

Integrating Ecological and Social Dimensions for Long-Term Playa Wetland Conservation

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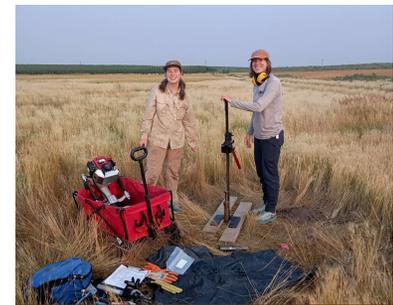
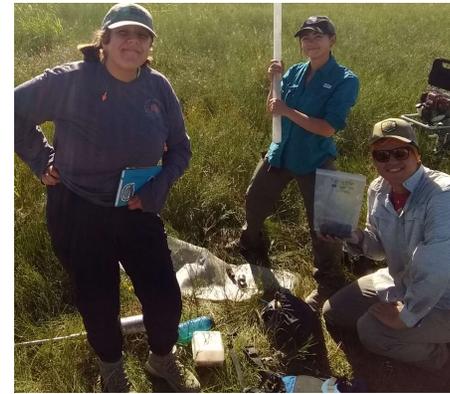


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COLORADO STATE UNIVERSITY



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- USDA and Local FSA offices
- Landscape Modeling Lab
- USDA project grant collaborators
- Private landowners



Project Overview

Surface water model

Data summaries

Key takeaways, future work

1 Study area

2 Data collection

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Does CRP wetland restoration affect wetland flooding?

?

Does sharing data affect landowner perceptions of wetland restoration?

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Wetland surface temperature, soil carbon, & greenhouse gas emissions



¡Vamos a la playa!



¡Vamos a la playa!

Playas are depressional freshwater wetlands of U.S. High Plains.

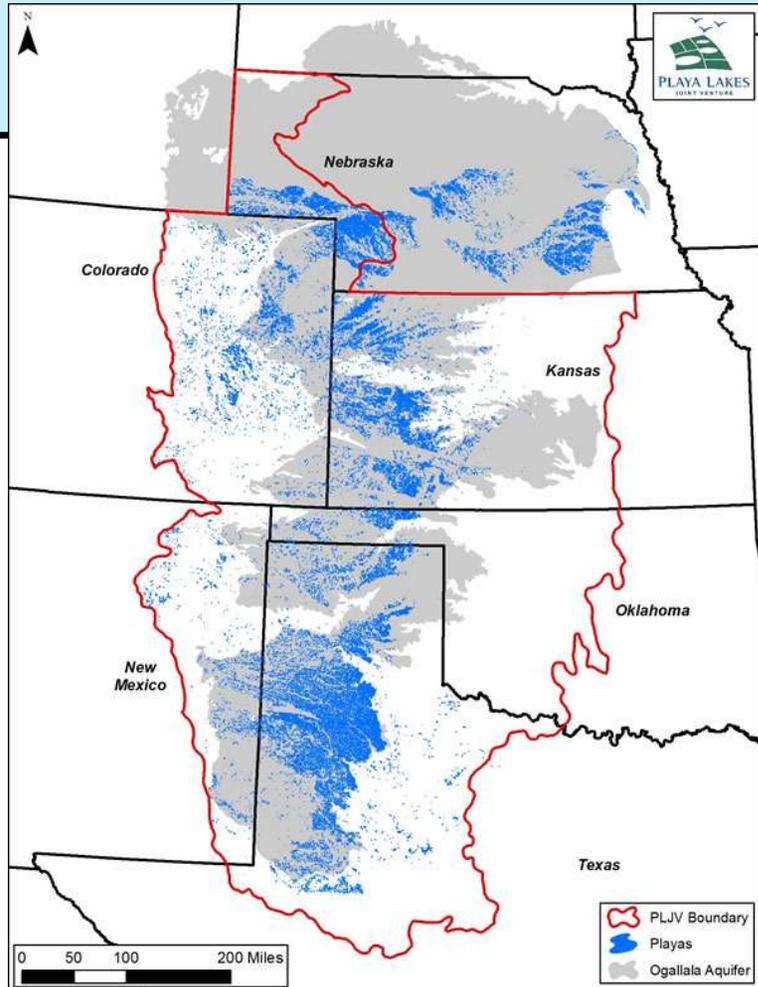
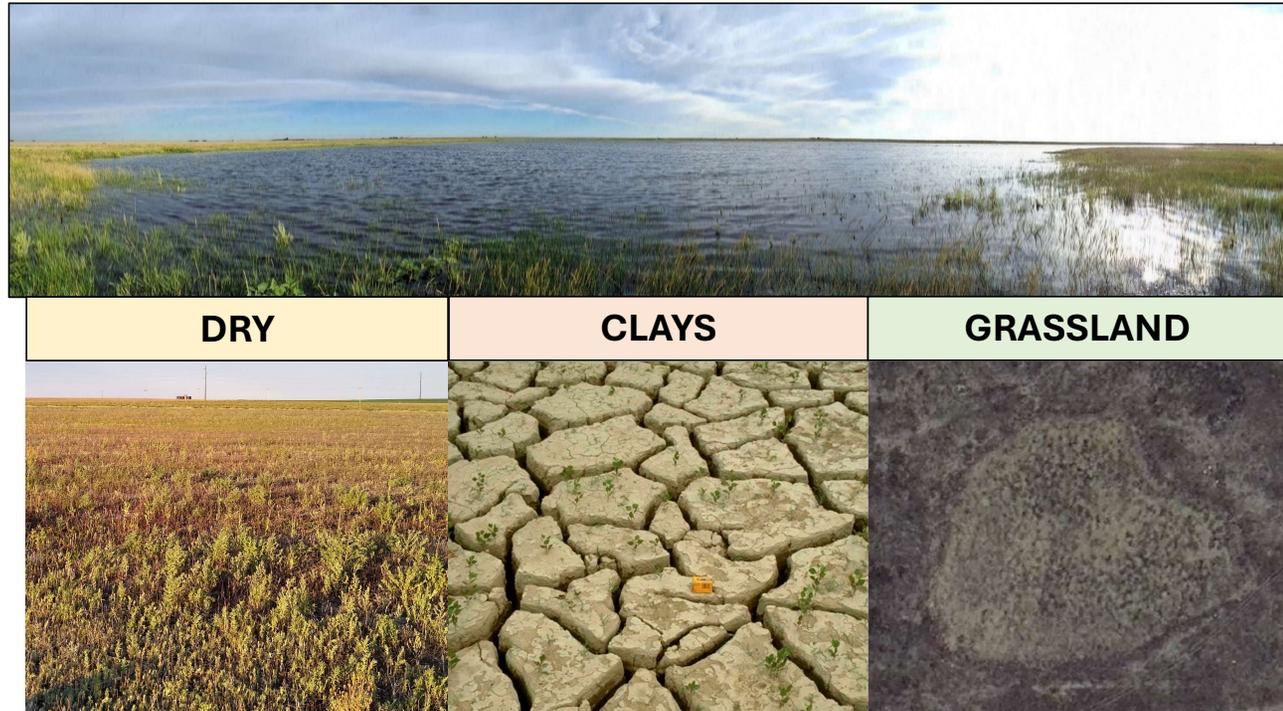


Photo Credit: Playa Lakes Joint Venture



Playas offer a wide range of benefits to both humans and wildlife.

Photo credit: Angela Safranek, Playa Lakes Joint Venture

Flood storage



Photo credit: Frank Venhaus, Playa Lakes Joint Venture

Recharge and filtration



Biodiversity hot spots

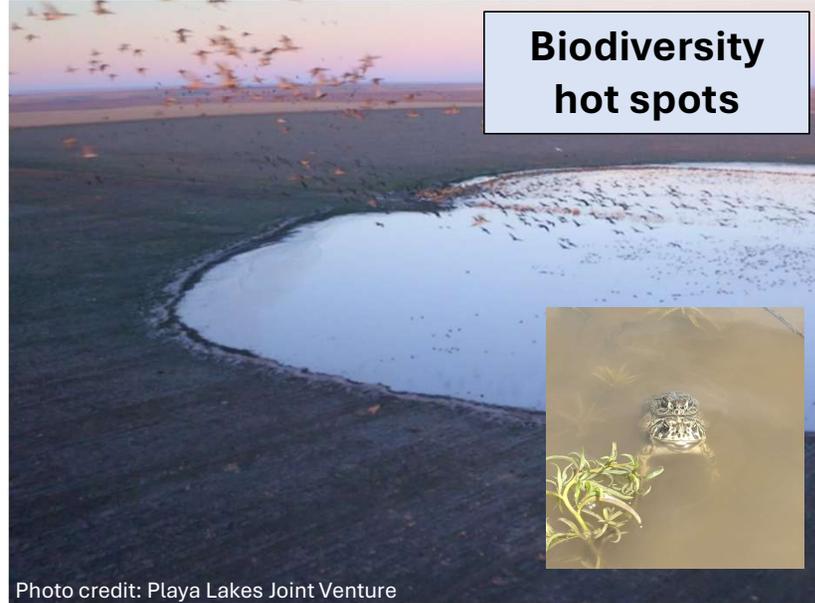


Photo credit: Playa Lakes Joint Venture



Recreation



Photo credit: valenciabirding.com



Photo credit: tulecreek.com



Most playas have been modified by agricultural practices, which alters wetland functions.



Photo Credit: Christopher Rustay, Playa Lakes Joint Venture

Most playas have been modified by agricultural practices, which alters wetland functions.

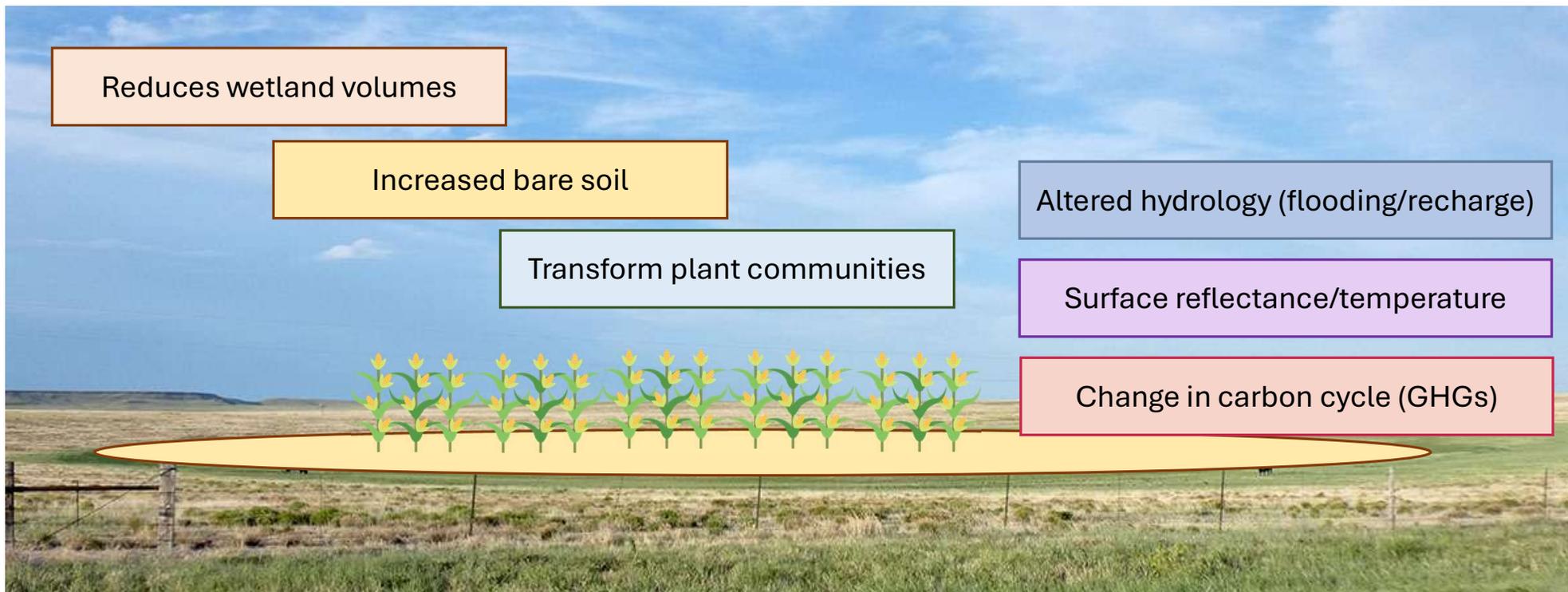
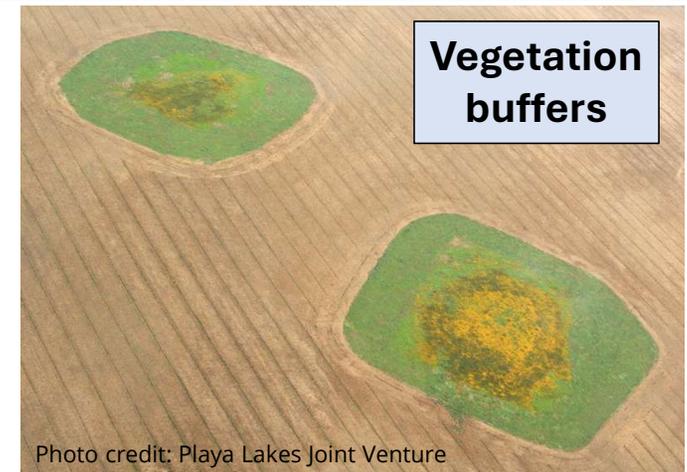
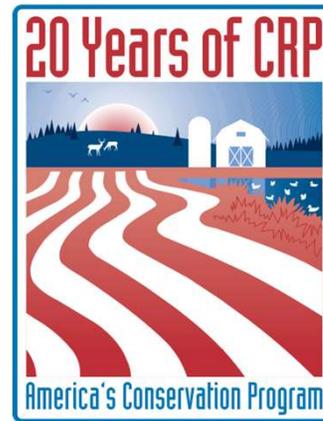
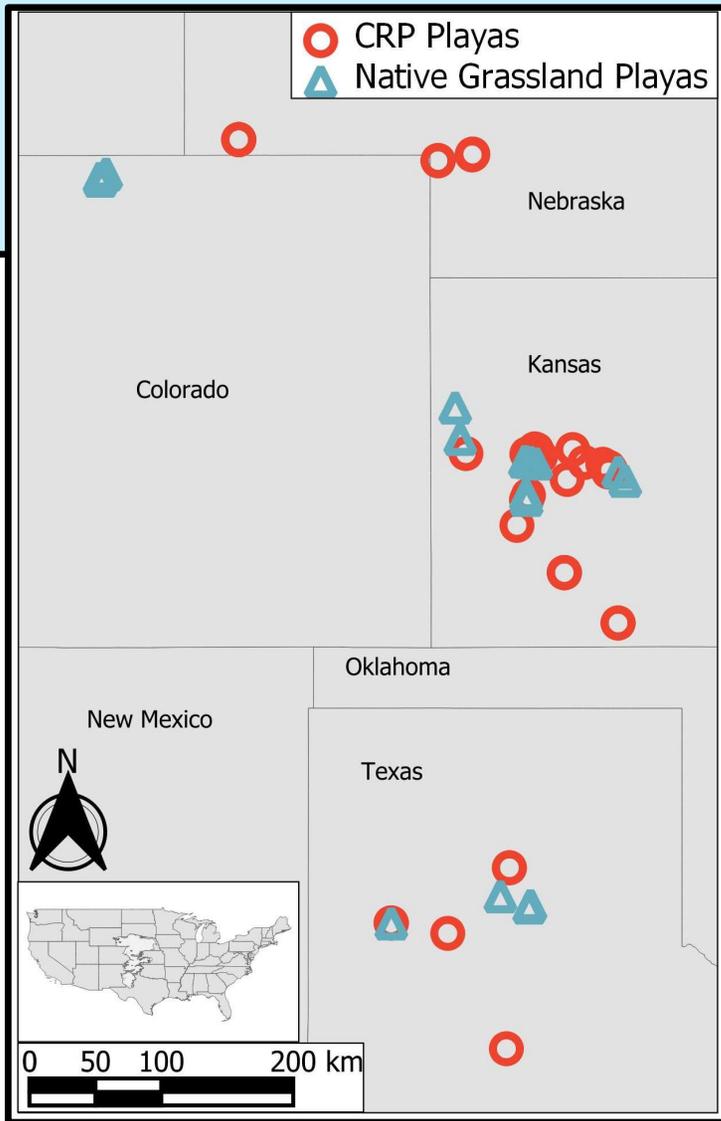


Photo Credit: Christopher Rustay, Playa Lakes Joint Venture

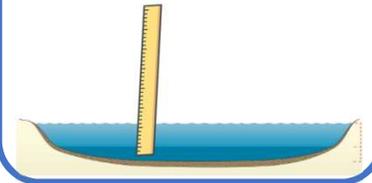
Wetland restoration can help reverse the impacts of land-use conversion.



Field Data Collection

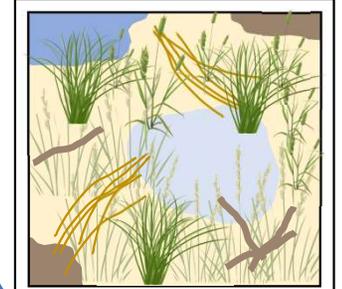


Water Depth



- OPEN WATER
- VEGETATION COVER
- THATCH/DEAD VEG
- SATURATED SOIL
- DRY SOIL

Percent Cover



Aboveground Biomass



Soil sampling



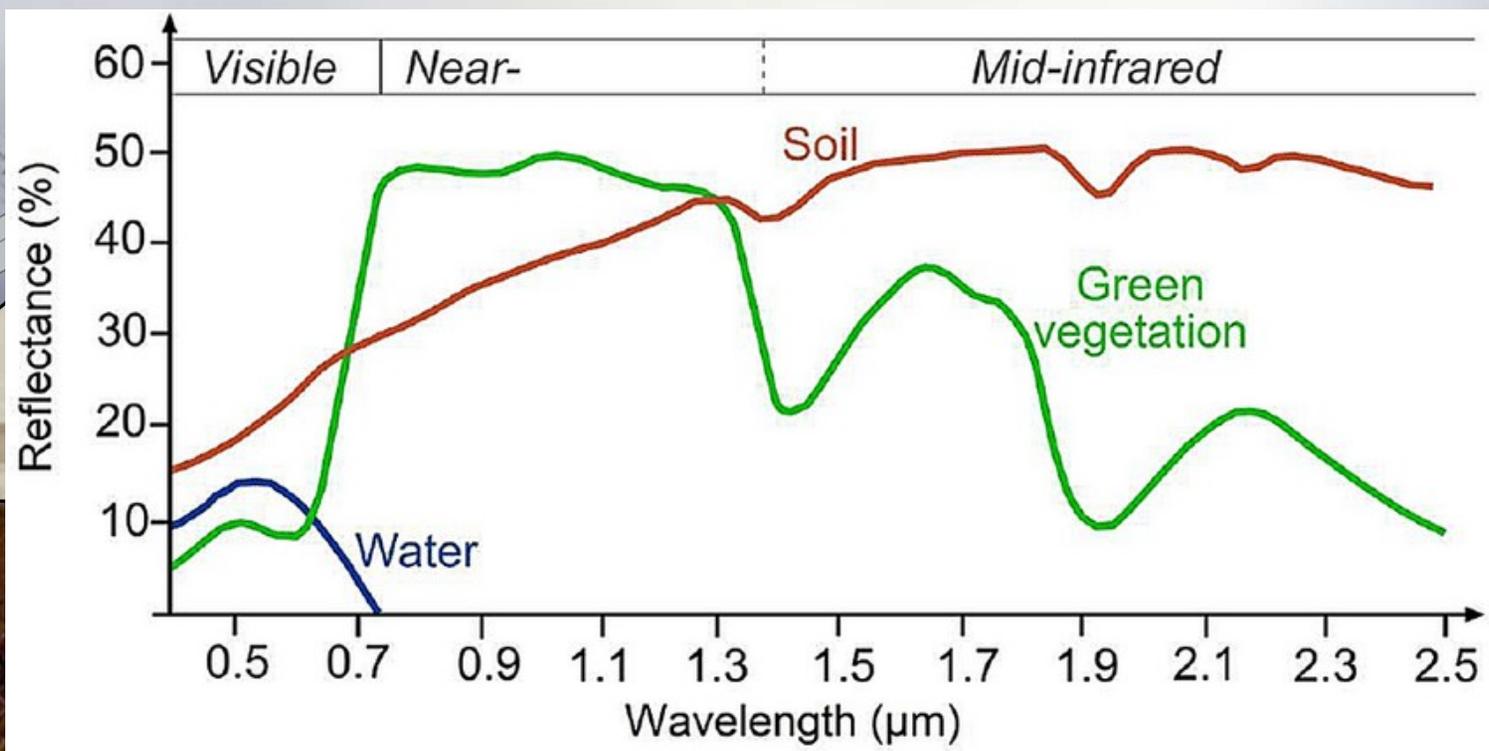
Greenhouse gas emissions



On-the-ground sampling is impractical, especially at the landscape scale.



Remote sensing for playa monitoring



USGS; seos-project.eu; Siegmund, Menz 2005

Remote sensing for playa monitoring

Landsat 8/9 reflectance of wet vs. dry playas

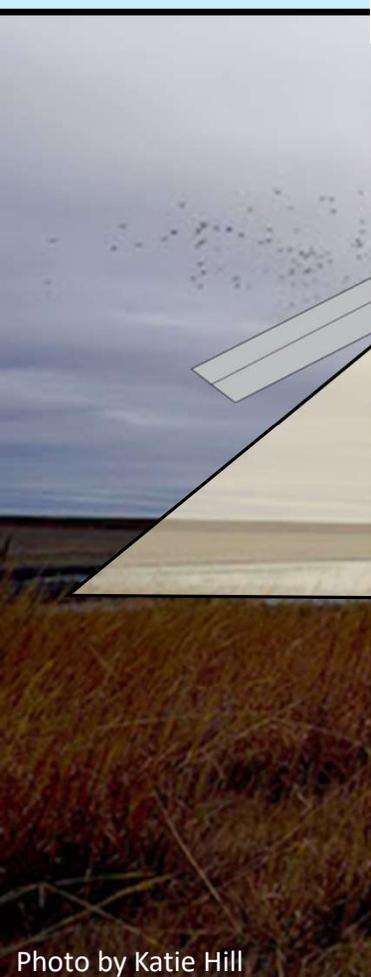
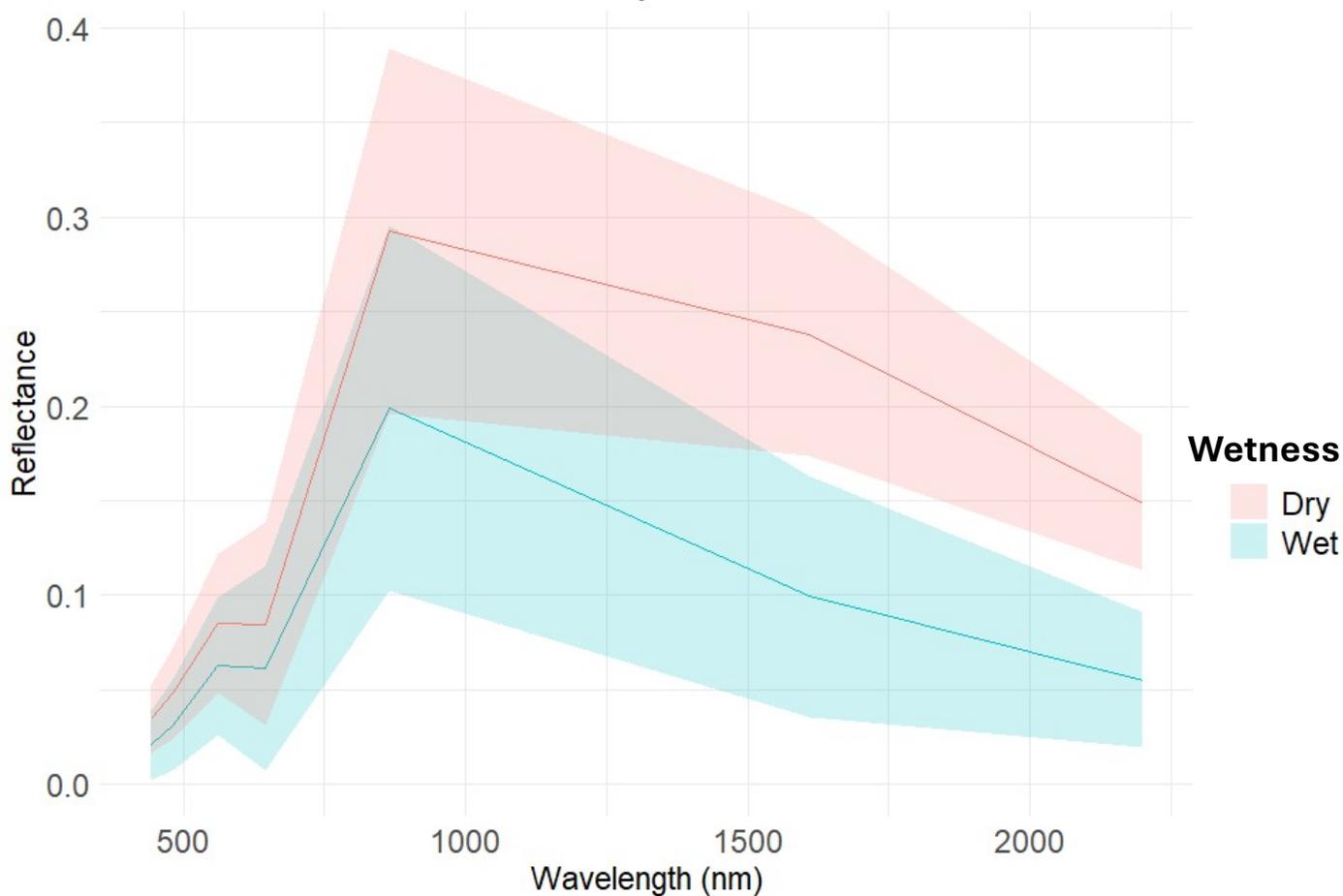
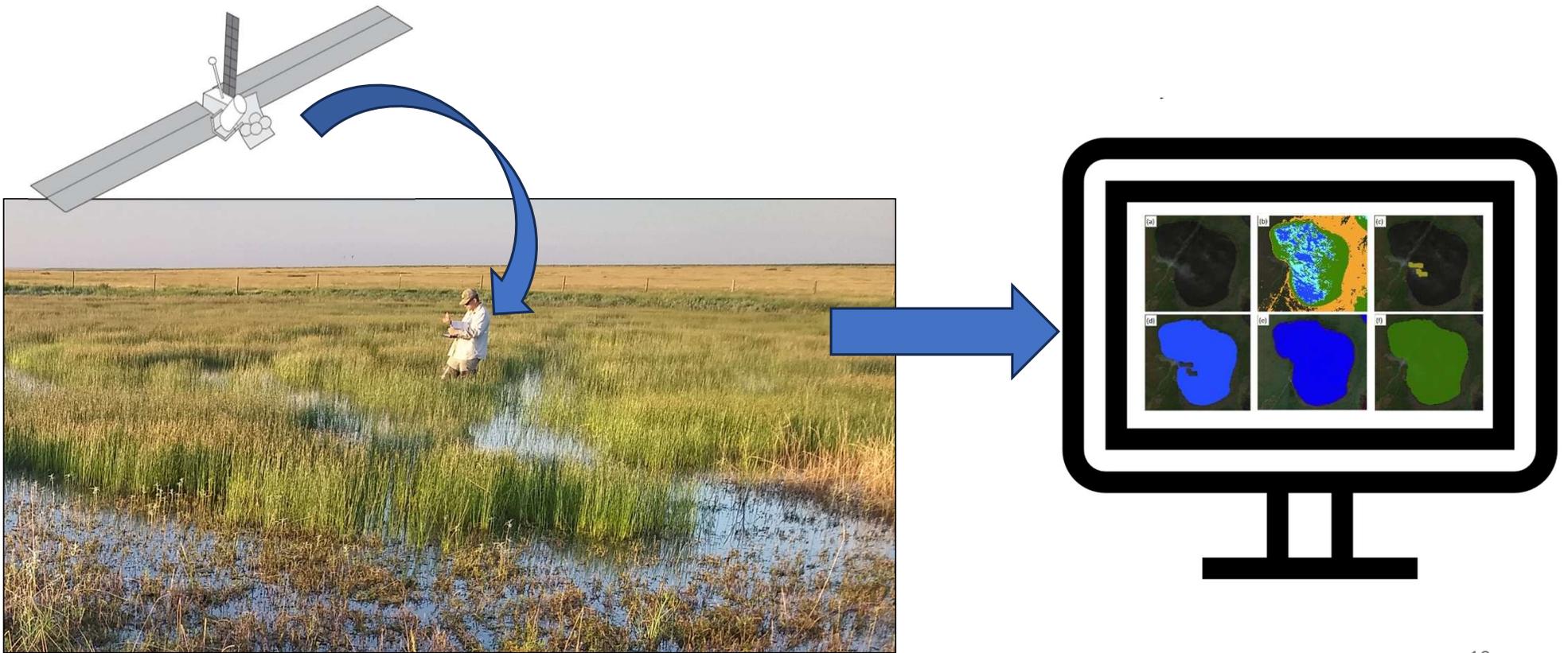


Photo by Katie Hill



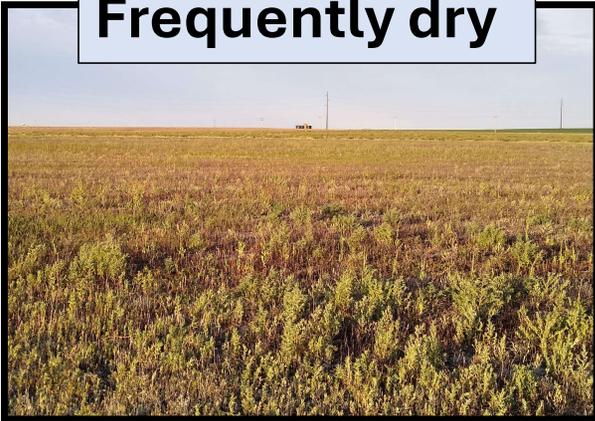
Hill, Playa Lakes Joint Venture

Machine learning models to the rescue!



Why Existing Models Struggle to Accurately Capture Playas

Frequently dry



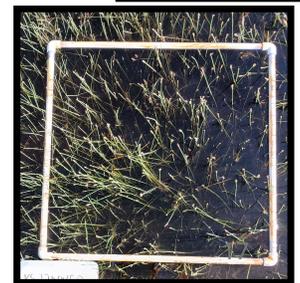
Shallow



Turbid



Varied Cover



Project Overview

Surface water model

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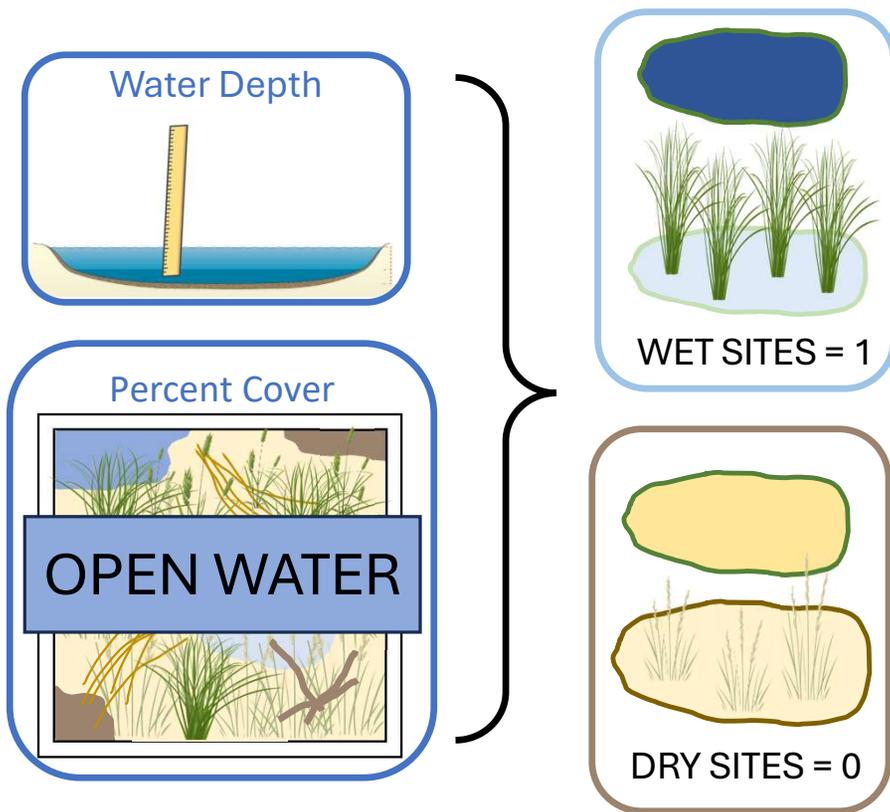
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Does CRP wetland restoration affect wetland flooding?

Surface Water Model: Main objectives

- 1) Create a custom surface water model for playas of the High Plains, trained on playa-specific field data.
- 2) Use this model to detect and predict playa flooding across space and time.
- 3) Use model predictions and CRP information to evaluate the effect of CRP age and practice on playa flooding

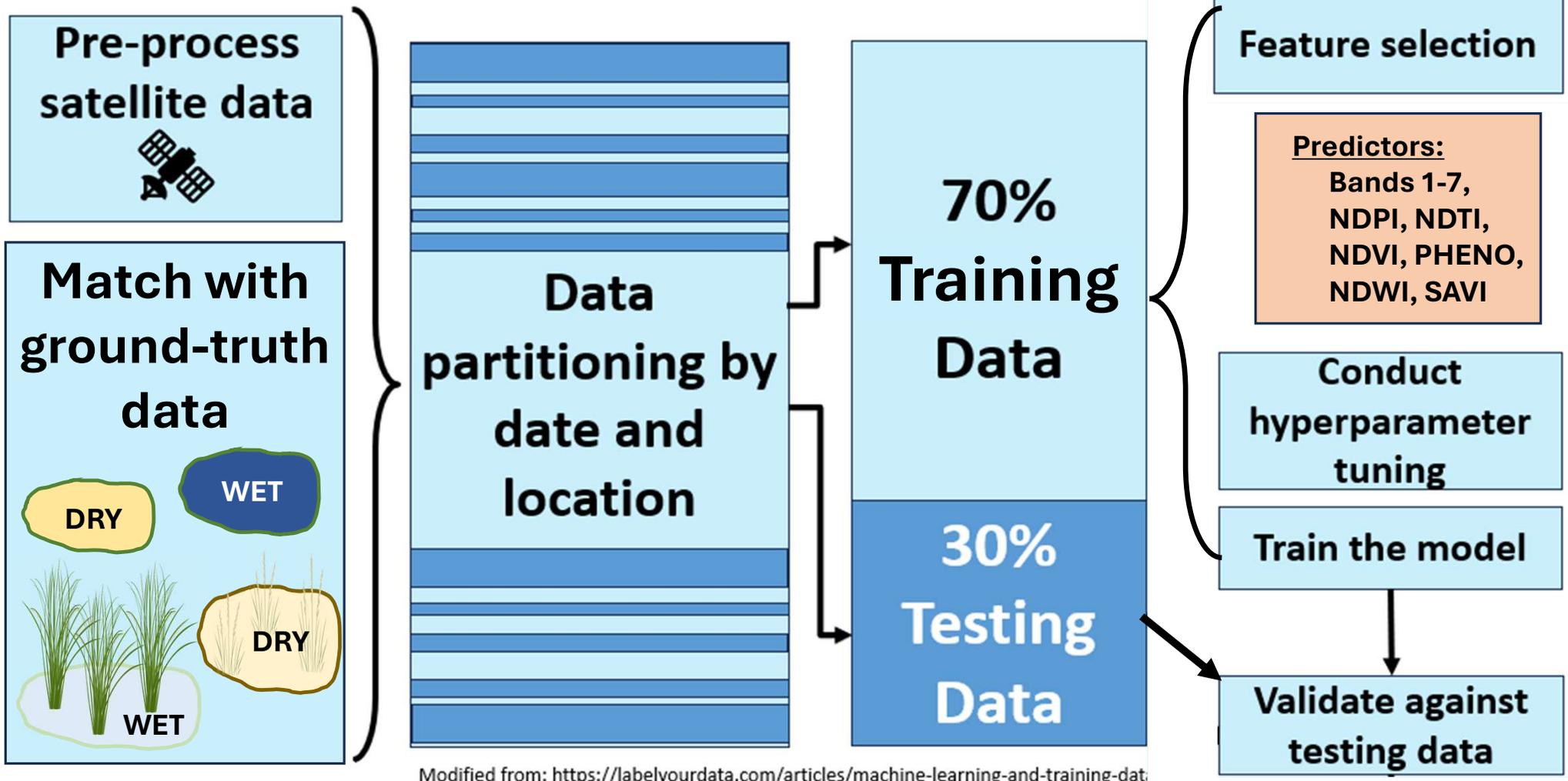
Models are only as good as the data they are trained on.



Landsat 8 and 9

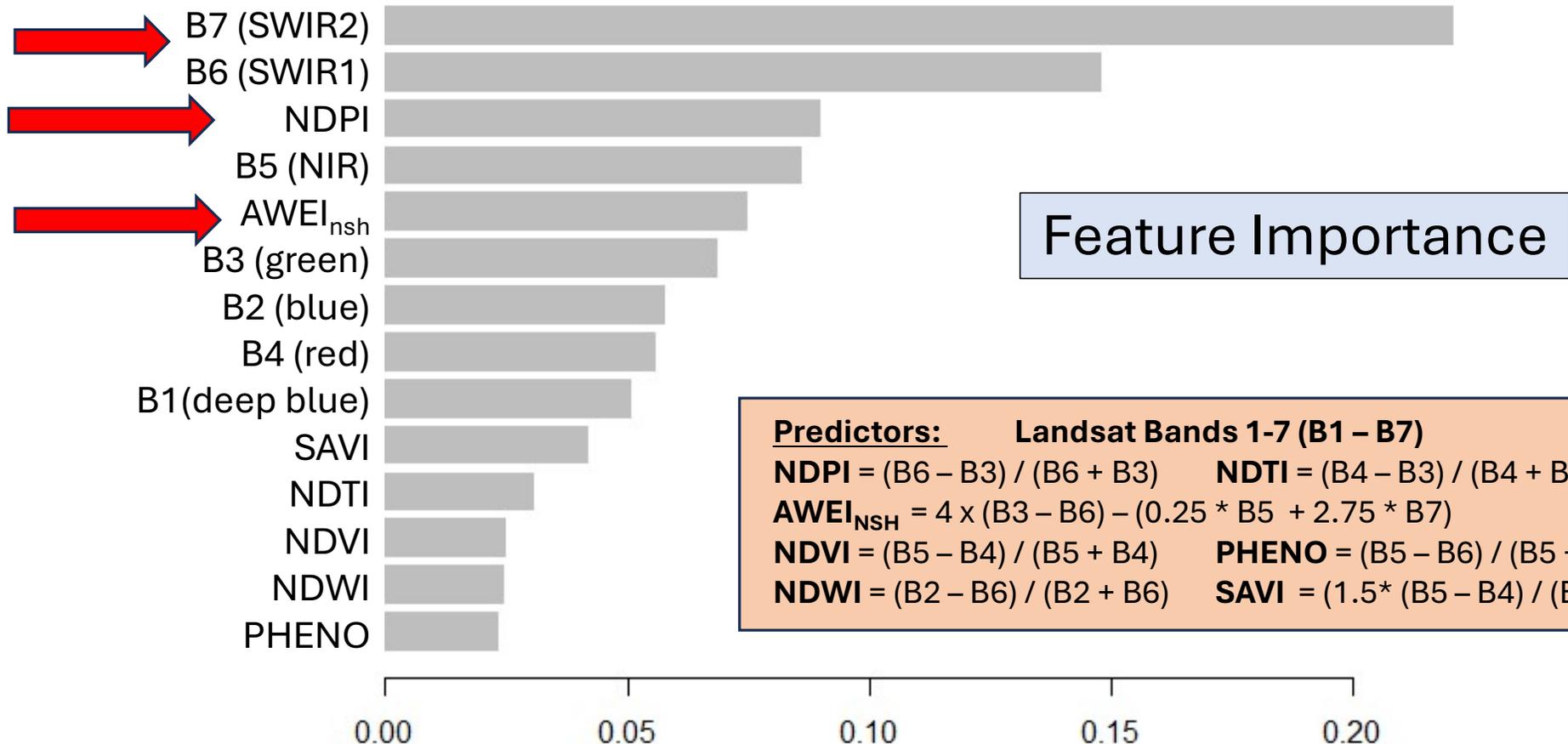
- Collection 2, Tier 1
- Launched February 2013 & September 2021
- 30 x 30 m pixels
- 8–16-day returns
- Analysis ready



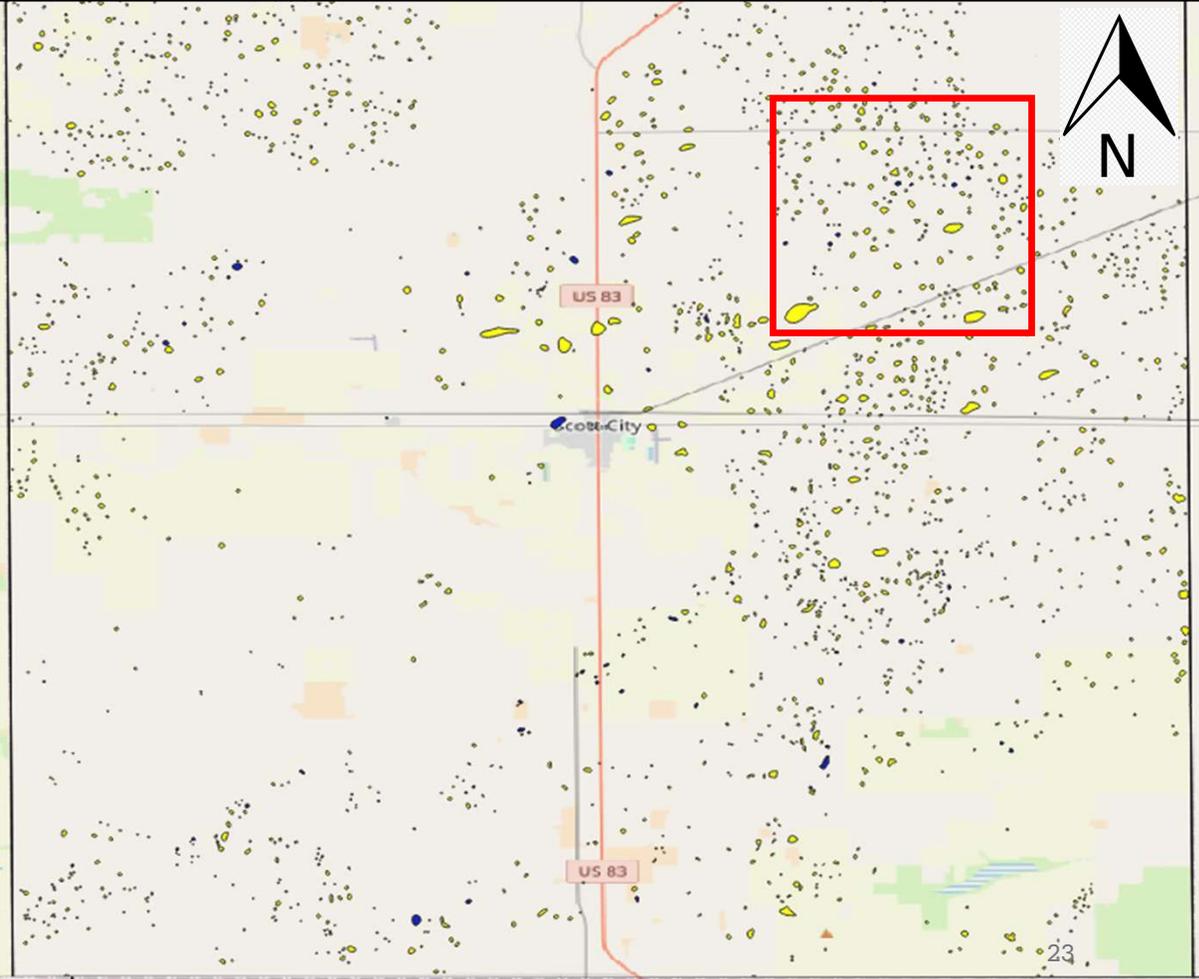
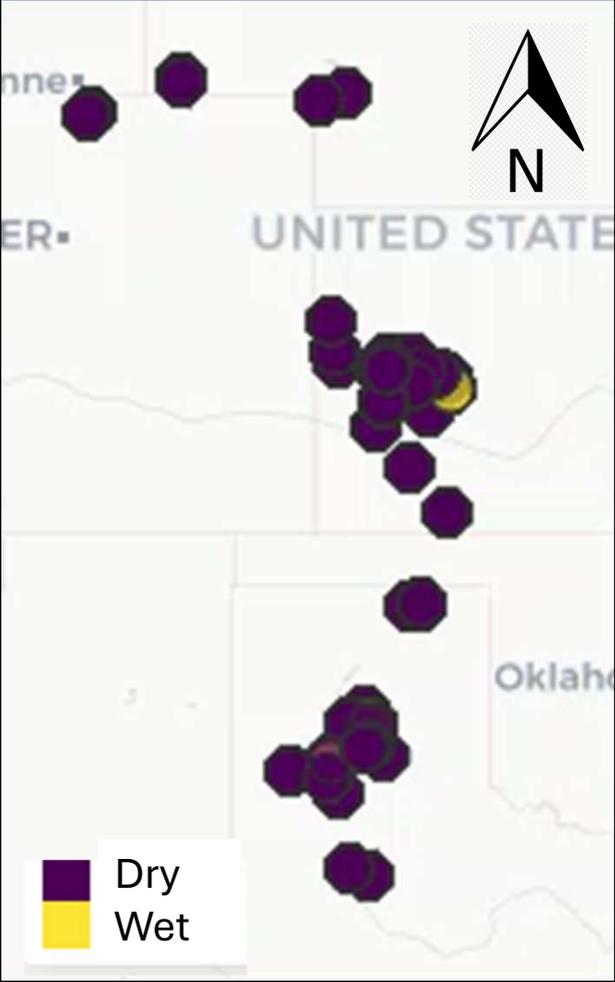


Modified from: <https://labelyourdata.com/articles/machine-learning-and-training-dat>

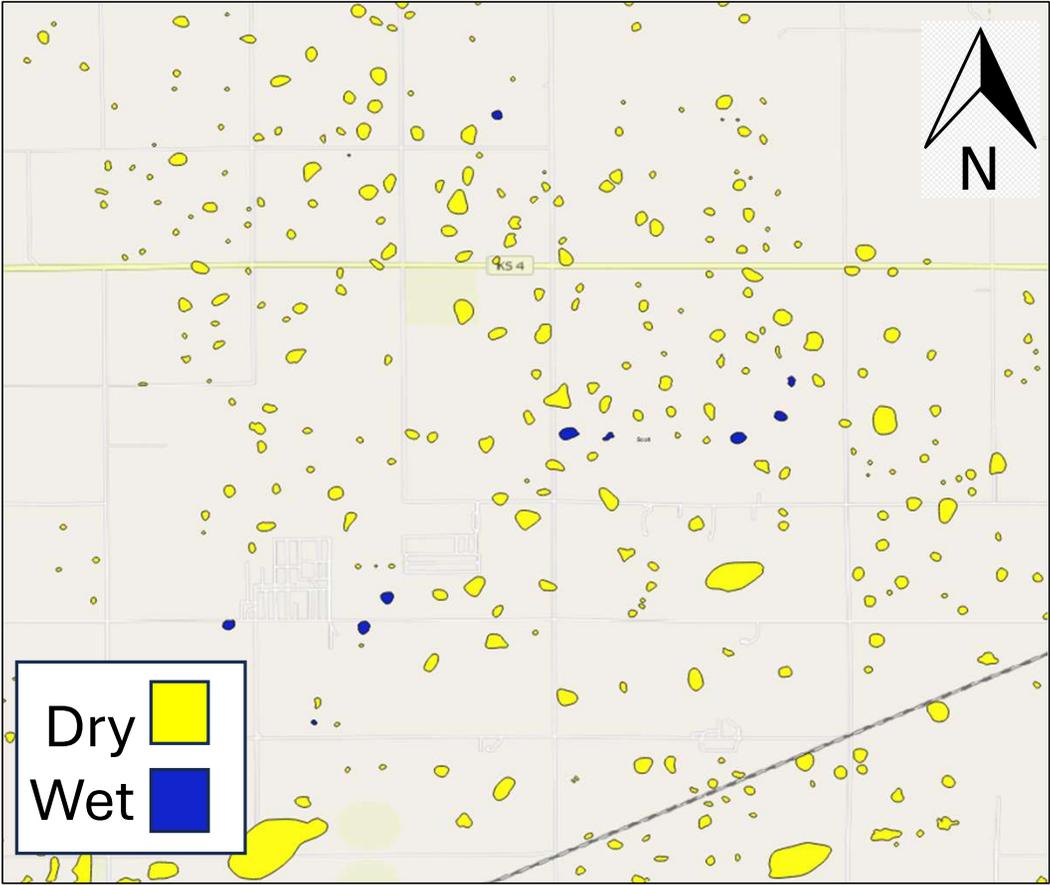
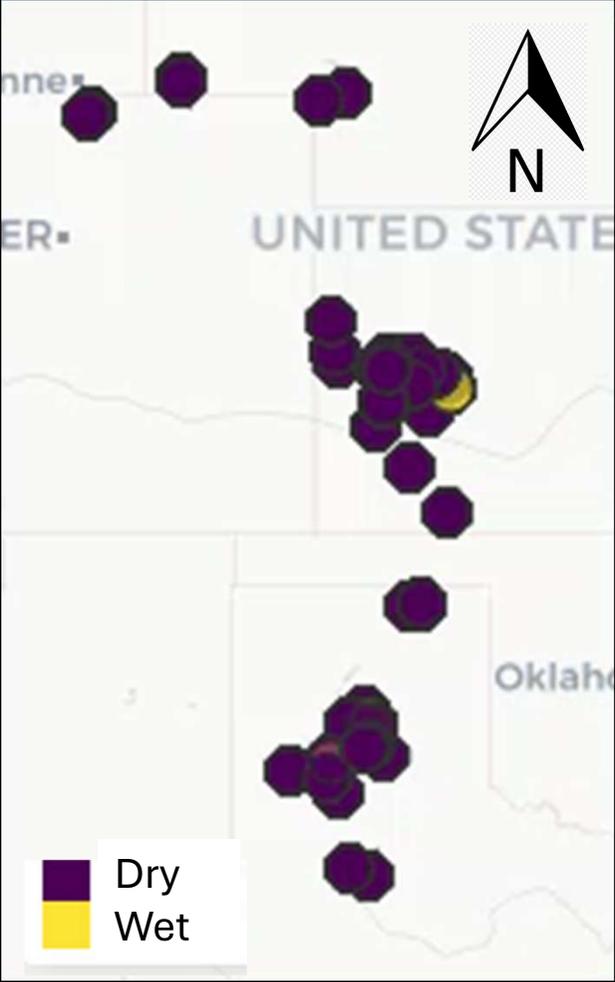
Data	Accuracy	Sensitivity	Specificity	N	Misclassified
Training	0.97	1.00	0.93	39	1
Testing	0.94	1.00	0.89	17	1



Surface water prediction over Time and Space



Surface water prediction over Time and Space



Does CRP effect flooding at playas?

Effect of CRP:

- Age (years in CRP)
- Practice

Covariates:

- Climate
- Wetland Area
- Surrounding Land Use



Efficient “sampling” = Informed land management decisions
= save agencies \$\$\$

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Does sharing data affect landowner perceptions of wetland restoration?

The Conservation Reserve Program depends entirely on voluntary participation.



Financial incentives

Positive program experiences

Active landowner involvement

Direct interaction



Knowledge of:

- Ecosystem value
- Positive Outcomes of Restoration

Effective science communication

Data summaries: Main objectives

1) What are the best practices for sharing data with landowners?

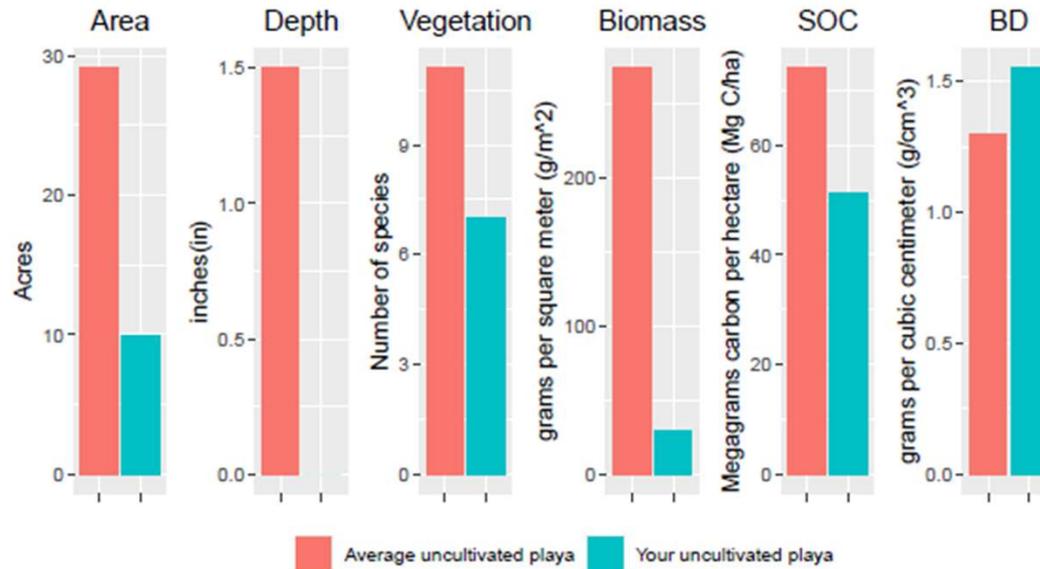
2) Can sharing ecological data change perceptions of playas, wetland conservation/restoration, and the CRP?

Direct Communication: Ecological Data Summaries

- Ecological data from 50 wetlands sampled in 2022-2024.
- 50 reports sent by mail to 31 project landowners
- Automated for easy replication across many wetlands and landowners
- Photos, “fun facts”, and narrative specific to each wetland



Your wetland compared to others sampled in the High Plains Region



Vegetation: The species counts measured across all wetlands sampled ranged from 2 to 19 species present. The most common species are displayed in the table below.

Table 2. The top ten plant species found across all wetlands sampled, ordered from most to least abundant. Both the common and scientific names are included as well as the native and wetland status of these plants.

Common Name(s)	Scientific Name	Native Status	Wetland Status
kochia	Bassia scoparia	Introduced	Non-wetland
bur ragweed	Ambrosia grayi	Native	Non-wetland
western wheatgrass	Pascopyrum smithii	Native	Non-wetland
barnyardgrass	Echinochloa crus-galli	Introduced	Non-wetland
buffalograss	Bouteloua dactyloides	Native	Non-wetland
narrowleaved goosefoot	Chenopodium leptophyllum	Native	Non-wetland
pink smartweed	Polygonum pensylvanicum	Native	Wetland
pepperwort or hairy water clover	Marsilea vestita	Native	Wetland
pale spikerush	Eleocharis macrostachya	Native	Wetland
frog fruit	Phyla nodiflora	Native	Non-wetland

spotted evening primrose (*Oenothera canescens*) : This plant mainly grows on playa margins and is a good indicator of the playa basin. It can also be found in prairie depressions, ditch margins, and other places of temporary water in the High Plains. Although it has little known wildlife value, it is been recognized by pollination ecologists as a plant of special value by attracting large numbers of native bees (Sources: Haukos and Smith 1997, Flora of North America, Lady Bird Johnson Wildflower Center).



Wildlife: Wetland vegetation provides habitat for different kinds of wildlife including amphibians, small and large mammals, reptiles, and a variety of resident and migratory birds. Below are photos of a few species we encountered while sampling wetlands across the High Plains region.



Landowner feedback and perceptions



Summary feedback:

- 1) Format
- 2) Content
- 3) Credibility

Perceptions of:

- 1) Playas
- 2) Wetland Restoration and conservation
- 3) CRP

Response analysis:

- 1) Positive and negative feedback on data summary
- 2) Change in perceptions of playas, restoration, & CRP

Outcomes:

- 1) Edit code and update summaries
- 2) Create list of best practices
- 3) Inform enrollment motivations
- 4) Improve relationships

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Wetland surface temperature, soil carbon, & greenhouse gas emissions

Key Takeaways and Future Work

- Surface water model: Remote sensing and machine learning are useful!
Next step: Train and test on additional data from collaborators from other regions (PPR and Midwest)
- Data summaries: Sharing data may motivate landowner buy-in and drive future participation in CRP.
- Future work: use other field data to evaluate surface temperature, carbon, and greenhouse gas dynamics.





Thank You!

Questions?

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