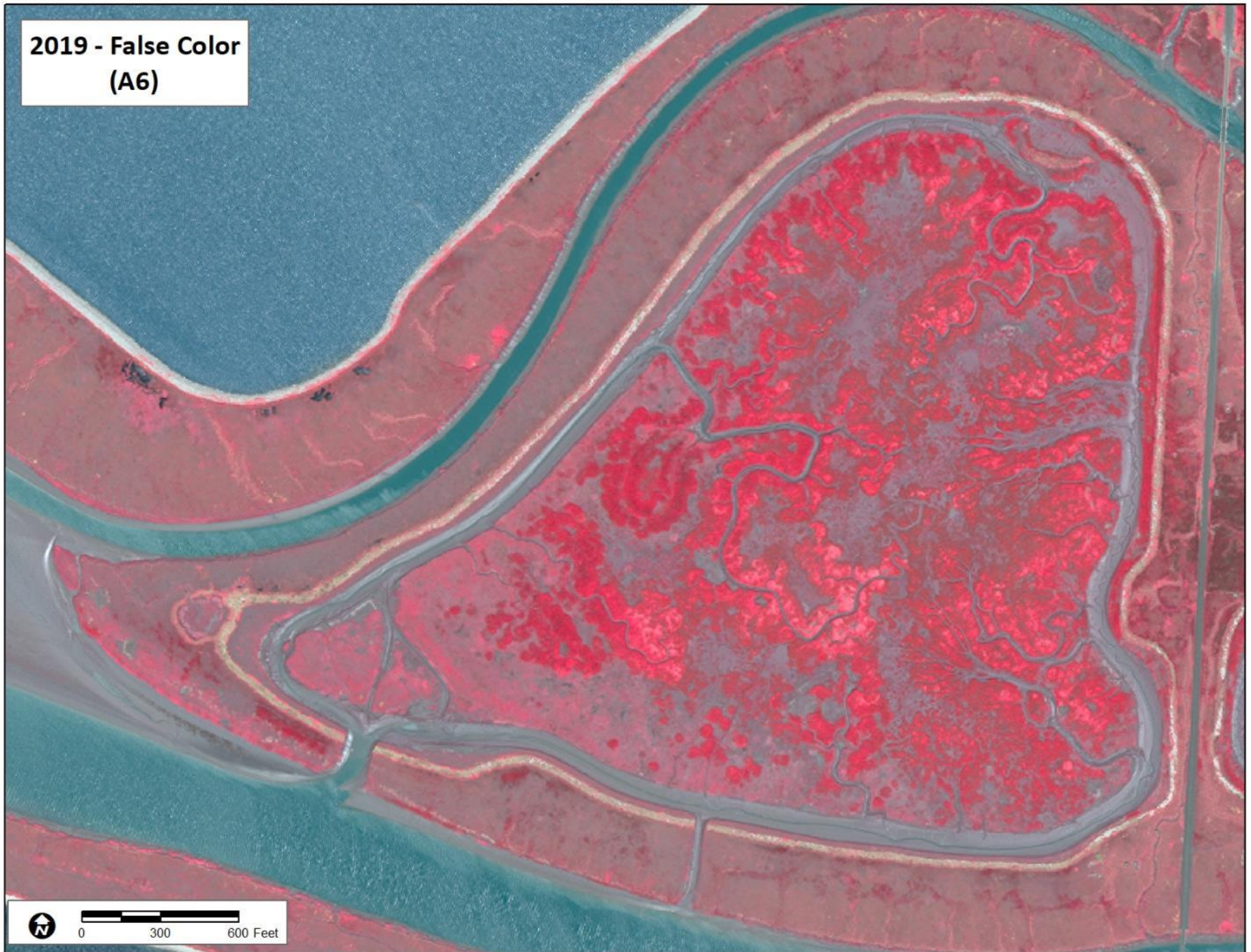
Questions?

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Habitat Evolution Mapping Project 2 – 2021/2019 Preliminary Results (E9/E8A)



2019 - False Color
(A6)



Habitat Evolution Mapping Project - Project Goals

Track evolution of tidal marsh habitats (**vegetation** and **mudflats**)

Tidal Marsh

- Salt, Brackish and Freshwater Marsh Habitats
- Habitats mapped as vegetation Alliance/Association
- Map floral colonization of restored ponds

Mudflats

- Map extent and distribution of mudflats
- Map presence of and distribution of biofilm

Other

- Map abiotic and upland habitats (including Pepperweed)
- Use ISP data to distinguish invasive and native Cordgrass
- Map channels (time permitting)

Methods - Overview

- Based on analysis of **high resolution multispectral satellite imagery**
- Extensive **ground truthing of habitat classifications**

Step 1. Develop **Vegetation Classification** (Habitat Types)

Step 2. **Satellite Imagery** acquisition

- time satellite flyover (~12pm) with Mean Lower Low Water (MLLW)
- Worldview-2 (2019 & 2021) - 8 band, ~0.5 meter
- Ikonos (2009-2011) - 4 band, ~1 meter

Step 3. **Habitat Model** (w/ ground truthing)

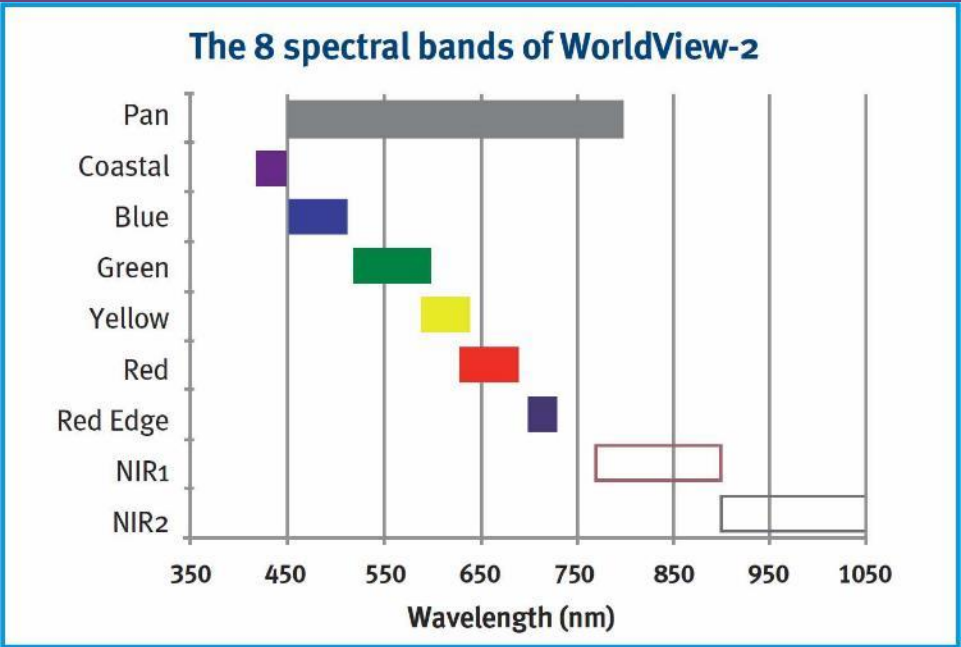
- supervised classification of image into habitat classes

Step 4: **Mudflat Model** (w/ ground truthing)

- mix of methods designed to optimize tidal variability

Step 5. Final **Model Validation**

Methods – Satellite Imagery (Worldview-2)



Spectral:	8 band multispectral, 1 band panchromatic	
Radiometric:	11 bit radiometric	
Spatial:	1.8 meters multispectral (at nadir),	0.46 meters panchromatic (at nadir)
Temporal:	1.1 days at 1 meter GSD or less 3.7 days at 20° off-nadir or less (0.52 meter GSD)	
Swath Width:	16.4 kilometers at nadir, bi-directional	

Preliminary Results (2019) – Accuracy Assessment (Error Matrix)

Mapped (Classified) Data																	
	Alkali Bulrush	Alkali Grasses	Alkali Heath	Bare Earth/Wrack	Cattail	Cordgrass	Freshwater Bulrush	Mud	Pepperweed	Pickleweed	Pickleweed /- Gumplant	Ruderal	Saltgrass	Spearscale	Water	TOTAL VISITED	PRODUCER'S ACCURACY (%)
Alkali Bulrush	28									2	2					32	88%
Alkali Grasses		1														1	100%
Alkali Heath																-	NA
Bare Earth/Wrack				4											1	5	80%
Cattail	3				10											13	77%
Cordgrass						14				8						22	64%
Freshwater Bulrush	2				1		5									8	63%
Mud								9								9	100%
Pepperweed	2								11	1	1			1		16	69%
Pickleweed	1									54	1					56	96%
Pickleweed /- Gumplant										3	6					9	67%
Ruderal										1		1				2	50%
Saltgrass										1			3			4	75%
Spearscale	1															1	0%
Water	1														1	2	50%
TOTAL MAPPED	38	1	-	4	11	14	5	9	11	70	10	1	3	1	2	OVERALL ACCURACY	
USER'S ACCURACY (%)	74%	100%	NA	100%	91%	100%	100%	100%	100%	77%	60%	100%	100%	0%	50%		

