

Analyzing Land Use Effects on Recharge through Playas to the High Plains Aquifer

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Background

Playas are ephemeral wetlands where recharge rates to the HPA are one to two orders of magnitude higher than the interplaya.¹ Recharge through playas is increasingly important as groundwater levels in the HPA have dropped 15.2 – 30.5 m (50 – 100 ft.) in Groundwater Management District 1 (GMD1) in Western KS since the 1950s.² However, playas have experienced severe degradation due to farming which may compromise the magnitude of recharge through playas.^{3, 4}

Research Question

- Which characteristics of playas including land use result in the greatest recharge to the HPA?
- It is hypothesized that natural playas recharge water to the HPA at higher rates than playas with modified land uses due to changes in soil structure and sedimentation.

Methods

This Poster

- Core and groundwater sampling to determine recharge rates
- Geospatial Analysis using ArcGIS to determine playa characteristics in the selected study sites over time

Related Analyses

- Ecological Surveys to determine playa impairment
- Shallow core collection to determine sedimentation rates
- Yield map geospatial analysis to determine the cost-benefit of farming through playas
- Hydrologic models to extend field recharge measurements to other playas

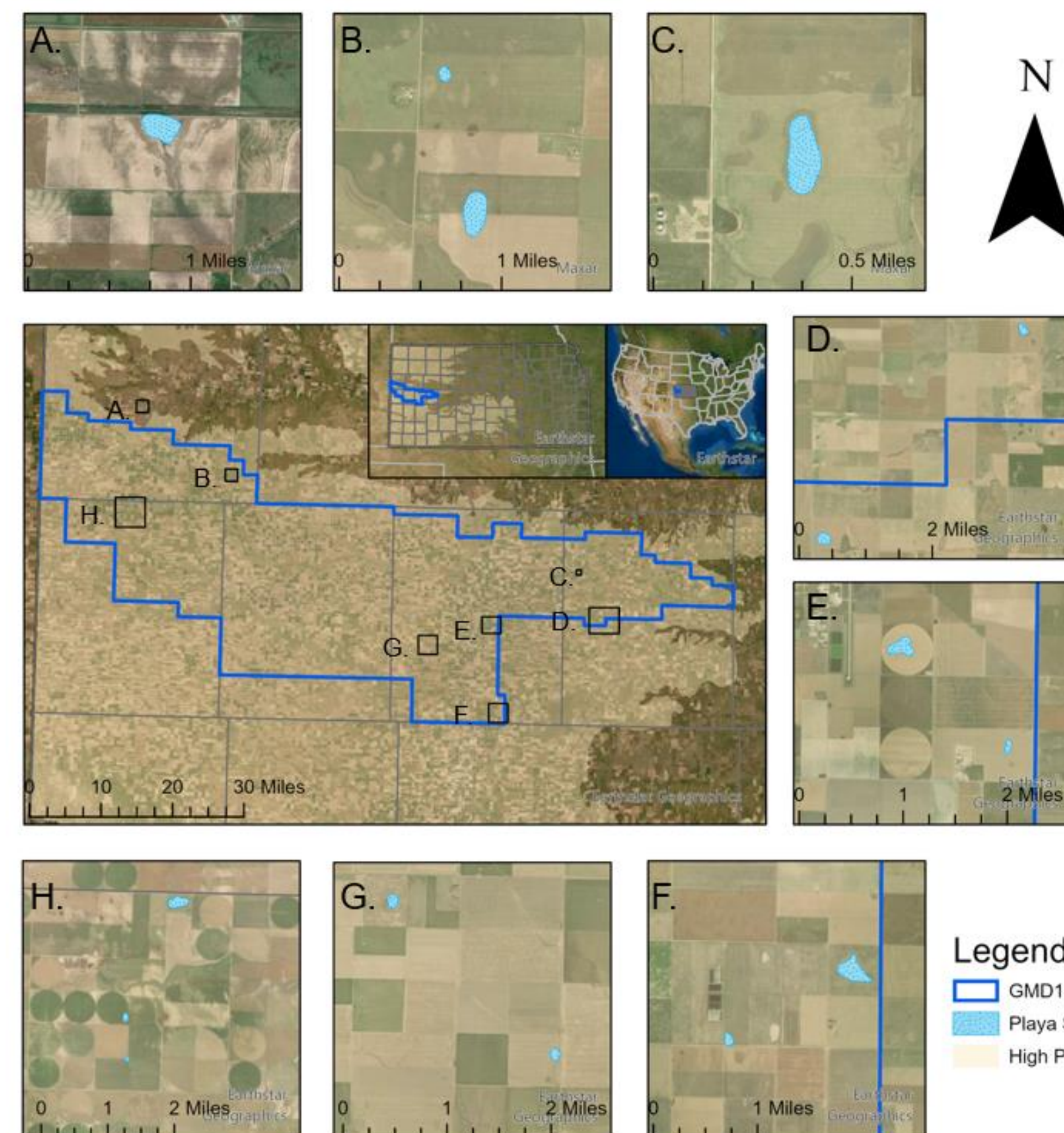


Fig. 1. In GMD1, 15 study sites were selected. The study sites represent a range in characteristics including size, depth to water, and land use.

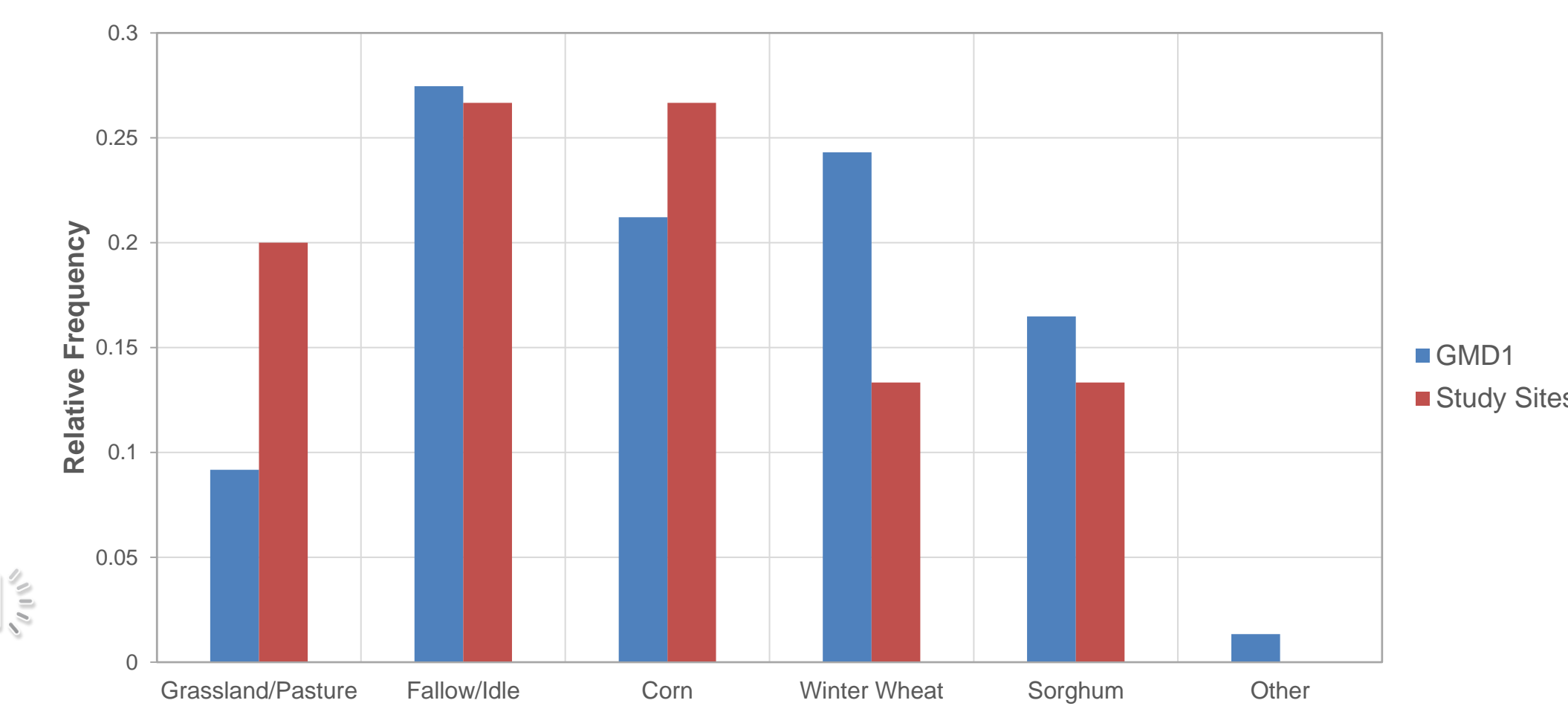


Fig. 2 (top). This photo was taken at the center of a playa looking towards the annulus. **Fig. 3 (bottom).** The study sites selected represent the land use within all playas in GMD1 in 2020. Source: USDA CropScape- Cropland Data Layer

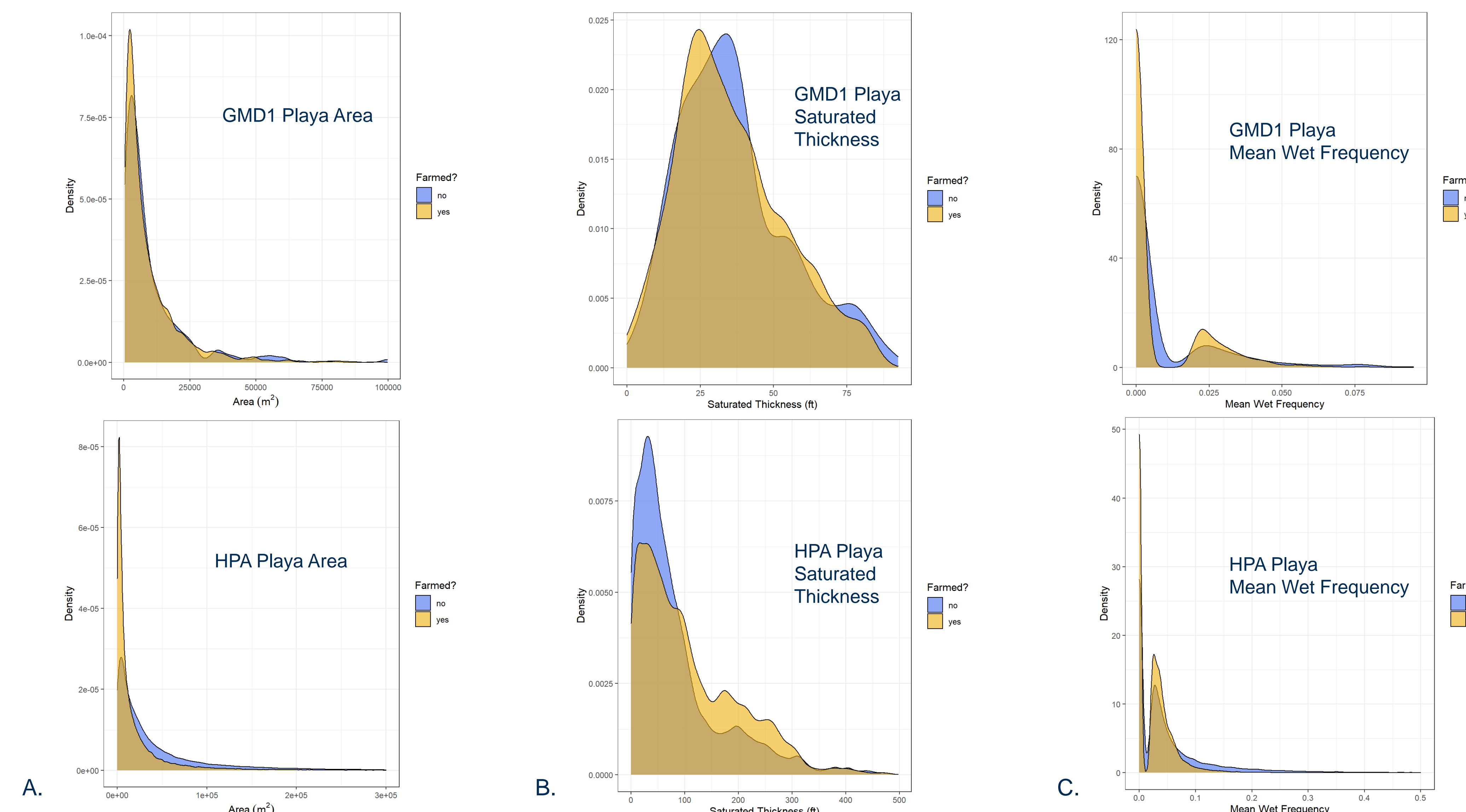


Fig. 4. Farming through playas affects several of their characteristics. Panel A compared areas of the farmed vs. unfarmed playas in GMD1 (top) and all playas on the HPA (bottom). Panel B compared the saturated aquifer thickness beneath farmed and unfarmed playas in GMD1 (top) and all playas on the HPA (bottom). Panel C compared mean wet frequency of the farmed vs. unfarmed playas in GMD1 (top) and all playas on the HPA (bottom). Source: PLJV Probable Playas dataset across GMD1 (n = 3,725) and the HPA (n = 71,847)

Results

- The study sites selected represent a range in playa characteristics across GMD1 including area, land use, and depth to water.
- The most common land uses within playas in GMD1 are fallow, winter wheat, corn, sorghum, and grassland. The selected study sites represent GMD1.
- Playa characteristics in GMD1 including area, saturated thickness, and mean wet frequency have some variations compared to probable playas across the HPA.

Future Work

- For the next year, deep core will be collected in additional playas varying in size and land use.
- Compiling recharge, sedimentation, biological diversity, and land use will determine the characteristics of playas most critical for recharging the HPA.

Acknowledgements

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