Employing NASA Earth Observations to Model Current and Historic Distribution of Crop Wild Relative, in Support of USDA ARS Genetic Resource Conservation Efforts

Abstract

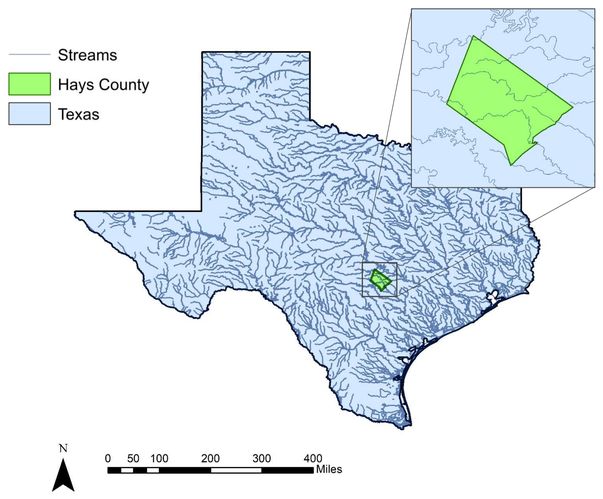
Northern wild rice (*Zizania palustris L.)* and Texas wild rice (*Zizania texana*) provide valuable ecosystem services, food sources, economic development, and cultural resources to local populations in Minnesota and Texas. Research on crop wild relatives, wild plants closely related to cultivated plants, is imperative to understanding gene flow and genetic diversity of harvested species. The United States Department of Agriculture (USDA) Agricultural Research Service (ARS) is responsible for conserving the genetic diversity of valuable species, such as wild rice. However, this organization lacks insight to the geographic distribution of *Zizania* populations. NASA Earth observations, including Landsat 5 Thematic Mapper, Landsat 8 Operational Land Imager and the Shuttle Radar Topography Mission version 3 were used to create models to detect wild rice presence. The team provided partners at the USDA ARS with distribution maps for northern wild rice and Texas wild rice populations in 2005 and 2015. Partners at USDA ARS will apply the end products to effectively enable strategic ecological planning, and better target field collections for species conservation.

Objectives

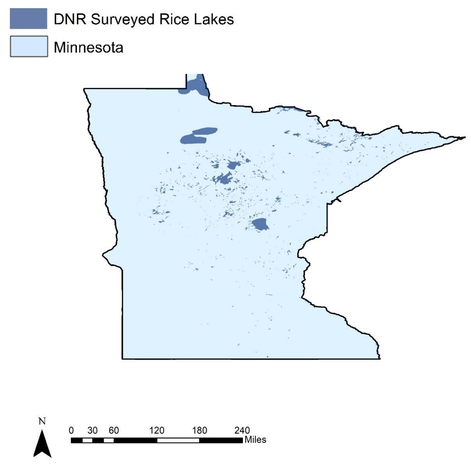
- **Detect** wild rice stands in Minnesota and Texas using NASA Earth observations
- **Monitor** changes in wild rice distribution over time and across various sensors
- **Investigate** the geographic scale at which this methodology can be successfully applied
- **Provide** guidance and methodology to allow the project partner to complete this process on their own

Study Area

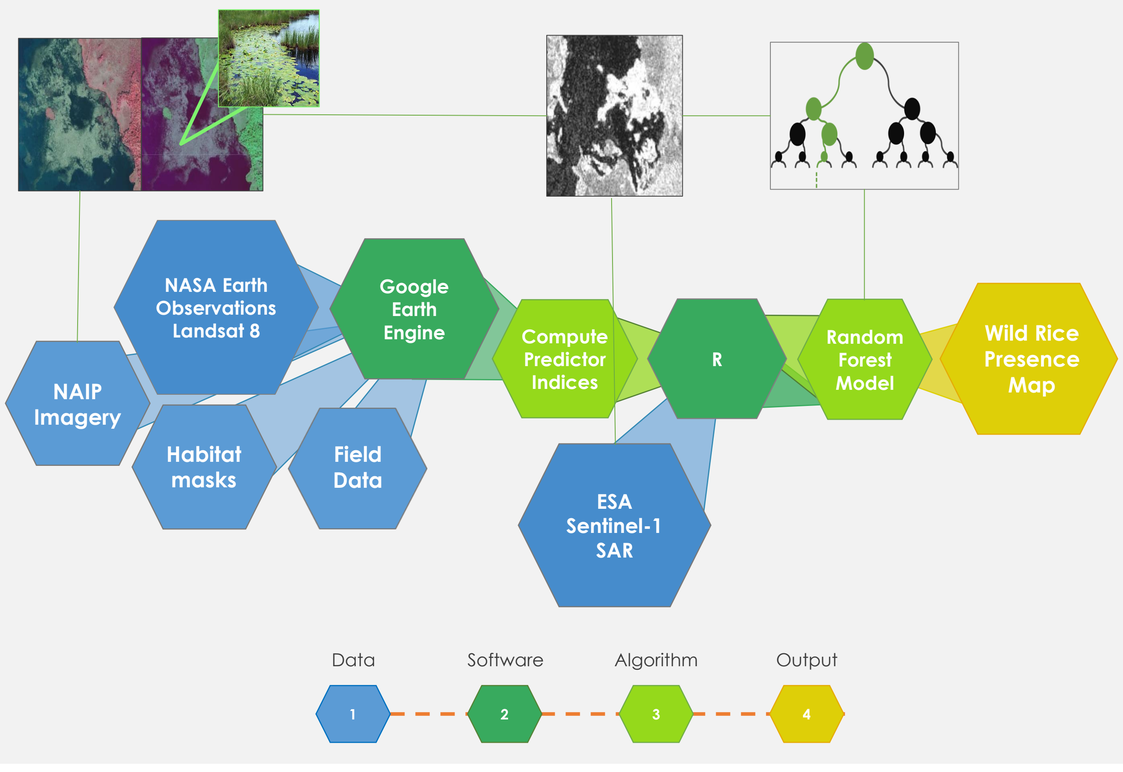
Hays County, Texas



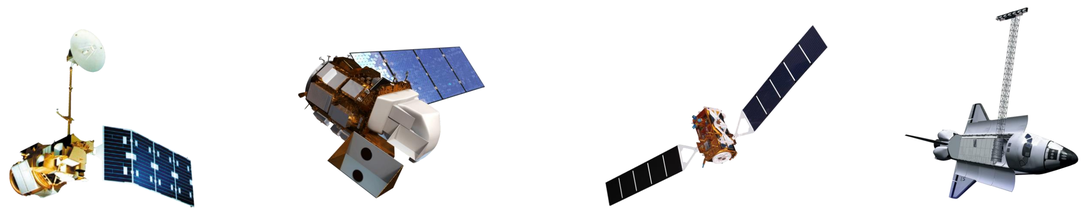
Wild Rice Areas, Minnesota



Methodology

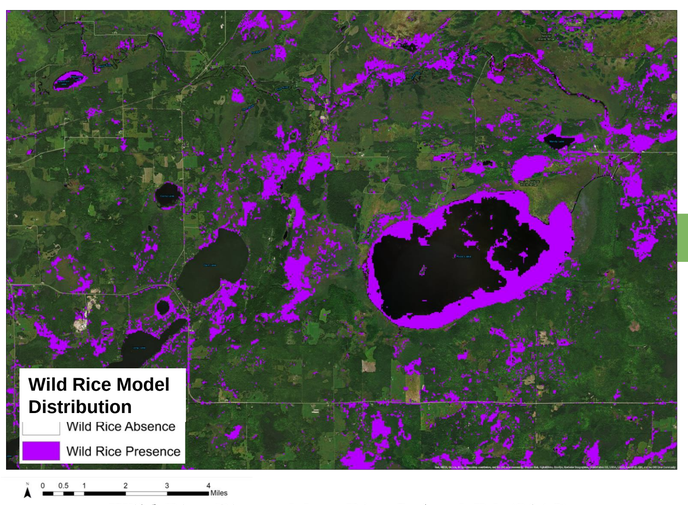


Earth Observations

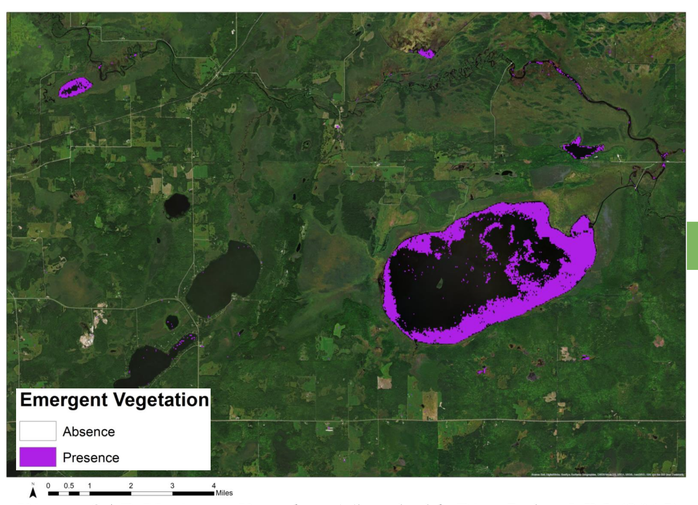


Landsat 5 | Landsat 8 | Sentinel-1 | SRTM

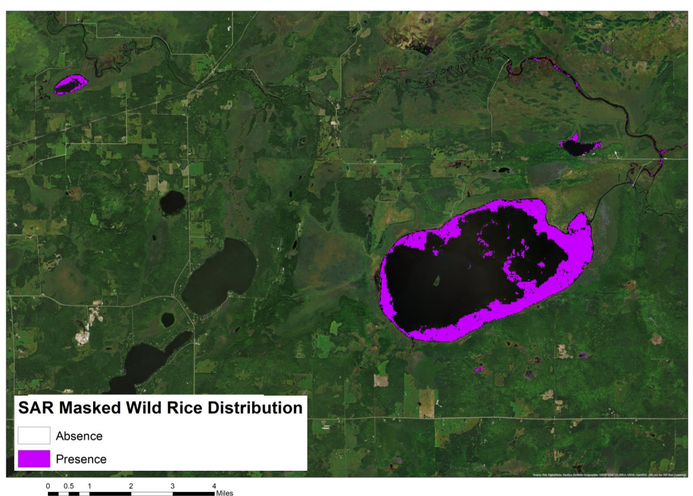
Results



Wild Rice Binary Map: Rice Lake, MN (2015)



Binary SAR Variance Based on Threshold: Rice Lake, MN (2015)



Wild Rice Presence Masked by Variance: Rice Lake, MN (2015)

Project Partners

USDA, Agricultural Research Service,
National Plant Germplasm System

Conclusions

- The team successfully detected wild rice using NASA Earth observations.
- Remote sensing may be a useful tool for the detection of other crop wild relatives.
- It is difficult to distinguish wild rice from other emergent aquatic vegetation using NAIP imagery.
- Incorporating the phenology of wild rice is necessary.
- Using two types of imagery (Sentinel-1 SAR and Landsat Spectral) helps to distinguish the unique spectral signatures and structure of wild rice.

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