

# Determining the Impact of Impoundment and Water Management on Wetland Condition around the Great Salt Lake, Utah



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# Research Question

**What is the impact of impoundment and water management on GSL wetland condition?**

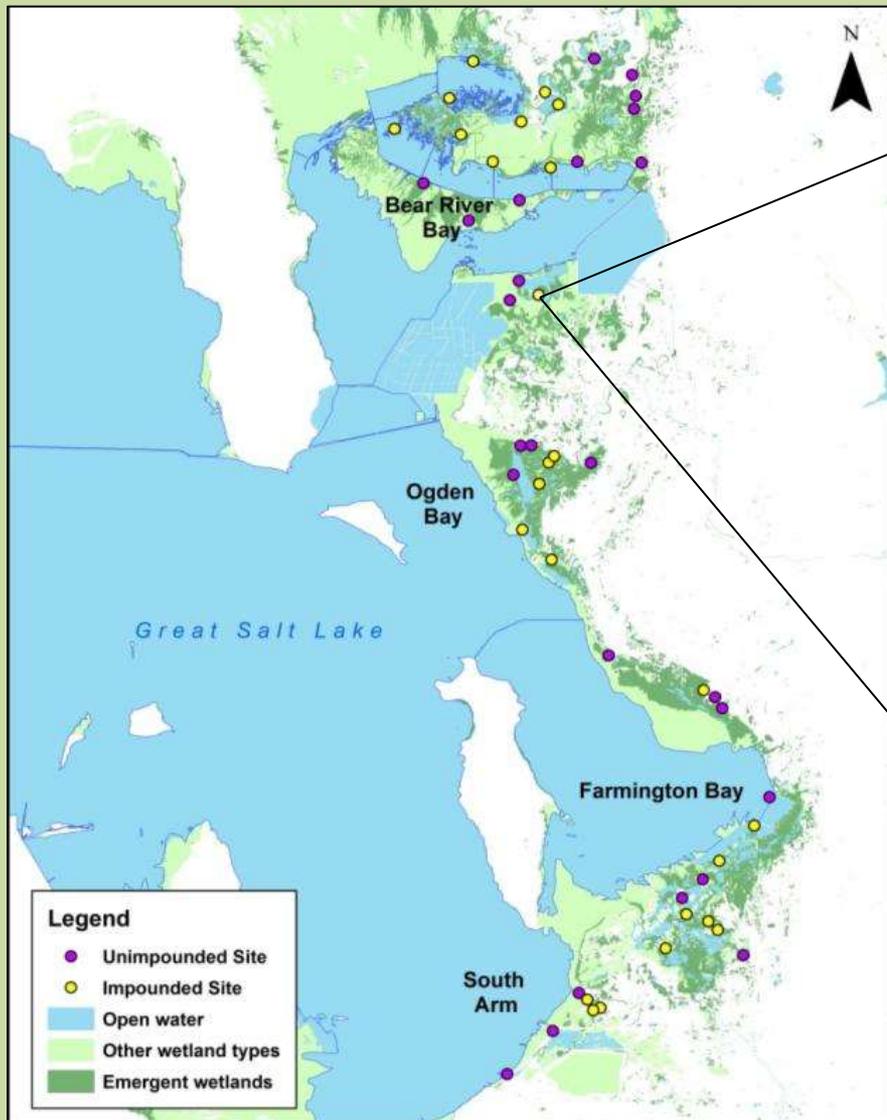


# GSL Ecological Condition Assessment

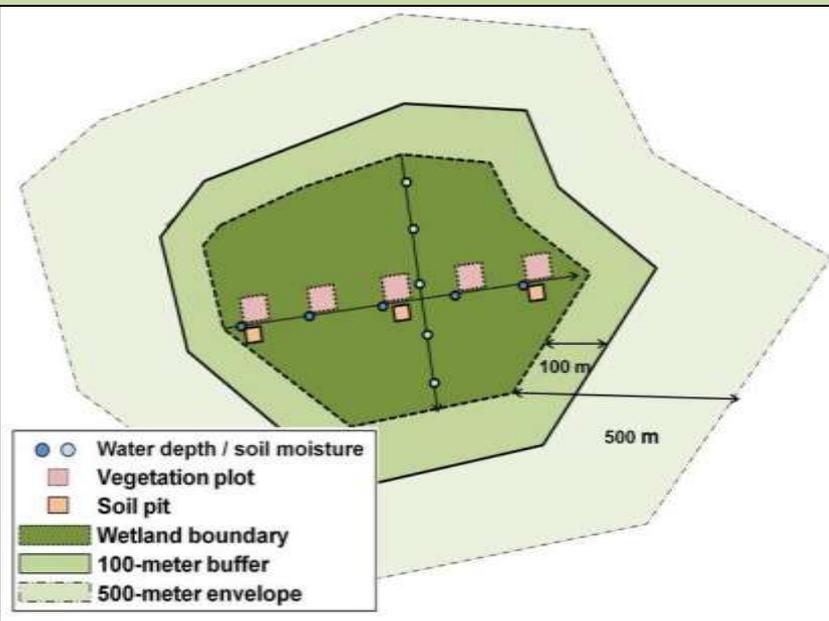


- Condition
- Reference
- Emergent wetlands
  - Species poor system
  - Salinity gradient
  - Unknown hydroperiod
  - Heavily managed for wildlife habitat

# Methods



2012-2015



# Methods



## Soils

- Horizon depth
- Texture
- Redoxi-morphic features
- Hydric soil class

# Methods



## Vegetation

- Structure
  - Patches
  - Strata
- Composition
  - Species
  - Cover

# Methods



## Hydrology

- Depth
  - Soil Moisture
- Inundation
- Hydro-period
  - Piezometers

# Analysis

1. Disturbance index and vegetation metrics

2. Condition network

3. Hydroperiod characterization

Land Use Disturbance +	
Water Quality Impairment +	
Physical Disturbance +	
Hydrologic Disturbance +	
Other Disturbances	

# Analysis

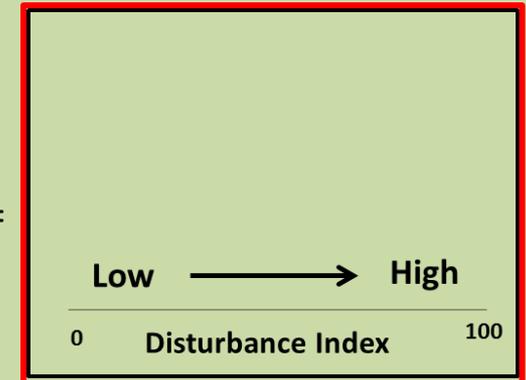
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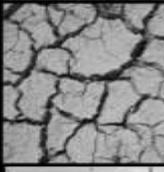


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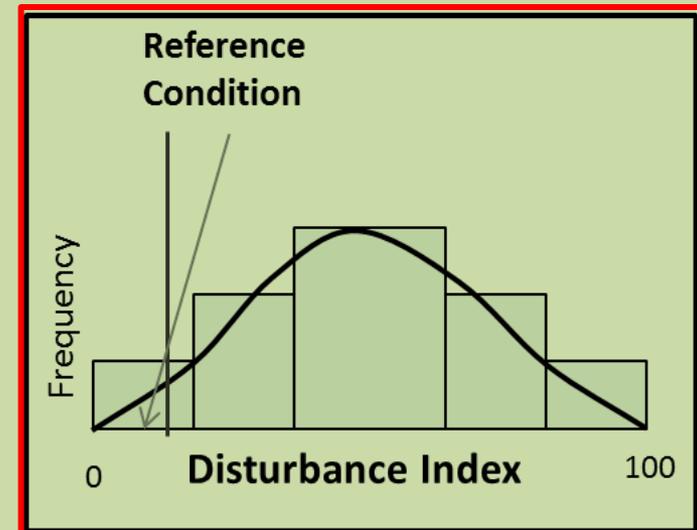
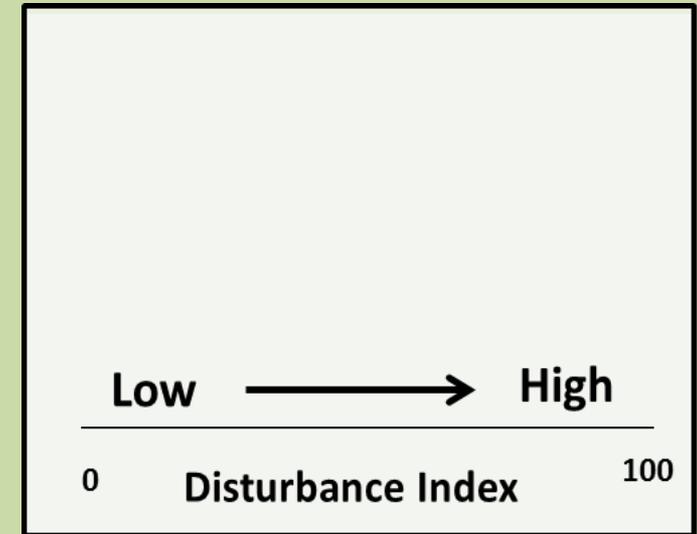
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# Analysis

1. Disturbance index and vegetation metrics

2. Condition network

3. Hydroperiod characterization

	Spp 1	Spp 2	Spp 3	Spp 4
Site 1	0	3	5	1
Site 2	1	0	6	0
Site 3	3	3	3	3
Site 4	0	6	0	0

	Site 1	Site 2	Site 3
Species richness	3.00	2	4
Native cover	0.75	0.95	0.50
Perennial cover	0.66	0.95	0.70
Obligate cover	0.55	0.95	0.66

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	Spp 1	Spp 2	Spp 3	Spp 4
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	Site 1	Site 2	Site 3
Species richness	3.00	2	4
Native cover	0.75	0.95	0.50
Perennial cover	0.66	0.95	0.70
Obligate cover	0.55	0.95	0.66

	Score	Condition
Site 1 (Reference)	5	50
Site 2	3.5	35
Site 3	2	20
Site 4	3	30

# Results – Reference Condition

## Least disturbed condition

Lowest 10% on disturbance index



# Results – Major Stressors



Grazing and  
pasture land



Head gates  
and roads



Ammonium



Salinity



Minimum  
water level

# Results – Reference Condition



Species  
richness - low

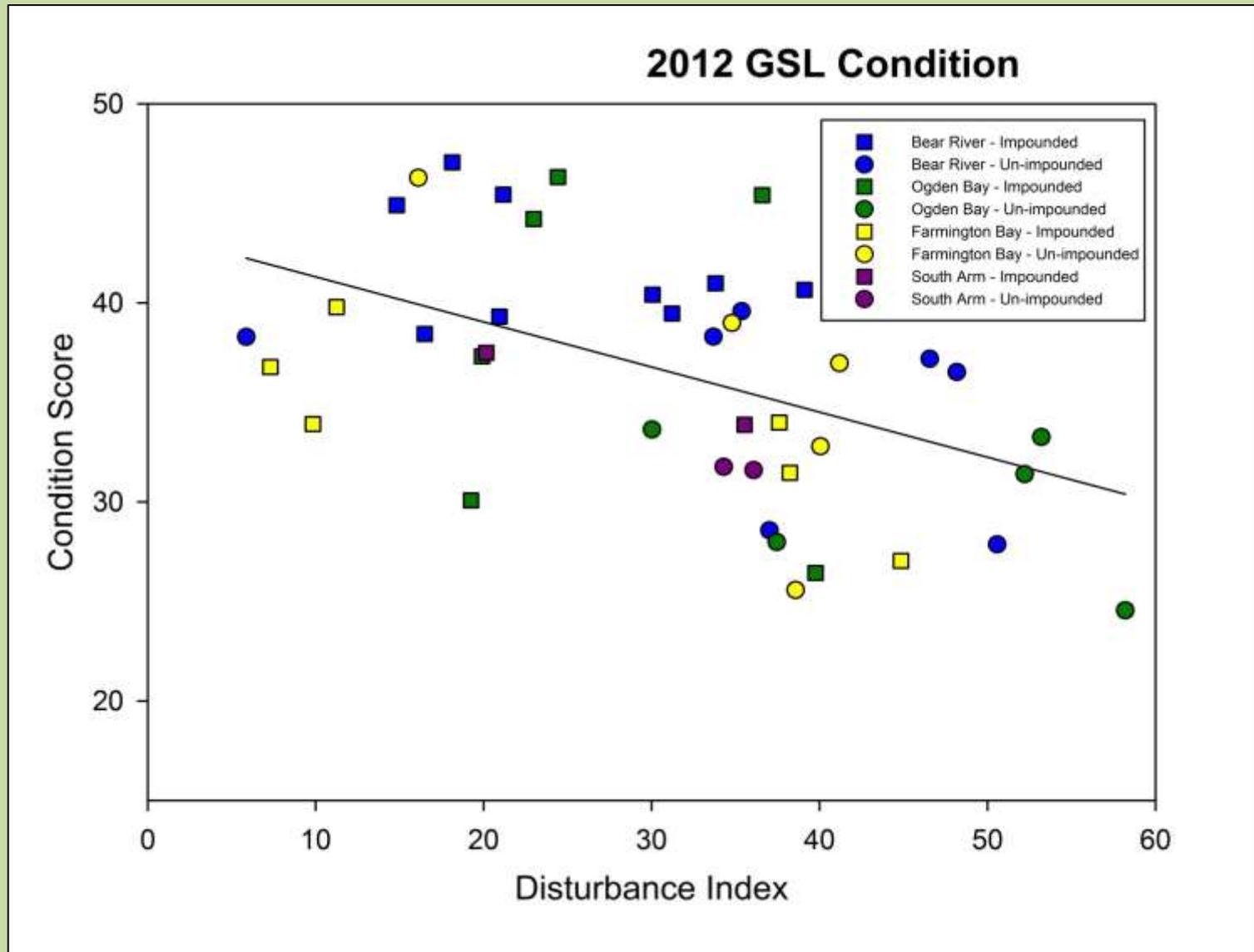
Native species  
cover - high

Perennial  
species cover  
- high

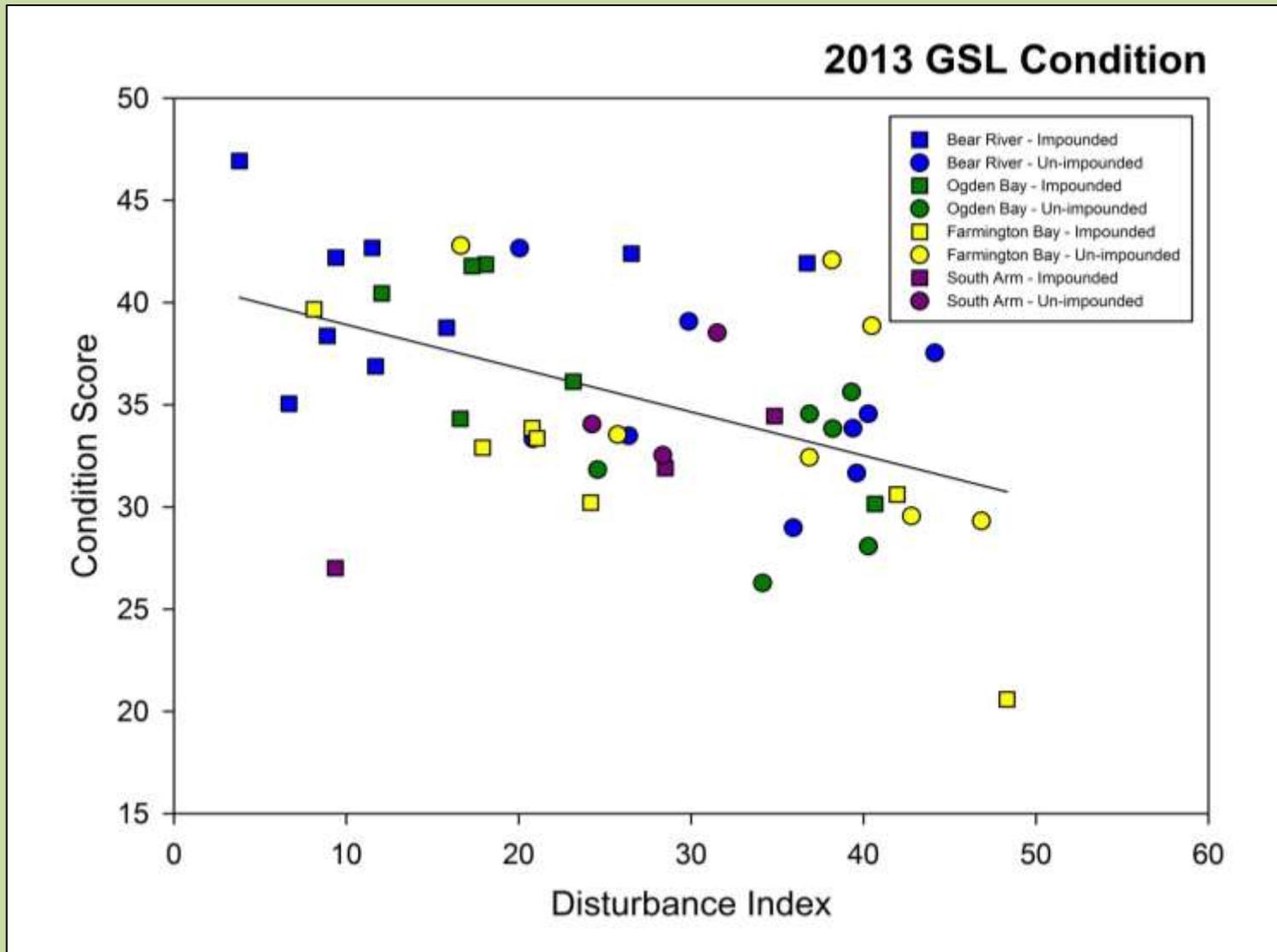
Obligate  
species cover -  
high

Structural  
complexity -  
low

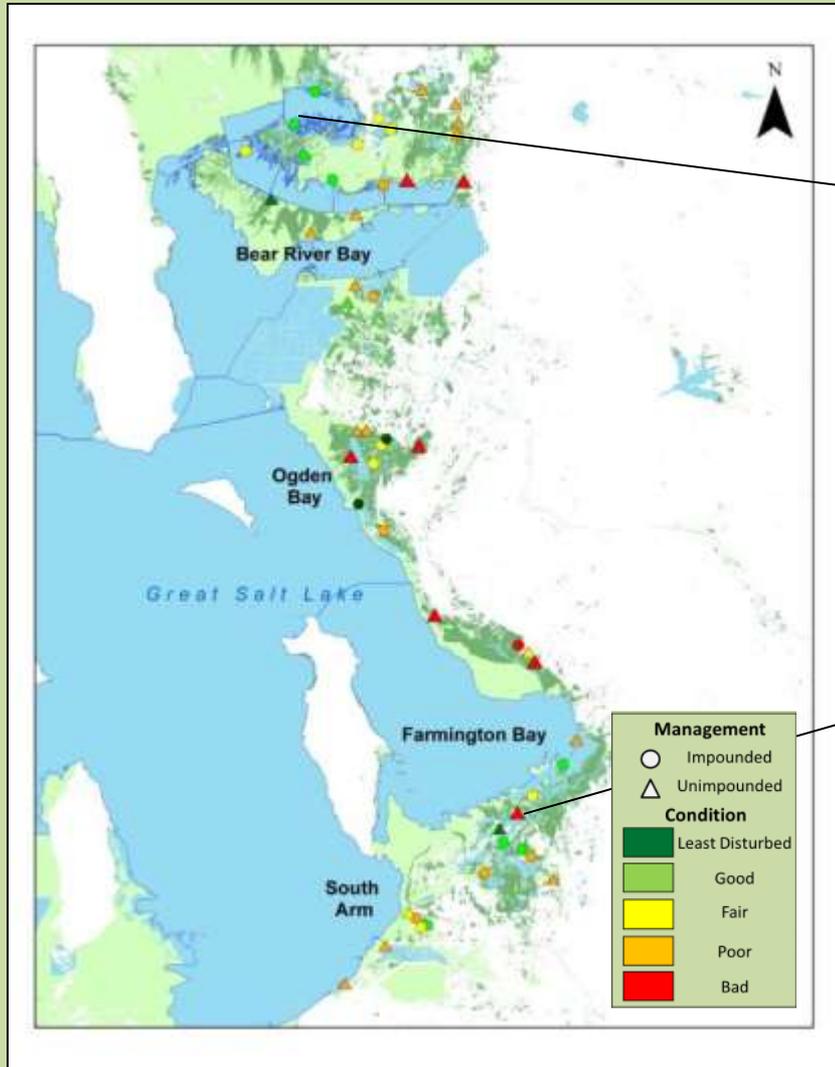
# Results – Reference Network



# Results – Reference Network



# Reference Network



# Inter-annual Variability

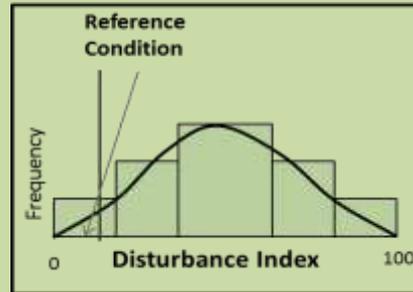


## Region-wide drought

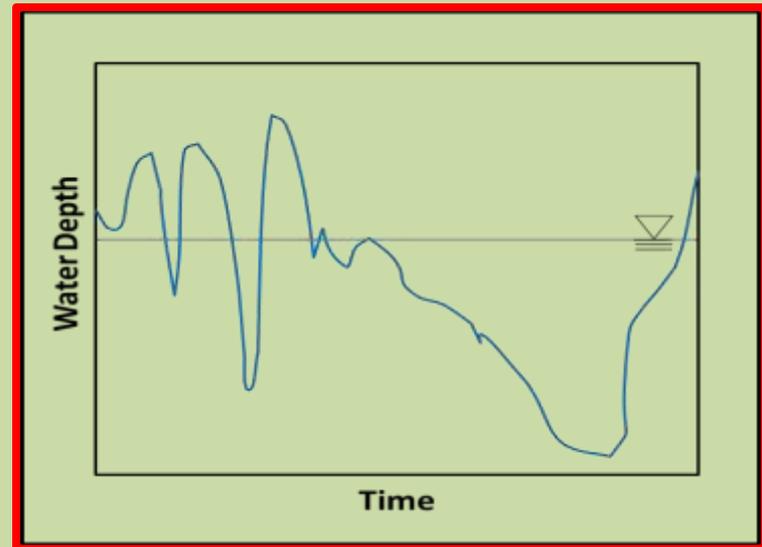
- $\Delta$  Least disturbed condition
- + Hydroperiod stressors
- Drier, longer
  - + annual, invasive, non-wetland species (small)

# Analysis

1. Disturbance index and vegetation metrics
2. Condition network
3. Hydroperiod characterization



	Score	Condition
Site 1 (Reference)	5	0
Site 2	3.5	1.5
Site 3	2	3
Site 4	3	2



# Analysis

- **Hydroperiod Statistics**

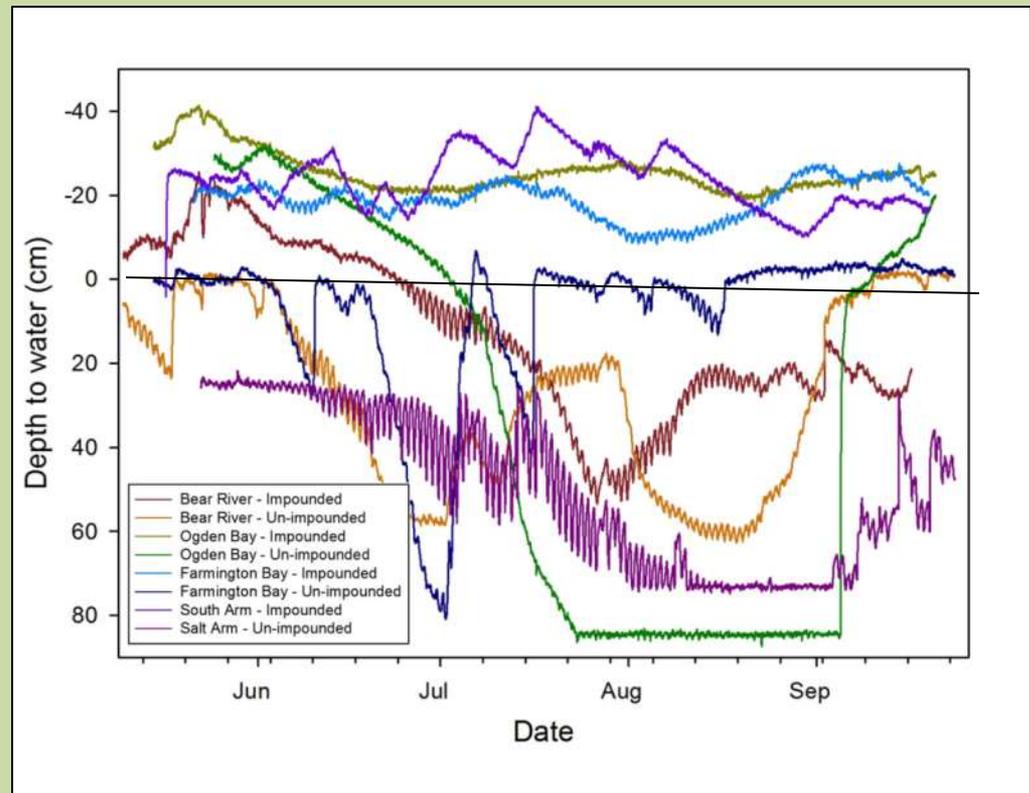
- Median, maximum, and minimum depth
- IQR, variance and standard deviation
- % Growing season days flooded, saturated, and dry

- **Classification of hydroperiod by**

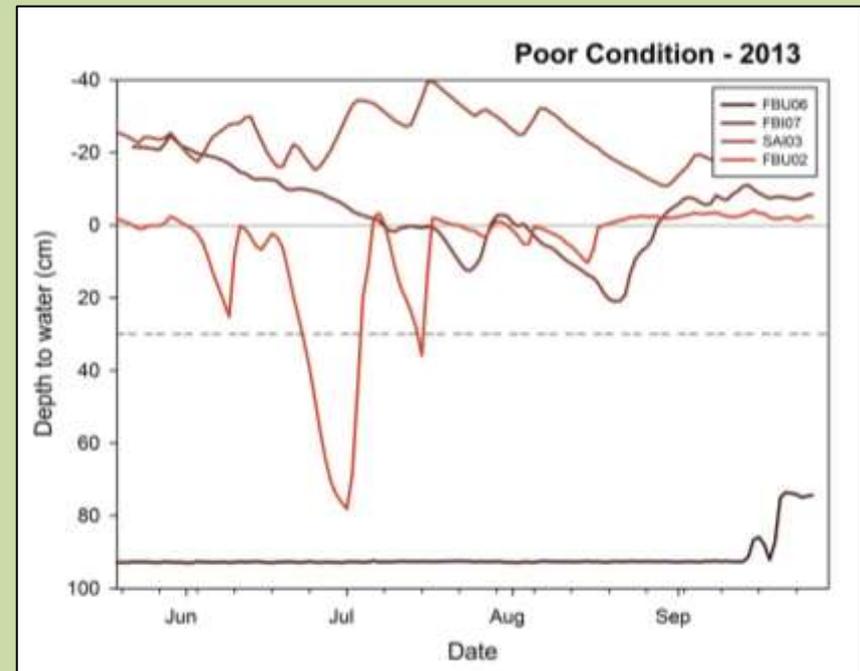
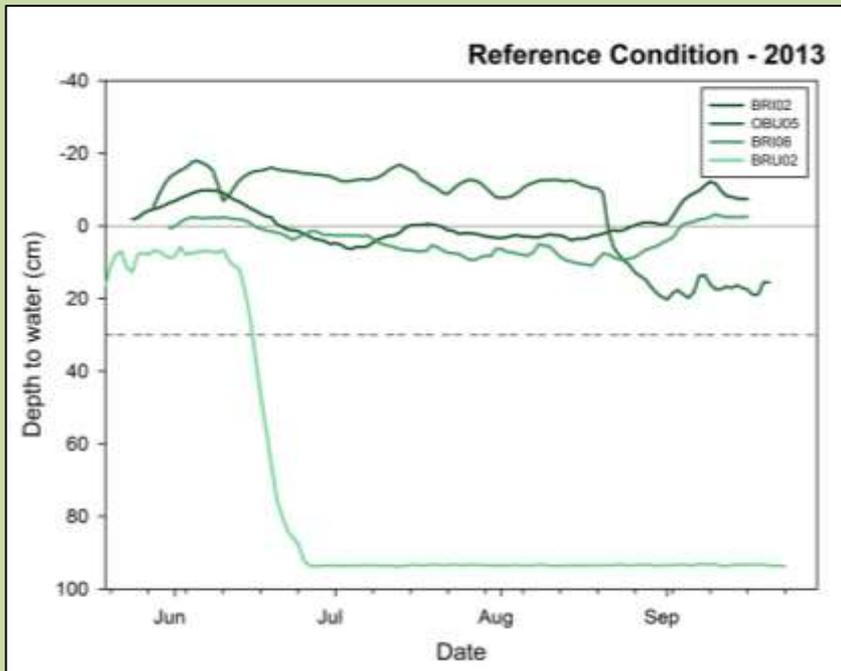
- Region
- Impoundment
- Condition

# Results – GSL Wetland Hydroperiod

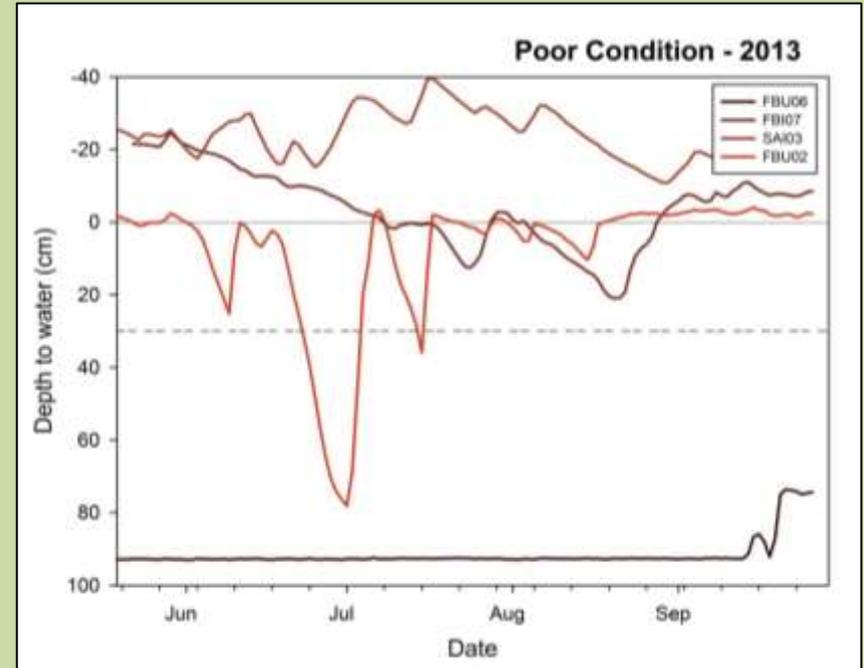
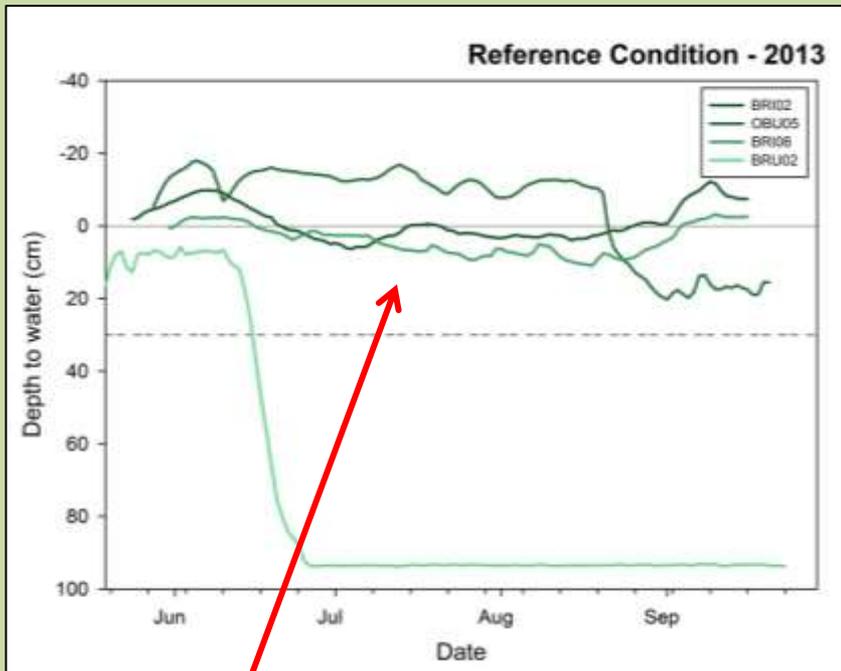
- Spring inundation
- Summer drawdown
- Highly variable:
  - Range of depths
  - Flooding duration
  - Drying
    - Timing
    - Duration
    - Magnitude



# Hydroperiod Characteristics



# Hydroperiod Characteristics



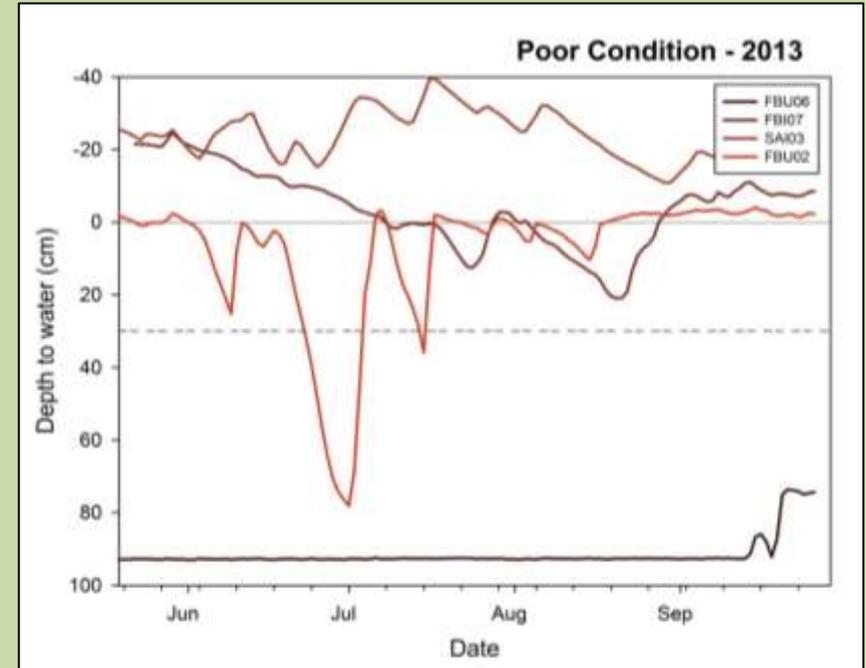
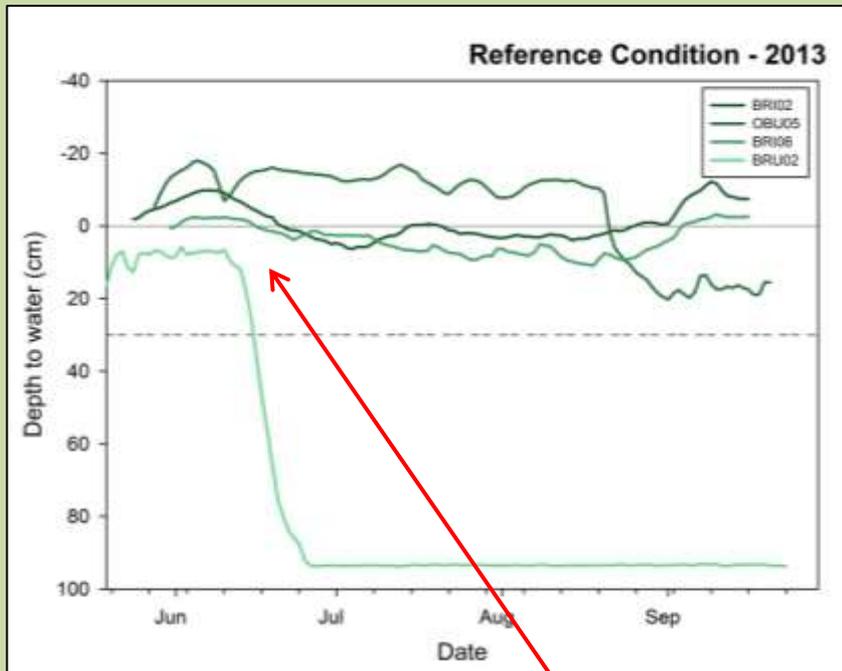
Minimum  
water level

Summer  
drawdown

Variability

Duration of  
drought

# Hydroperiod Characteristics



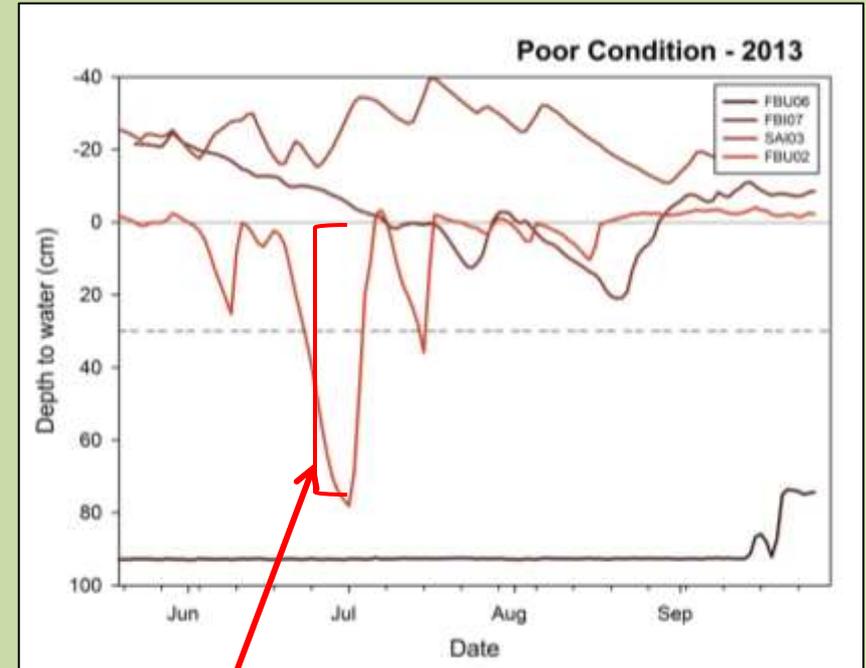
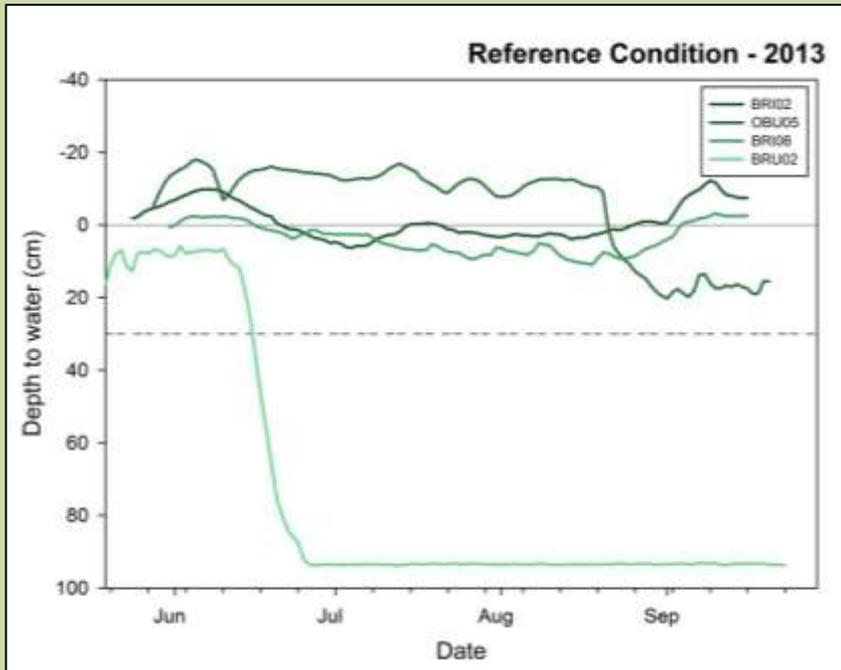
Minimum  
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# Hydroperiod Characteristics



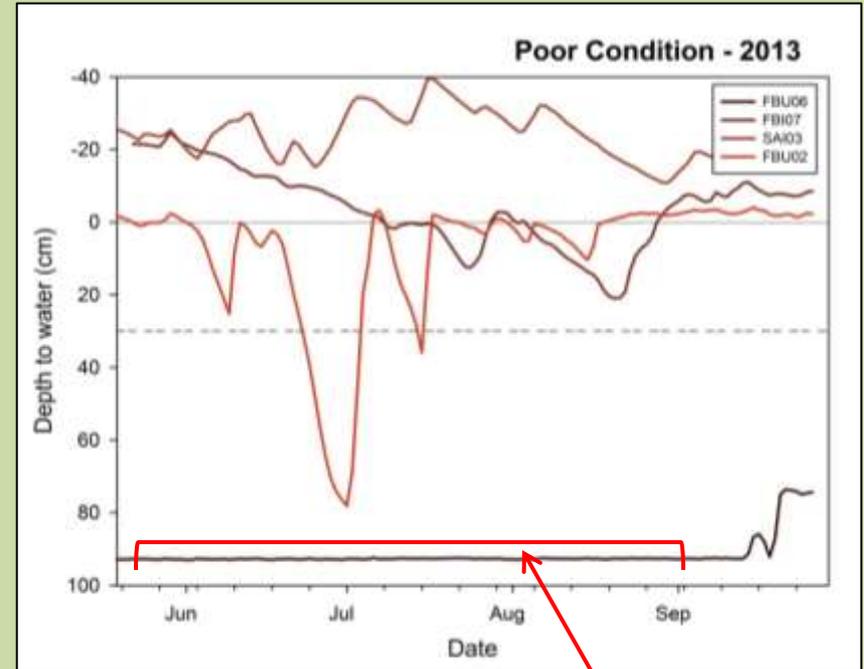
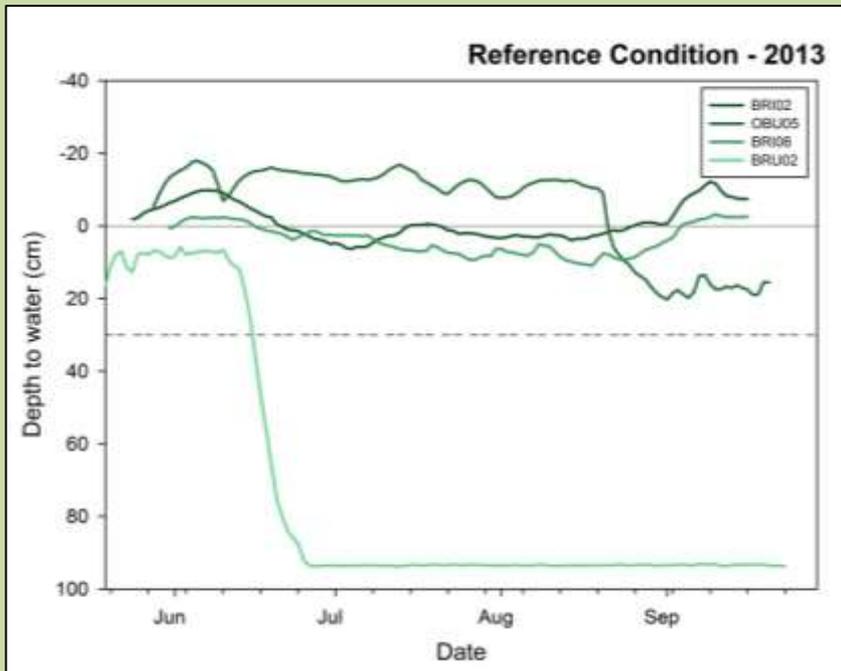
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# Hydroperiod Characteristics



Minimum  
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Summer  
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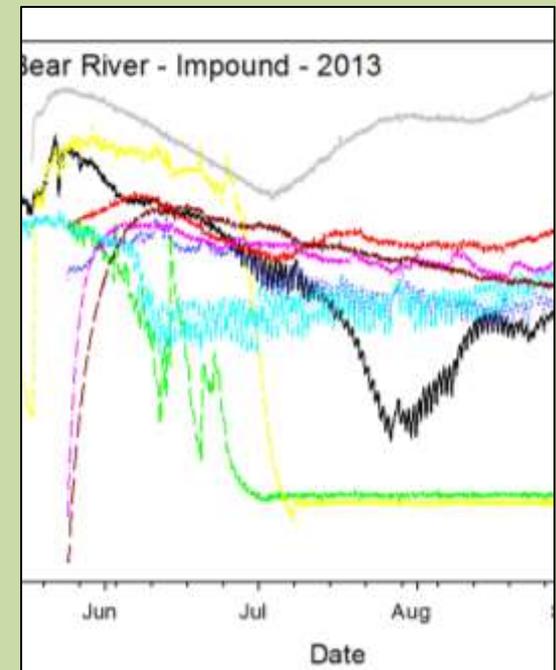
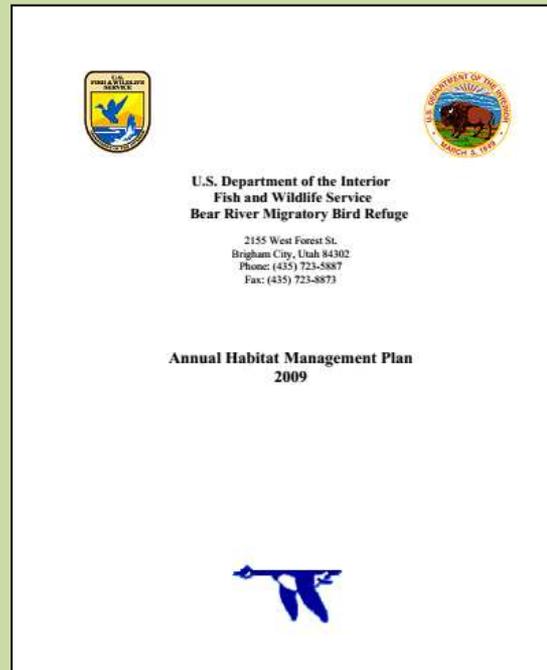
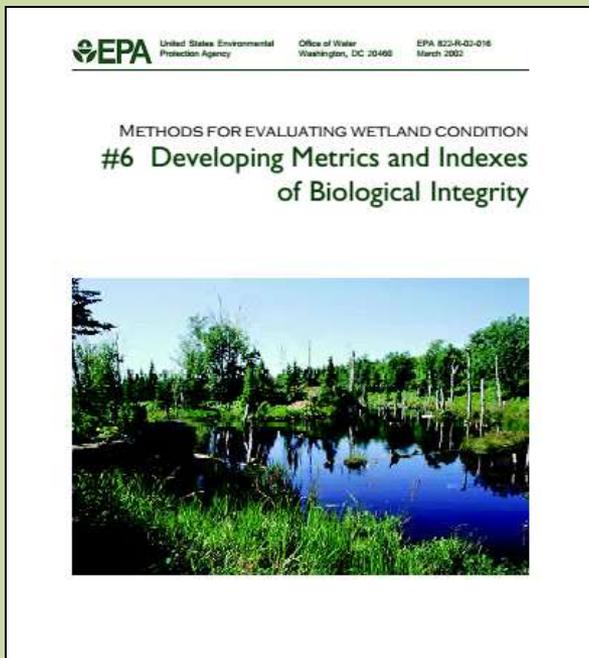
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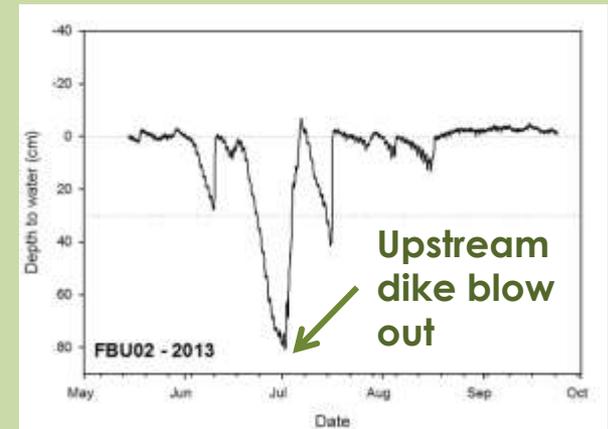
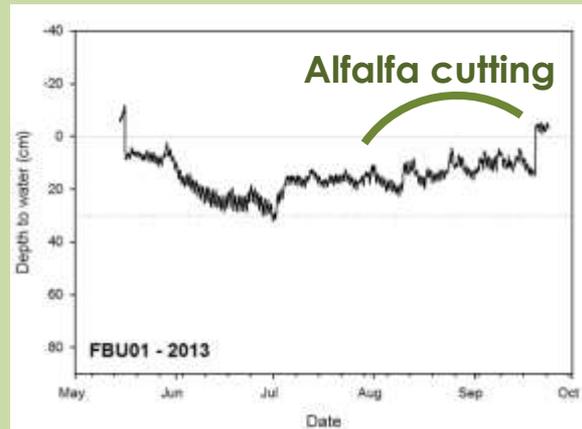
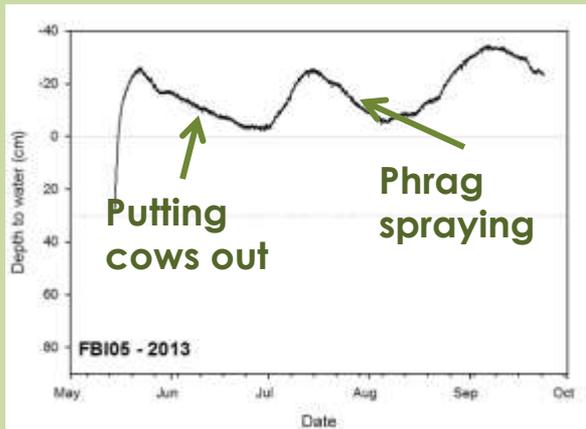
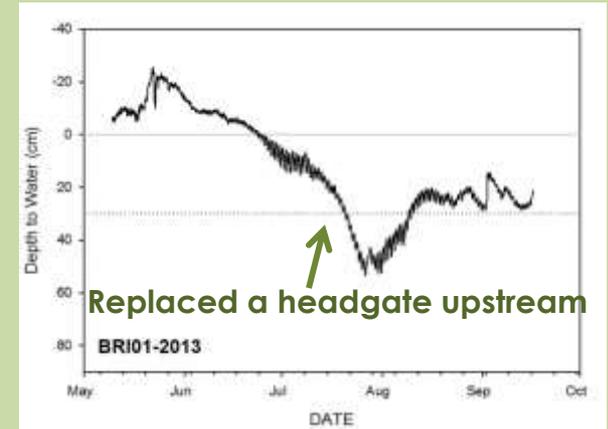
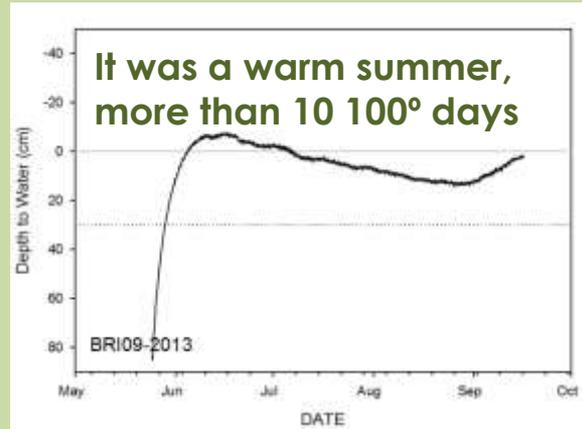
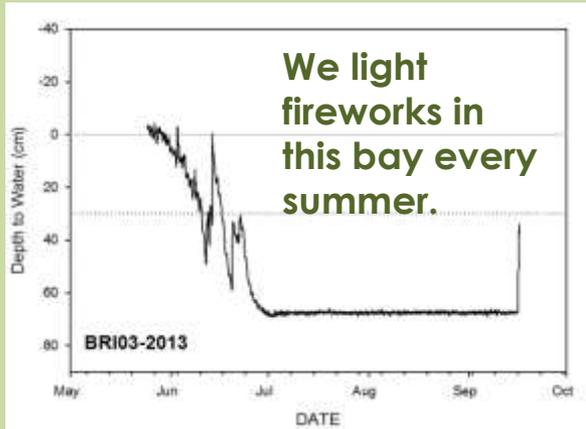
# Manager Interviews

## Objectives:

- Develop relevant assessment method
- Record management strategies
- Understand odd field data



# What's Going On?



# Monitoring and Useful Metrics



## What do you monitor?

- Bird use (good)
- Sago pondweed growth (good)
- *Phragmites* and cattail (bad)

## What metrics would be useful to you?

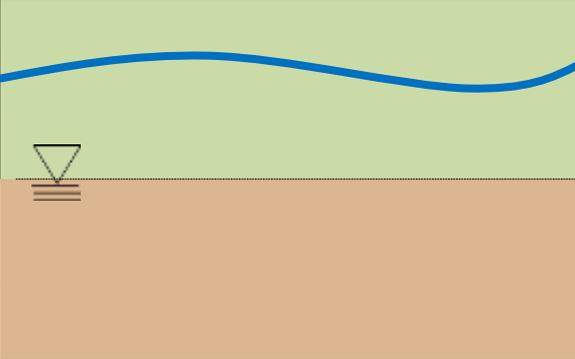
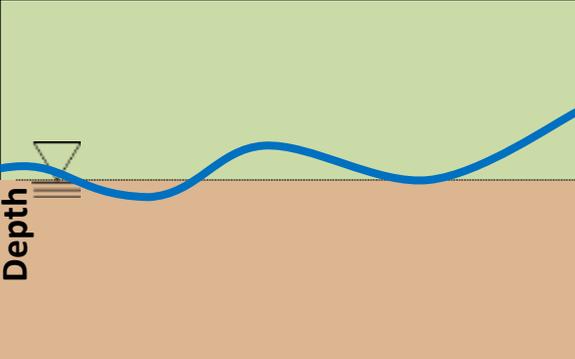
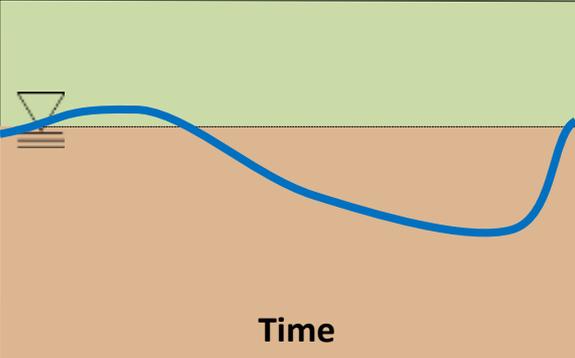
- Salinity parameters for *Schoenoplectus maritimus*
- Ideal water depth for *S. maritimus*
- Rooting depth of *S. maritimus*

# Reference Condition

- Sago pondweed and alkali bulrush
- Little to no *Phragmites*
- **No** agreement on hydroperiod or impoundment
  - Standing water, 18-24 inches **OR**
  - Dynamic, natural



# Bulrushes

Species	Hydroperiod	Disturbance
 <p><i>Schoenoplectus acutus</i></p>		
 <p><i>Schoenoplectus americanus</i></p>	 <p>Depth</p>	
 <p><i>Schoenoplectus maritimus</i></p>	 <p>Time</p>	

# Bulrushes

Species	Biomass	Seed Production
 <p><i>Schoenoplectus acutus</i></p>	<p>+ flooding 10-20 cm July – Aug + salinity 6-12 dS/m</p>	<p>? Flooding depth + salinity 6-12 dS/m</p>
 <p><i>Schoenoplectus americanus</i></p>	<p>+ flooding 0-10 cm July – Aug + salinity 0-8 dS/m</p>	<p>? (grazing pressure)</p>
 <p><i>Schoenoplectus maritimus</i></p>	<p>+ saturation 0 – -20 cm July – Aug + August drawdown</p>	<p>+ 20-30 day drawdown (20-40 cm below surface) + average depth much lower than other species</p>

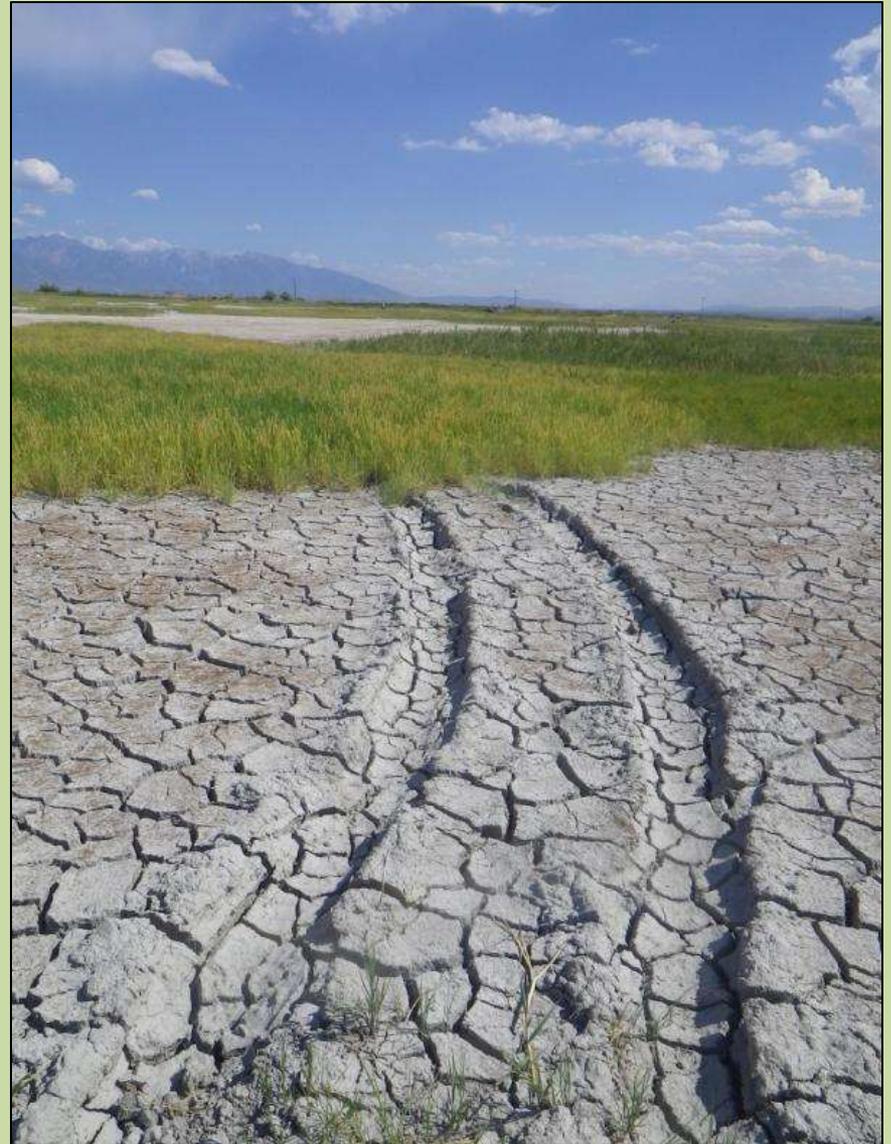
# Conclusions

## **Preliminary Conclusions**

- GSL wetland condition
- Impact of impoundment
- Impact of water management

## **Future Work**

- 4<sup>th</sup> year monitoring
- Interviews
- Bird use and bird food



# Acknowledgements

## Funding from:



## Committee members

Dr. Karin Kettenring  
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Dr. Toby Hooker  
Dr. Joe Wheaton

**Wetland Ecology Lab**

**Awesome field technician help**

**Interview participants**