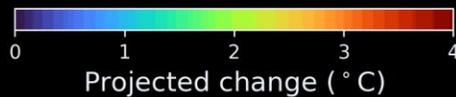
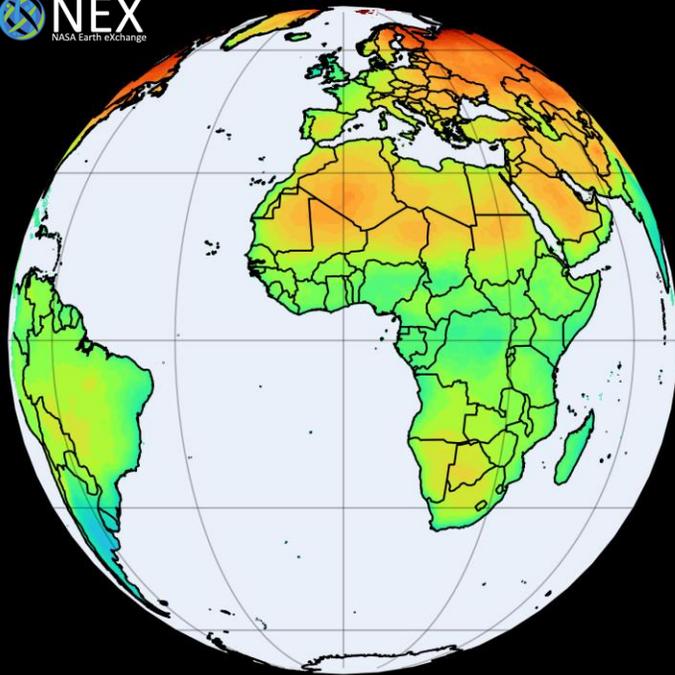


Ian G. Brosnan, Ph.D.  
Principal Investigator  
NASA Earth eXchange (NEX)

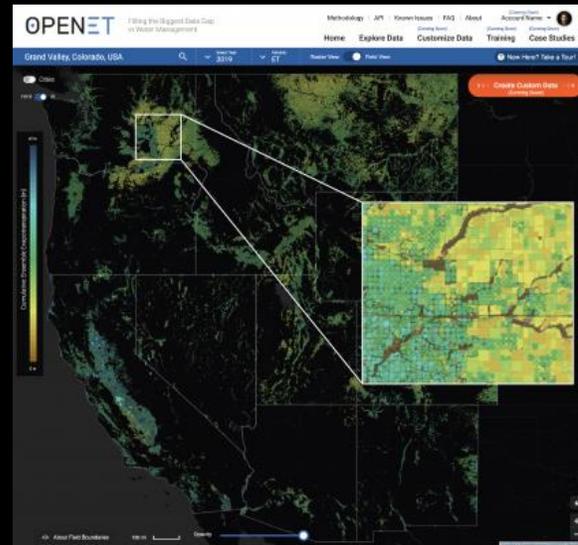
February 26<sup>th</sup>, 2024

Pre-decisional, for discussion only. Not for sharing outside of  
NASA-ARC-SG

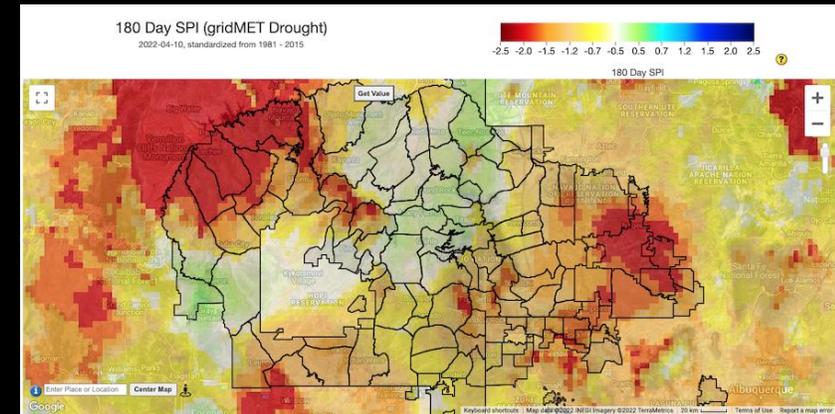
Photo: Reid Wiseman 2014 (NASA/ISS)



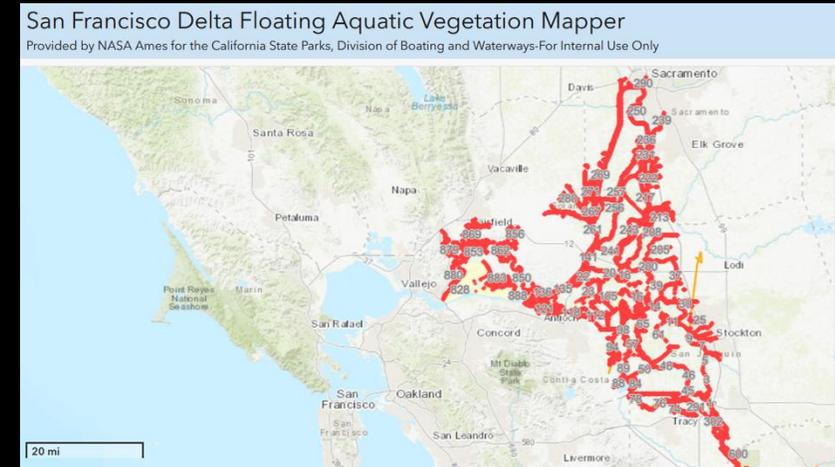
NEX-GDDP-CMIP6: Global daily 25km downscaled climate projections to 2100



OpenET: ET data for improved water management across the western United States



Drought Severity Evaluation Tool (DSET): Improve drought reporting and management in the Navajo Nation.



Floating Aquatic Vegetation Mapper: Develop science-based, adaptive-management tools for Invasive Aquatic Vegetation

# Navajo Nation Drought Severity Evaluation Tool (DSET)

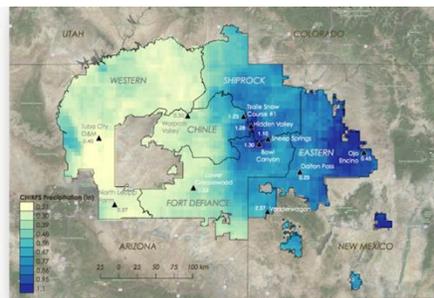
- Goal to improve upon drought reporting for the Navajo Nation Department of Water Resources
- Partner-driven tool where co-development and sustained relationships were key
- Acknowledgment of preexisting Indigenous knowledge systems and capacity building efforts ensured continued use of the tool



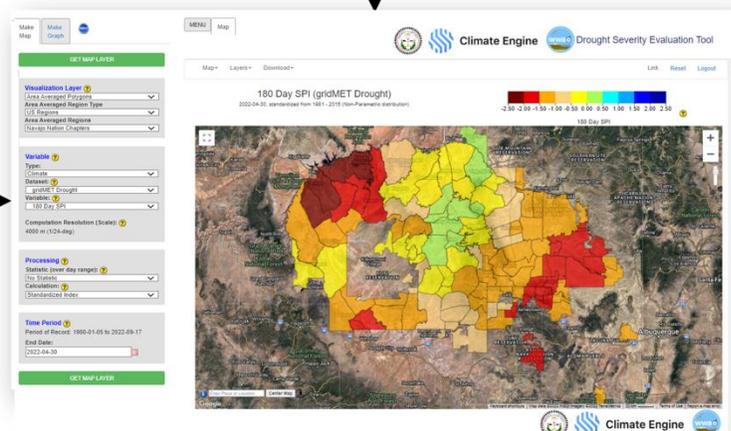
Navajo Rain Gauge Data



Satellite Data



Modeled Data and Drought Indices



Drought Severity Evaluation Tool (DSET)

***"I'm...Navajo – I grew up on the Navajo Reservation. It is monumental to have an organization like NASA work with us to diversify and augment the water tools we have at our disposal."***  
 Carlee McClellan, Navajo Nation Department of Water Resources

# Aquatic Invasive Species Management in a Time of Change

David Bubenheim, Ph.D.



David Bubenheim, Ph.D.

**Problem:** Invasive aquatic plants affect waterways worldwide with ecological, economic, and social impacts.

- CA Delta of critical regional and national importance
- Invasives threaten ecology, water, and economies
- Unpredictable response to climate variation

**Purpose:** Develop science-based, adaptive-management tools for Invasive Aquatic Vegetation

- Satellite mapping
- Operations support
- Management assessment
- Adaptive management
- Operational validation
- Transfer to Resource Managers



## California Delta

- Largest freshwater west coast estuary
- Delta agricultural production, \$2.7 billion annual.
- Irrigates Central Valley cropland, \$30 billion annual value.
- Drinking water for 25 million people in CA.
- Home to 56 rare, threatened, or endangered species.
- Urban population of Delta over 10 million.
- Complex array of stakeholders, regulatory oversight, and competing resource management objectives
- Appropriate validation site for national/international transfer

## Partners



## NASA Unique Contribution



**Remote Sensing**  
FAV & SAV Mapping, Operations, Assessment, Management



**Landscape Scale Modeling**  
River Watershed Delta Inputs  
Delta Land-Use / Water Quality



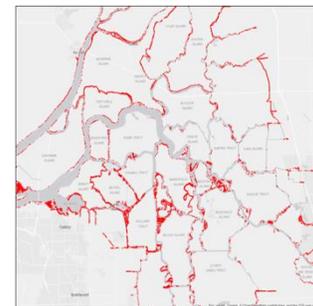
**Biological Impacts (Controlled Environment & Field Studies)**  
Response to environment variation  
Parameterize response models



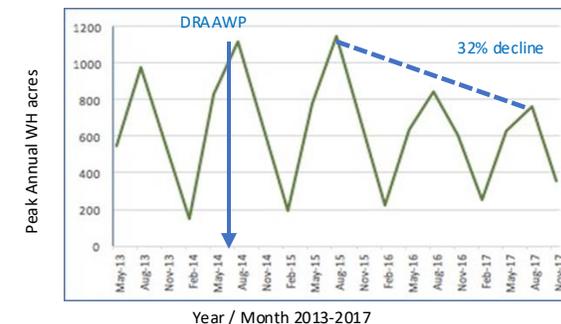
**Decision Support**  
Tools for operations, adaptive management and strategic planning and policy.

## Early USDA Sponsored DRAAWP\* Results

Delta FAV Map Ver 1



Total Delta FAV Coverage



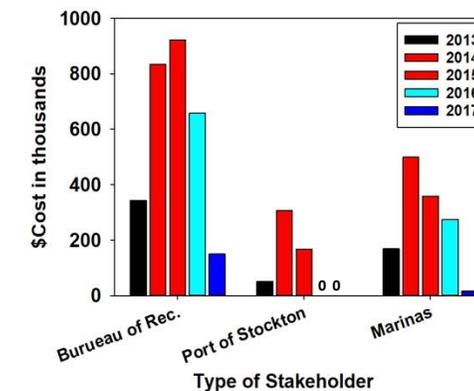
Sacramento River Delta Inputs



San Joaquin River Delta Inputs



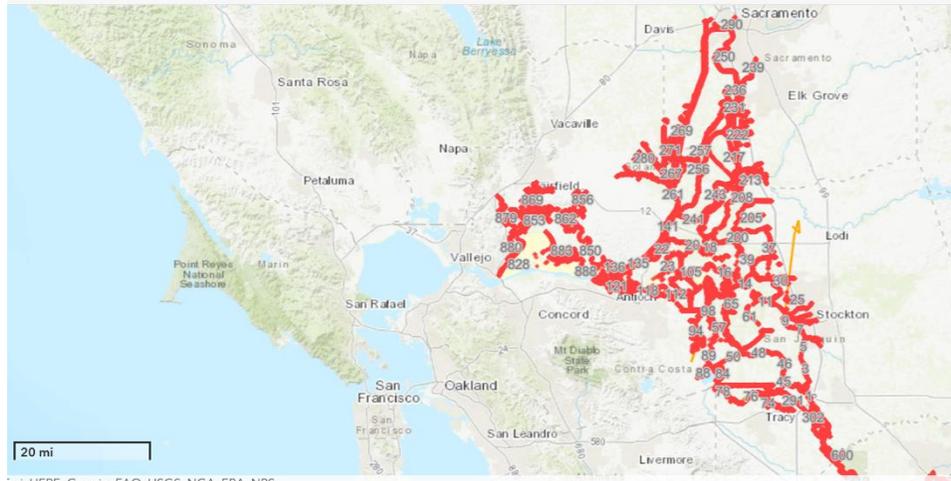
FAV Treatment Cost



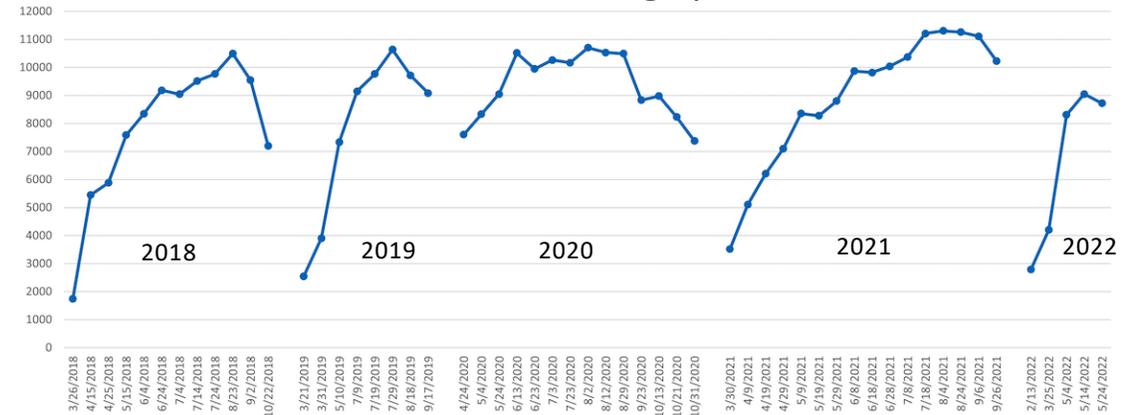
\*Delta Areawide Aquatic Weed Project (DRAAWP)

## San Francisco Delta Floating Aquatic Vegetation Mapper

Provided by NASA Ames for the California State Parks, Division of Boating and Waterways-For Internal Use Only



## Delta Total Floating Aquatic Vegetation Acres - 2018 to present Sentinel-2 imagery



## San Francisco Delta Floating Aquatic Vegetation Mapper

Provided by NASA Ames for the California State Parks, Division of Boating and Waterways-For Internal Use Only

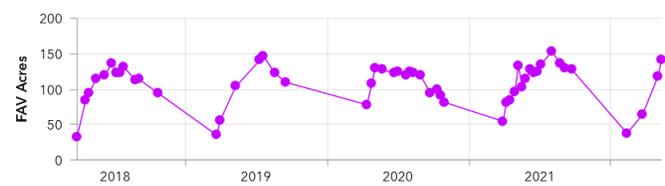
### Historical FAV (acres) and Treatments (gallons) by Treatment Site 2018-present Treatment Site #7



### FAV Acres by Treatment Site May 14, 2022

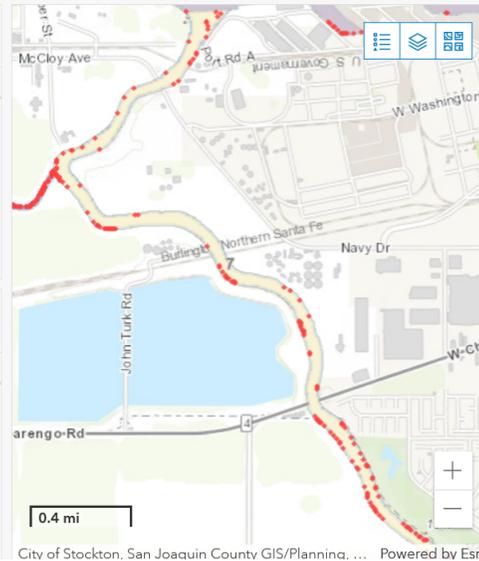
Treatment Site	FAV Acres
5	3.63
6	19.94
7	3.61
8	56.22
9	12.92

### Historical FAV Coverage (acres) by Specialist Area 2018-present Specialist Area #8

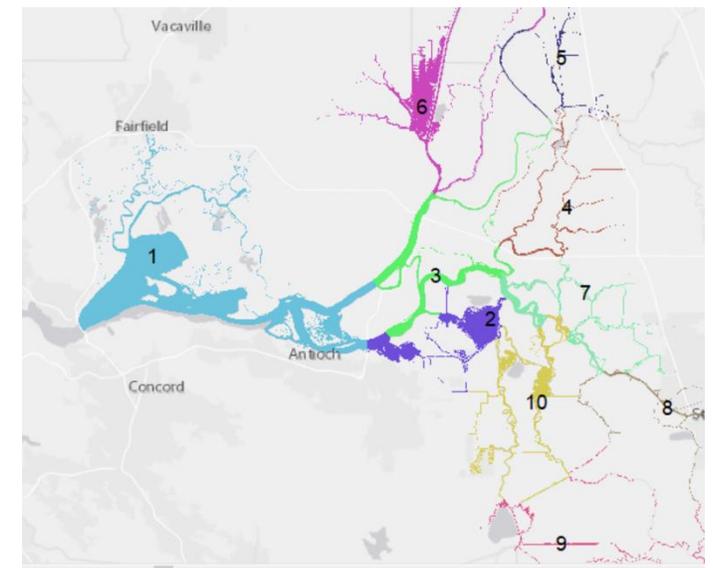


### FAV Acres by Specialist Area May 14, 2022

Specialist Area	FAV Acres
8	141.32



## Delta DBW Specialist Areas







# Touchpoints



Grants  
ARSET  
DEVELOP  
Reimbursable