WET MEADOW HYDROLOGIC STUDY

Program Context: Within the Central Platte River Valley (CPRV), the benefits of preserving and restoring wet meadows have been recognized by scientists and conservationists for decades (e.g. U.S. Fish and Wildlife Service, 1981). While the Program's focus on wet meadows has shifted through time in response to the limited use of central Platte wet meadows by whooping cranes (Howlin and Nasman, 2017), effective management and preservation of wet meadow remains a key objective. Uncertainty remains about the connection between Program flow management activities and wet meadow hydrology. Existing literature suggests that saturation, inundation, and/or shallow groundwater during the months of April-June are driving factors behind wet meadow vegetation persistence, but few studies have definitively linked groundwater levels and decision-making (Wesche et al., 1994). For the past 8-years, the Program has collected hydrological and meteorological data from wet meadow sites to improve the understanding of controls and characteristics of wet meadow hydrology to support management of wet meadow sites. Extension Big Question #10 and the corresponding wet meadow hydrology study is a carryover item from the First Increment. The learning objectives for this study are:

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

Looking Back: Two Program managed wet meadow tracts, Shoemaker Island and Fox, provide the extensive spatiotemporal data coverage necessary for tackling these objectives, with nearly continuous stage, precipitation, ET, and groundwater level measurements throughout the 8-year study period. Their distinct site histories also enable comparisons of hydrologic regimes between native and restored wet meadows. Over the last year, field data collection continued as more than 140,000 existing measurements were subject to a QC process that enhanced the quality and completeness of the wet meadow data set. A new outline of study methods was developed and presented to the GC in late 2021, and has since been adopted, with associated data analysis and modeling in progress.

Preliminary Results: Distinct hydrological differences exist between the two wet meadow study sites. We focused on groundwater depth, which is directly linked to presence of wetland vegetation and strongly associated with wet meadow function. The Fox site had consistently deeper groundwater tables along monitoring transects and recorded standing water at lesser spatial and temporal extents than the Shoemaker site. We incorporated LIDAR topography data to overcome challenges associated with spatiotemporal variations in groundwater depth. **Figure 1** presents groundwater level and topography data for the 2017 growing season at the two sites, highlighting key differences in depth and inundation dynamics.

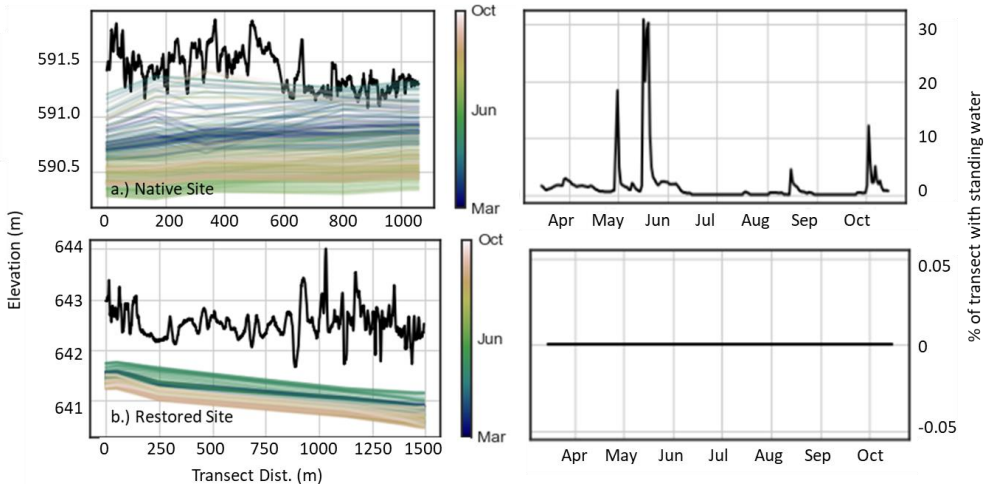

Figure 1 – Left: Mean daily water tables (colored lines) in relation to ground surface (black line) during the 2017 growing season at a.) Shoemaker and b.) Fox wet meadow sites. Right: Corresponding plots showing the daily percentage of monitoring transects that record standing water.

We also developed analytical models that can be used to predict groundwater levels at wet meadow sites. Models incorporate the groundwater changes due to stage, evapotranspiration, and precipitation. Preliminary results show relatively accurate groundwater level predictions, particularly during summer and fall months (e.g., **Figure 2**). Soon, calibrated models will be used to predict the effects of different management strategies on wet meadow water levels. Ultimately, we expect models to reveal useful insights about controls of wet meadow hydrology.

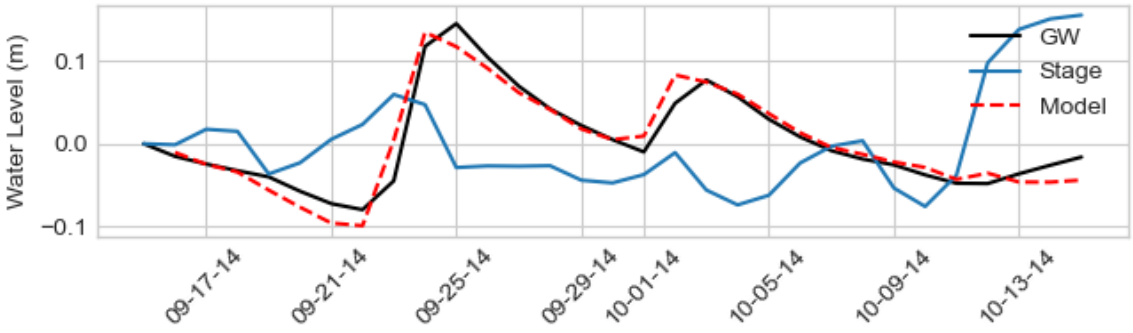

Figure 2 – Example of measured groundwater (GW) and modeled groundwater (Model) level results from a tested analytical model.

Looking Forward: The ability to make predictions about how different management strategies can benefit wet meadow hydrology has been identified as a distinct need for managers of wet meadow sites. Using models and hydrologic reference information from Objectives 1 and 2, we'll develop a tool that managers throughout the CPRV can use at wet meadow sites to inform hydrologic targets and test management options.

REFERENCES

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