



BUFFALO NATIONAL RIVER WATER RESOURCES

Delineating 100- and 500-year Floodplains
to Aid in Riverbank Management Along the
Buffalo National River in Northern Arkansas

Peter Blatchford

Cara Hannel

Benjamin Grimes

Sambath
Jayapregasham



MEET THE TEAM



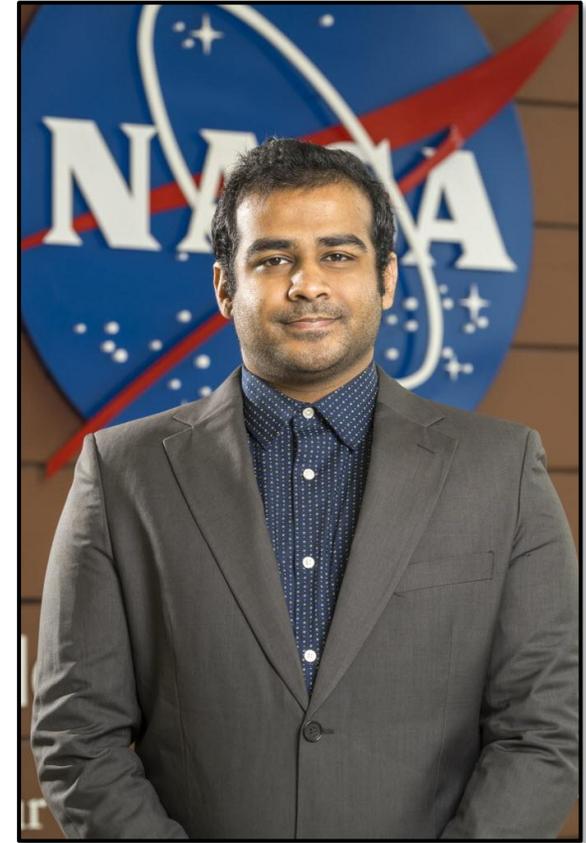
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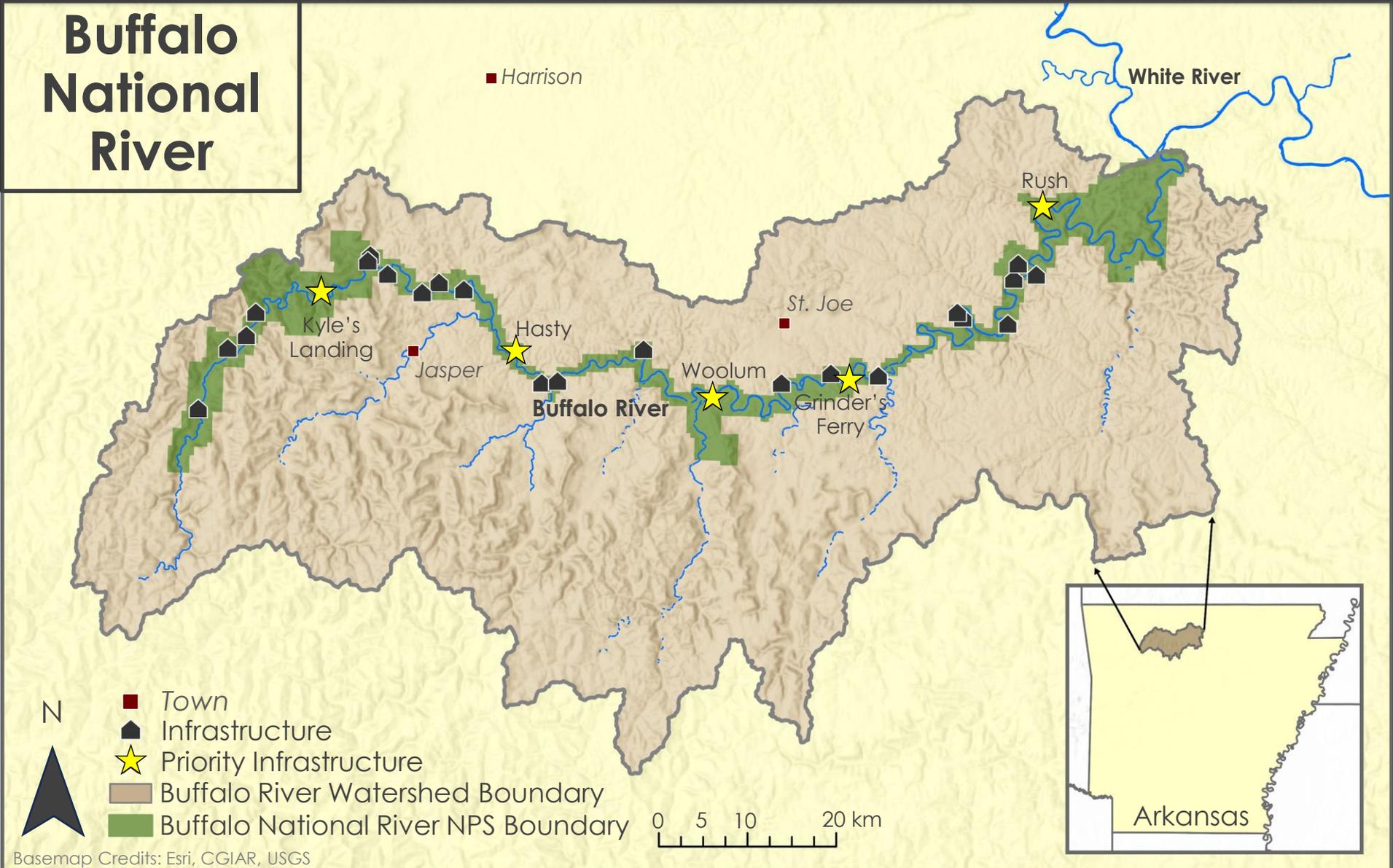
GLOBAL & REGIONAL IMPACTS OF FLOODS



Flooding has negative **ecological**, **human**, and **economic** impacts



STUDY AREA & PERIOD



March
2004
|
|
|
November
2024

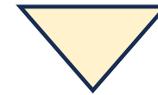
COMMUNITY CONCERNS

**Future
Infrastructure
Development**



Ozark Pigtoe

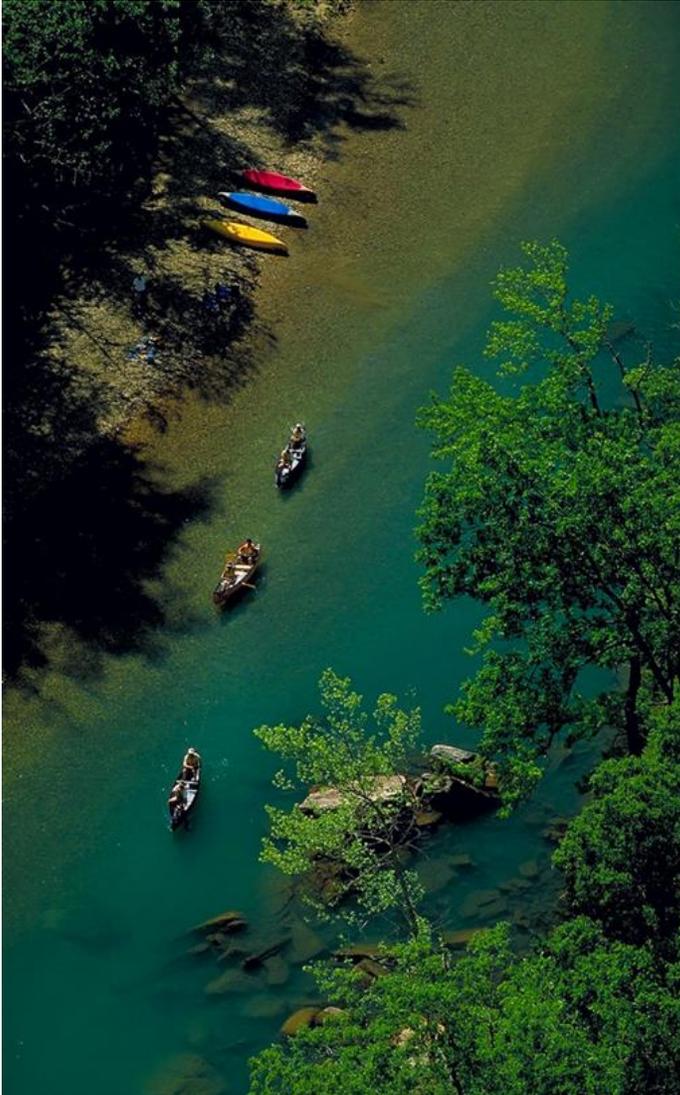
**Maintaining
Recreational
Sites**



**Protecting
Ecological
Resources**



PROJECT PARTNER

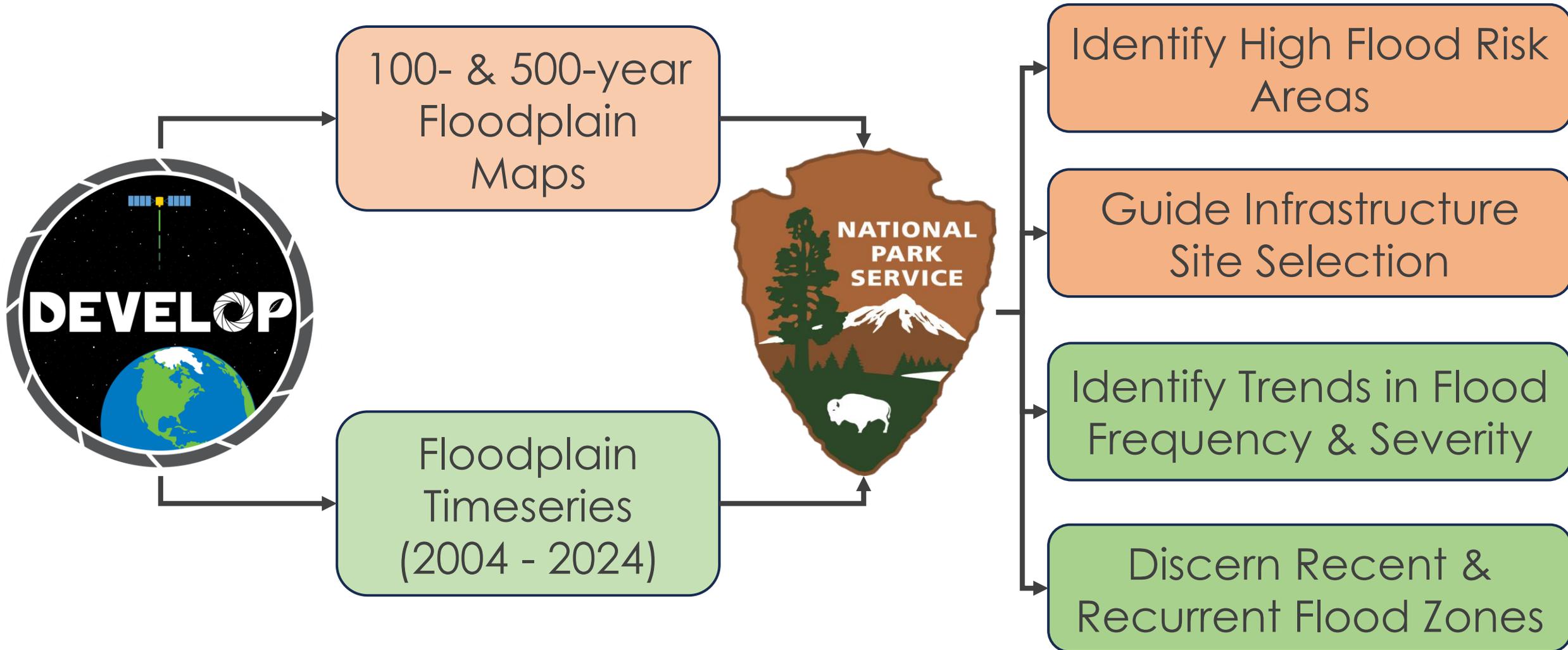


National Park Service at the Buffalo National River

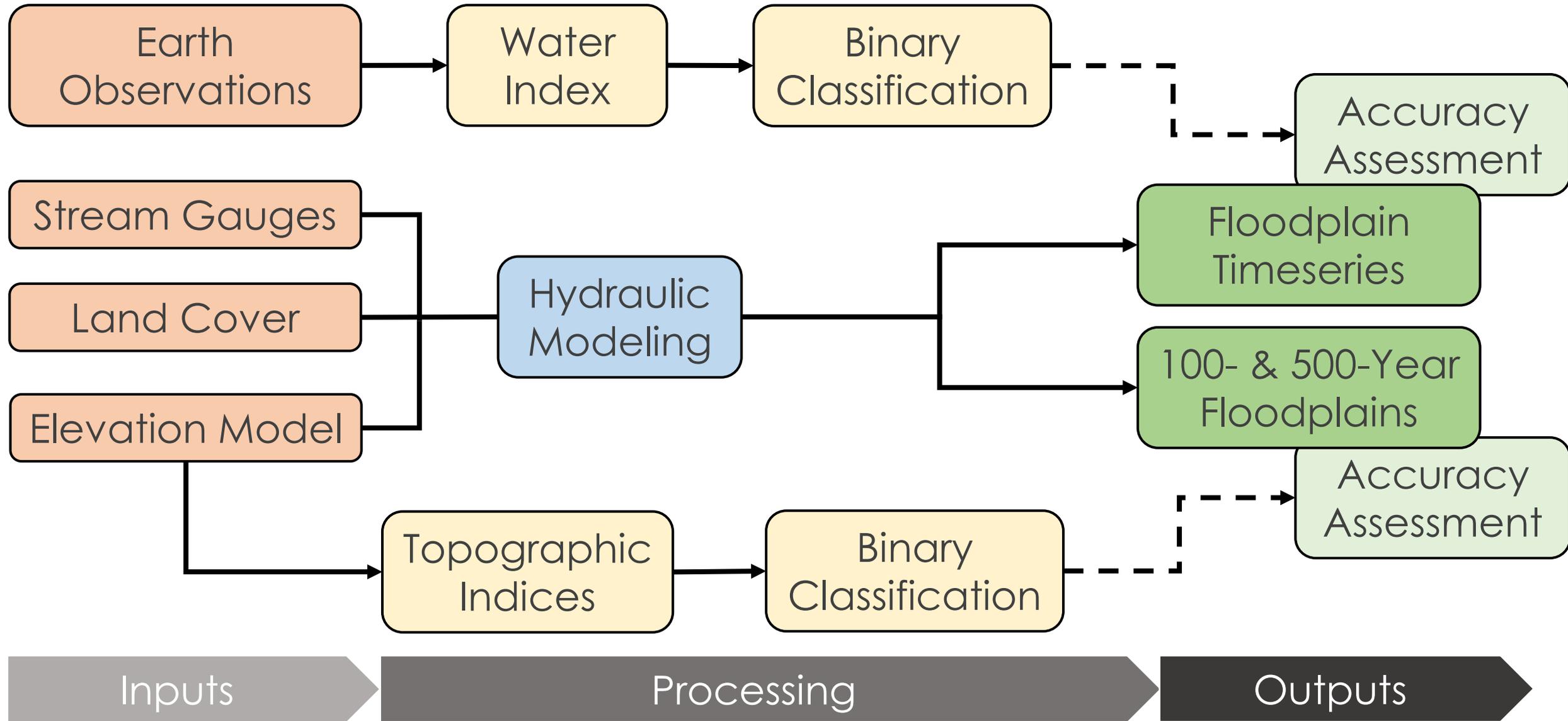
Mission: “Preserve a free-flowing river and to conserve and interpret the combination of natural, scenic, cultural, and scientific features... of the Ozark Mountains.”

Current procedure: Estimate regulatory flood zones using data from 1987 and anecdotal experiences (likely imprecise)

PROJECT OBJECTIVES



METHODOLOGY



EARTH OBSERVATIONS

National Aeronautics and Space Administration (NASA)

Landsat 5
Thematic Mapper



Landsat 7
Enhanced Thematic Mapper Plus

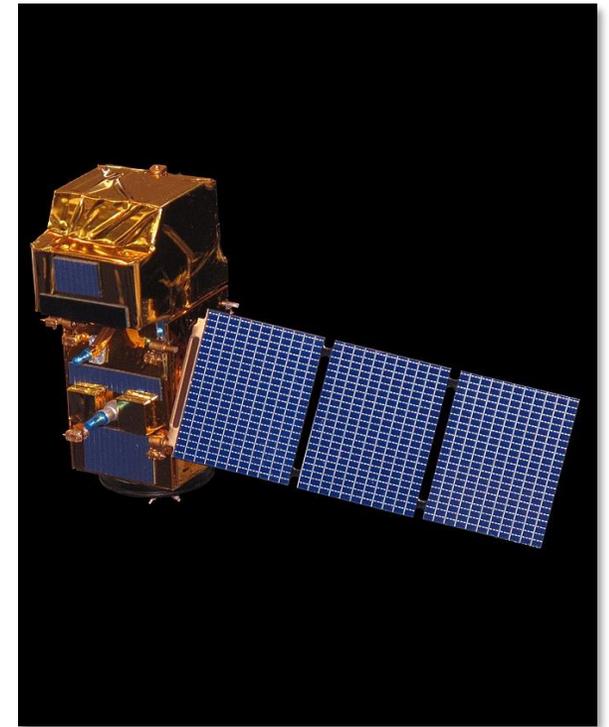


European Space Agency (ESA)

Sentinel-1
Synthetic Aperture Radar



Sentinel-2
MultiSpectral Instrument



EARTH OBSERVATIONS – COMMERCIAL

Planet Labs
Super Dove

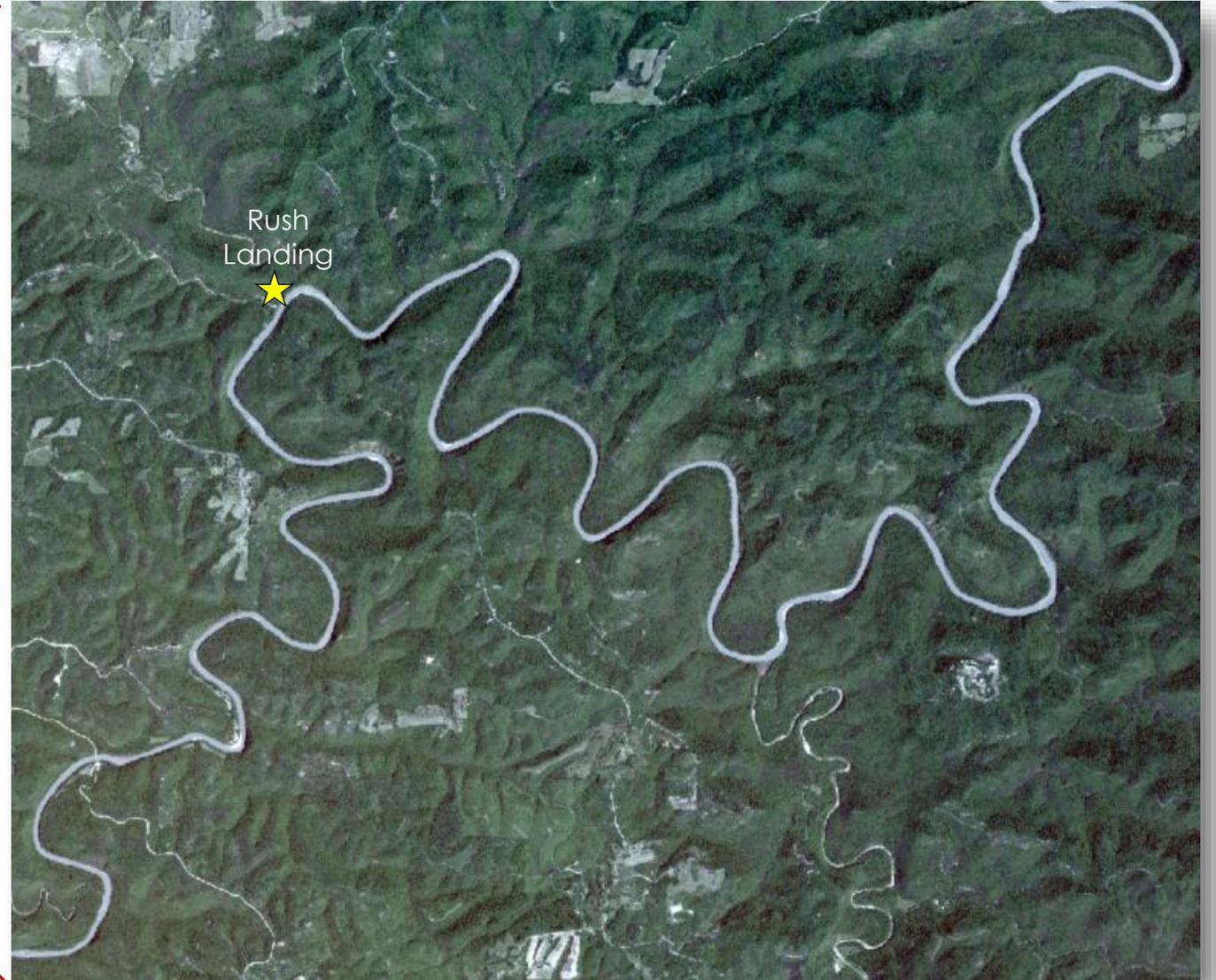
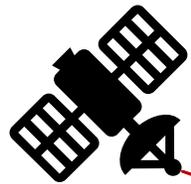
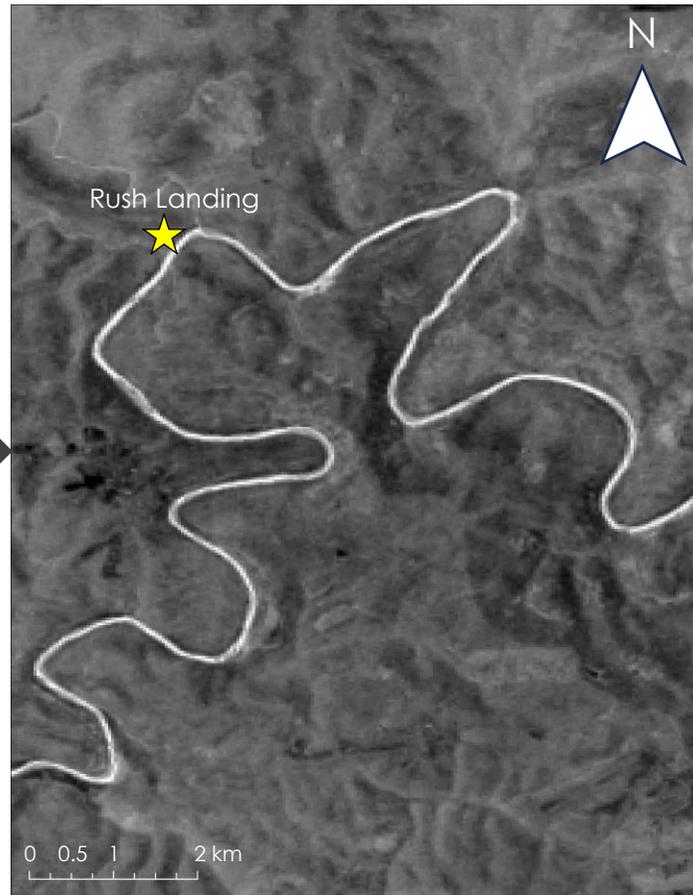


IMAGE PROCESSING

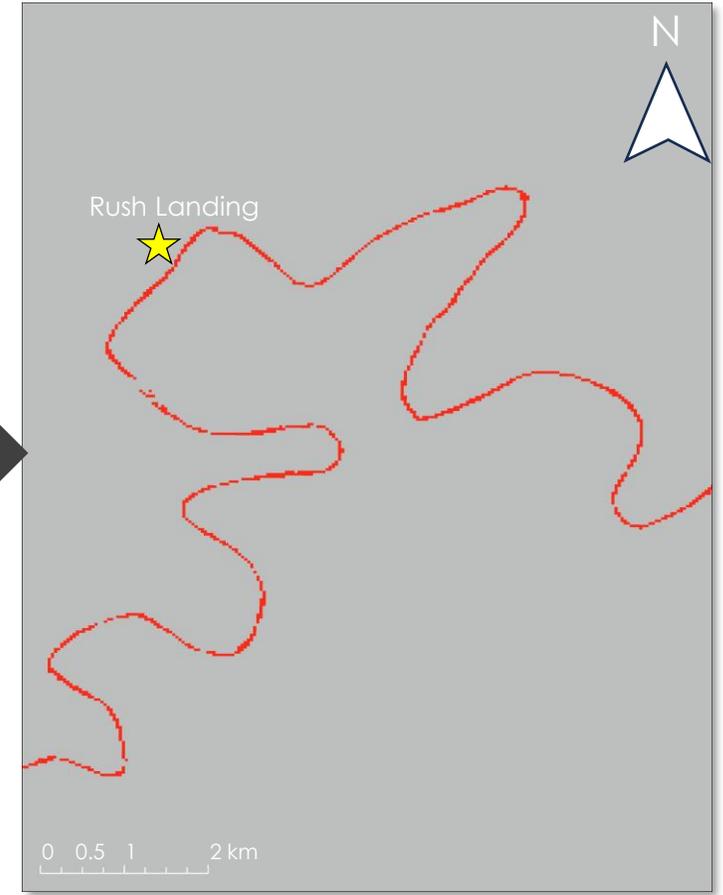
Landsat 5 Multispectral Image



Normalized Difference Water Index (NDWI)

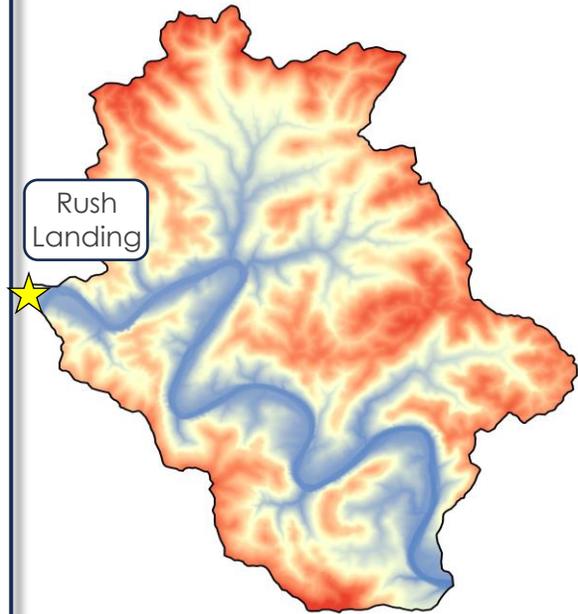


Binary NDWI

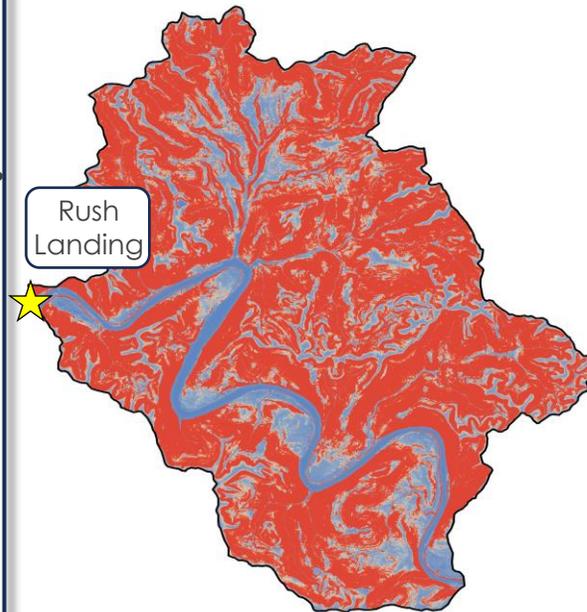


TOPOGRAPHIC INDICES

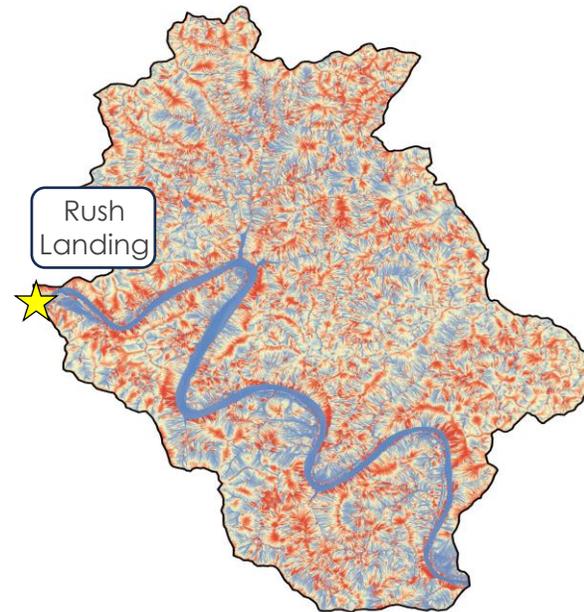
Digital Elevation Model (DEM)



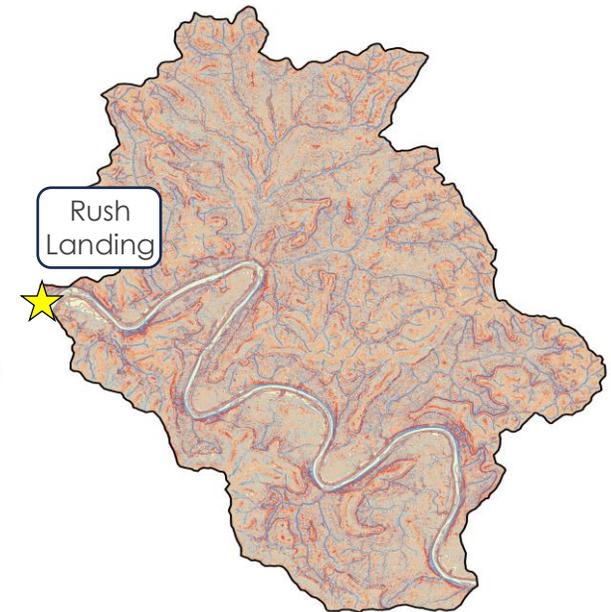
Multi-Resolution Valley Bottom Flatness (MRVBF)



Topographic Wetness Index (TWI)



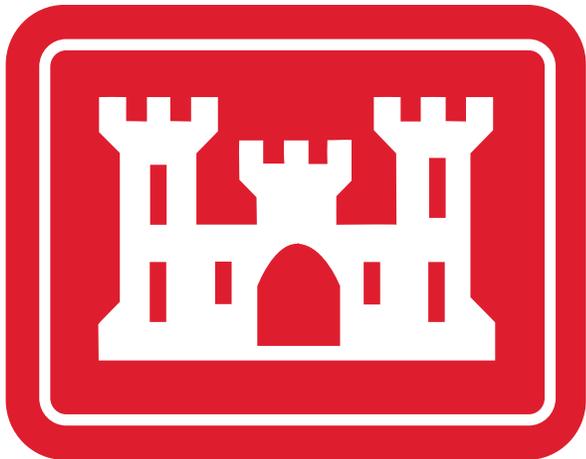
Topographic Positioning Index (TPI)



HYDRAULIC MODELING (HEC-RAS)

Hydrologic Engineering Center – River Analysis System

Developed by
the U.S. Army
Corps of
Engineers



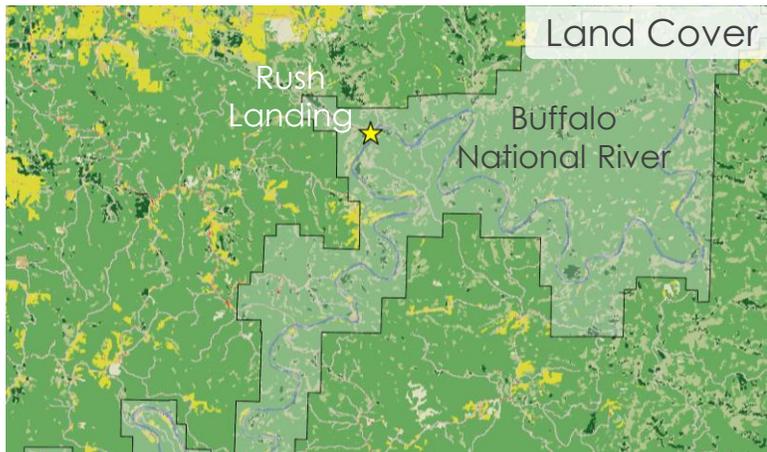
Free-to-download
publicly available
software



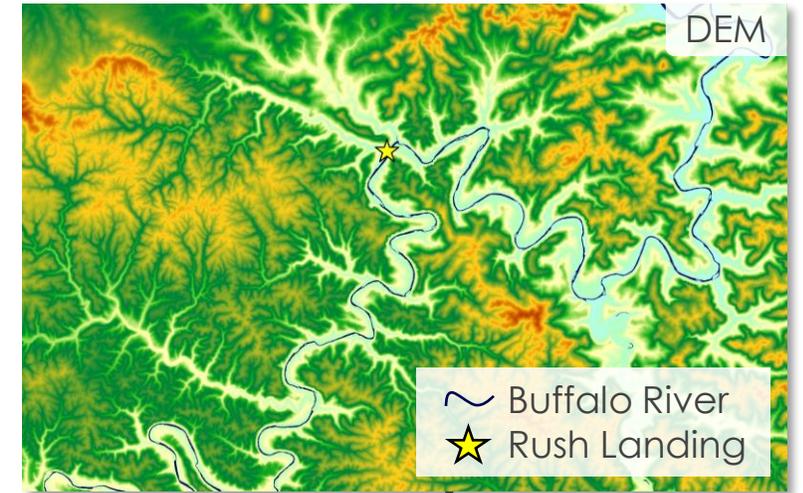
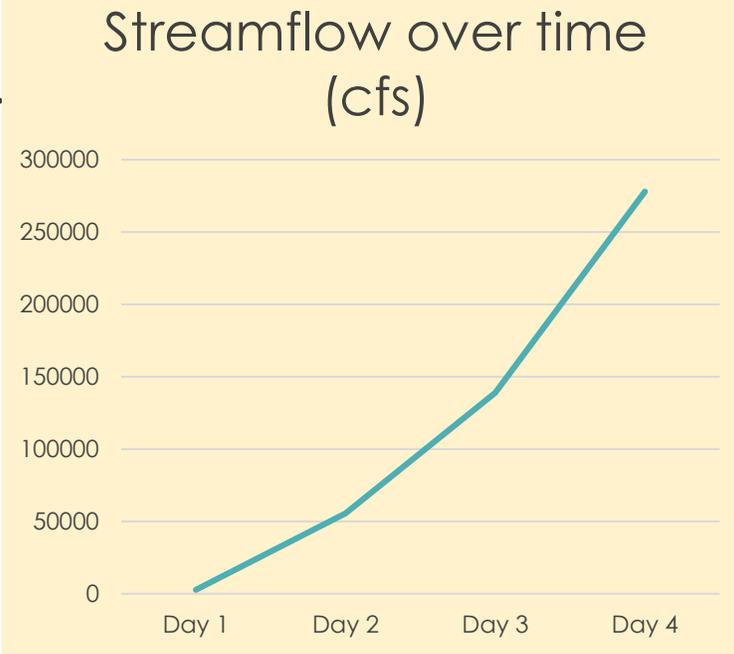
Can be used to
create 2D
unsteady flow
models



HYDRAULIC MODELING (HEC-RAS)



Hypothetical Storm



Manning's n Values

Outputs:
100- and 500-
Year Floodplains
+
Timeseries Maps

CONFUSION MATRICES

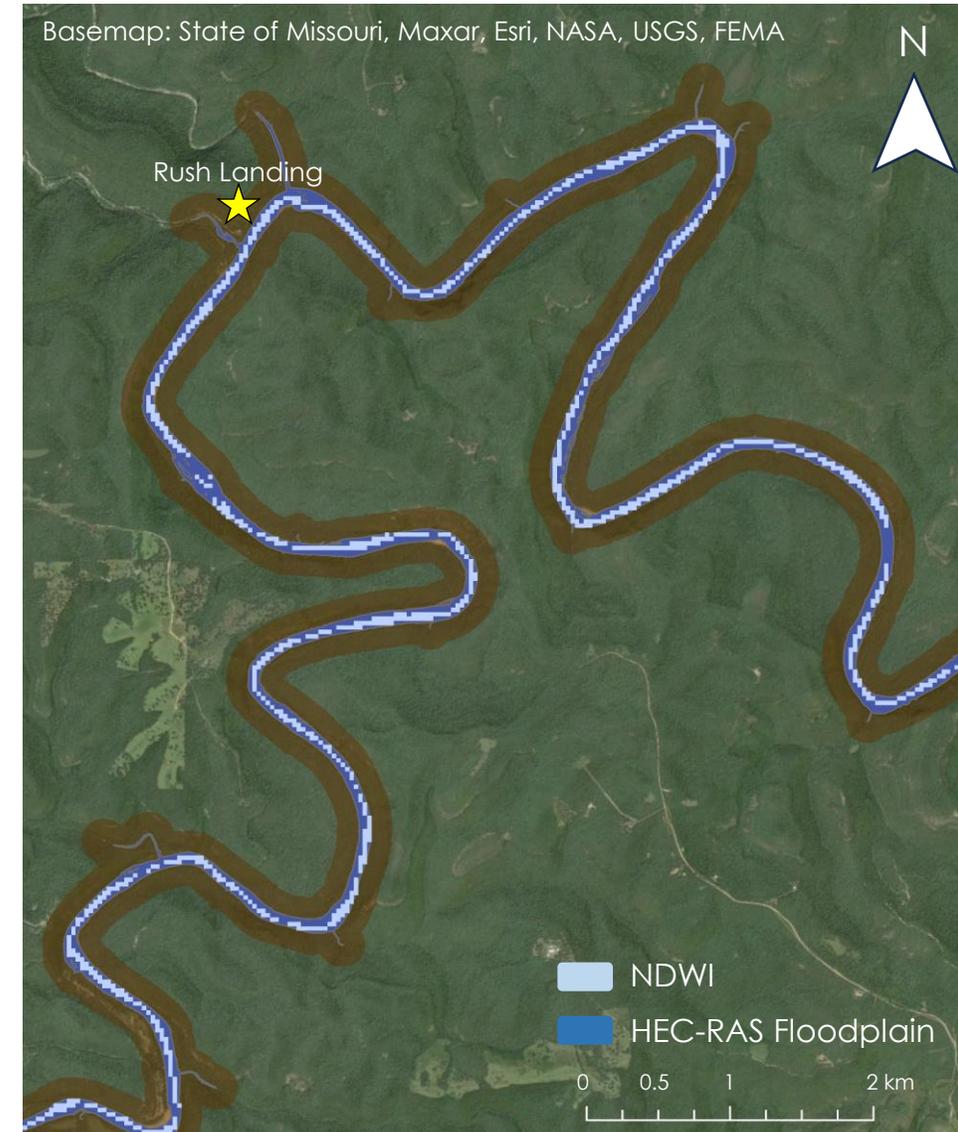
Class		HEC-RAS Floodplain	
		Flooded Area	Non-Flooded Area
NDWI/ TWI	Flooded Area	True Positive	False Negative
	Non-Flooded Area	False Positive	True Negative

NDWI

- Accuracy: 85.83%
- Agreement: 47.40% (Moderate)

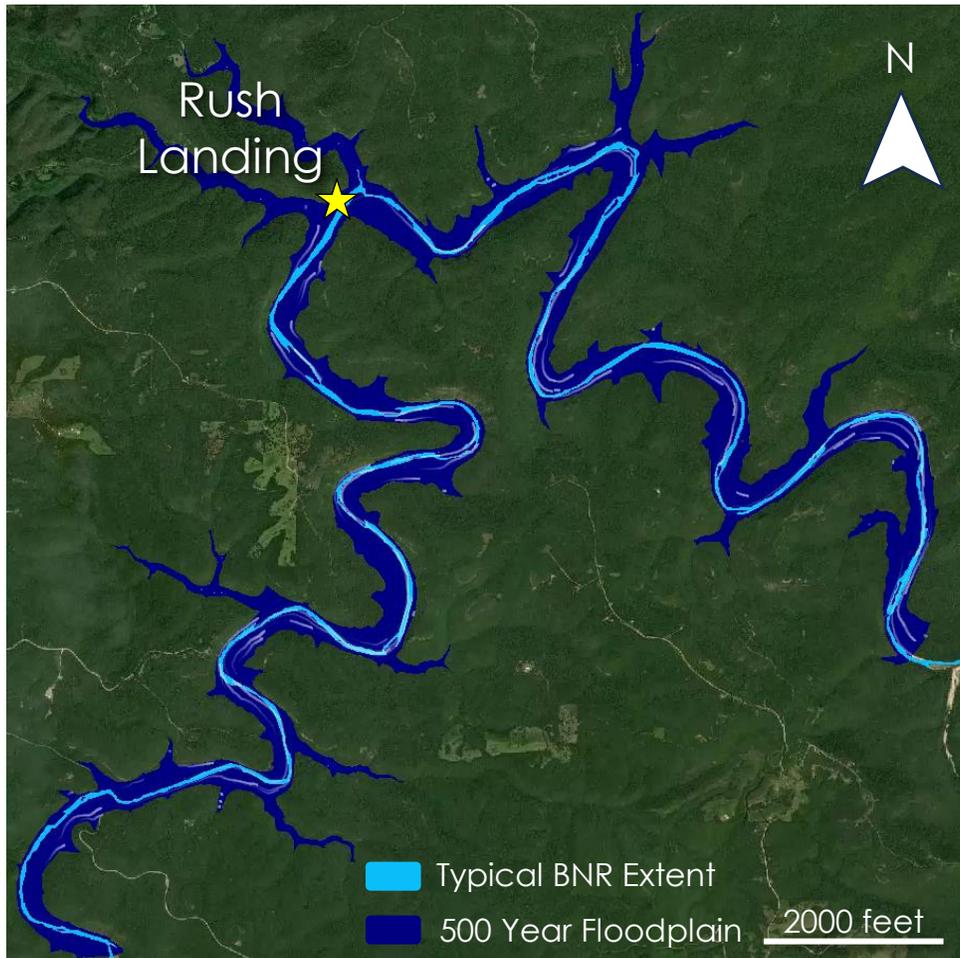
TWI

- Accuracy: 87.43%
- Agreement: 75.12% (Substantial)



FLOOD EXTENT MAPS

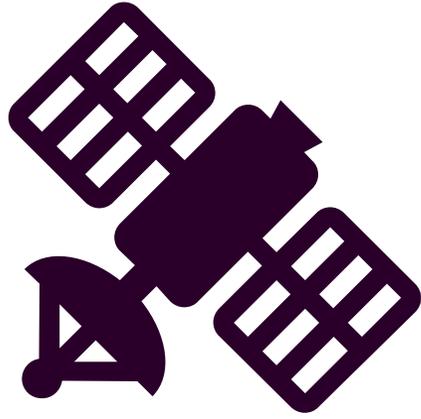
500-year Floodplain



Flood Timeseries (2004-2024)



LIMITATIONS



Satellite Data

- Lack of coverage
- Cloud cover
- Low spatial resolution



Flood Discharge

- Estimated from USGS



Modeling

- Topography-based flood maps only

CONCLUSIONS

Accuracy Assessment Procedure

- Moderate agreement with NDWI
- Substantial agreement with TWI
- Additional hydraulic controls could improve models



This methodology is feasible and can be used for...

- Assessing risk to priority infrastructure
- Guiding park planning and management
- Replicating process to map additional sites



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- **DEVELOP Center Lead & Fellows:** Alyson Bergamini, Laramie Plott, Brent Bowler, Jennifer Hall, Brooklyn Appling
- **NPS Partners:** Jennifer Haack-Gaynor, Derek Filipek
- **Other:** Patrick O'Shea

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