



Wet meadow hydrology

TAC Presentation
October 2021
By: Kristen Cognac

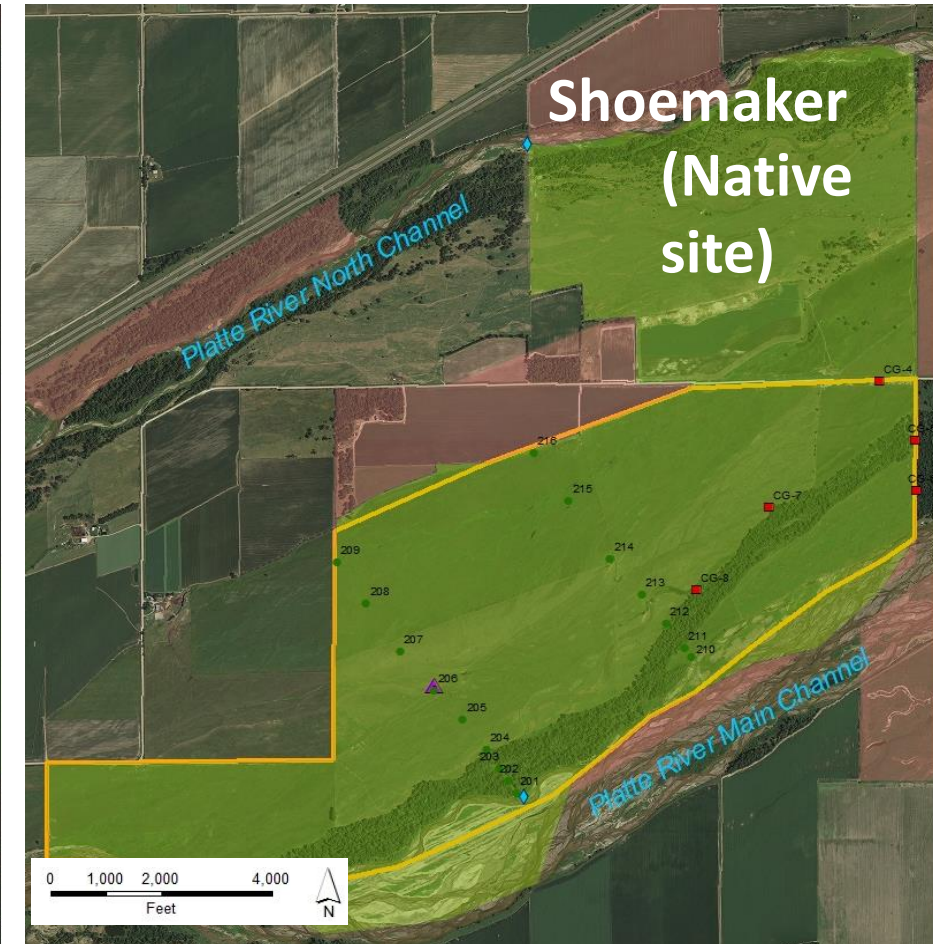
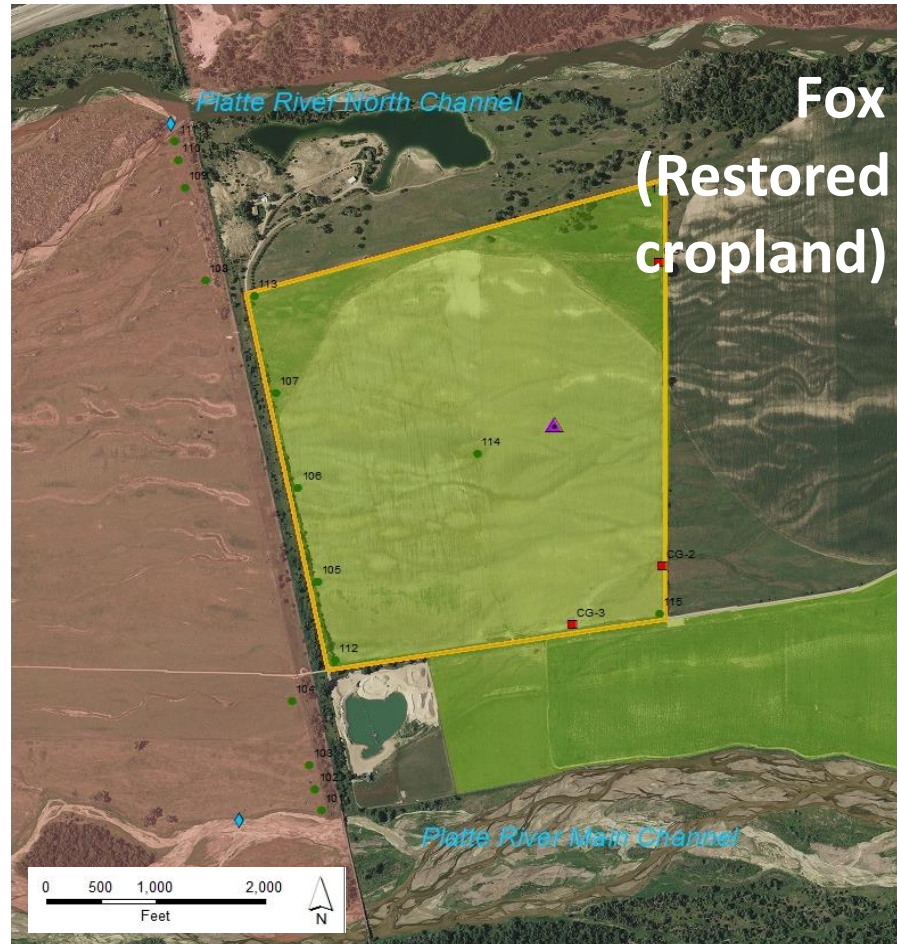
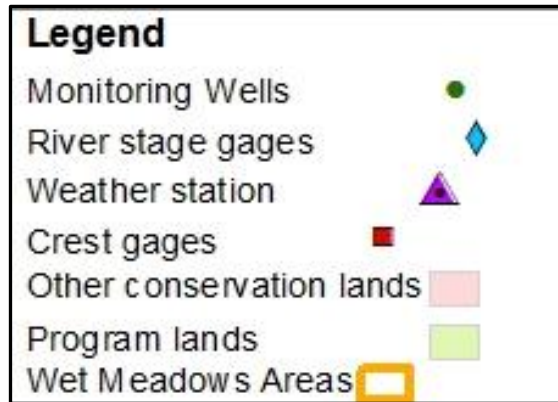
Background

- Restoration and maintenance of wet meadows have been long-term priorities for PRRIP.
- Wet meadow hydrology
 - Shallow groundwater (GW) levels are essential for vegetation and ecosystems.
- Management :
 - Controls for shallow GW levels?
 - Efficient strategies (e.g. cost, water-use)?



Background

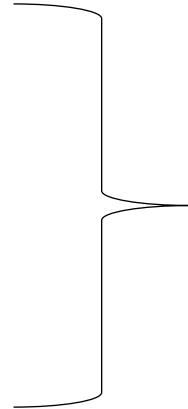
Hydrological and climatological monitoring at the Fox and Shoemaker wet meadow sites.



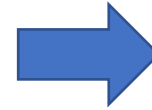
Wet Meadow Data

Hourly time series for hydrologic and climatological variables:

- River Stage
- GW Elevation
- Weather and ET
- Soil Moisture
- Crest Stage



March 2013 to
August 2021

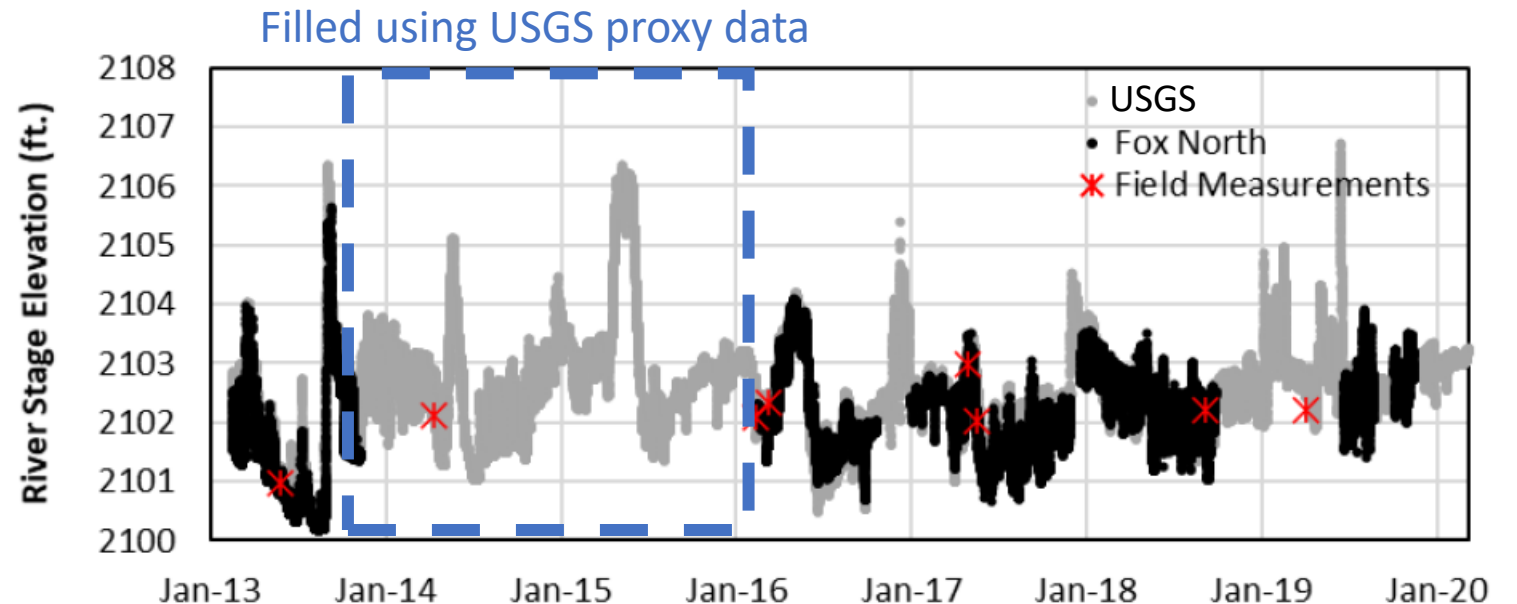


> 8000 data values
per year per
measurement station

Wet Meadow Data - QC

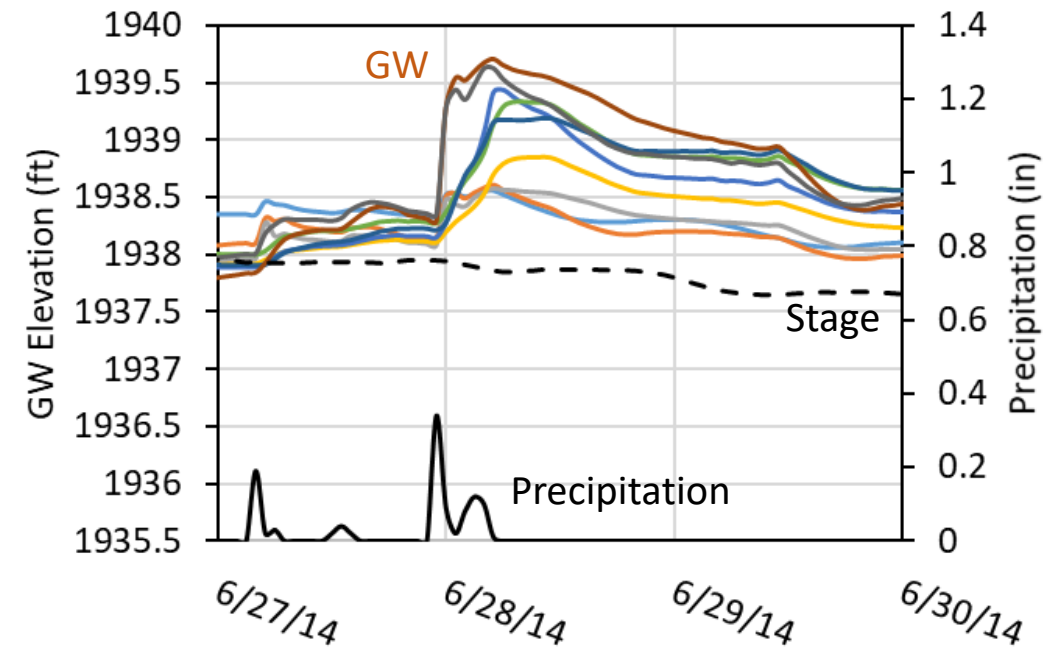
- **Data QC** – to ensure data meet high-quality standards prior to analysis.
- **QC Criteria** – Accurate in time and space, absent of gaps.
- **Major Issues** – disturbances, gaps, insufficient validation, sensor issues.
- **Corrections** - removal, shifting, and filling gaps

USGS data aided in
QC and filling gaps



Wet Meadow Hydrologic Study

Next step - Design a study that informs the understanding and management of wet meadow sites.



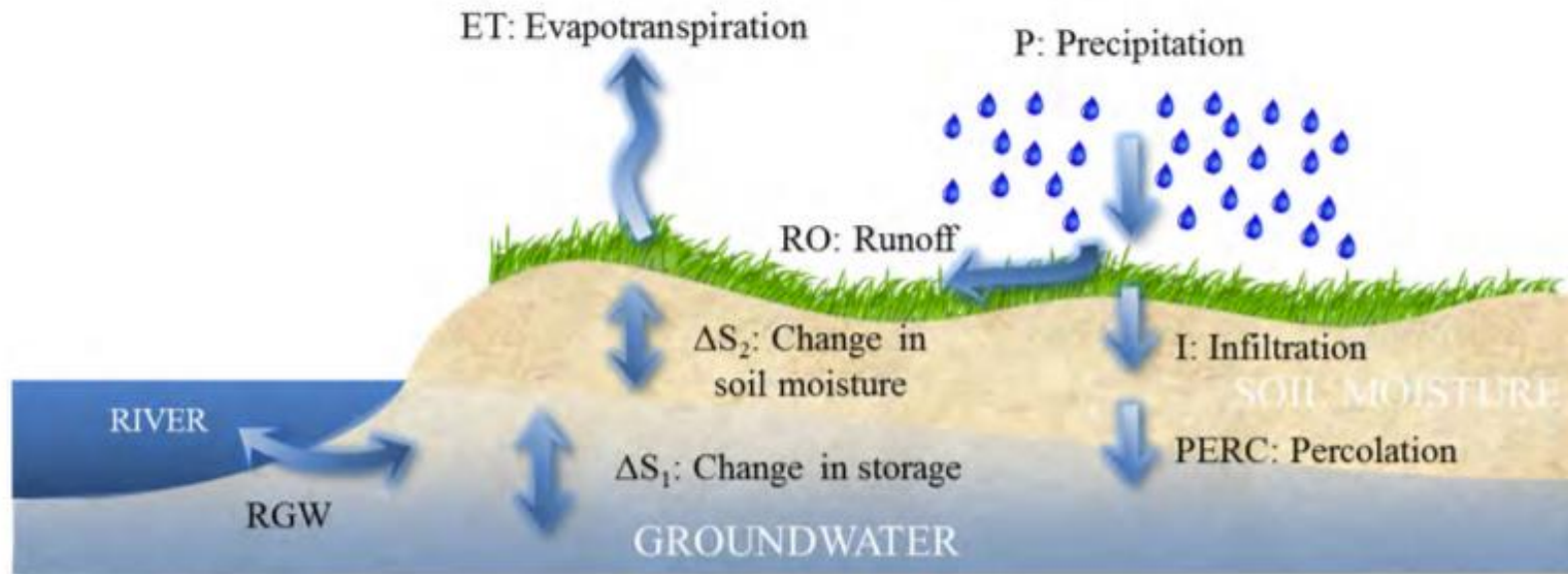
Proposed study objectives

1. Develop models that quantify relationships between hydrological and meteorological variables and groundwater levels at a natural wet meadow site (Shoemaker).
2. Develop hydrological management targets using data from the natural wet meadow site that can be applied at other sites.
3. Develop a tool that helps us understand wet meadow hydrology to inform management decisions.

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

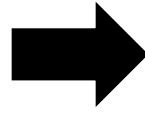
Primary controls at wet meadow sites to groundwater water levels.

- Precipitation,
- River stage, and
- ET



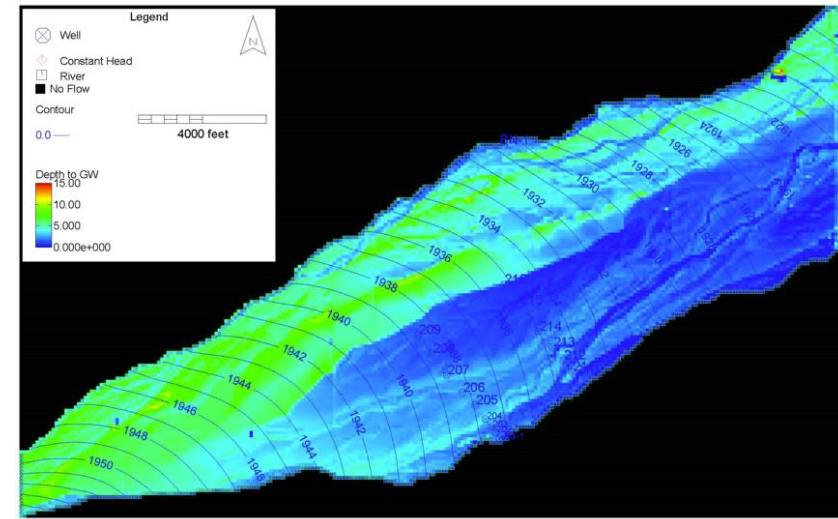
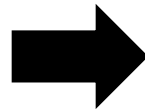
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Analytical Models (Superposition)



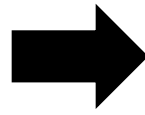
$$S_{(x,t)} = \underbrace{s_0 * \text{erfc}\left(\frac{x}{\sqrt{4\alpha t}}\right)}_{\text{Stage}} + \underbrace{\frac{P}{S}}_{\text{Precip.}} - \underbrace{\frac{ET_{scaled}}{S}}_{\text{ET}}$$

Numerical Models

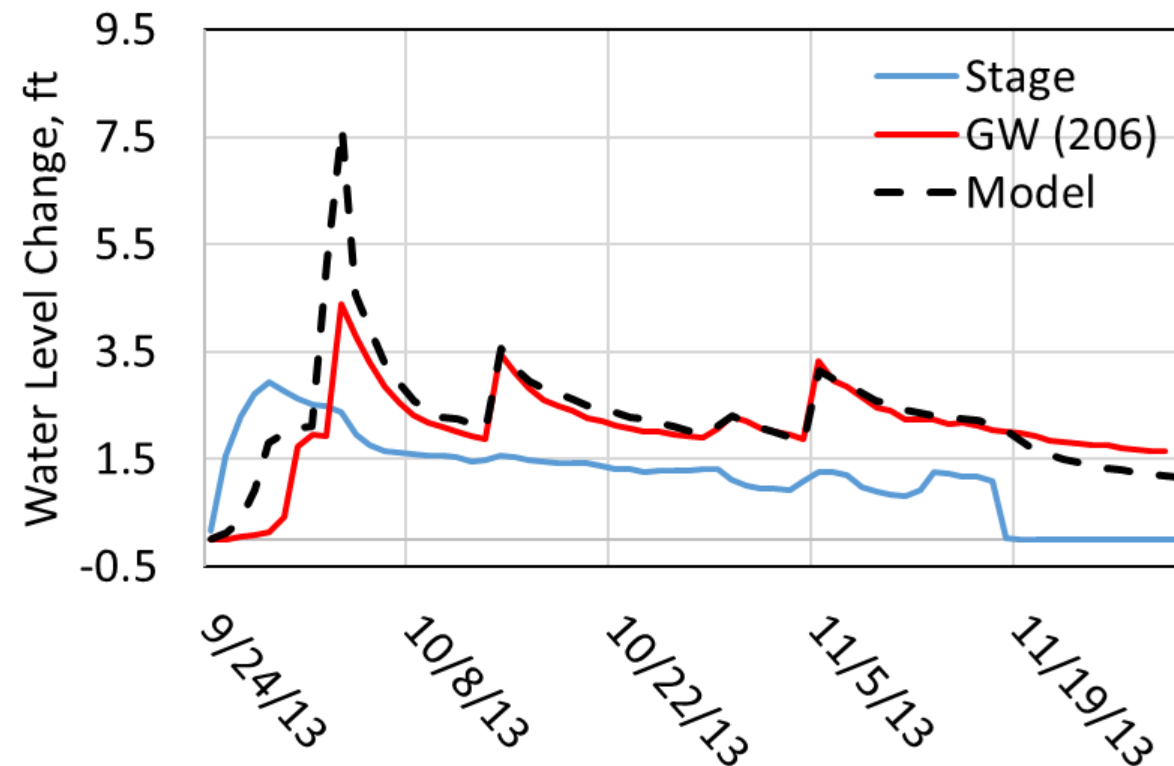


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Analytical Models
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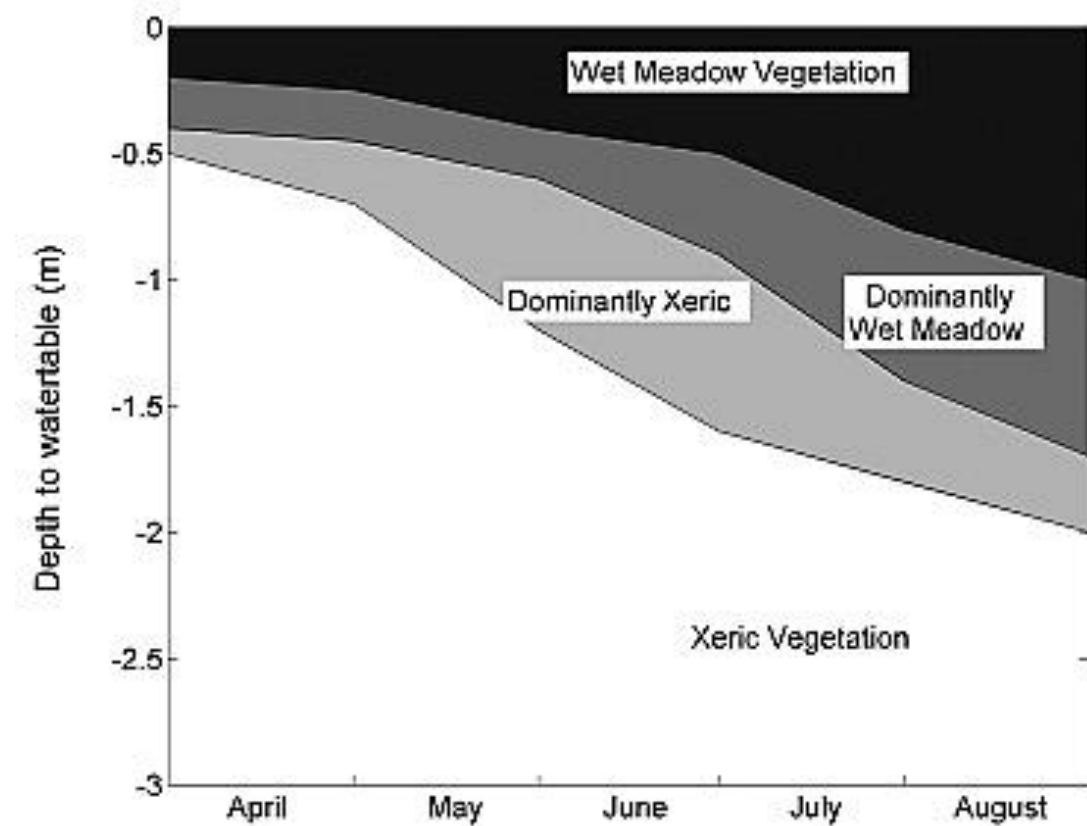


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2. Determine hydrological management targets

- Extract statistics from Shoemaker wet meadow
- Publications on wet meadow vegetation - groundwater relationships
- Hydrological targets
 - Depth to water
 - Duration / timing
- Ridge swale topography

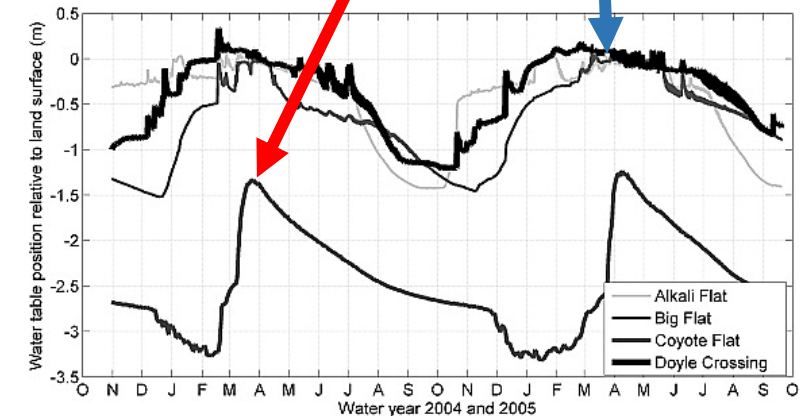
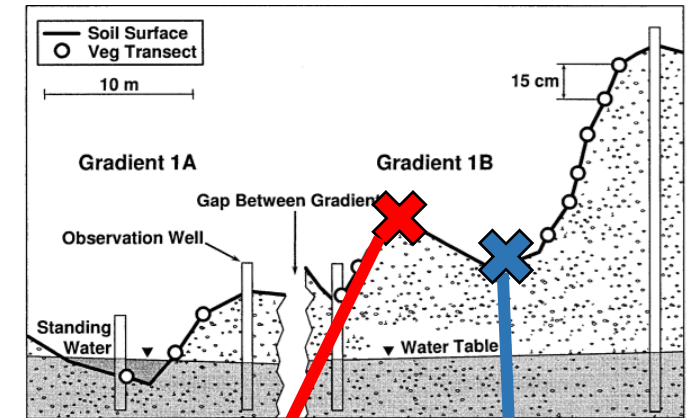


[Loheide and Gorelick, 2007]

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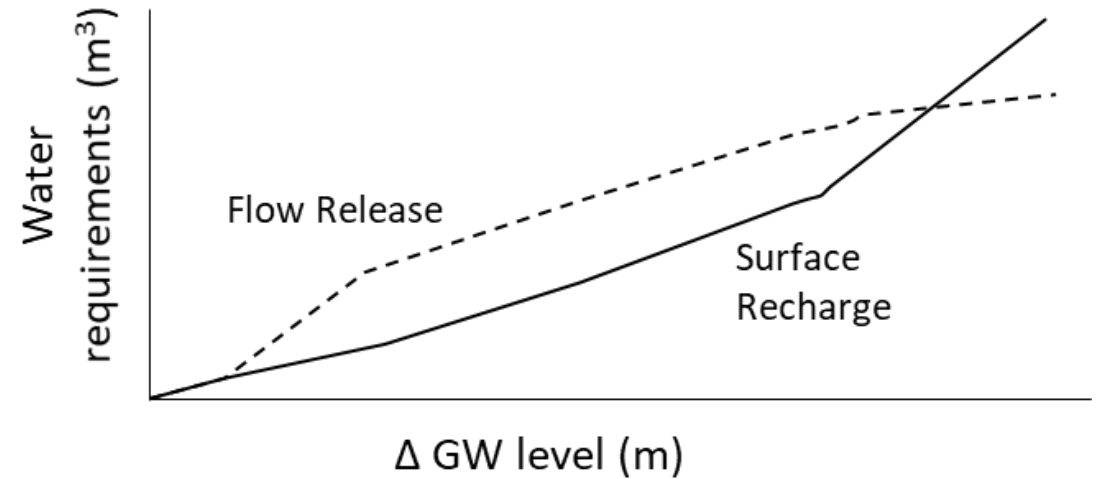
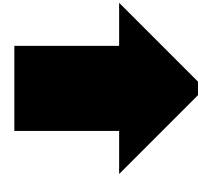
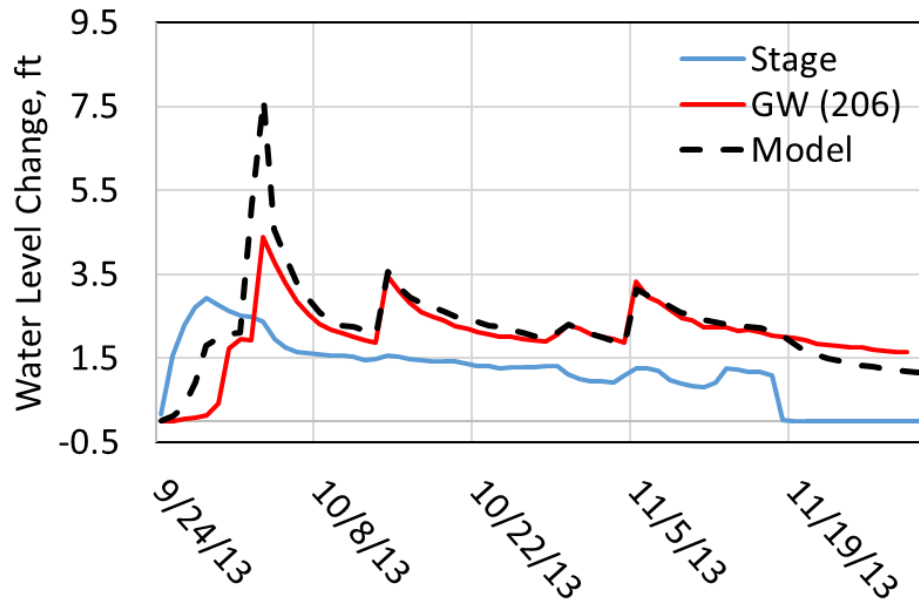
[Henszey et al. 2004]



[Loheide and Gorelick, 2007]

3. Develop a tool to understand wet meadow hydrology / mgmt.

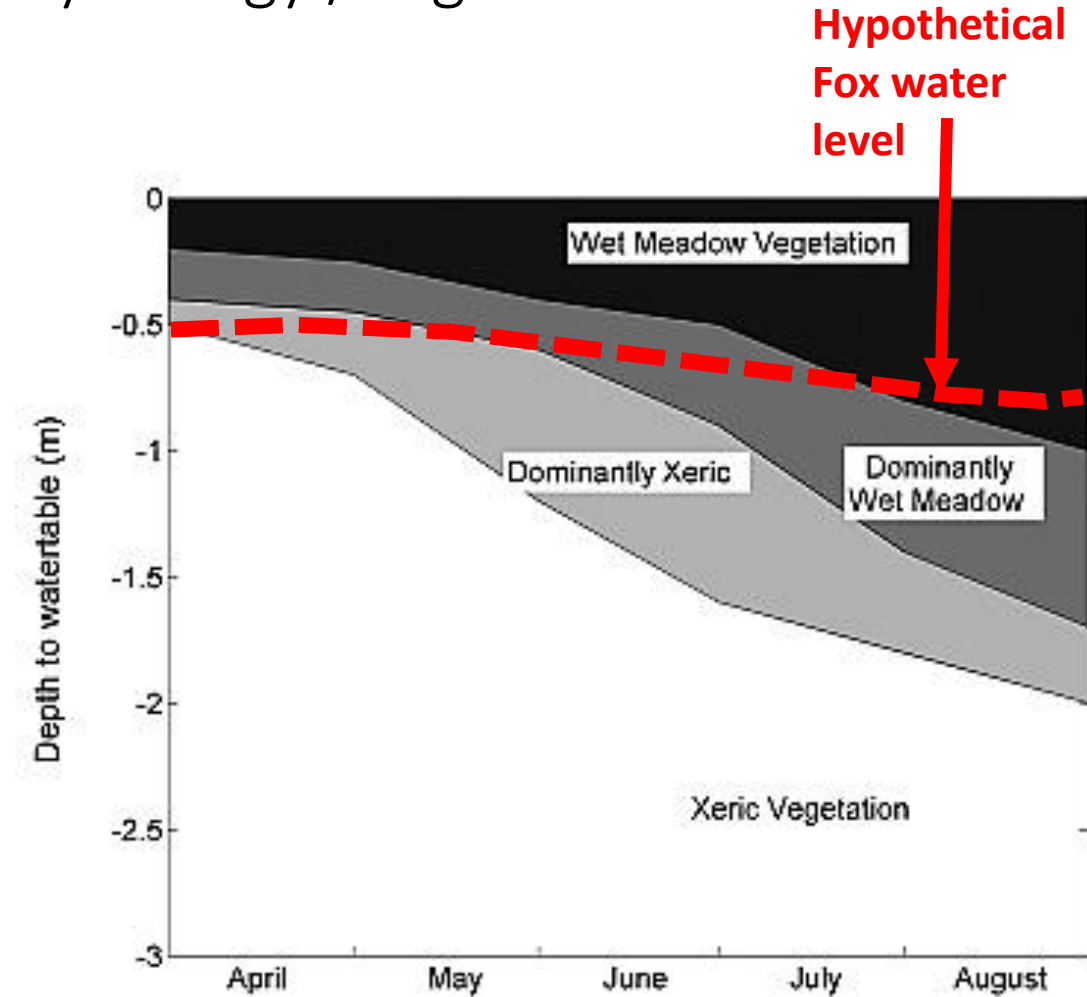
- Use calibrated models to test management scenarios



3. Develop a tool to understand wet meadow hydrology / mgmt.

Test method using data from Fox site.

Calculate surface water and bank infiltration water requirements for raising groundwater levels to targets.

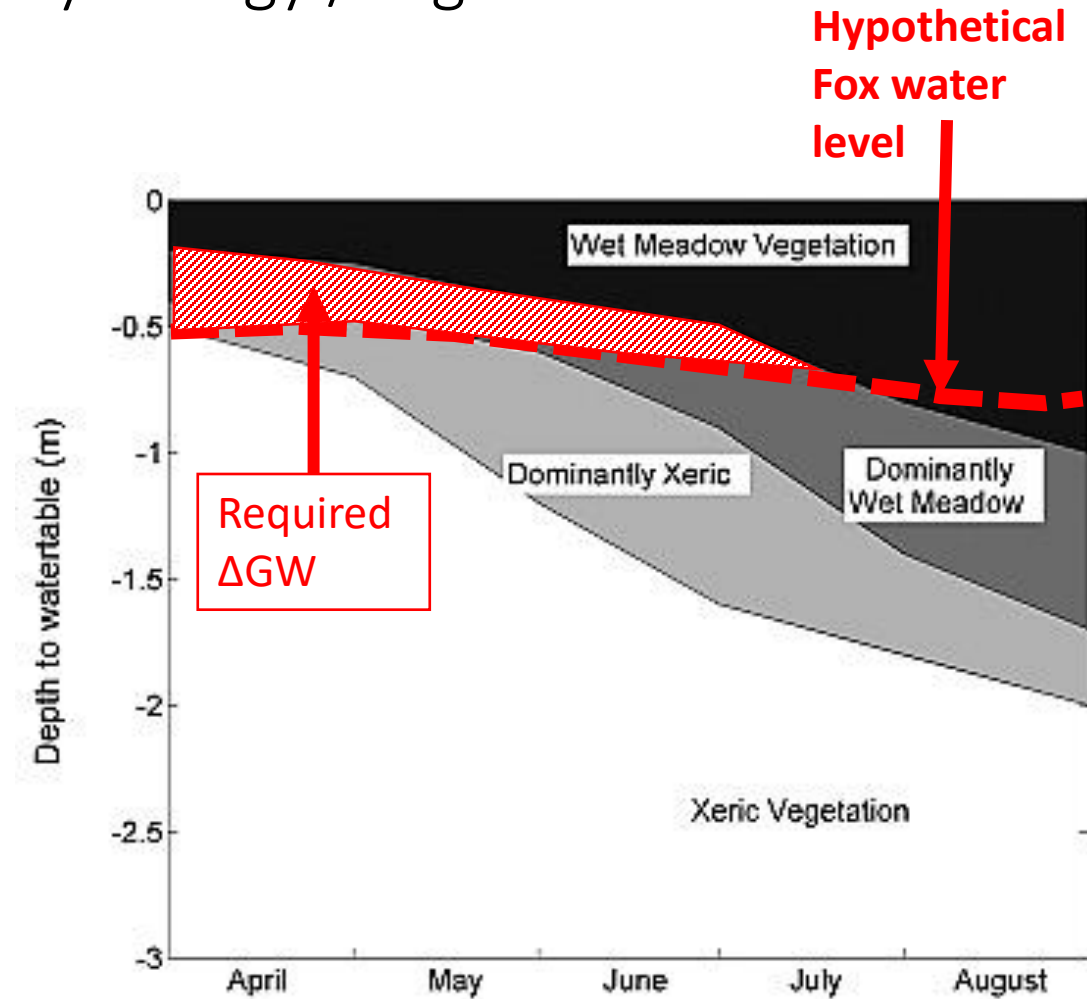


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Proposed study approach

