Using Landsat and Sentinel to Identify and Detect Giant Cane in Amistad National Recreation Area for Future Invasive Species Land Management

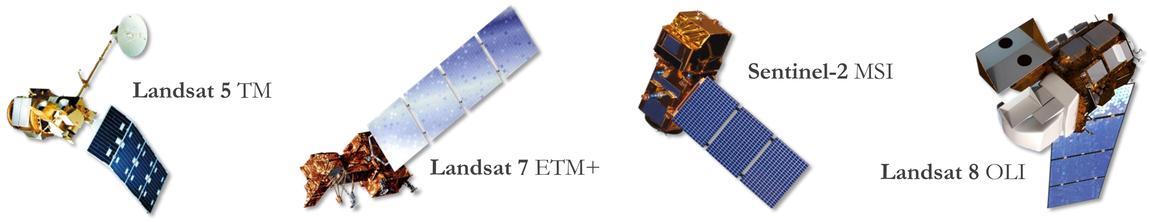
Abstract

Portions of Amistad National Recreation Area (NRA) are threatened by the presence of an invasive grass species know as giant cane (Arundo donax), which drastically alters riparian habitats by out-competing native vegetation and depleting vital resources. Giant cane does not provide viable habitat or food for native species of wildlife, making it an important eradication target of land managers at the National Park Service (NPS). The NPS requires precise distribution maps of giant cane over the entire extent of Amistad NRA for effective land management, however their typical monitoring methods are ground based, labor intensive, and limited in scope. The Amistad Ecological Forecasting team created historic and current classified species distribution maps for the entire extent of Amistad NRA using Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI, and Sentinel-2 MSI data for the years 1996 to 2018. Change analysis was then conducted on these classified images to differentiate between long-lasting and ephemeral stands of giant cane. Finally, the team forecasted species distribution and created predictive maps of giant cane extent through the year 2025 to help the NPS prioritize their future land management efforts.

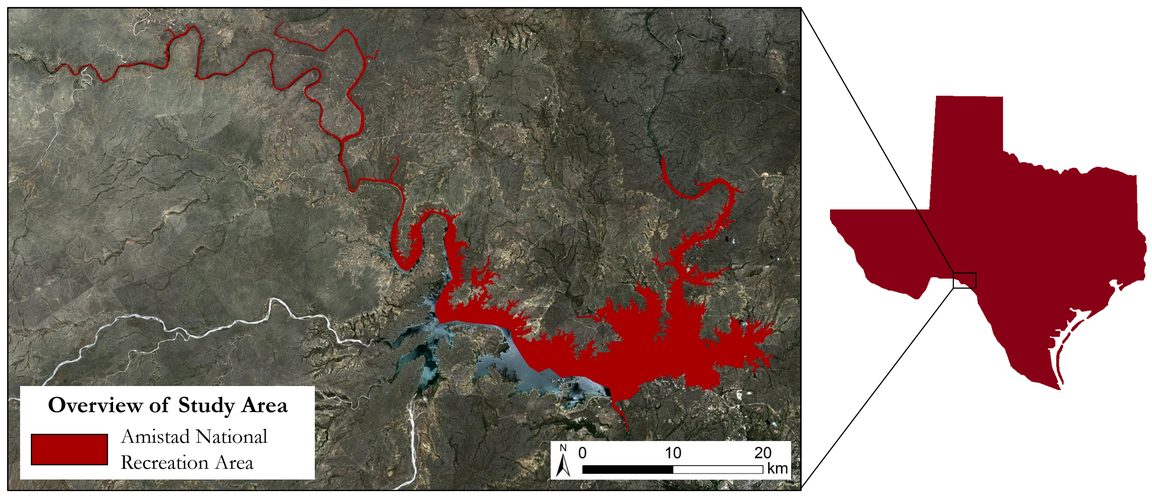
Objectives

- **Map** current giant cane distribution in Amistad National Recreation Area
- **Generate** historic giant cane distribution maps from 1996-2017
- **Differentiate** ephemeral and persistent stands of giant cane
- **Analyze** changes in giant cane distribution through time
- **Provide** a reproducible giant cane monitoring method for the NPS

Earth Observations



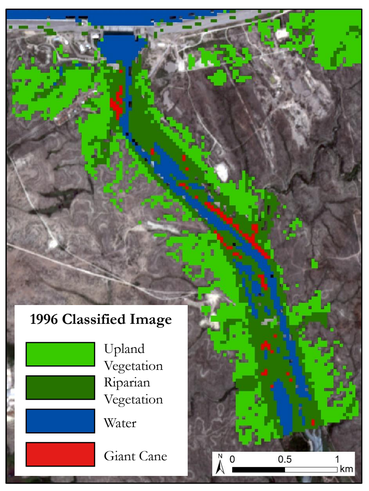
Study Area

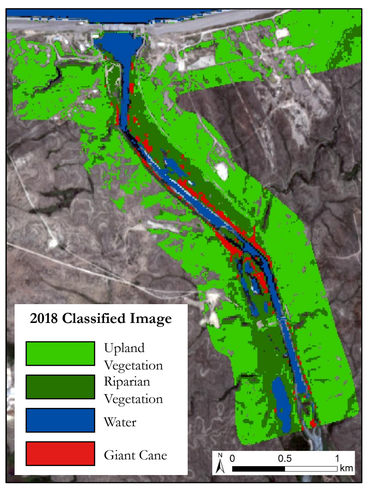


Methodology

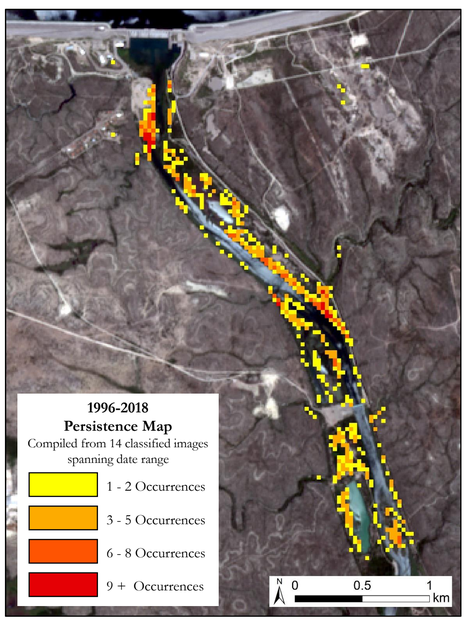
Acquire Landsat and Sentinel imagery → **Preprocess** imagery, composite bands, mosaic and clip images → **Train the classifier** to giant cane and other land cover types based on *in situ* vegetation data → **Classify** images via random forest method → **Repeat classification** for multiple years → **Assess accuracy** and refine training areas → **Aggregate** giant cane classifications to make persistence maps

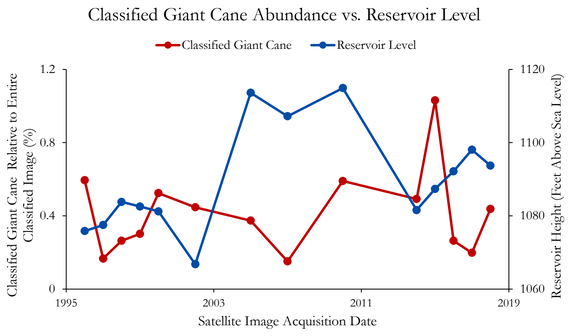
Results

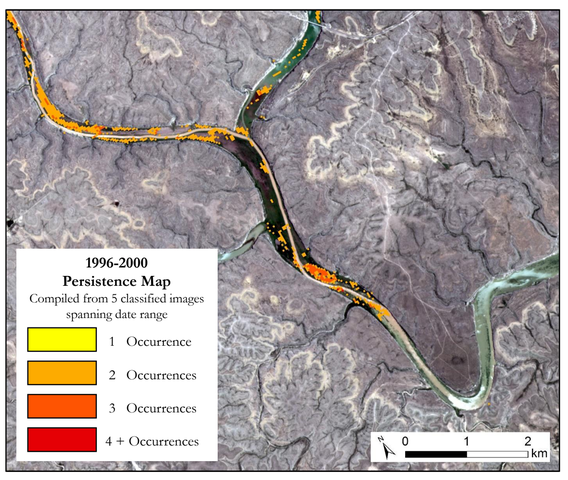


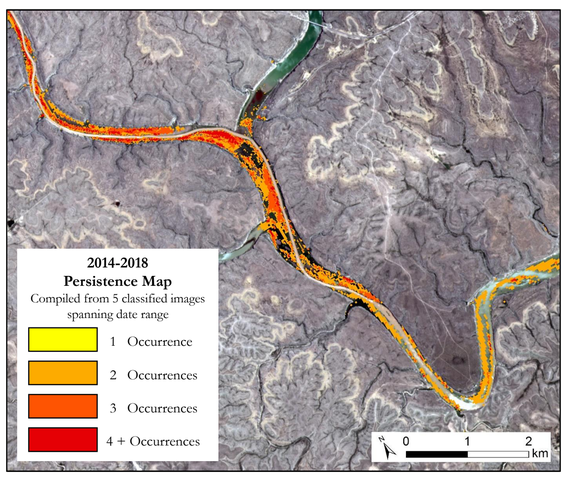


Multiple Classified Images









Persistence maps from different decades can be used to identify temporal change in the abundance of giant cane.

Conclusions

- NASA Earth observations provide a reproducible method for mapping the distribution of giant cane via random forest image classification.
- Temporal trends in giant cane distribution can be assessed via historic imagery.
- Total abundance of giant cane within Amistad NRA has not changed significantly over the last several decades, although the precise distribution of giant cane over the same period does vary.
- Distinctly-persistent stands and variation in the distribution of giant cane can be identified through the aggregation of classified images from multiple years.
- Variation in image quality, reservoir level, and other factors complicate the production of consistent distribution maps.

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Amistad National Recreation Area

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