

# Wet meadow hydrology Update

Science Reporting Session  
February 2022  
By: Kristen Cognac

- Wet meadows are ecological resources
- Management and preservation are long-term priorities for PRRIP.
- Extension big question #10 – improving the understanding and management of wet meadow sites with respect to hydrology





## Background – Why hydrology?

Groundwater-fed wetlands and grasslands

Highly variable GW levels

Shallow GW table (<0-2m

Standing water for part of year

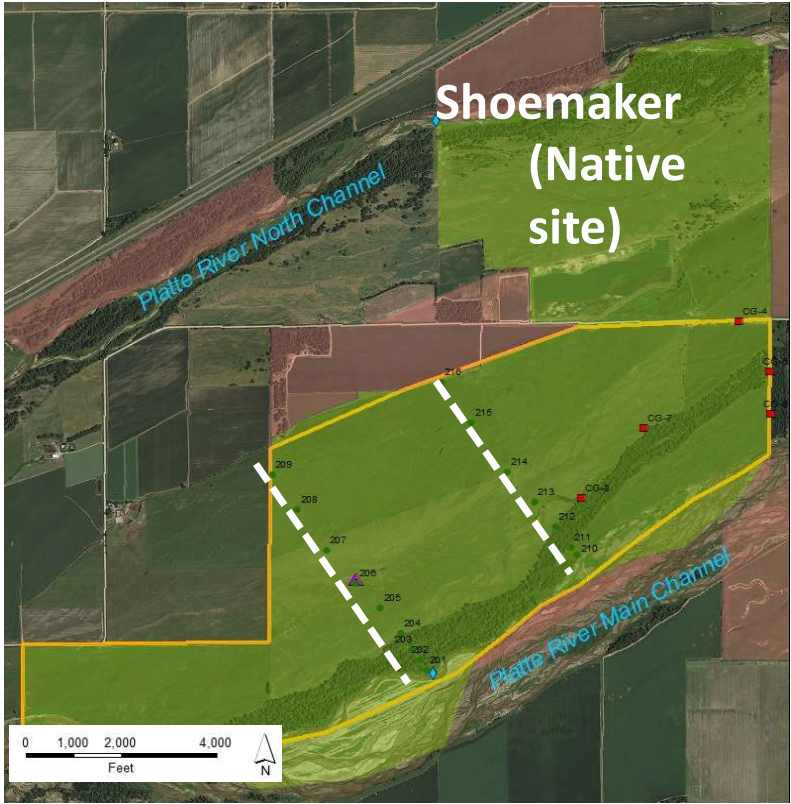
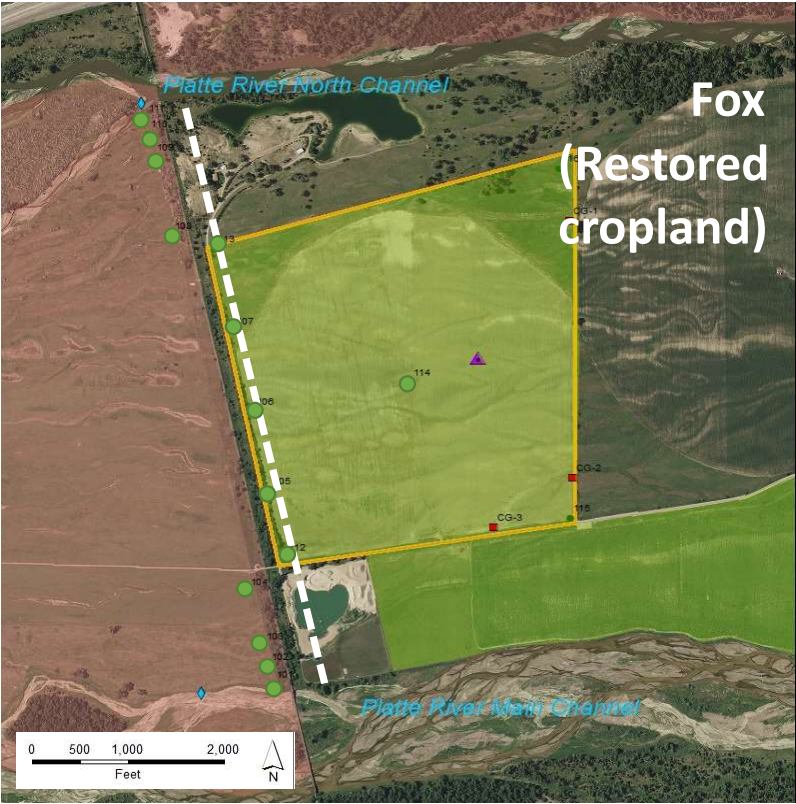
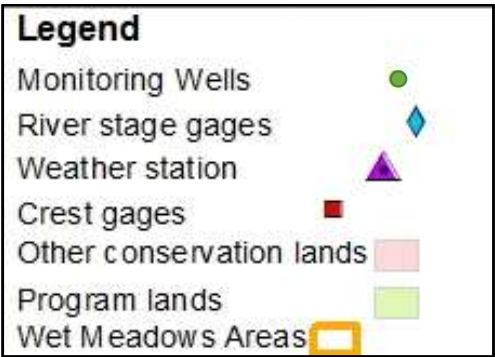
**Vegetation and hydrology are tightly linked**



[Brinley Buckley et al., 2021]

# Background

Since 2013 - hydrological and climatological monitoring at the Fox and Shoemaker wet meadow sites.





### Objectives

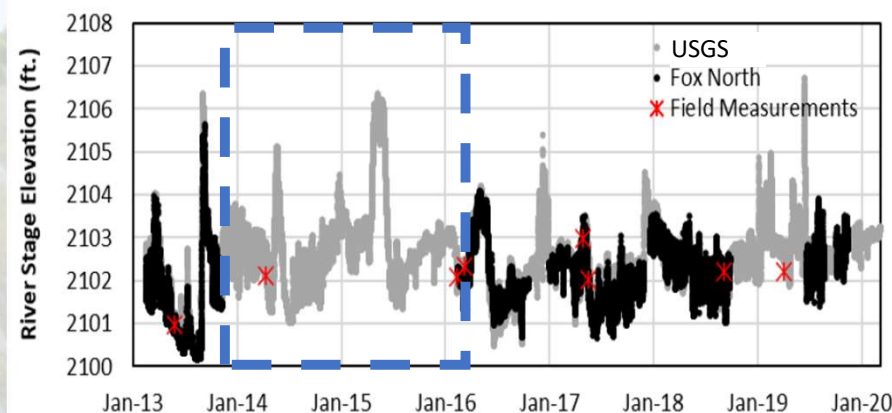
1. Develop quantitative methods that relate hydrologic and meteorological variables to groundwater levels at wet meadow sites.
2. Draw conclusions about hydrologic regimes of wet meadows through a robust, long-term monitoring dataset
3. Develop a tool to guide and test management strategies with respect to wet meadow hydrology.

## Where we're at

### 2021 Updates:

- Continued field data collection
- Conducted comprehensive data QC
- Developed hydrologic study objectives and methodology and presented to the GC
- Testing / calibrating analytical models
- Performing data analysis

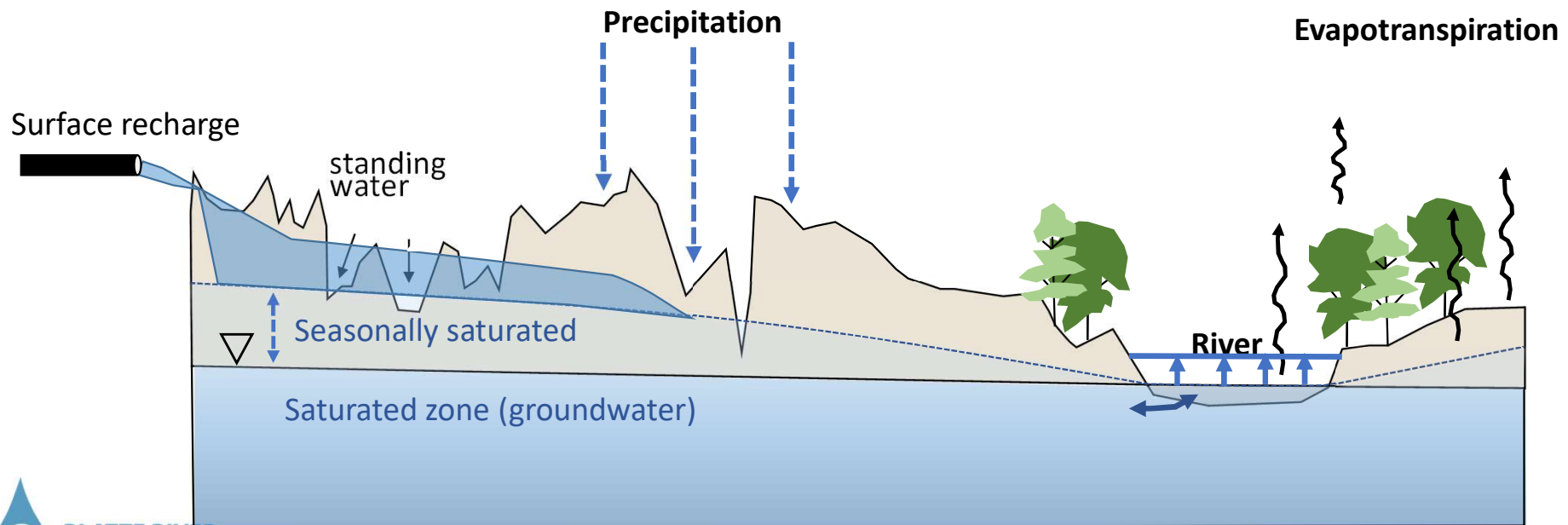
Filled using USGS proxy data



# 1. Quantify hydrological, meteorological, GW, wet meadow relationships

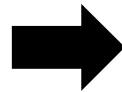
## What controls groundwater levels?

- Precipitation,
- River stage, and
- ET



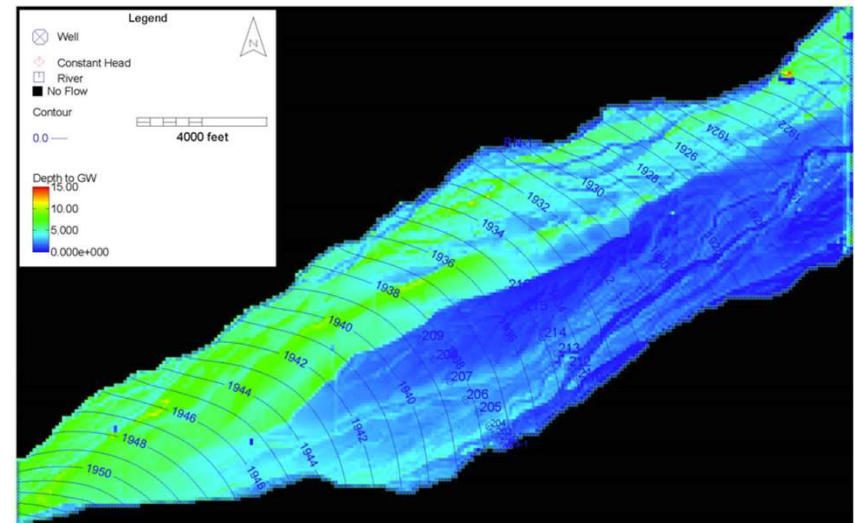
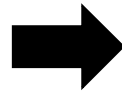
# 1. Quantify hydrological, meteorological, GW, wet meadow relationships

Analytical Models  
(Superposition)



$$s(x,t) = \underbrace{s_0 * \operatorname{erfc}\left(\frac{x}{\sqrt{4\alpha t}}\right)}_{\text{Stage}} + \underbrace{\frac{P}{S}}_{\text{Precip.}} - \underbrace{\frac{ET_{scaled}}{S}}_{\text{ET}}$$

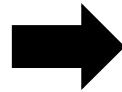
Numerical Models



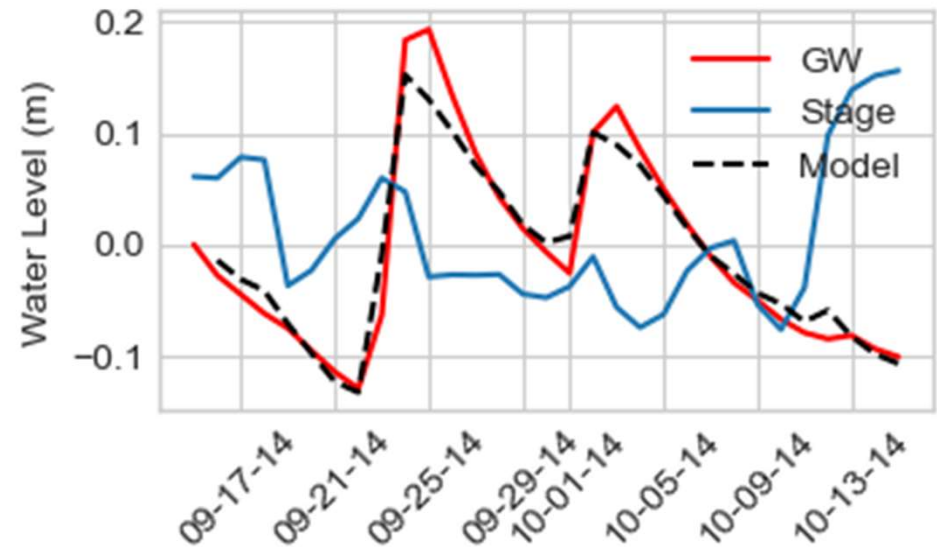
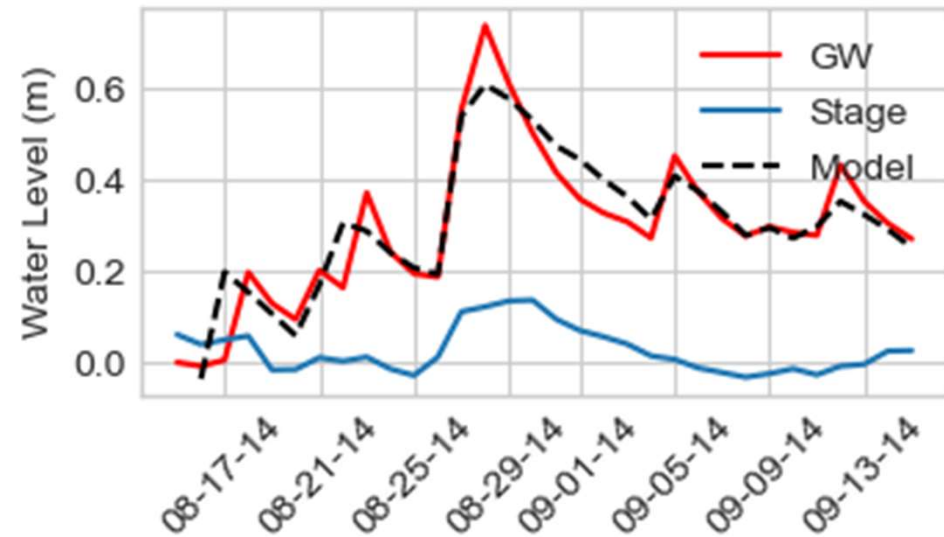


# 1. Quantify hydrological, meteorological, GW, wet meadow relationships

Analytical Models  
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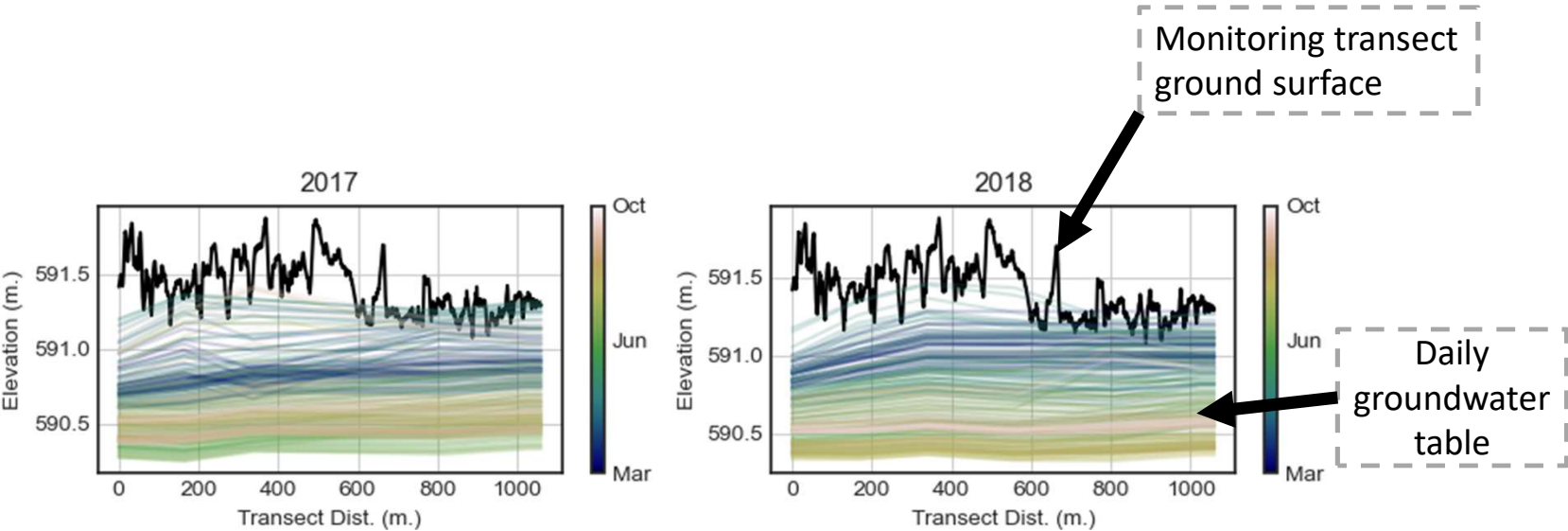
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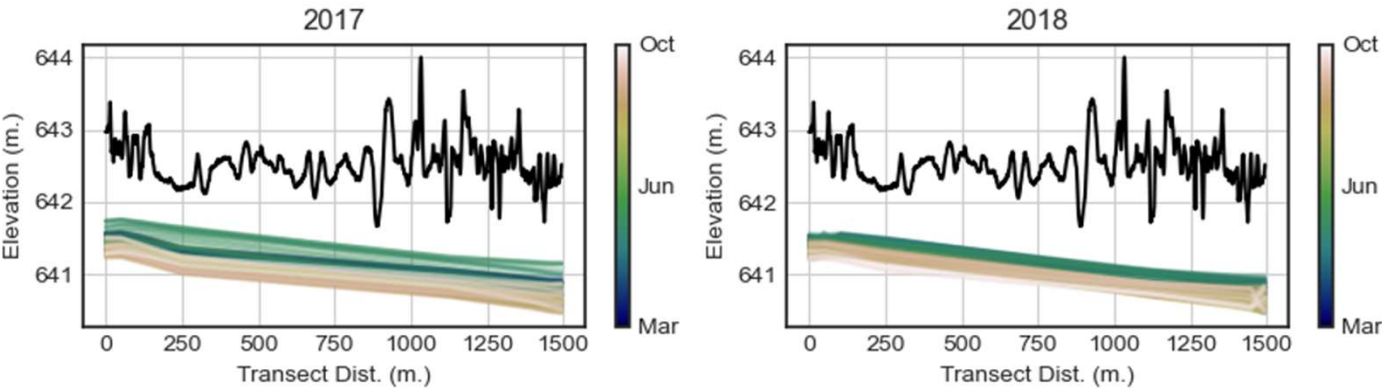
Calibrated models can then be used to predict how management affects groundwater.

2. Draw conclusions about hydrologic regimes of wet meadows

**Shoemaker Island –**  
Native, functioning  
wet meadow site

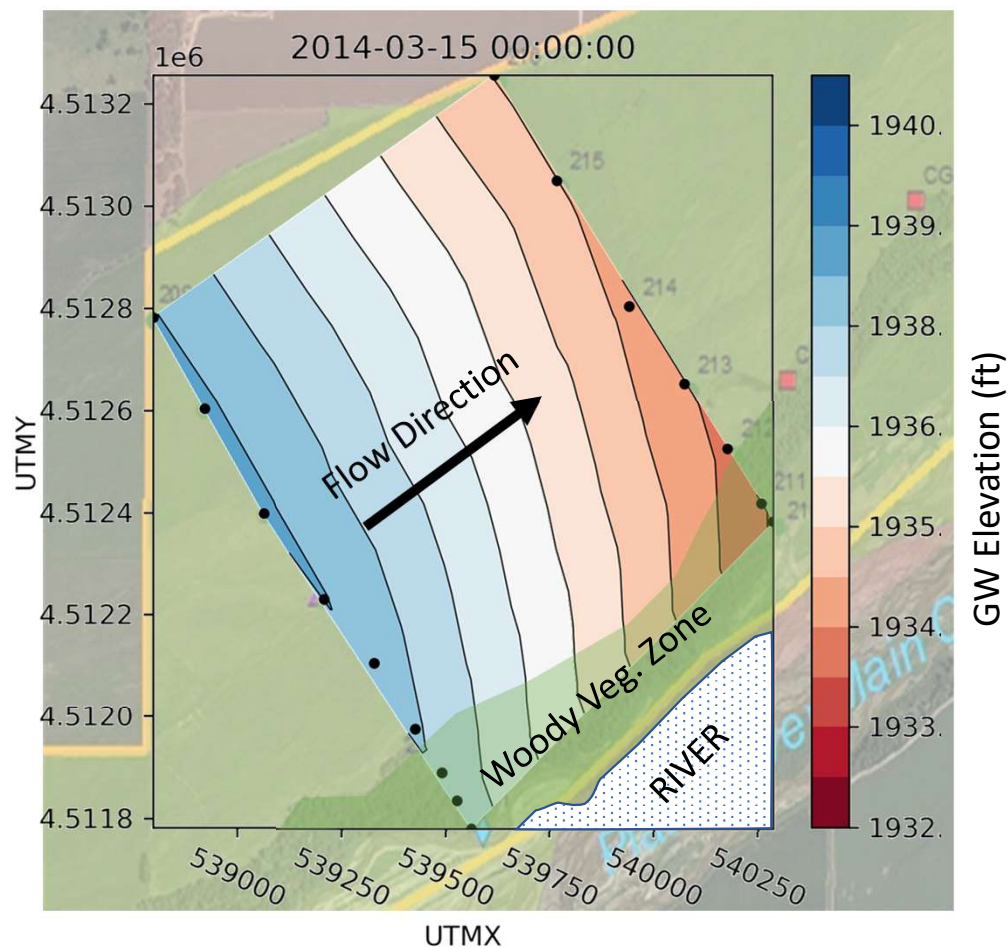
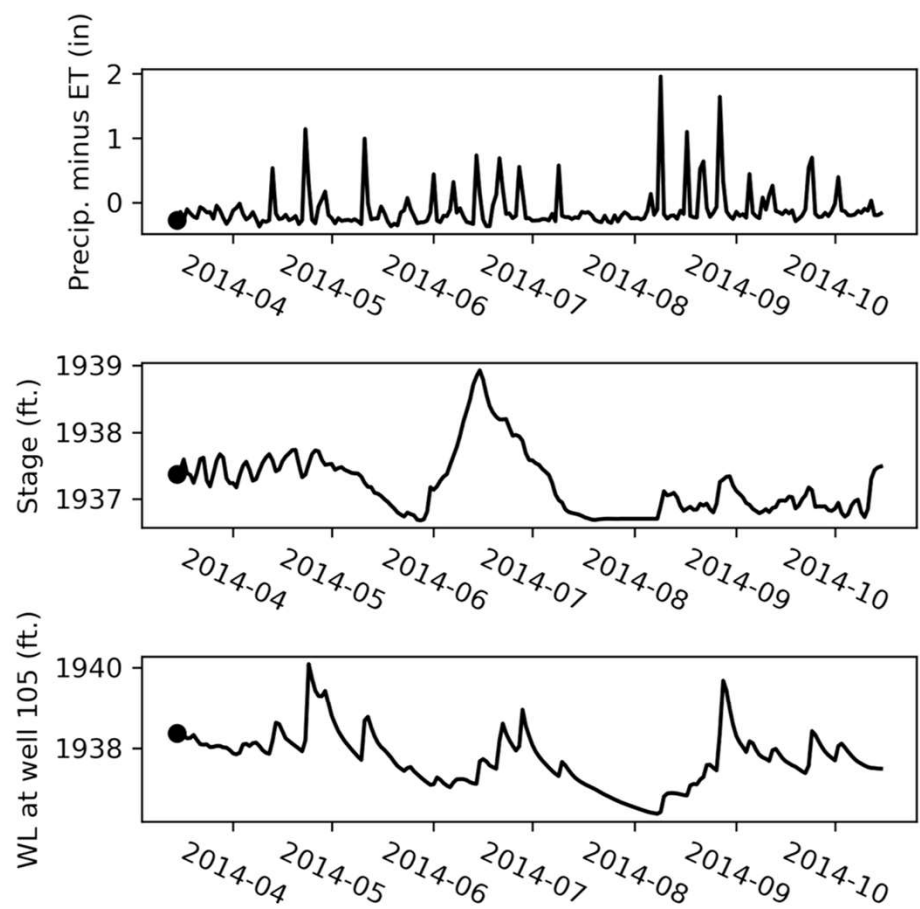


**Fox – Restored wet  
meadow site**



(different y-scale)

## 2. Hydrologic regimes of wet meadows

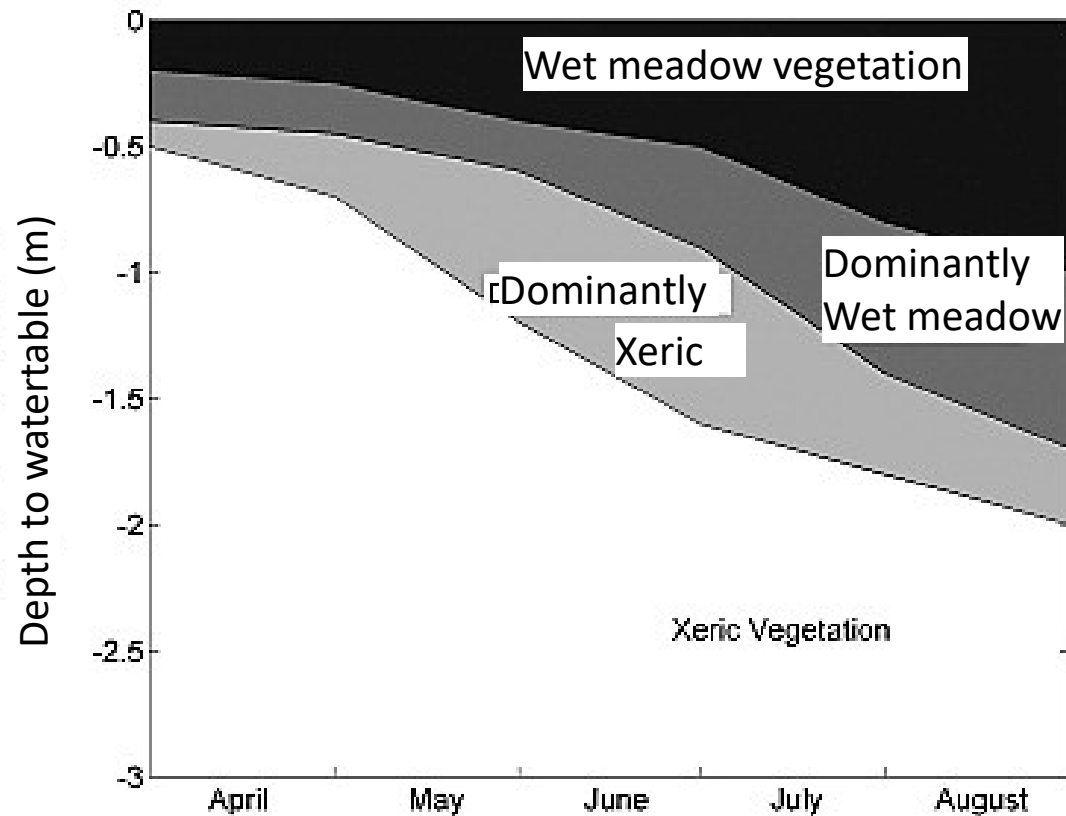




## 2. Draw conclusions about hydrologic regimes of wet meadows

How much would GW levels need to rise at the Fox site to support wet meadow vegetation?

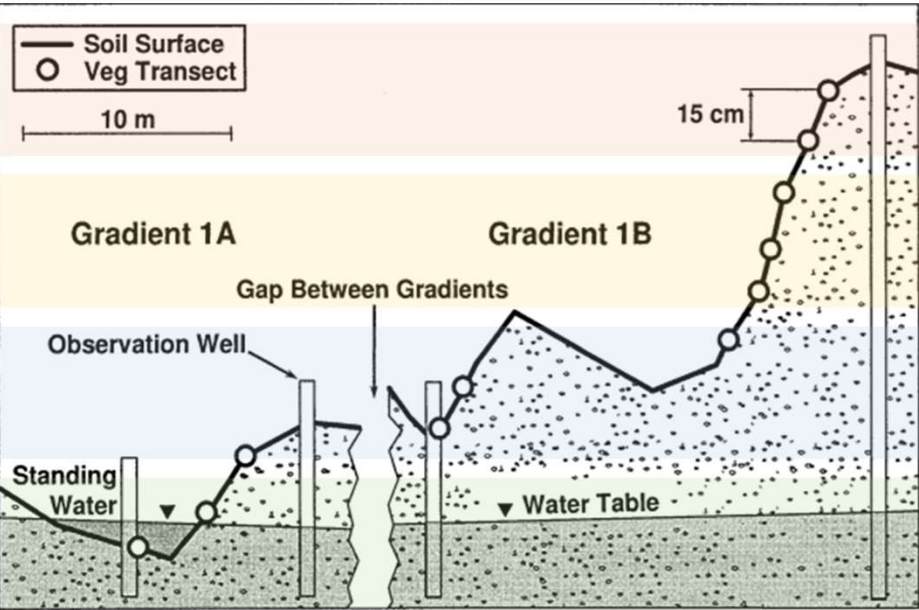
- Determine target groundwater levels using:
  - Studies that link veg. to GW levels
  - Data from Shoemaker wet meadow.



[Loheide and Gorelick, 2007]

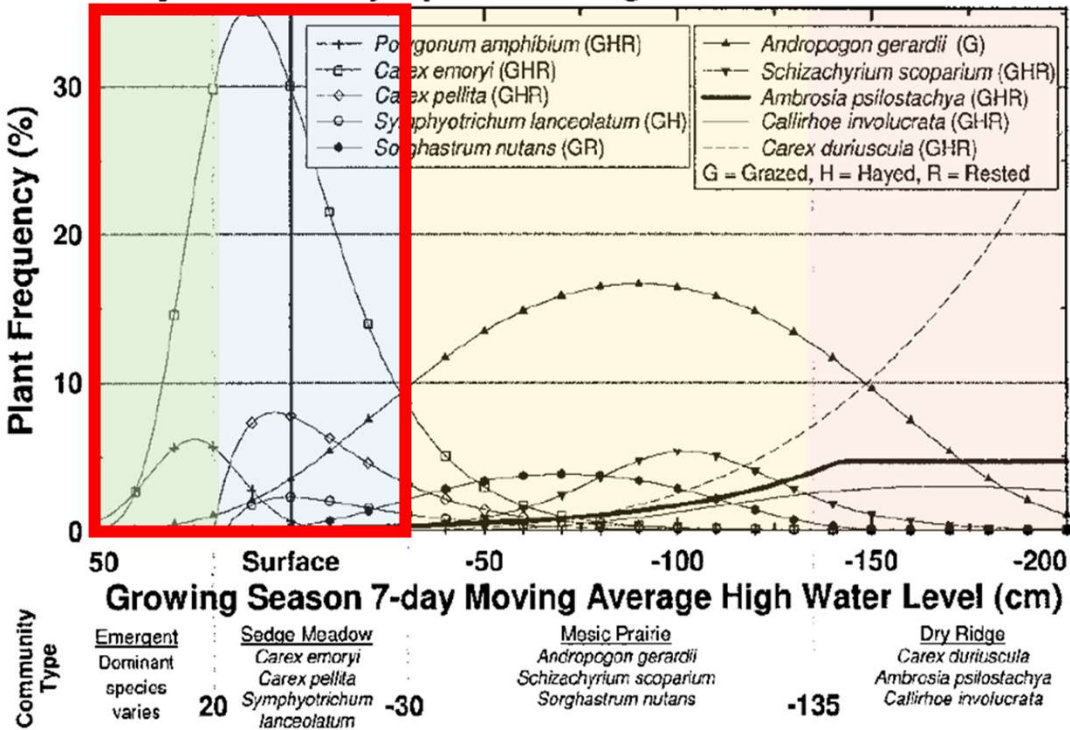
## 2. Draw conclusions about hydrologic regimes of wet meadows

[Henszey et al., 2004]

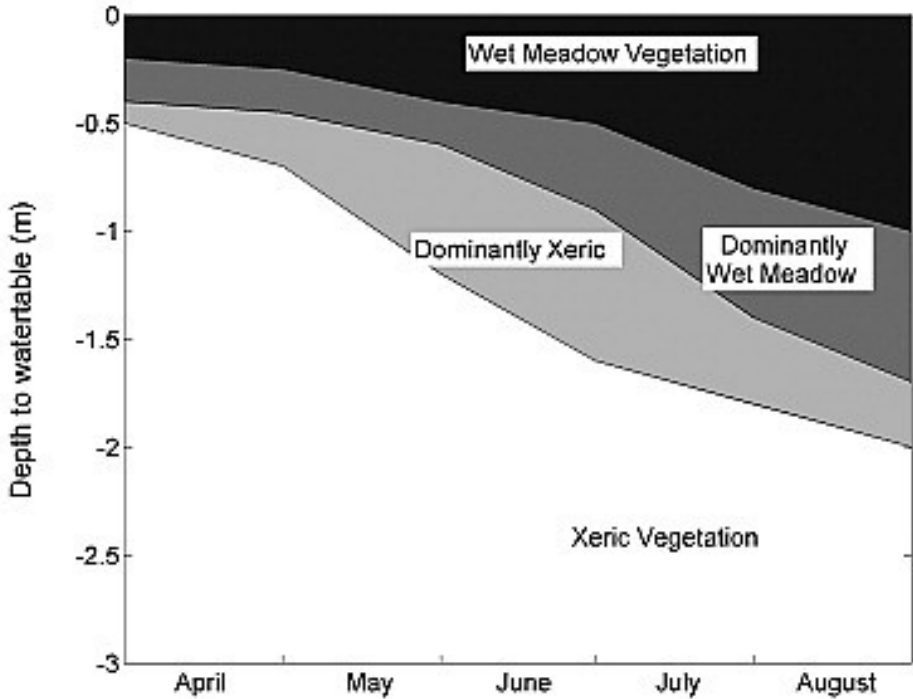


- Dry Ridge
- Sedge Meadow
- Mesic Prairie
- Emergent

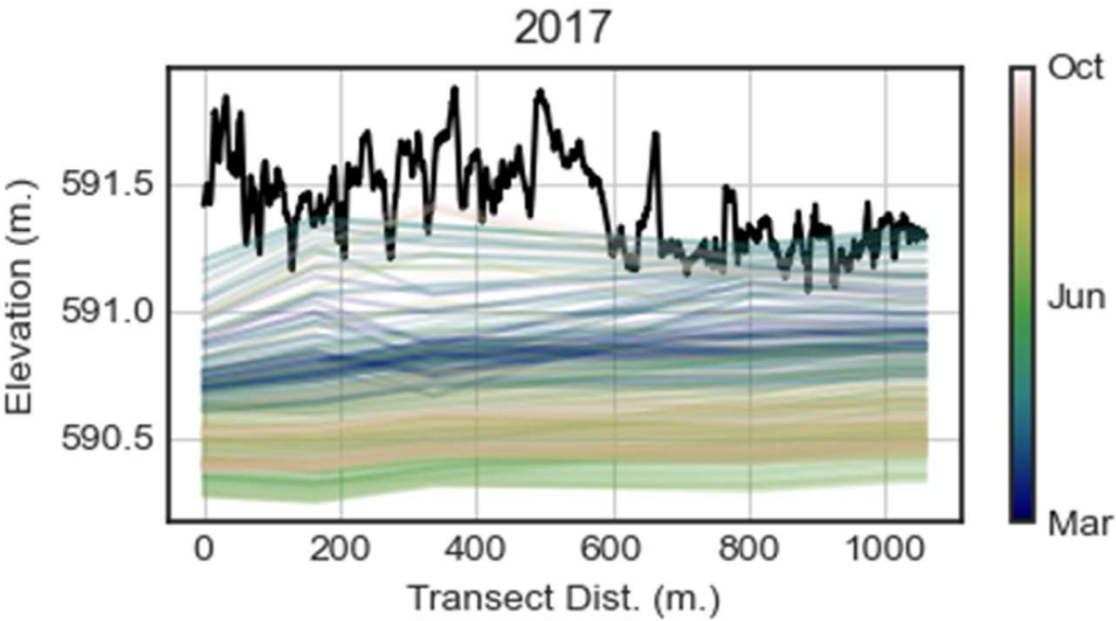
Key Community Species along a Water-Level Gradient



2. Draw conclusions about hydrologic regimes of wet meadows

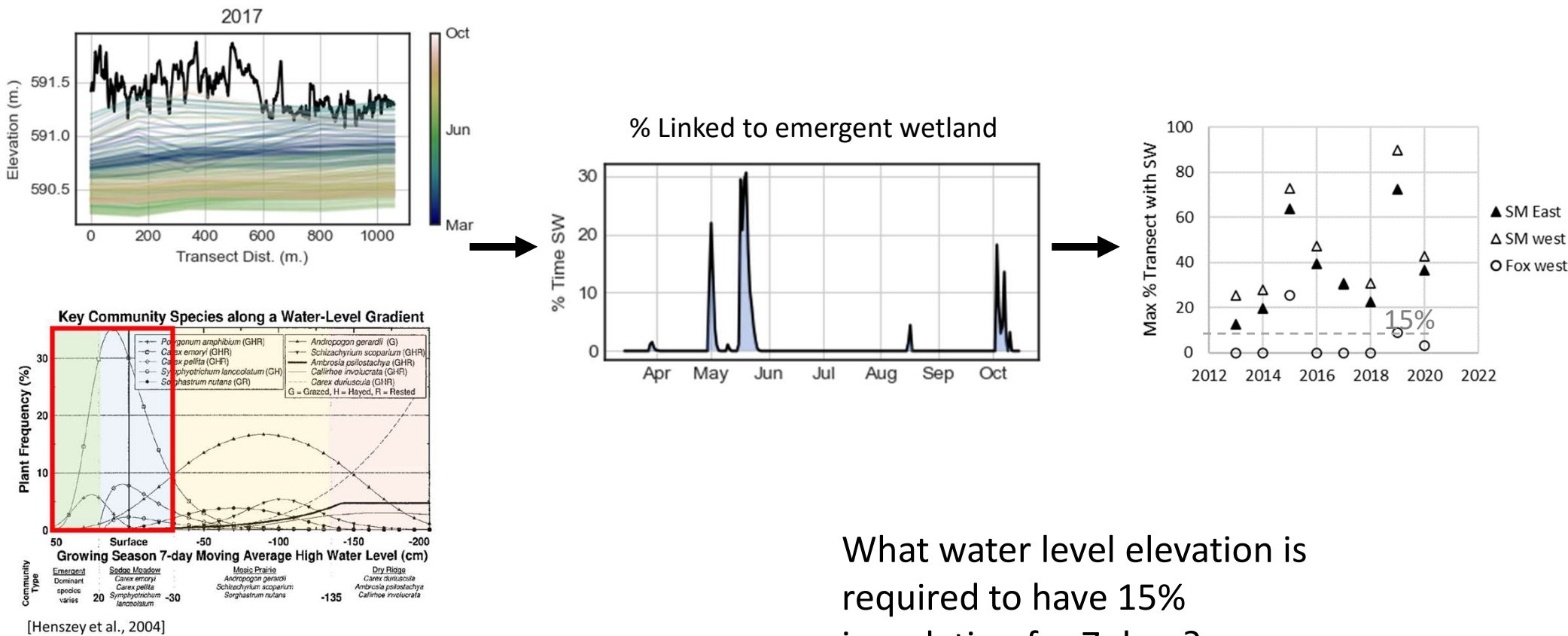


[Loheide and Gorelick, 2007]





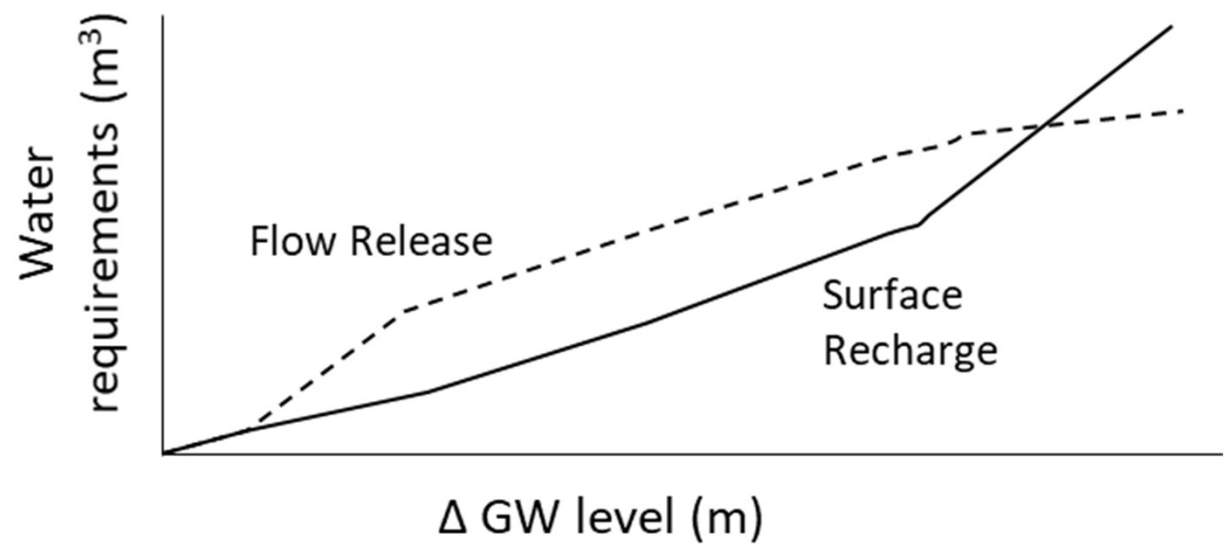
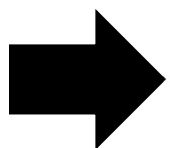
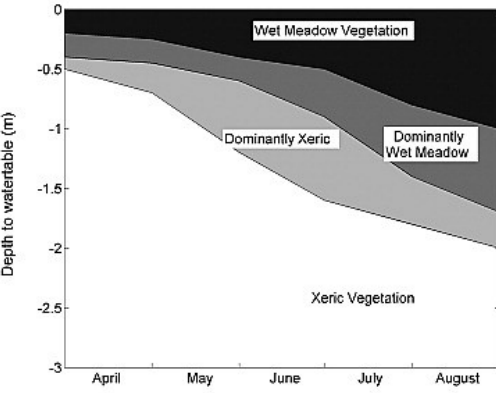
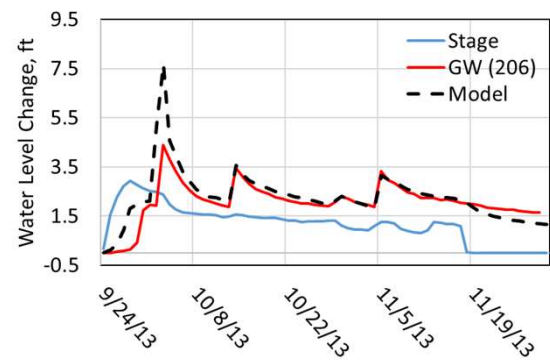
## 2. Draw conclusions about hydrologic regimes of wet meadows



What water level elevation is required to have 15% inundation for 7 days?

Next steps - Develop a tool to support management at wet meadow sites

- Use calibrated models to test management scenarios



**Goal: advance our understanding of wet meadow hydrology to support management.**

What we've done:

- 8+ years of data
- QC
- Management needs
- Preliminary models and hydrologic targets

What's to come:

- Models
- Hydrologic targets
- Tool
- Learn something





Questions?