



The SECAS Third Thursday Web Forum

Landscape scale assessment of floodplain inundation frequency
using Landsat imagery

Agenda

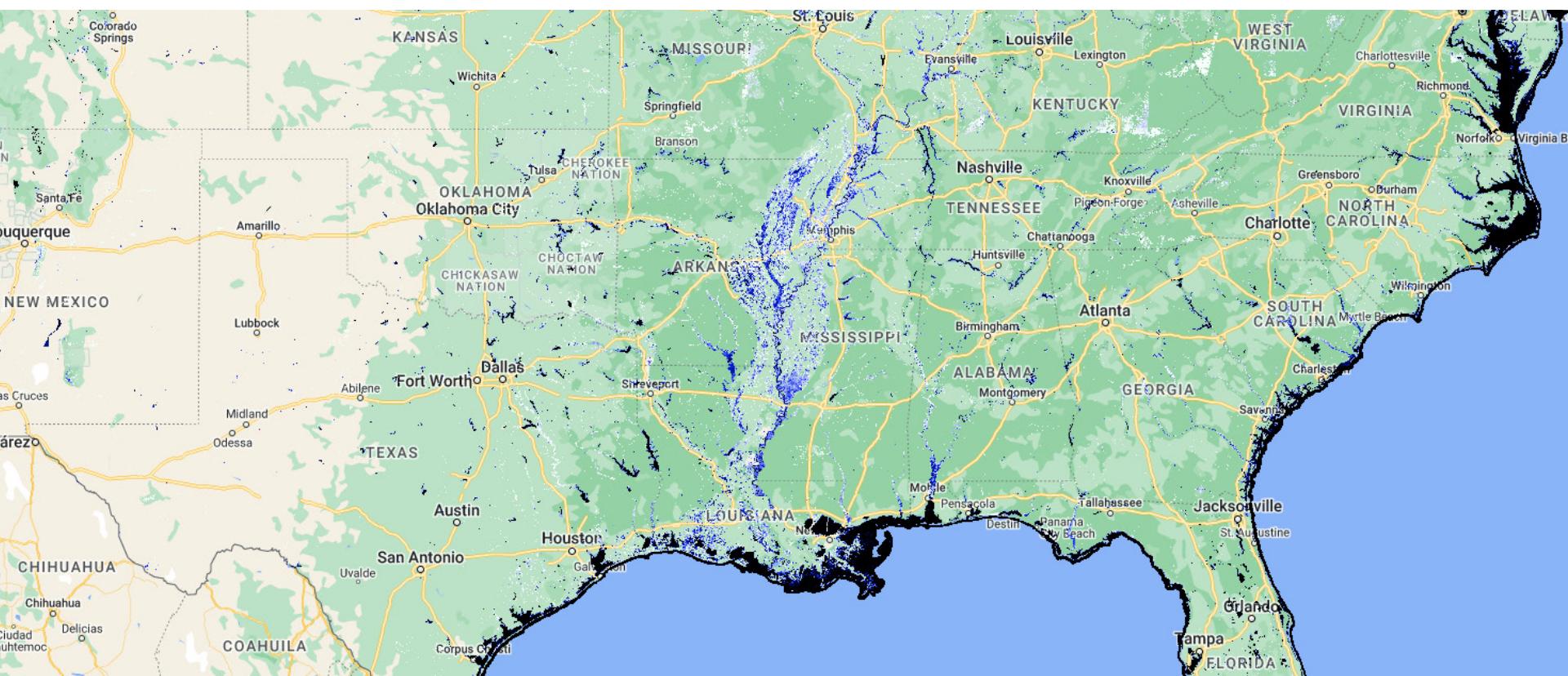
- Introduction
- Monthly topic
- Q&A and discussion
- Preview of next webinar
- Staff updates



Landscape scale assessment of floodplain inundation frequency using Landsat imagery

Yvonne Allen, U.S. Fish and Wildlife Service

9-15-2022



Multitemporal Imagery to Assess Floodplain Inundation Extent and Frequency

15 Sep 2022

yvonne_allen@fws.gov

USFWS

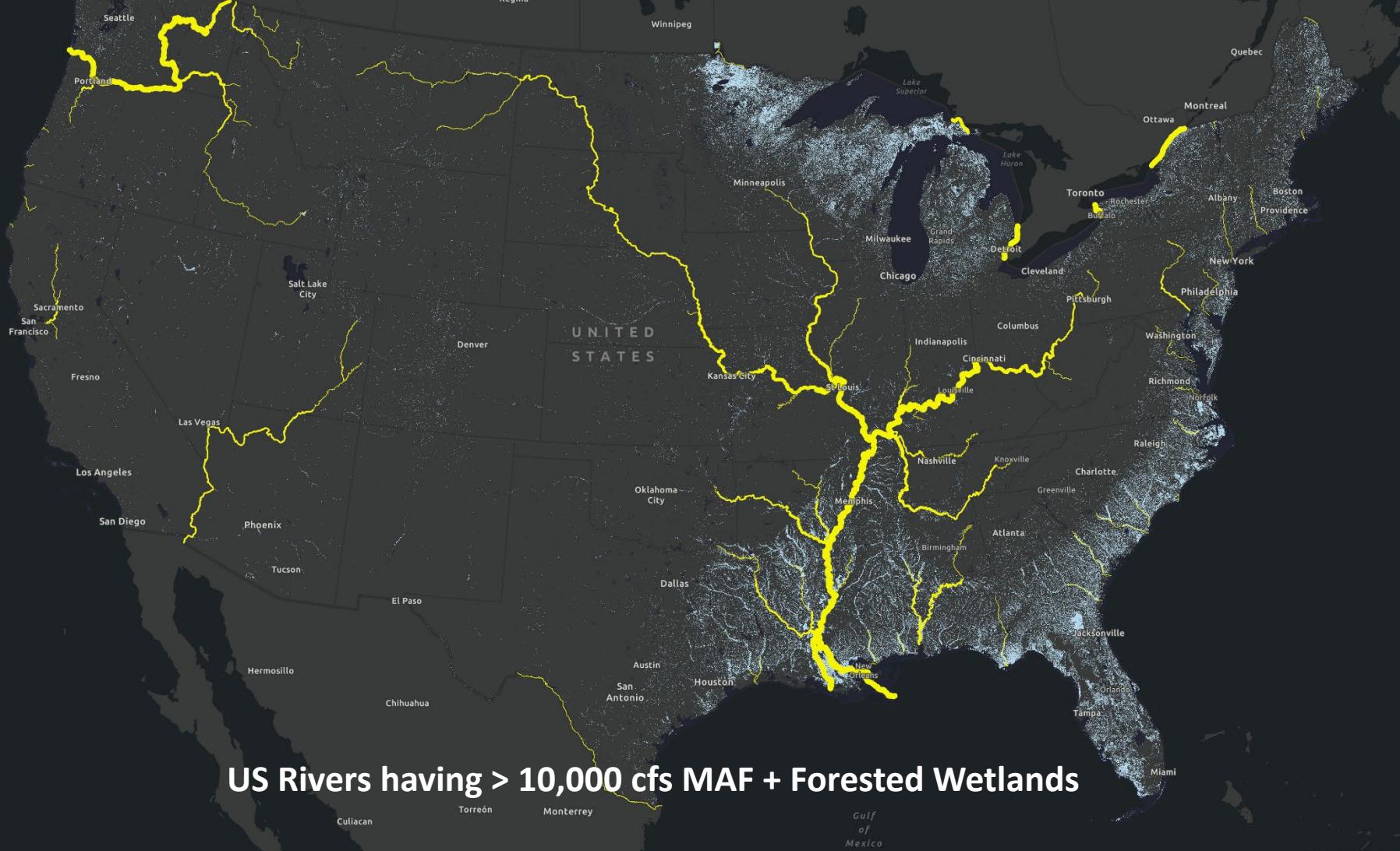
Science Applications and Migratory Birds Program
Southeast Region



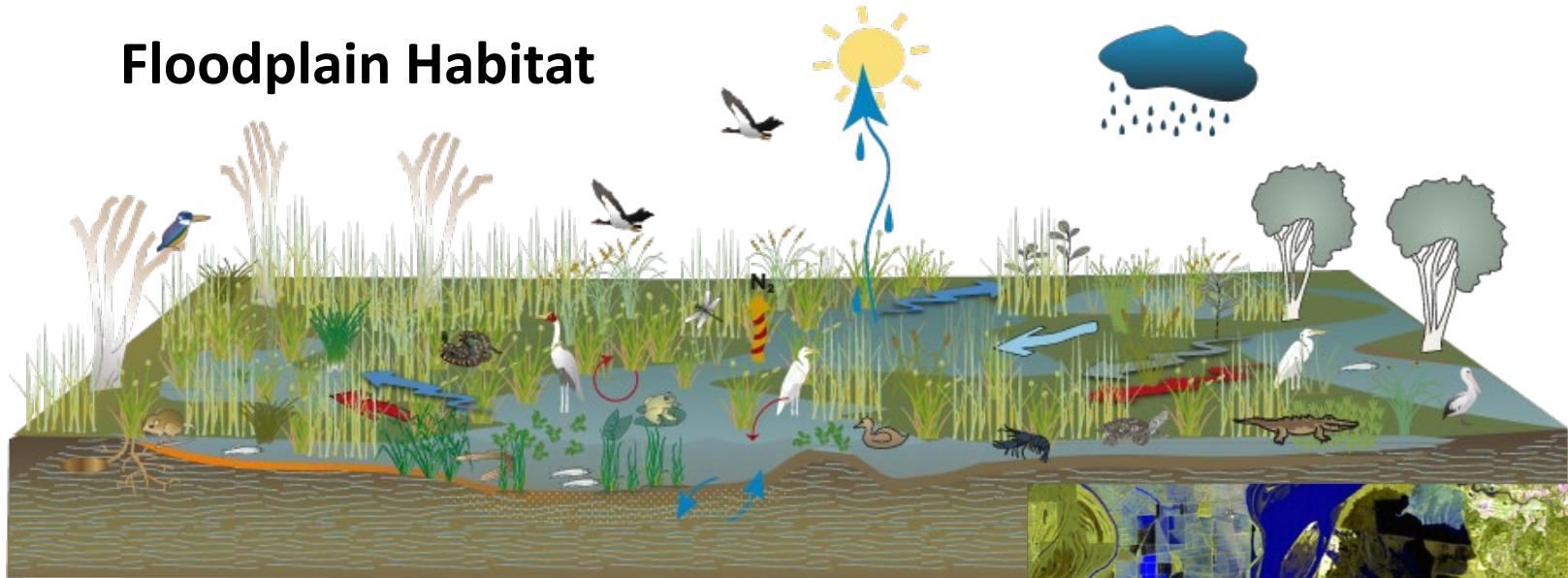
Outline

- Motivation for creating “Inundation Frequency and Extent Using Imagery”
- Under the hood – process for creating IF and temporal considerations
- Comparison with other similar datasets
 - JRC, NWI, FEMA
- Four example applications
- Demonstration of Google Earth Engine App

Motivation: Mapping Large River Floodplain Conditions in the SE



Floodplain Habitat



Floodplain Ecosystem Services

- habitat for aquatic species
- habitat for terrestrial species
- nutrient cycling
- flood risk reduction
- *Floodplain inundation extent and frequency drive the delivery of ecosystem services*



Raw Materials:

- Landsat Imagery (early 1980s to present)
- Cloud and Snow Free
- Extent of open water **and** flooded veg
- Acquired **Dec-Mar** (Apr)
 - capture a variety of hydro conditions
 - reduce obscuring from vegetation
(canopy, ground, floating)



National distribution of peak flows

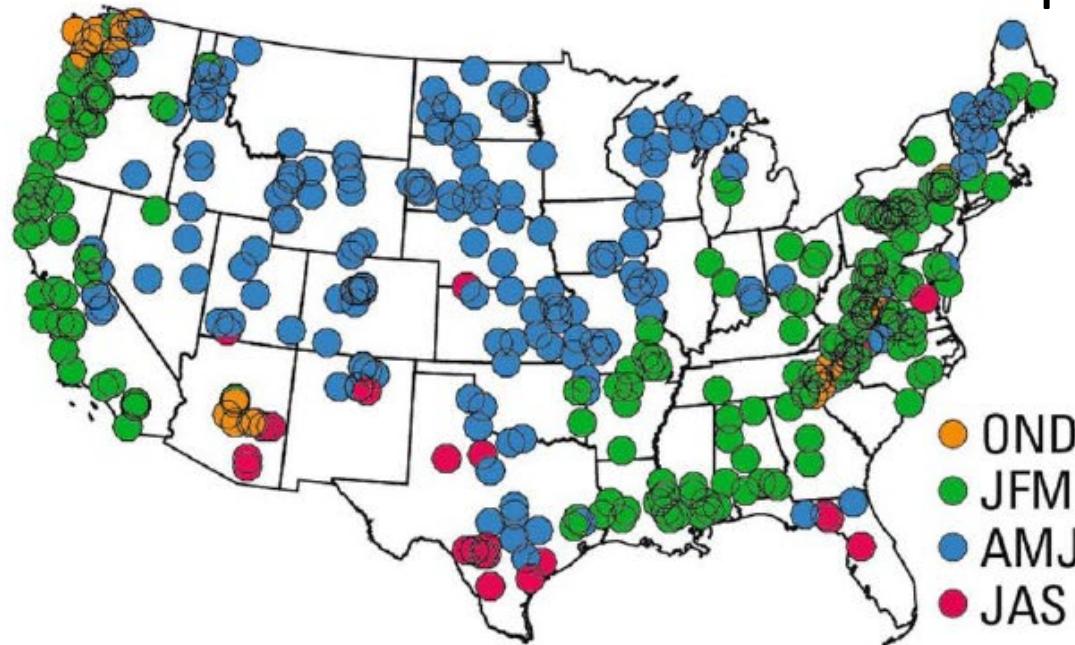
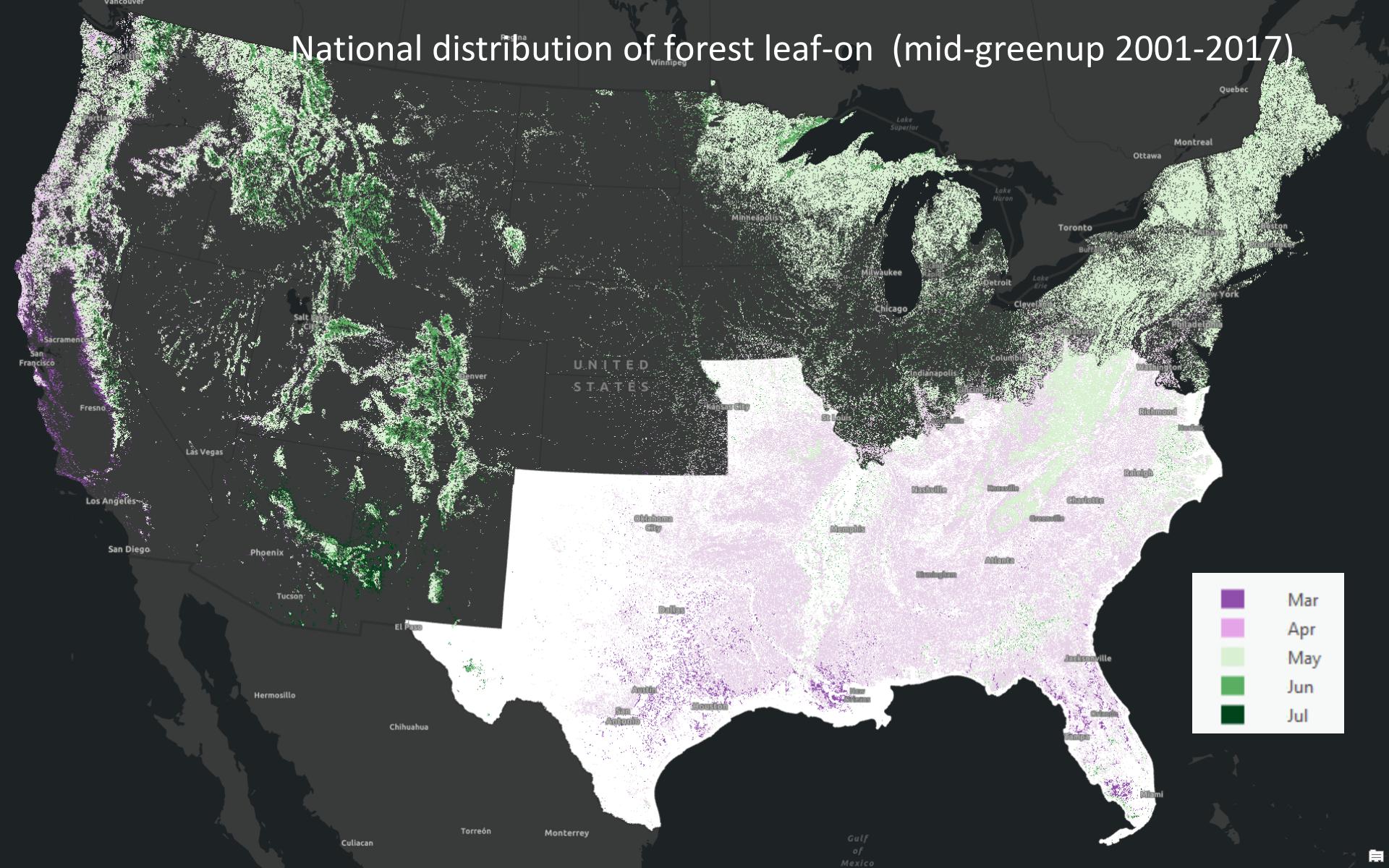


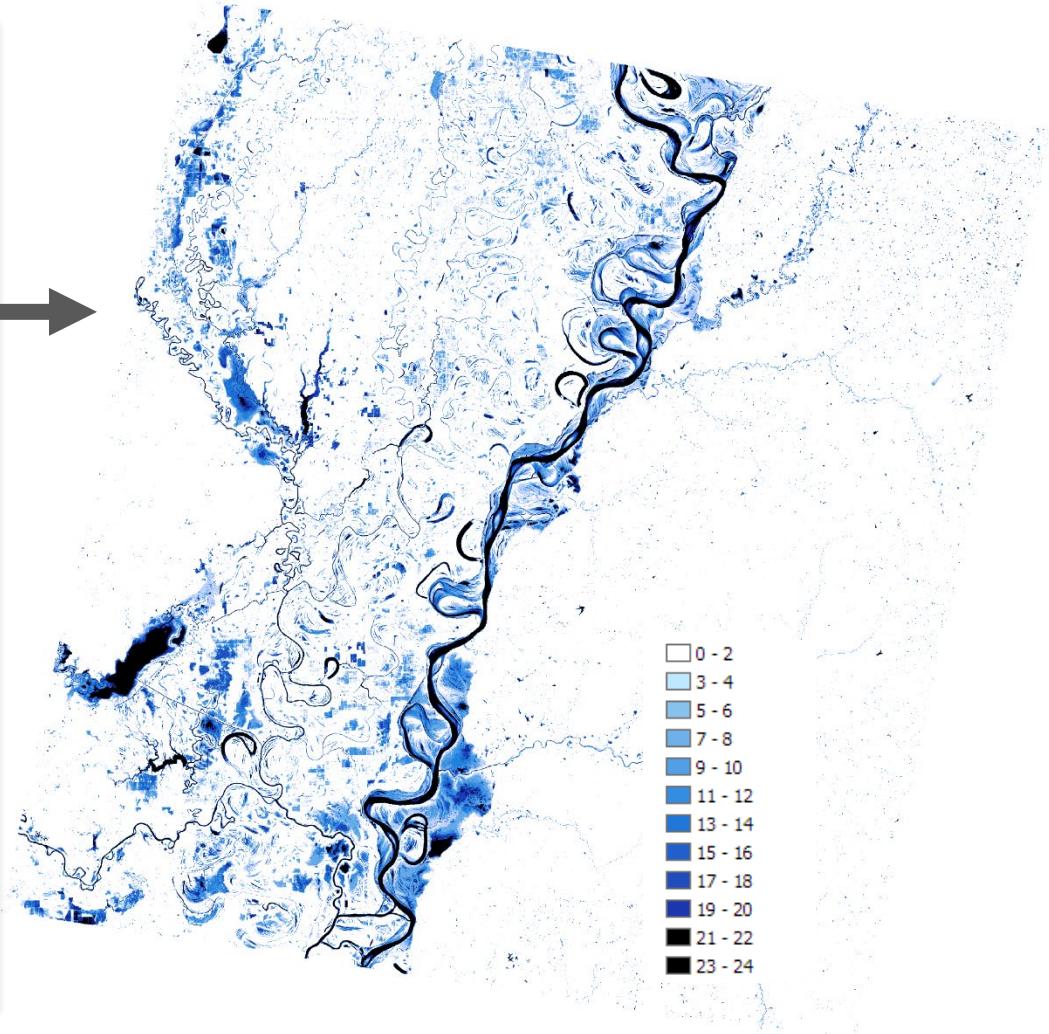
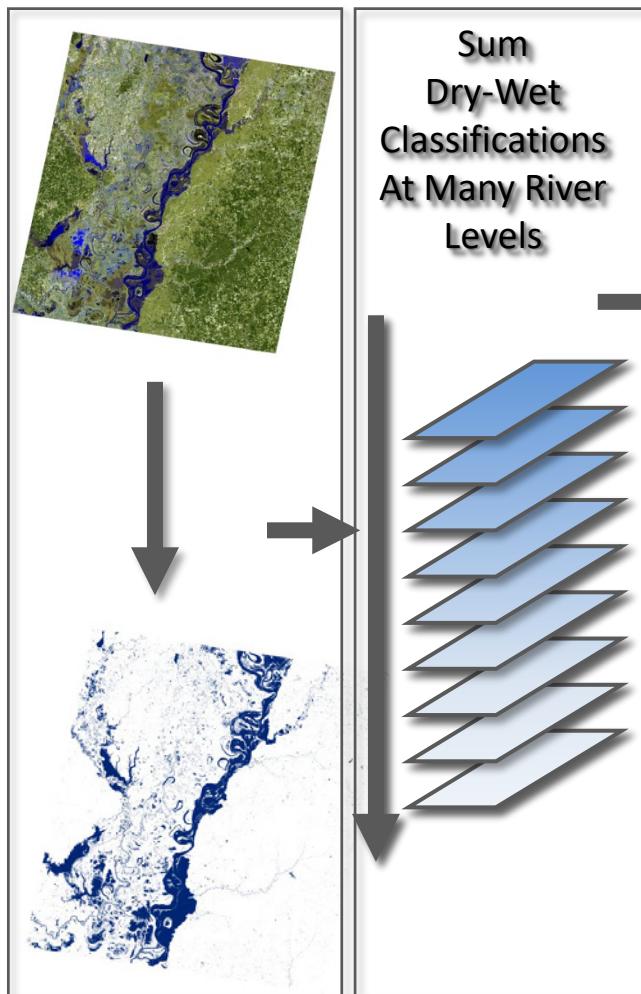
Figure 1. Mean season of the annual peak flow from 1966-2015 at 415 streamflow gauges in the USGS HCDN-2009 network. The seasons are defined as October-December (OND), January-March (JFM), April-June (AMJ), and July-September (JAS).

From: Dickinson et.al 2019 “Seasonality of climatic drivers of flood variability in the conterminous United States” Nature Scientific Reports 9:15321

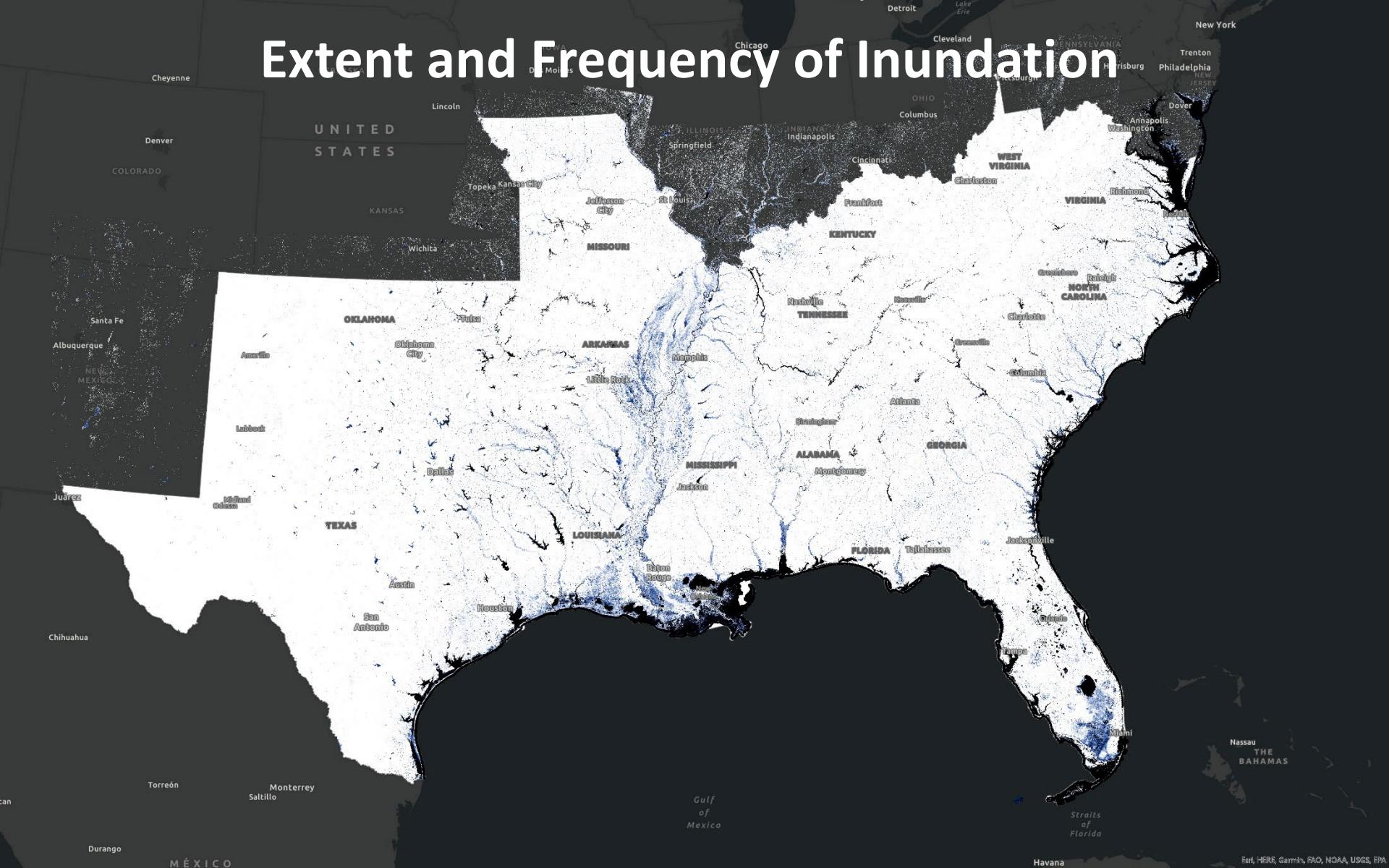
National distribution of forest leaf-on (mid-greenup 2001-2017)



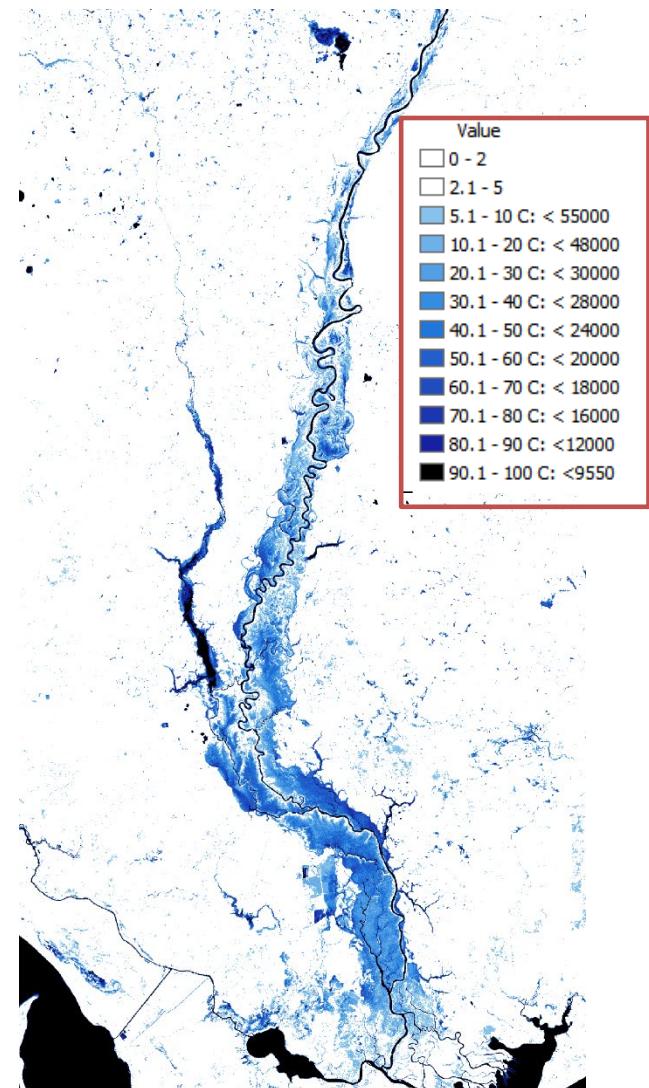
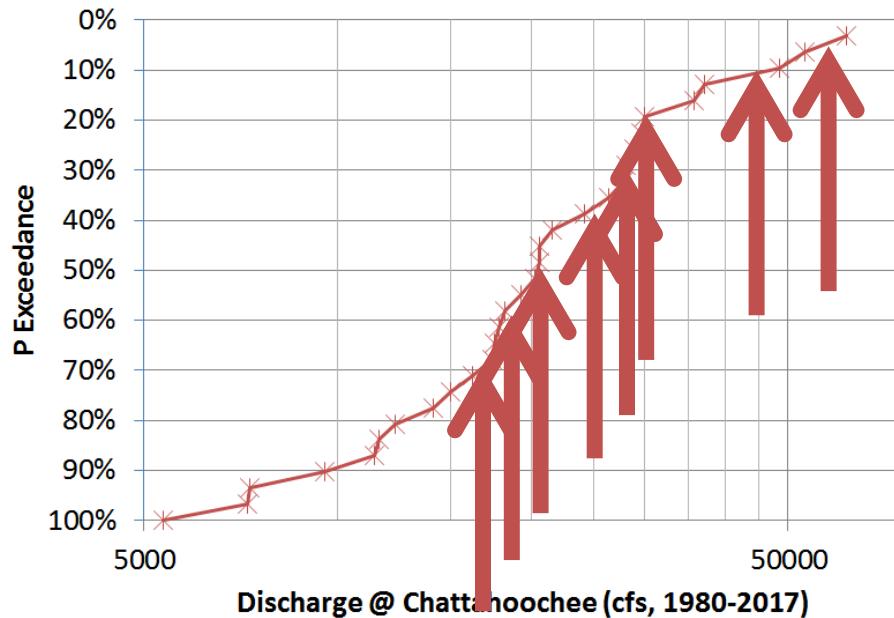
Extent and Frequency of Inundation



Extent and Frequency of Inundation



Extent and Frequency of Inundation – tied to local gaging



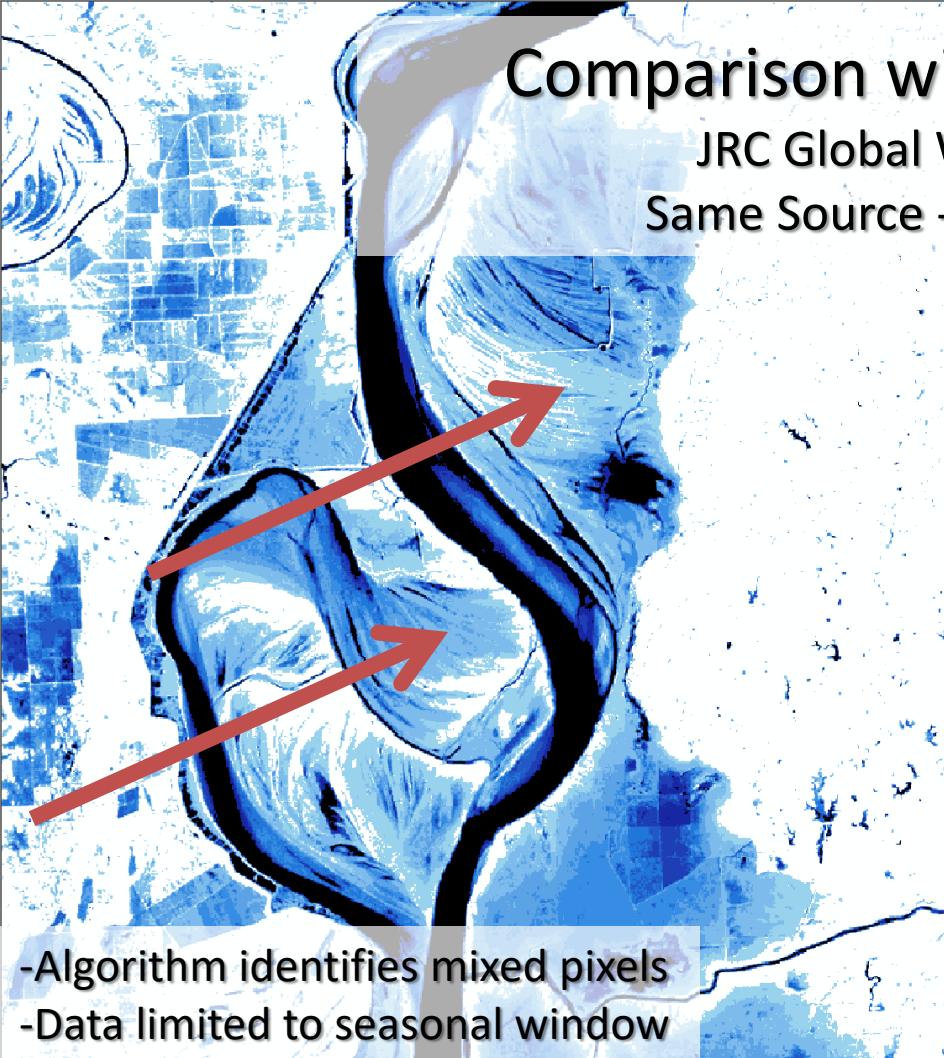
Application: Apalachicola River

- Estimate spatial extent of inundation with discharge
- Target monitoring locations for changes in flooding extent due to changes in water control manual

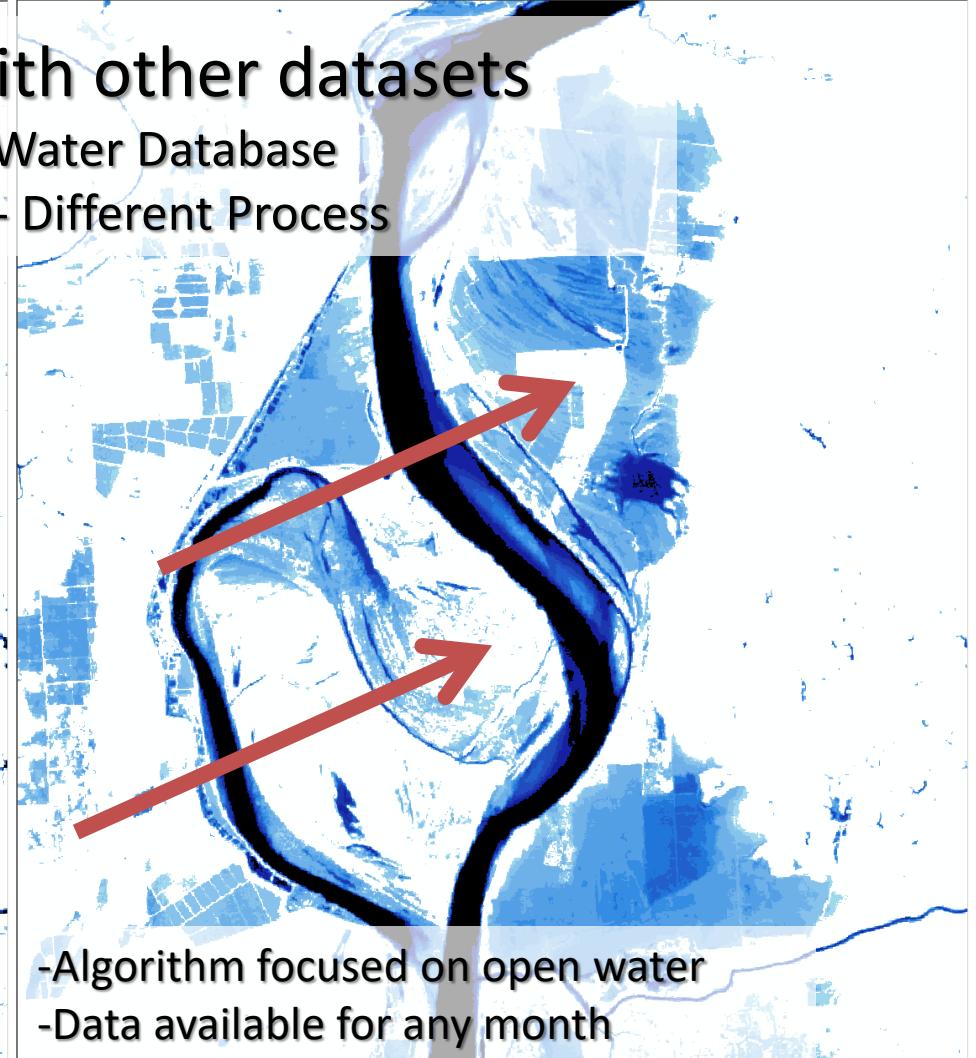
Comparison with other datasets

JRC Global Water Database

Same Source - Different Process

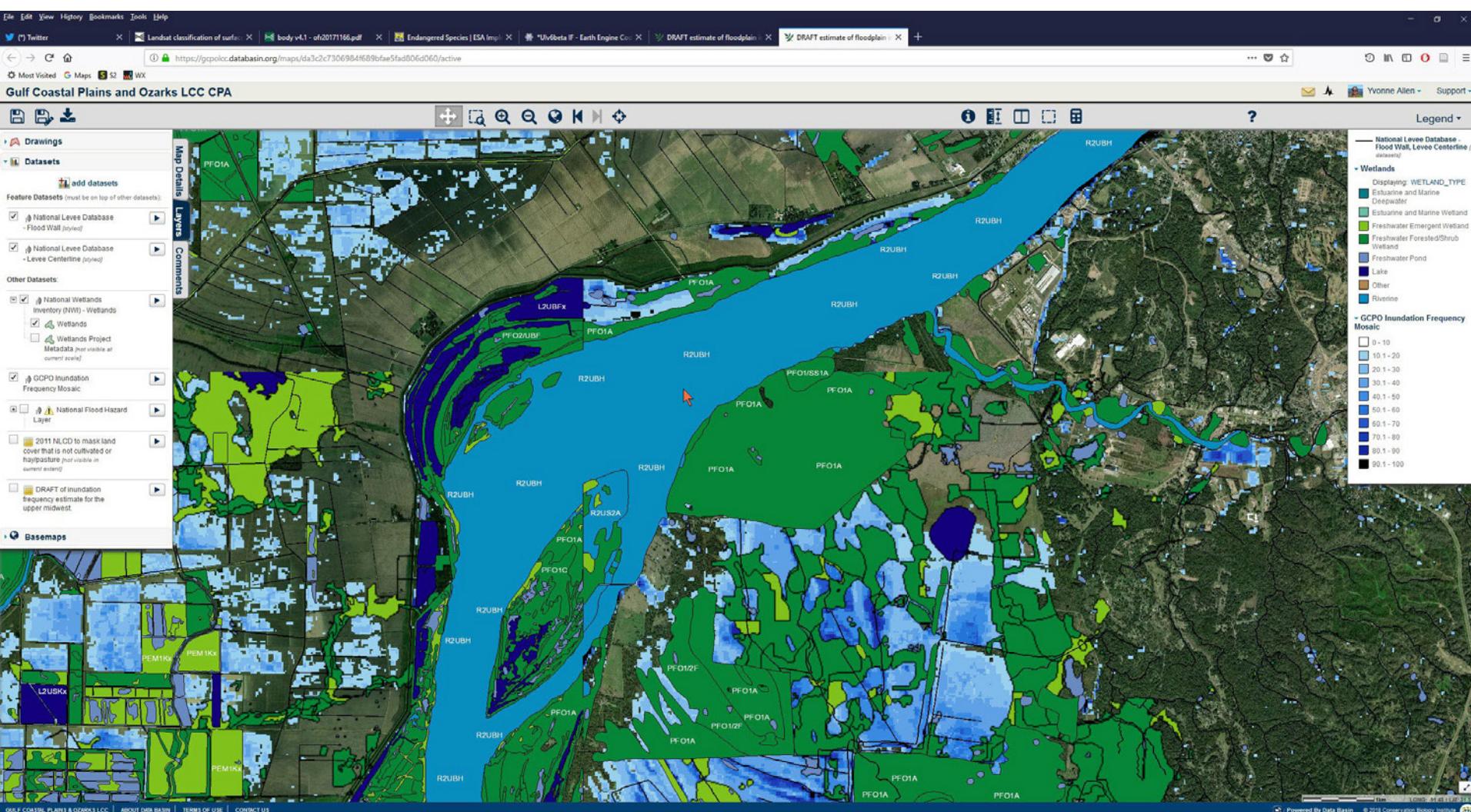


Inundation Index

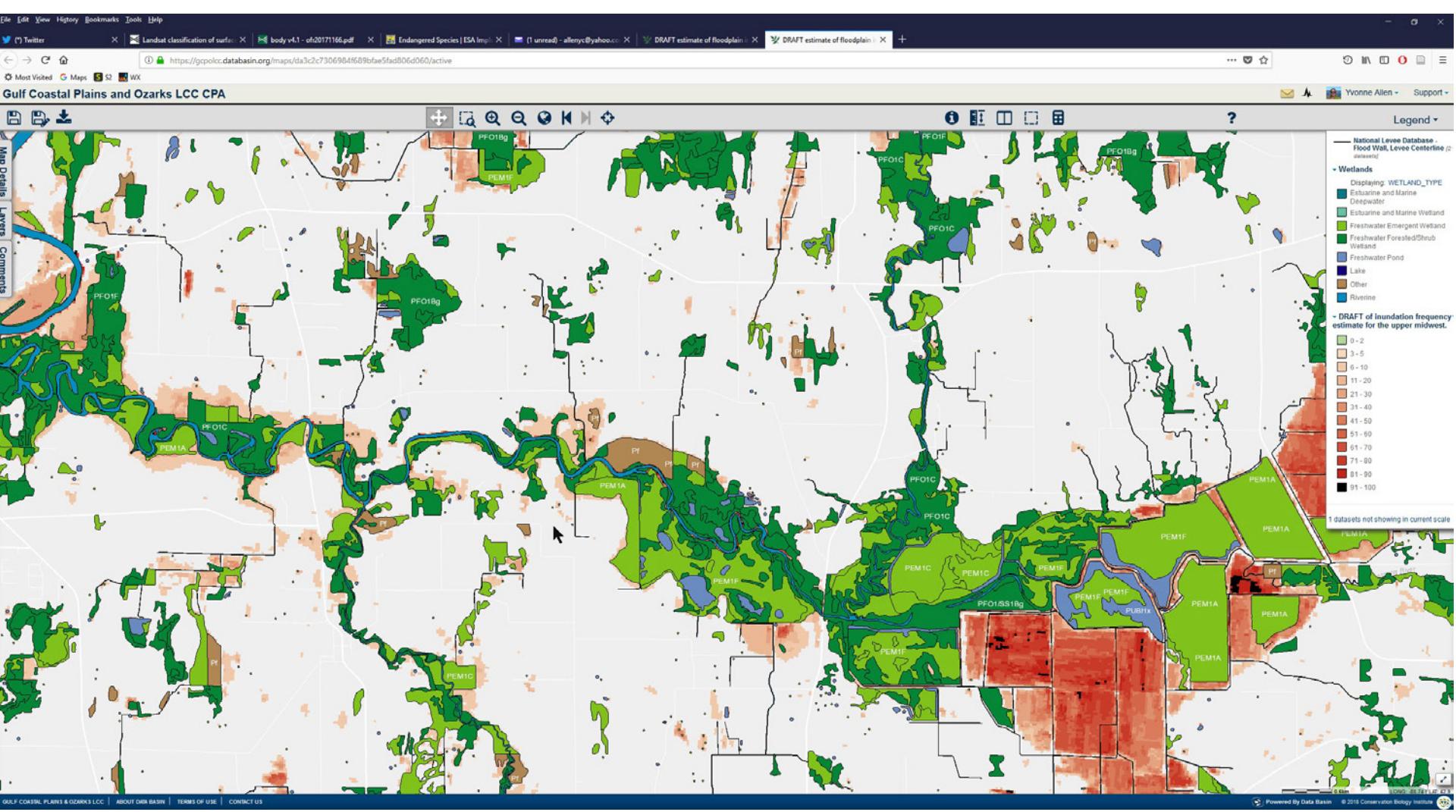


JRC Global Water Database

Comparison with NWI – Lower Mississippi



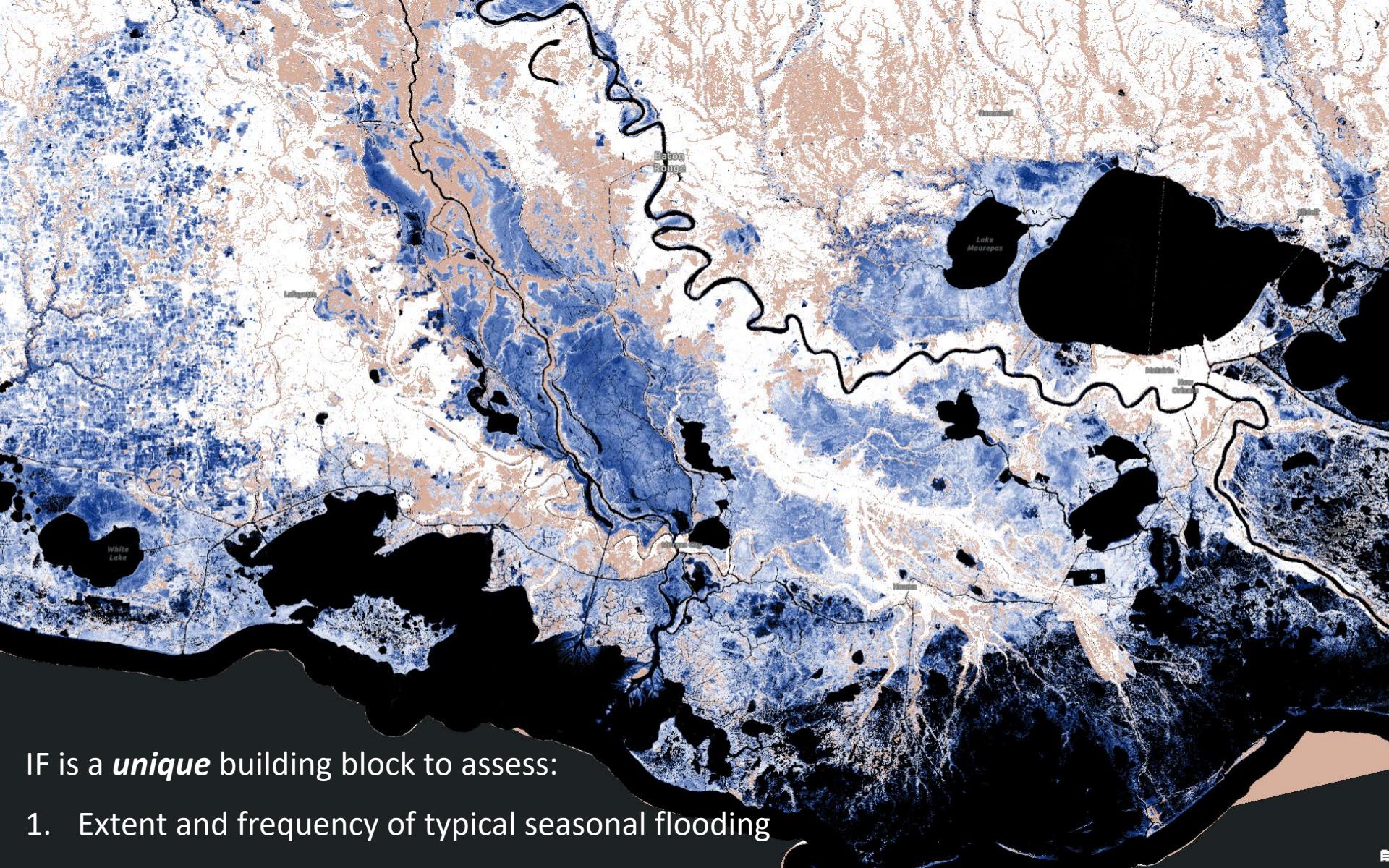
Comparison with FEMA FIRMS and NWI - SE Wisconsin



IF is a *unique* building block...

Four example applications:

1. Extent and frequency of typical seasonal flooding
2. Floodplain reconnection opportunities
3. Habitat suitability for floodplain dependent/sensitive species
4. Floodplain condition at a given time (e.g. during Lidar acquisition)

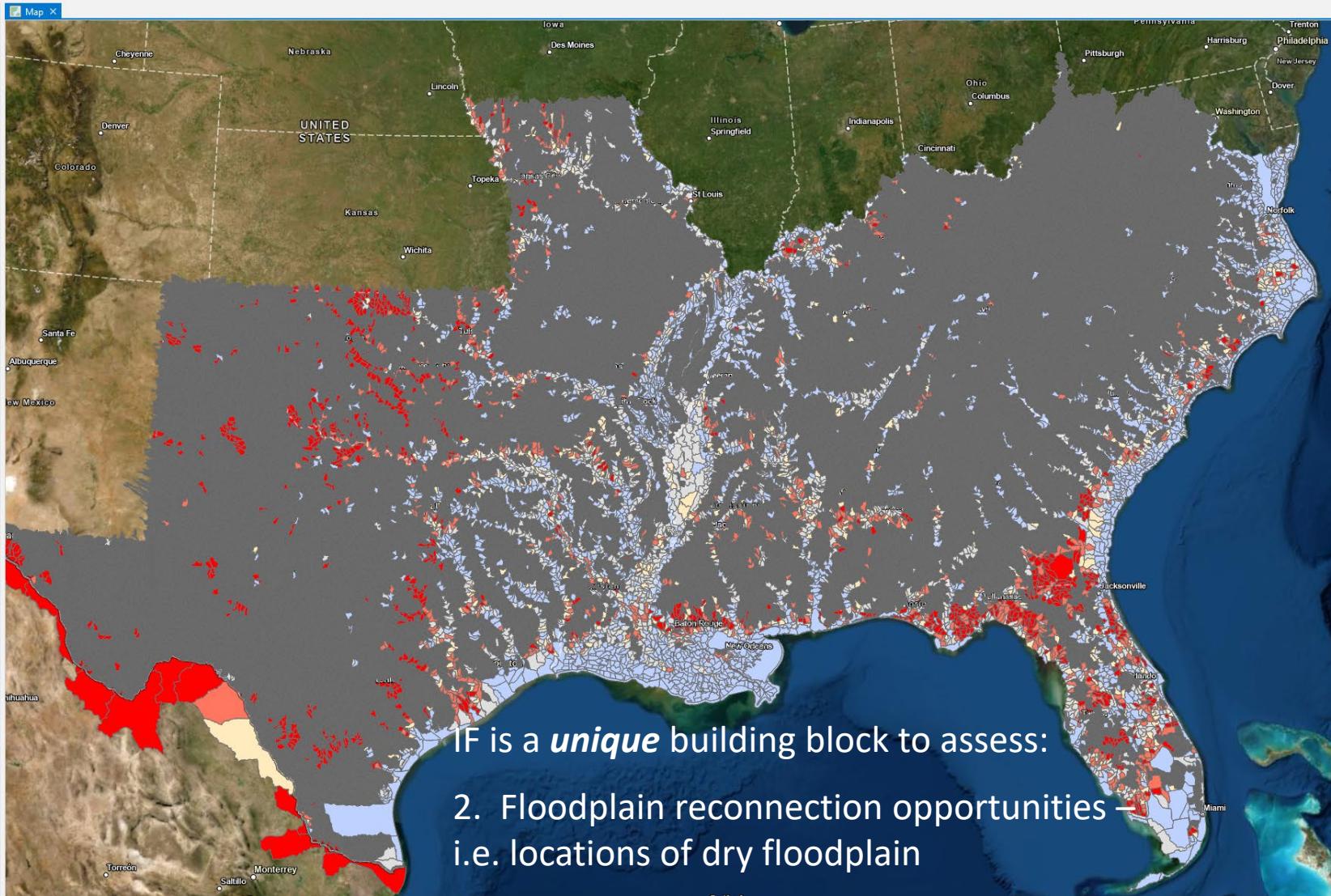


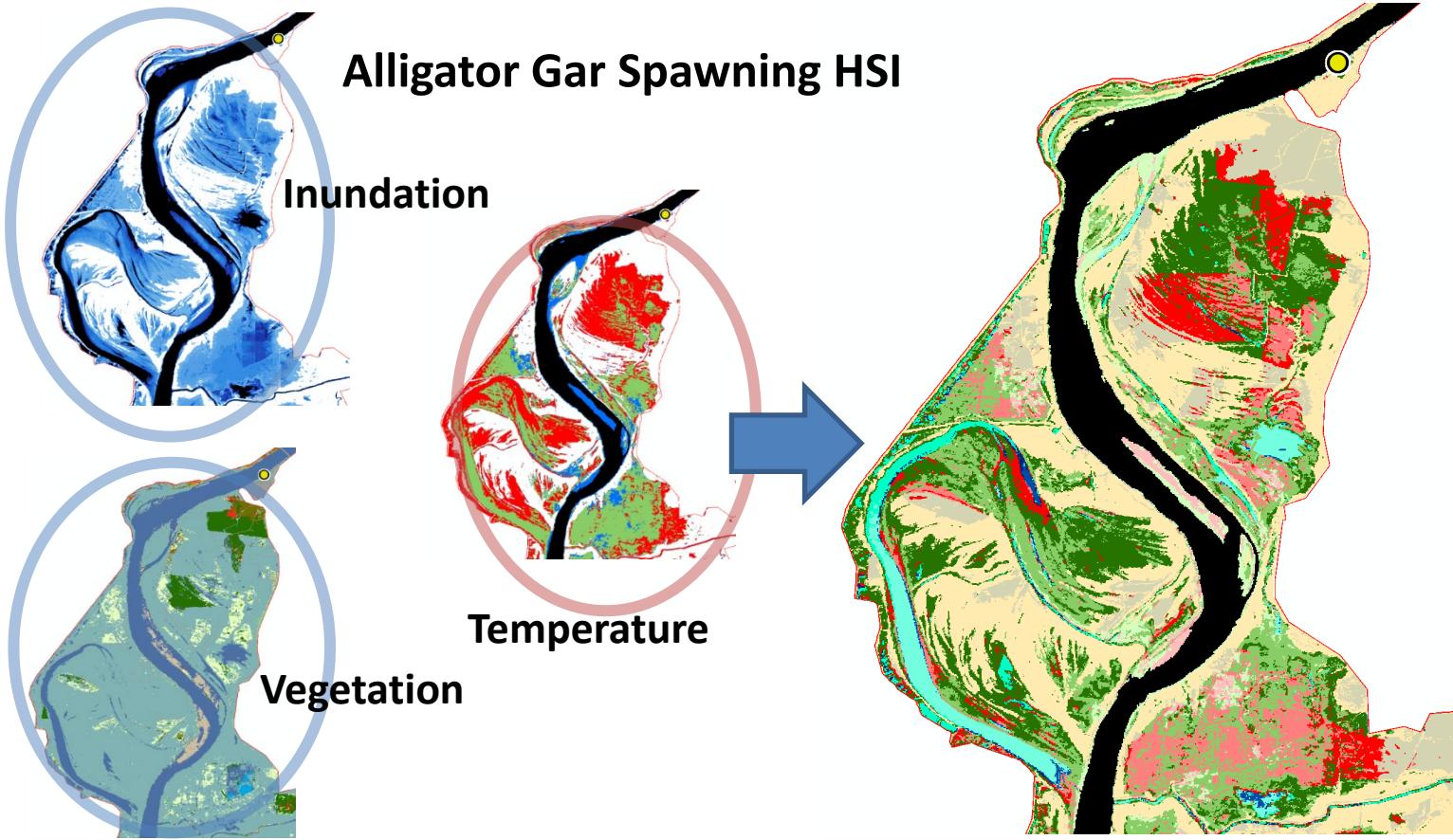
IF is a *unique* building block to assess:

1. Extent and frequency of typical seasonal flooding

Contents

- Search
- Drawing Order
- Map
- SE_HUC12 - Percent of Total Area that is FP
- Custom
- 0.005618 - 10.000000
 - 10.000001 - 20.000000
 - 20.000001 - 30.000000
 - 30.000001 - 74.888190
 - 74.888191 - 100.000000
- SE_HUC12
- Hybrid Reference Layer
- Estimated_floodplain_SE.tif
- SE_HUC12
- SE_HUC12_PerDryFP
- 0.000000 - 50.000000
 - 50.000001 - 75.000000
 - 75.000001 - 80.000000
 - 80.000001 - 90.000000
 - 90.000001 - 100.000000
- Floodplain_plus_IF_reclass_v4.tif
- Floodplain_plus_IF_reclass_v3.tif
- SE_TX_OK_MERGE_V3_RECLASS_V2.tif
- SE_TX_OK_MERGE_V3.tif
- BaseBlueprint_5070
- BaseBlueprintExtent2022.tif
- World Imagery
- Standalone Tables
- se_fp_zonal



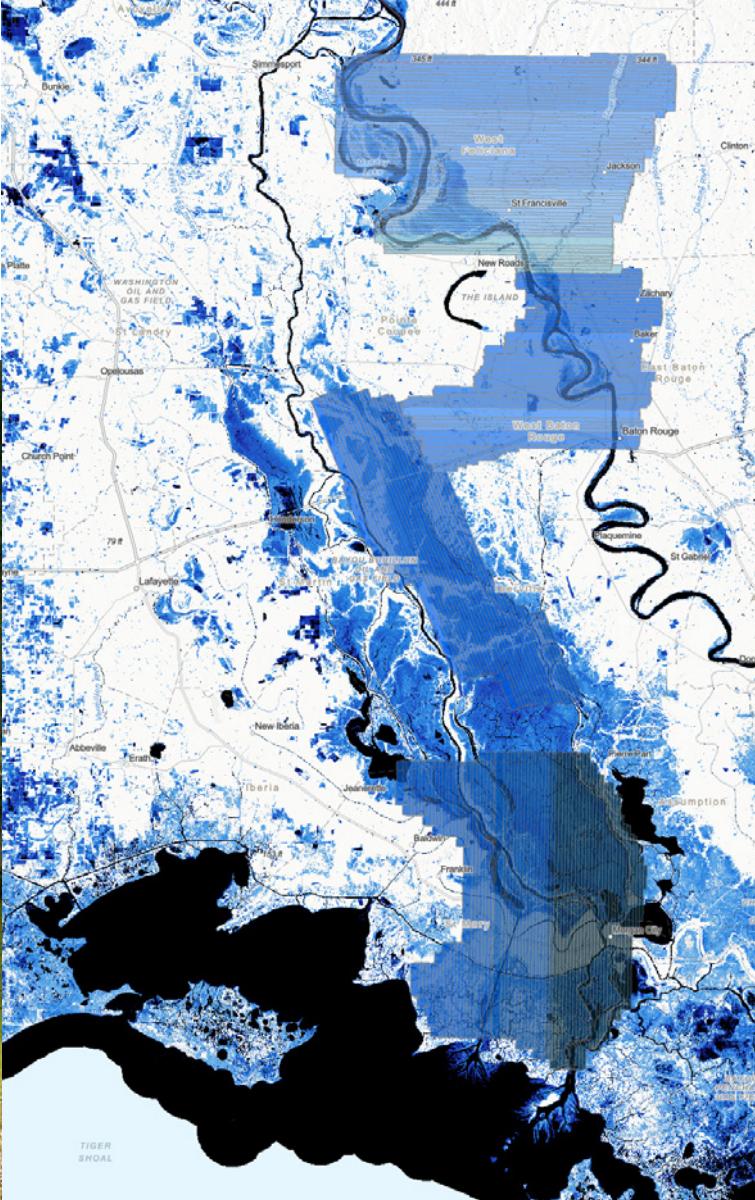


IF is a *unique* building block to assess:

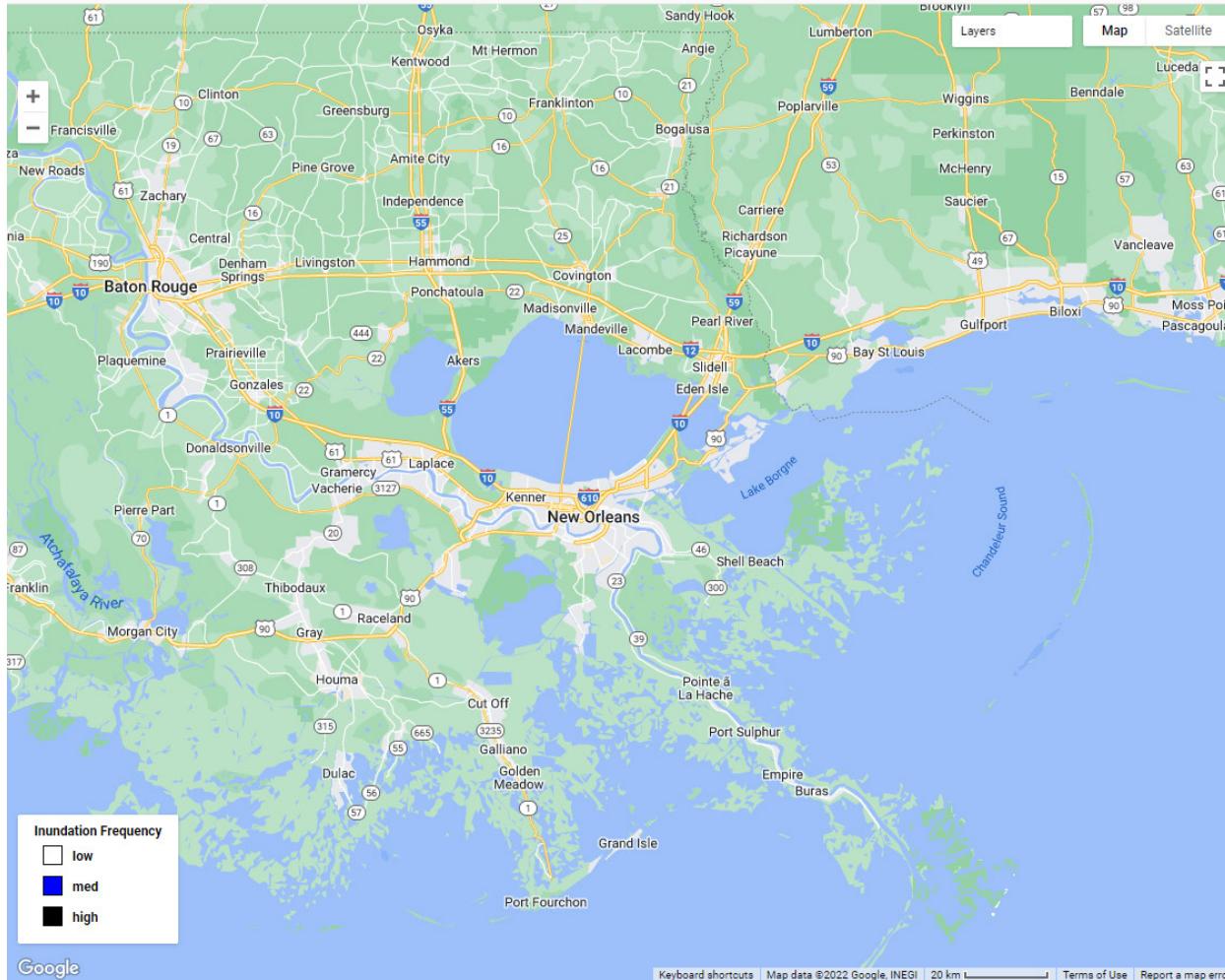
3. Habitat suitability (e.g. floodplain dependent/sensitive species)

IF is a *unique* building block to assess:

4. Floodplain condition at a given time (e.g. during Lidar acquisition)



Google Earth Engine App Demo



Sentinel-2 Inundation Frequency Explorer *

Step 1: Navigate to your area of interest

Step 2: Click here to draw an AOI

Step 3: Wait for inundation frequency layers to draw

Background color shows the number of images used:
green=good > 20 images,
red=poor <10 Images

If desired, adjust temporal settings below and repeat step 2

Start Month: (default is 12)

End Month: (default is 3)

Start Year: (default is 2017)

End Year: (default is 2030)

Clear AOI

Clear IF Layers

* Notes:

- 1) Uses imagery to show the extent and relative frequency of inundation
- 2) Methods are documented here: <https://onlinelibrary.wiley.com/doi/abs/10.1002/rra.2987>
- 3) Results are optimal during leaf-off conditions with no obscuring ground vegetation
- 4) Results are relative based on the input imagery, for more information about converting to absolute return frequencies, refer to the publication listed above
- 5) Please contact the author: yvonne_allen@fws.gov for further information

Preliminary Classification of Water Areas Within the Atchafalaya Basin Floodway System by Using Landsat Imagery

Using Multitemporal Remote Sensing Imagery and Inundation Measures to Improve Land Change Estimates in Coastal Wetlands

Yvonne C. Allen • Brady R. Couvillion • John A. Barras

RIVER RESEARCH AND APPLICATIONS

River Res. Applic., 32: 1609–1620 (2016)

Published online 18 December 2015 in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/rra.2987

2 September 2011

LANDSCAPE SCALE ASSESSMENT OF FLOODPLAIN INUNDATION FREQUENCY USING LANDSAT IMAGERY

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and sediment delivery, may be further

change · Remote sensing · Inundation ·
Landsat

ABSTI

In large river ecosystems, the timing, extent, duration and frequency of inundation are critical to habitat and the supply of important ecosystem goods and services. Sea level rise and seasonal inundation of the floodplain governs ecosystem structure and function. Inundation events have altered the connectivity of many rivers with their floodplains, impacting the mainstem river and the adjacent floodplain.

Open-File Report 2008-1320

U.S. Department
U.S. Geological Survey

North American Journal of Fisheries Management 40:580–594, 2020

Published 2020. This article is a U.S. Government work and is in the public domain in the USA. *North American Journal of Fisheries Management*

published by Wiley Periodicals, Inc. on behalf of American Fisheries Society.

ISSN: 0275-5947 print / 1548-8675 online

DOI: 10.1002/namf.10433

SPECIAL SECTION: ALLIGATOR GAR

Using Remote Sensing to Assess Alligator Gar Spawning Habitat Suitability in the Lower Mississippi River

Yvonne Allen,* Kayla Kimmel, and Glenn Constant
U.S. Fish and Wildlife Service, Baton Rouge Fish and Wildlife Conservation Office, 243 Parker Coliseum,
Louisiana State University, Baton Rouge, Louisiana 70803, USA

Open Access Article

Conservation–Protection of Forests for Wildlife in the Mississippi Alluvial Valley

by A. Blaine Elliott¹ , Anne E. Mini¹ , S. Keith McKnight²  and Daniel J. Twedt^{3,*} 

¹ Lower Mississippi Valley Joint Venture, 193 Business Park Drive, Ridgeland, MS 39157, USA

² Lower Mississippi Valley Joint Venture, 11942 FM 848, Tyler, TX 75707, USA

³ U.S. Geological Survey, Patuxent Wildlife Research Center, 3918 Central Ave., Memphis, TN 38152, USA

* Author to whom correspondence should be addressed.

Forests 2020, 11(1), 75; <https://doi.org/10.3390/f11010075>

Received: 2 December 2019 / Revised: 19 December 2019 / Accepted: 23 December 2019 / Published: 8 January 2020

(This article belongs to the Special Issue Protected Areas in Forest Conservation: Challenges and Opportunities)

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References

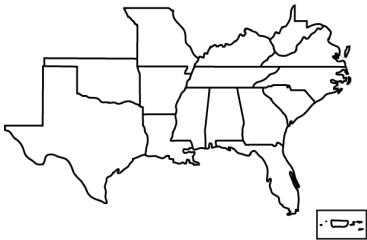
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<https://pubs.er.usgs.gov/publication/ofr20081320>
- Allen, Y. C., B. R. Couvillion, and J. A. Barras. 2011. Using Multitemporal Remote Sensing Imagery and Inundation Measures to Improve Land Change Estimates in Coastal Wetlands. *Estuaries and Coasts* 35:190–200. <http://link.springer.com/article/10.1007/s12237-011-9437-z>
- Allen, Y. 2016. Landscape Scale Assessment of Floodplain Inundation Frequency Using Landsat Imagery. *River Research and Applications* 32:1609–1620. <http://onlinelibrary.wiley.com/doi/10.1002/rra.2987/abstract>
- Elliott, A. B., A. E. Mini, S. K. McKnight, and D. J. Twedt. 2020. Conservation–Protection of Forests for Wildlife in the Mississippi Alluvial Valley. *Forests* 11:75. <https://www.mdpi.com/1999-4907/11/1/75>
- Allen, Y., K. Kimmel, and G. Constant. 2020. Using Remote Sensing to Assess Alligator Gar Spawning Habitat Suitability in the Lower Mississippi River. *North American Journal of Fisheries Management* 40:580–594.
<https://afspubs.onlinelibrary.wiley.com/doi/abs/10.1002/nafm.10433>
- Mapped comparison: <https://fws.maps.arcgis.com/apps/mapviewer/index.html?webmap=33f0148fc3d94f91a174bd78adfabc08>

Questions??

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Or DOI Teams Chat
Yvonne Allen





Next Third Thursday
Web Forum

10-20-2022

10:00 am

Kyle Buck and Rick
Durbrow

U.S. Environmental
Protection Agency

secassoutheast.org

Carbon and stormwater credit parks for regional recreation, social equity, and resilience in Florida

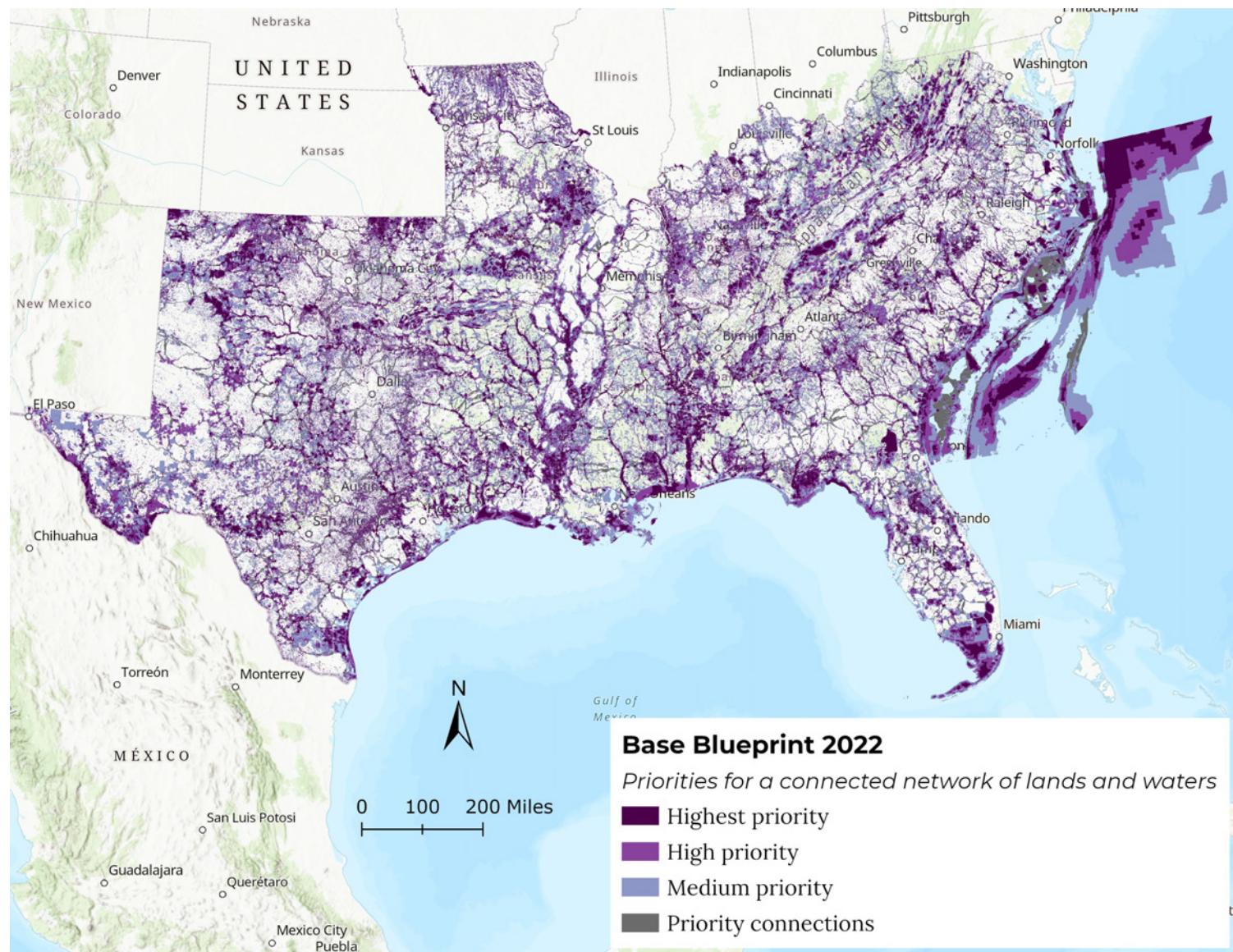


A photograph of a waterfall in a lush, green forest. The waterfall flows down several tiers of dark, mossy rocks, creating a misty spray at the bottom. The surrounding trees are dense and vibrant.

Staff updates

- Progress on Southeast Blueprint 2022

Progress on Southeast Conservation Blueprint 2022



How to get involved in SECAS

- Sign up for the SECAS newsletter

secassoutheast.org

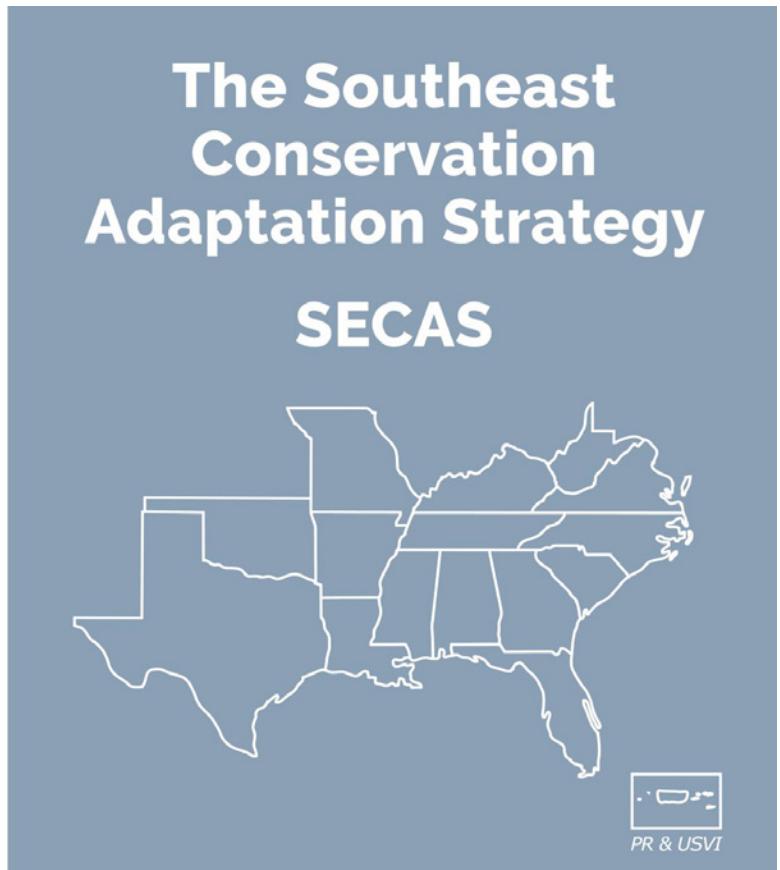
- Connect with SECAS staff or partners

secassoutheast.org/staff

secassoutheast.org/partners

- Explore the Southeast Conservation Blueprint

secassoutheast.org/blueprint



A photograph of a lighthouse at sunset. The sky is filled with warm, orange and yellow hues near the horizon, transitioning to cooler blues and purples higher up. The lighthouse, a white tower with a dark lantern room, stands on a grassy hill to the right. In the foreground, there's a dark, textured area that appears to be a path or a field of tall grass. A large, solid dark blue rectangular box is overlaid on the left side of the image, containing the text "Questions?" in a white, sans-serif font.

Questions?