Investigating hydrologic alteration as a main driver of forest composition shifts in a Florida river

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NATIONAL FISH AND WILDLIFE FOUNDATION

NFWF

APALACHICOLA RIVERKEEPER

SCHOOL OF FOREST, FISHERIES, AND GEOMATICS SCIENCES

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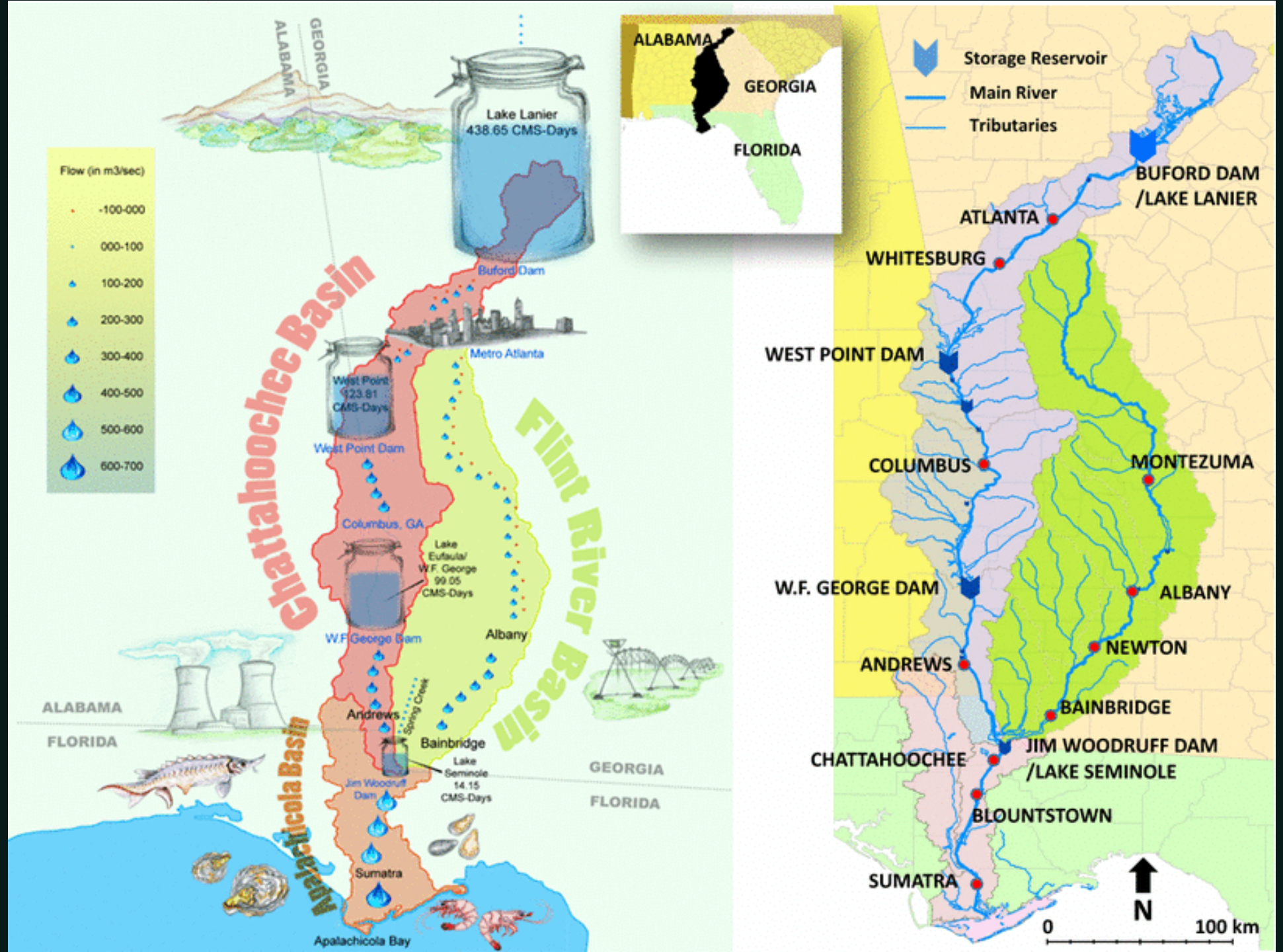
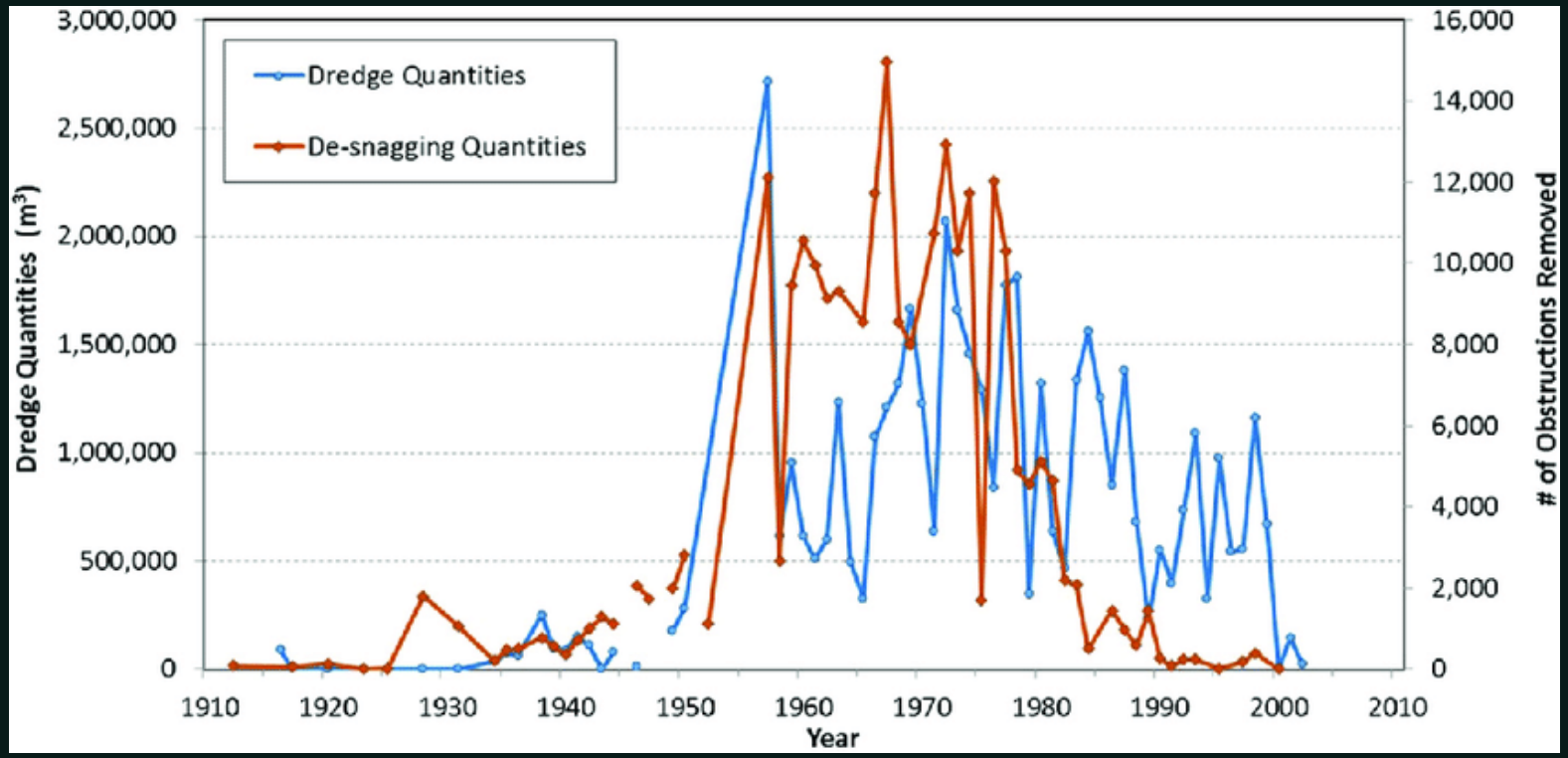
The Apalachicola River and Bay Basin



Leitman, Pine, and Kiker (2016)

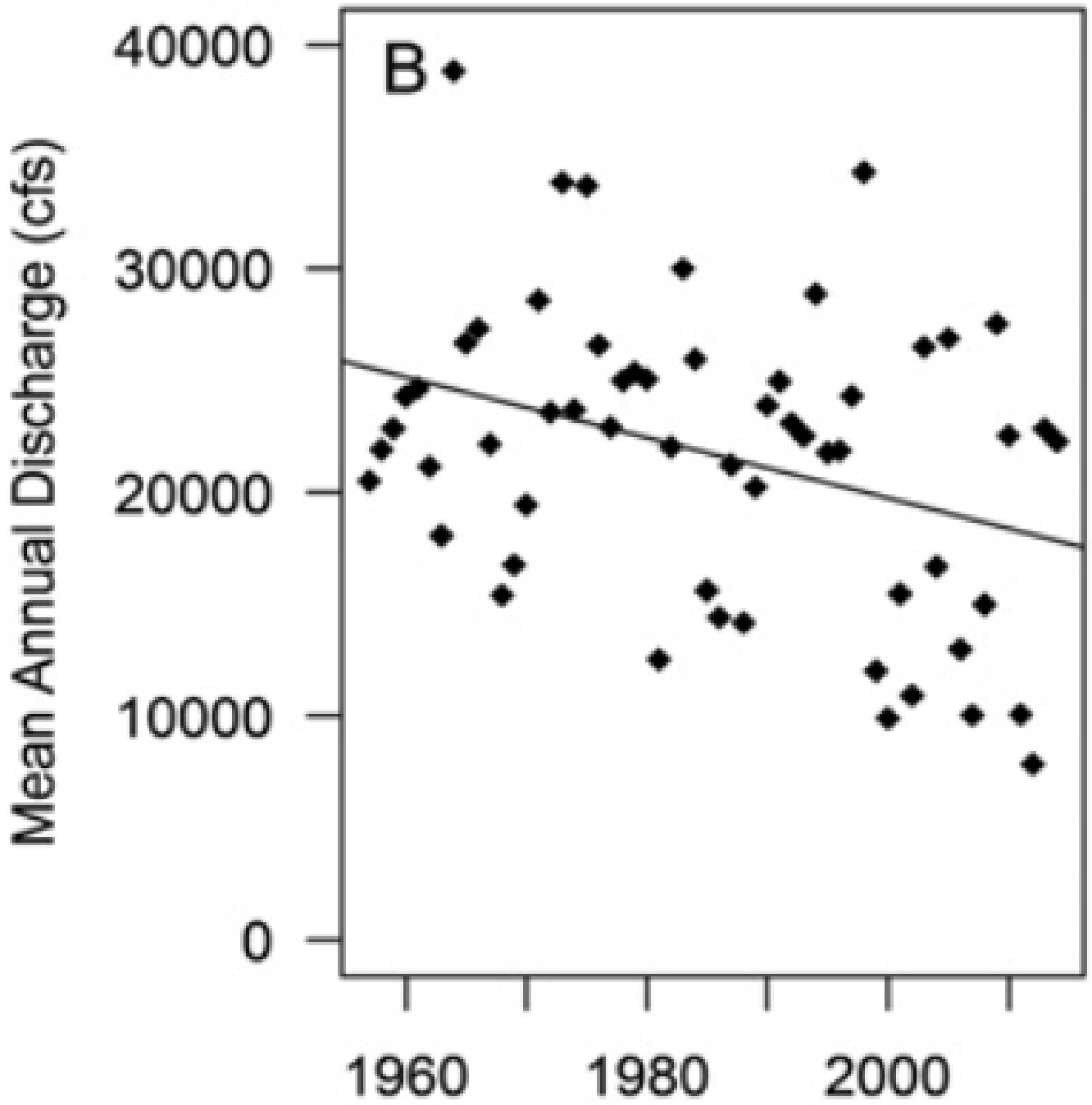
Navigational Dredging (1957 - 2002)



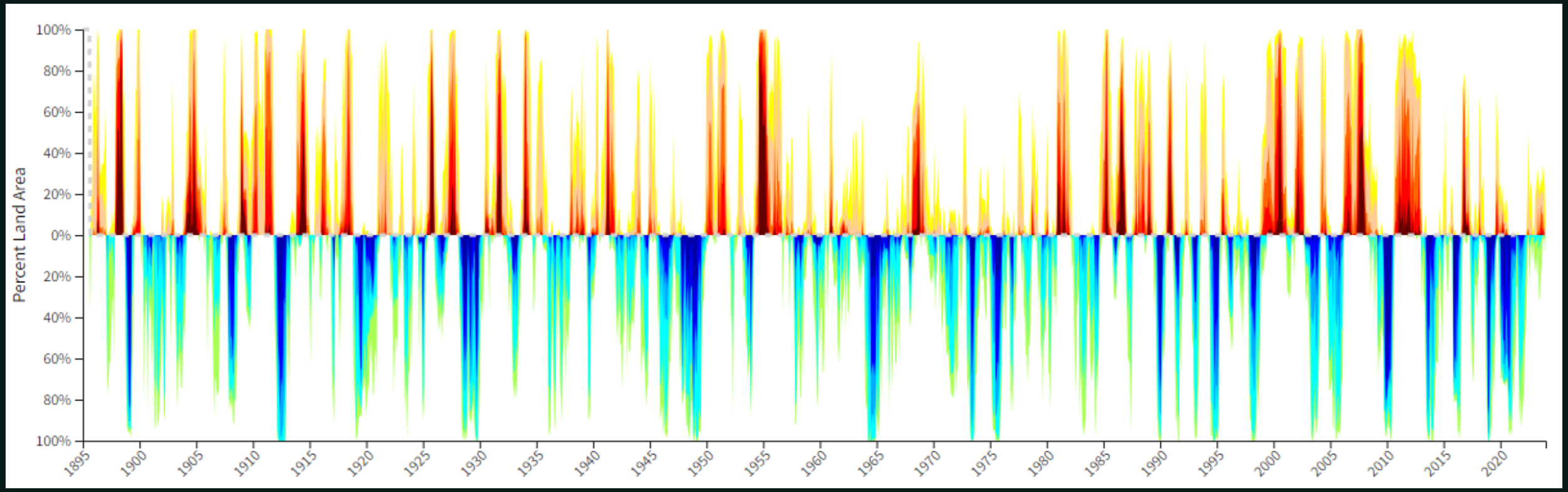
Mossa, J. Chen, Y.H., Walls, S., Kondolf, G.M. & Wu, C.Y. (2017). Anthropogenic landforms and sediments from dredging and disposing sand along the Apalachicola River and its floodplain. Geomorphology 294. 10.1016/j.geomorph.2017.03.010.

Fisch, N. C., & Pine, W. E. (2016). A Complex Relationship between Freshwater Discharge and Oyster Fishery Catch Per Unit Effort in Apalachicola Bay, Florida: an Evaluation from 1960 to 2013. *Journal of Shellfish Research*, *35*(4), 809–825. https://doi.org/10.2983/035.035.0409

Mean daily discharge (cfs) of the Apalachicola River from 1958 to 2014, measured at USGS gauge 02358700 in Blountstown, FL. The trend line is a simple linear regression of mean annual discharge regressed on year as a reference.



ACF Basin Drought Record
1895 to 2023

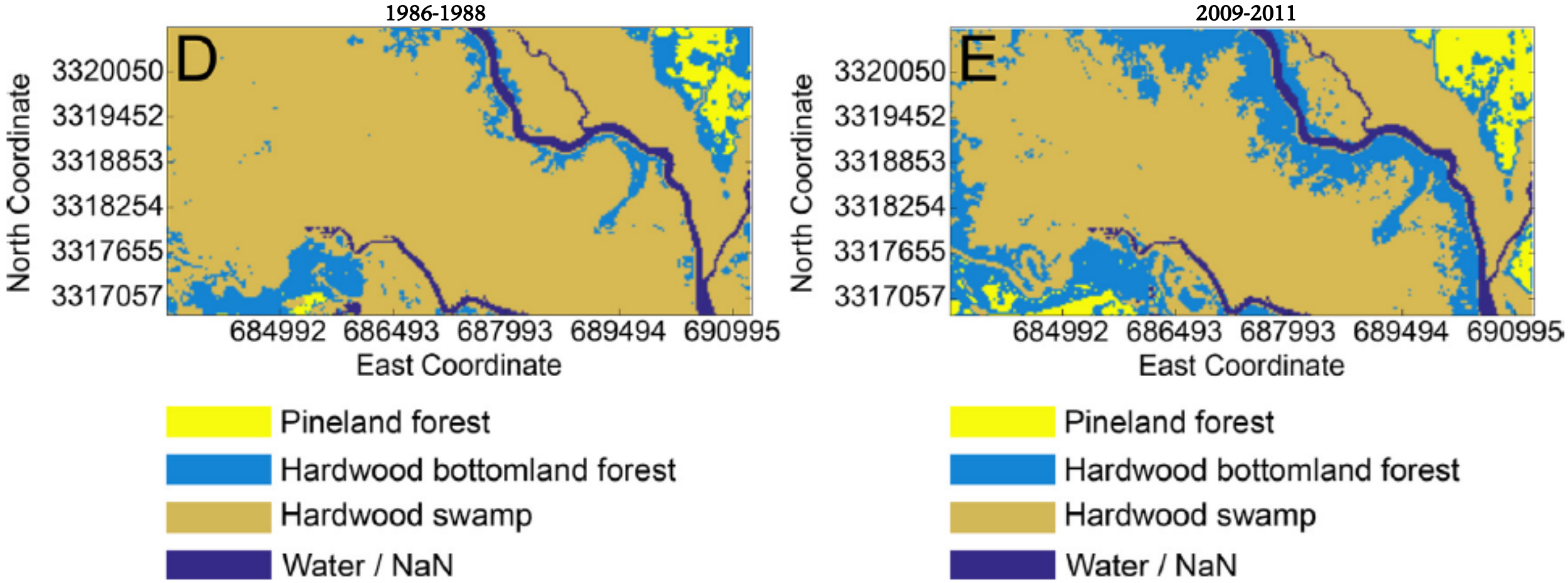


Drought.gov/watersheds/acf-dashboard

Significant Forest Composition Change (1976 - 2004)

- 17% fewer floodplain trees
- Swamp tree density decreased by 37%
- Water tupelo (*N. aquatica*) density decreased 20%
- Ogeechee tupelo (*N. ogeche*) density decreased 44%
- Pop ash (*F. caroliniana*) density decreased 38%

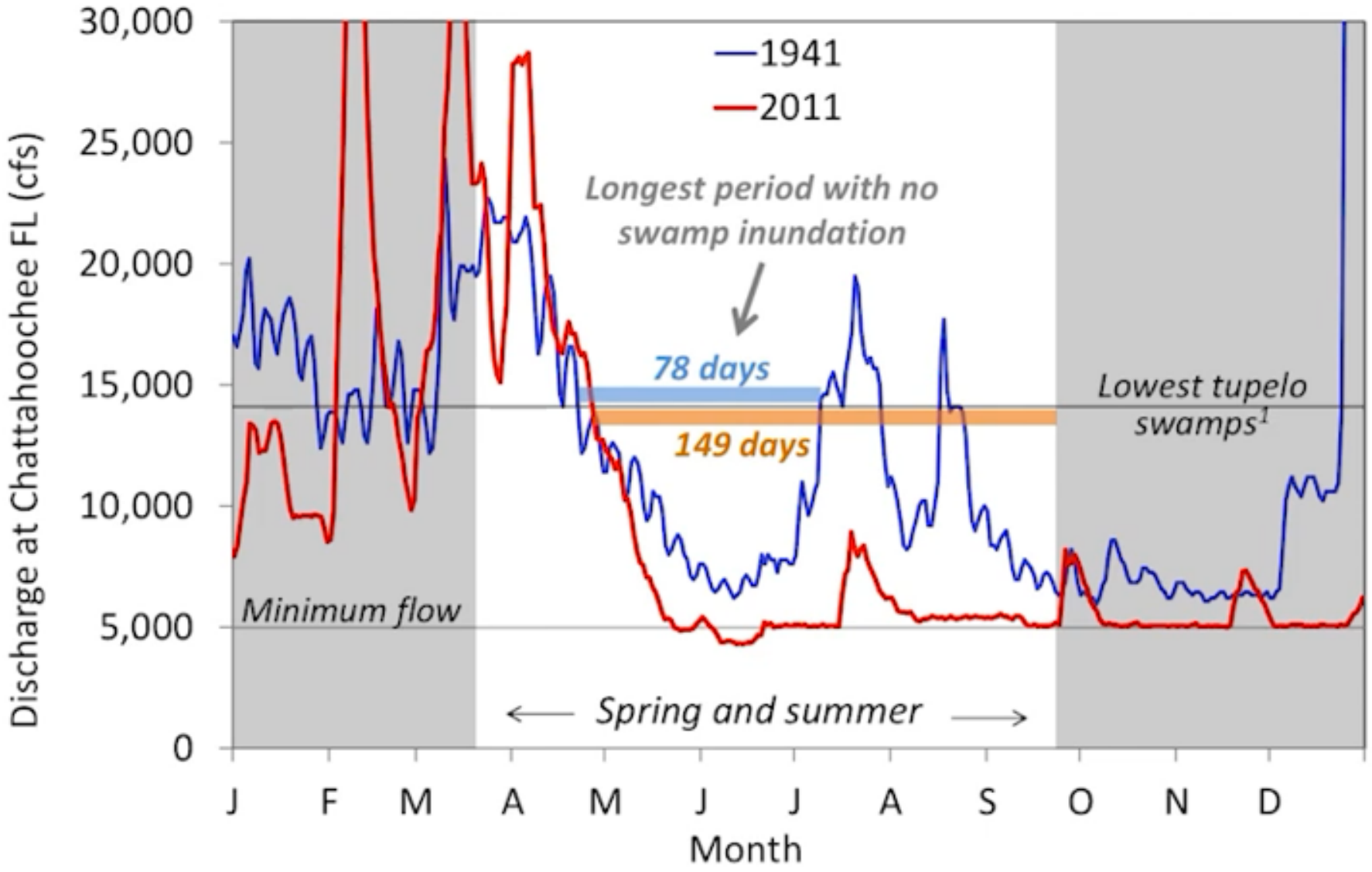
Darst, M.R. and Light, H.M. (2008). Drier forest composition associated with hydrologic change in the Apalachicola River Floodplain, Florida. Scientific Investigations Report 2008-5062. Reston, Virginia: U.S. Department of the Interior, U.S. Geological Survey.



Cecilia, D.L., Toffolon, M., Woodcock, C. E., & Fagherazzi, S. (2016). Interactions between river stage and wetland vegetation detected with a seasonality index derived from LANDSAT images in the Apalachicola Delta, Florida. *Advances in Water Resources*, *89*, 10–23. https://doi.org/10.1016/j.advwatres.2015.12.019

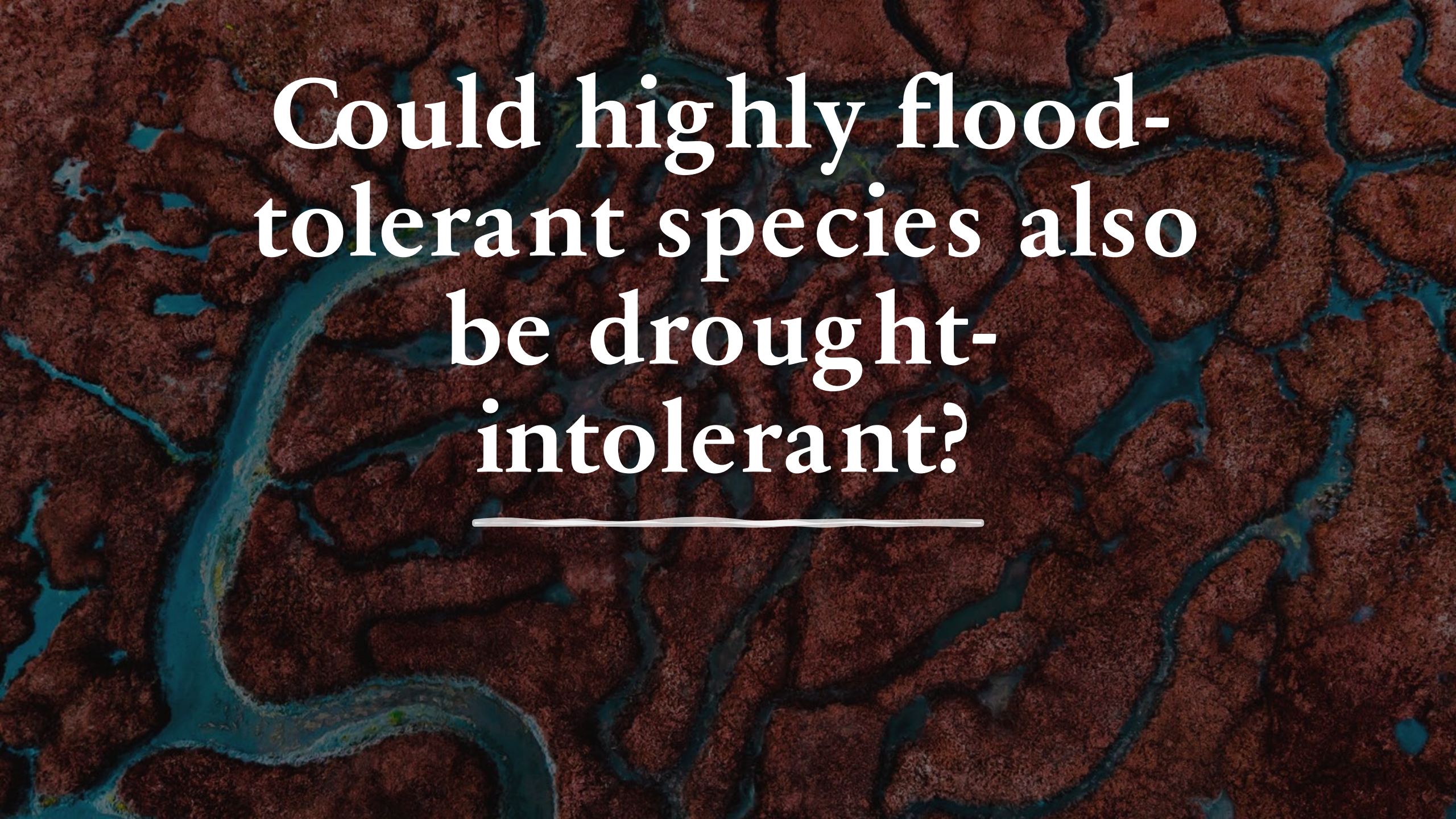
Typical low-flow year in earlier and later periods

Earlier=1923-1955; later=1985-2017

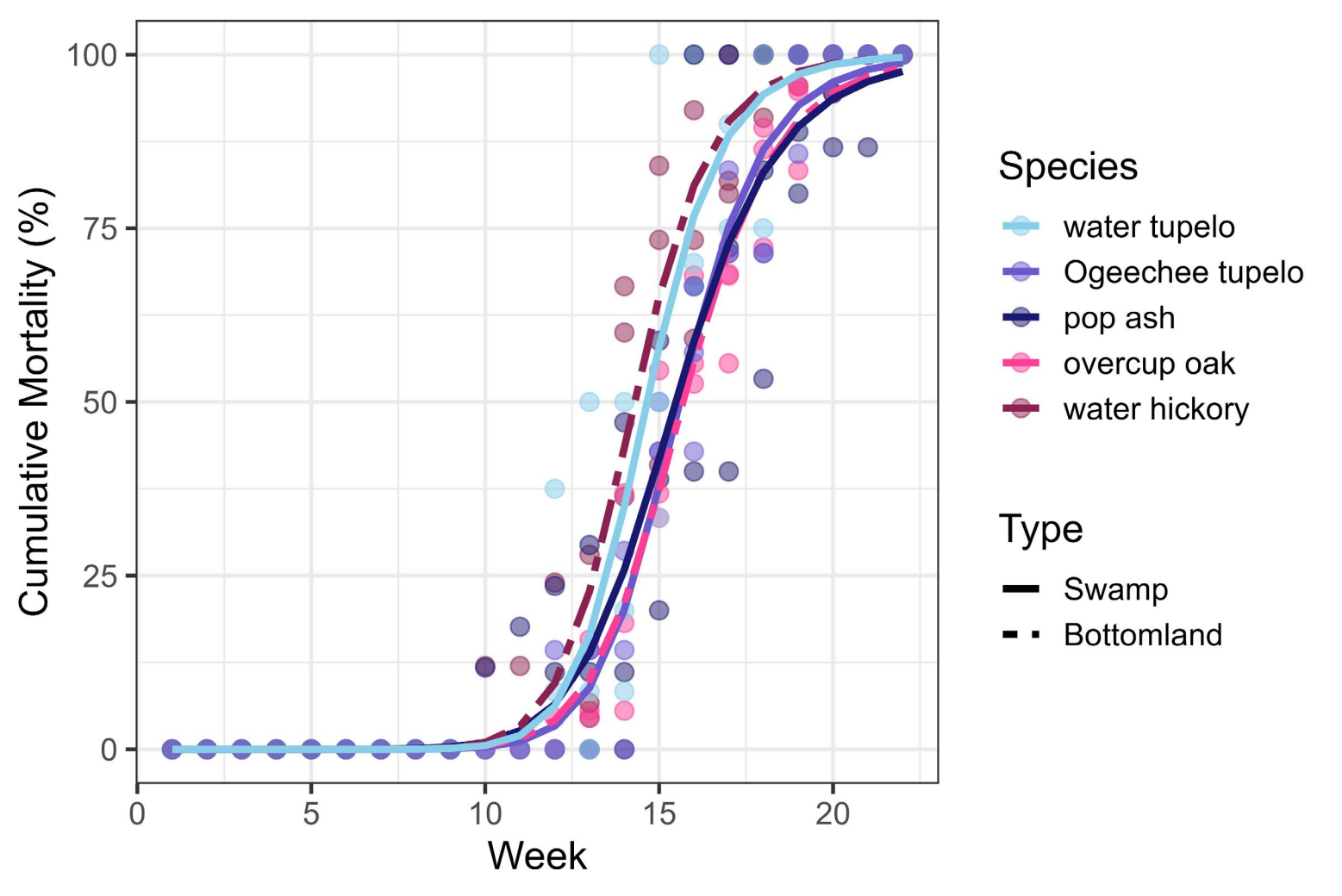


[1]Flow currently required to inundate lowest 10% of swamps=14,100 cfs; 50% of swamps=18,000 cfs

Helen Light (2018)


Could highly flood-tolerant species also be drought-intolerant?

Drought Resistance Thresholds in Floodplain Forests: Testing Seedling Mortality of Five Tree Species under Increasing Moisture Deficiency.



Tracy et al. (2024)

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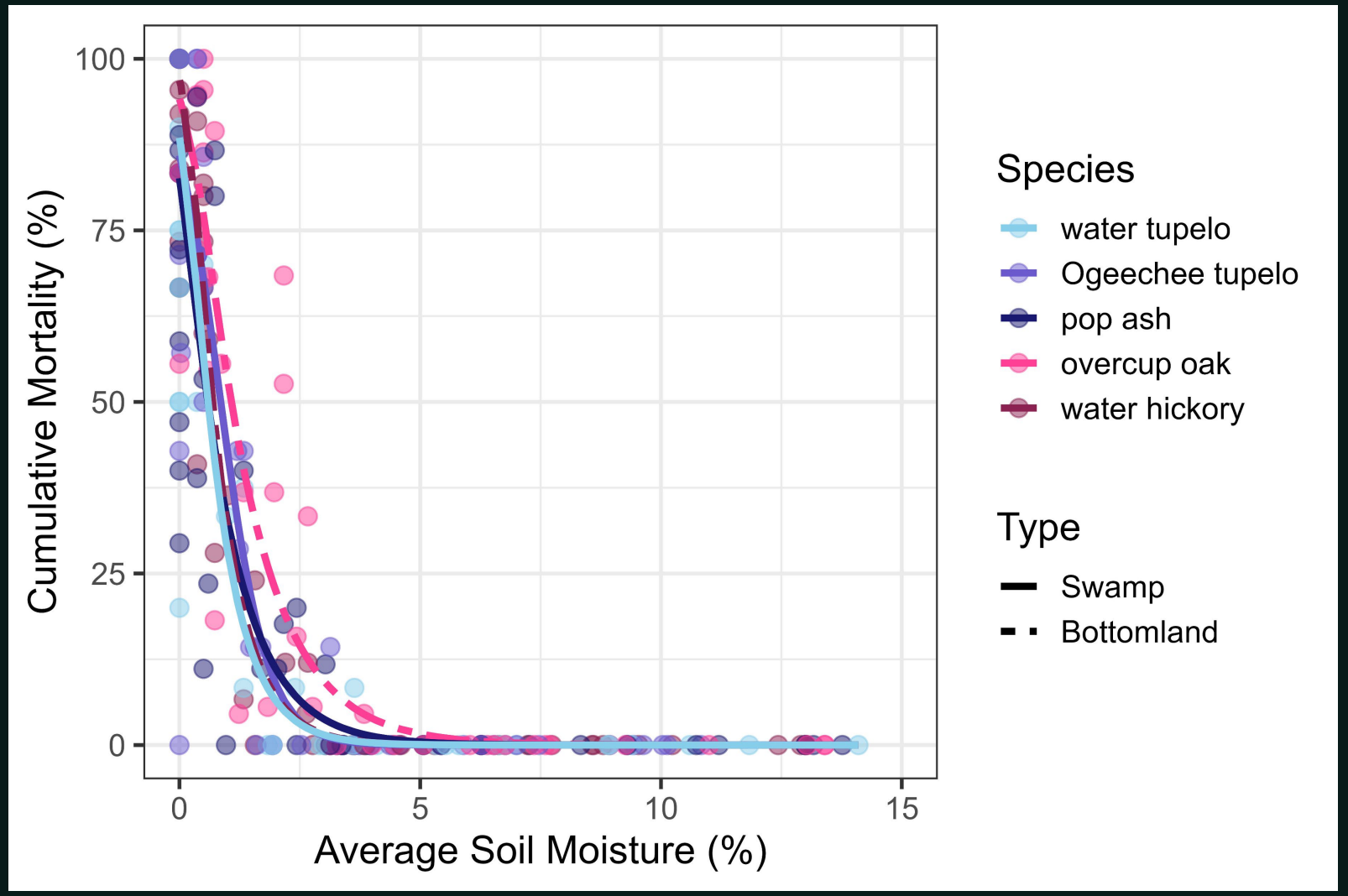

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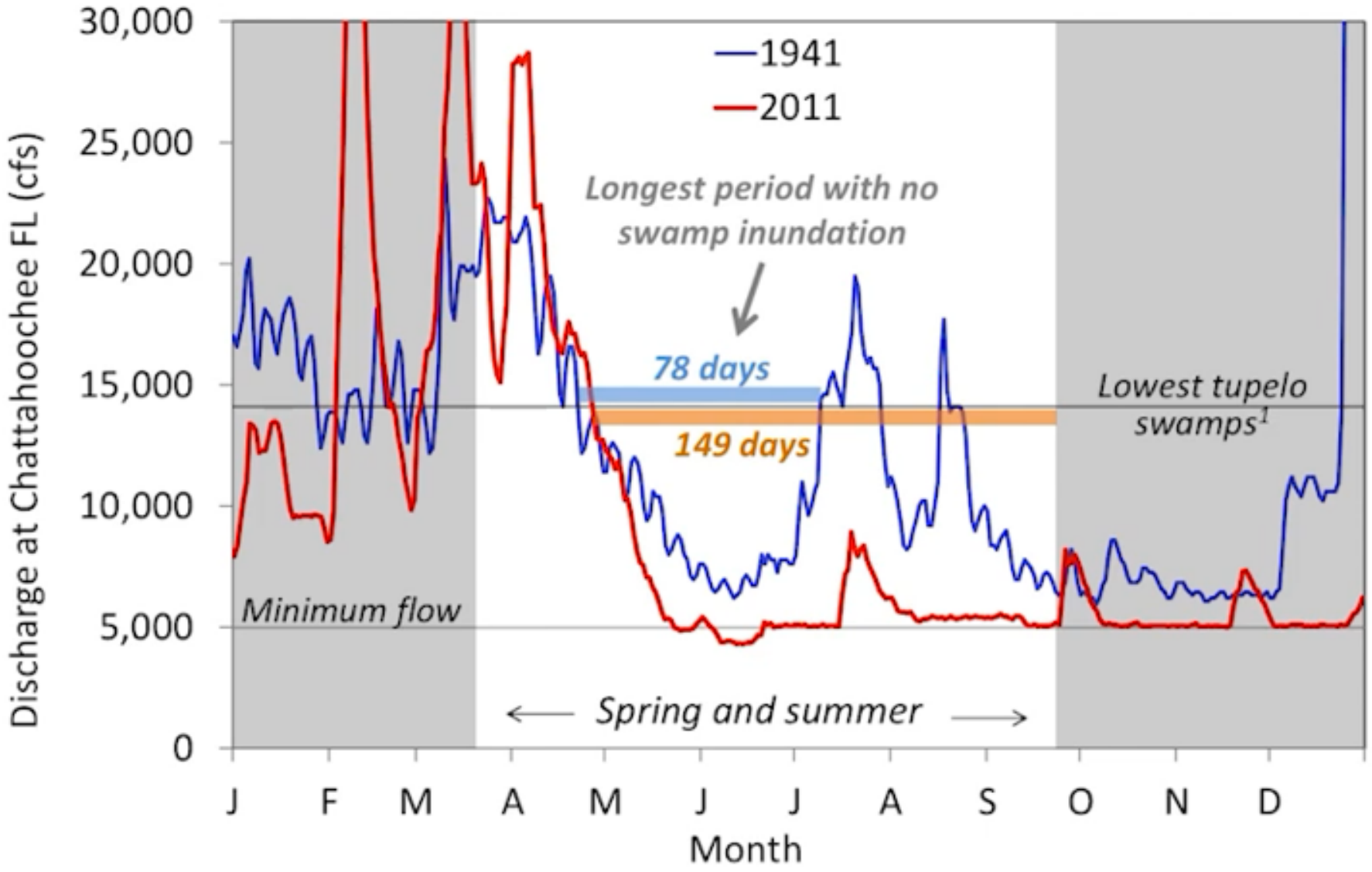

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Helen Light (2018)

Testing winter flood tolerance of 1st year seedlings

Recent publication in *Forest Ecology and Management*:

Flood Dynamics and Tree Resilience: First-Year Seedlings of Five Floodplain Forest Species Responding to Diverse Inundation Scenarios

John E. Tracy[a], Ajay Sharma[b], Matthew Deitch[a], James Colee[c], Mack Thetford[a], Daniel Johnson[c]

[a]*University of Florida West Florida Research and Education Center, 5988 US-90, Milton, FL 32583, USA*

[b]*Auburn University, College of Forestry, Wildlife and Environment Bldg, 602 Duncan Dr, Auburn, AL 36849, USA*

[c]*University of Florida, School of Forest, Fisheries, & Geomatics Sciences, 1745 McCarty Dr, Gainesville, FL 32611, USA*

Germination strategies differ between heavy vs. light seed species

water hickory

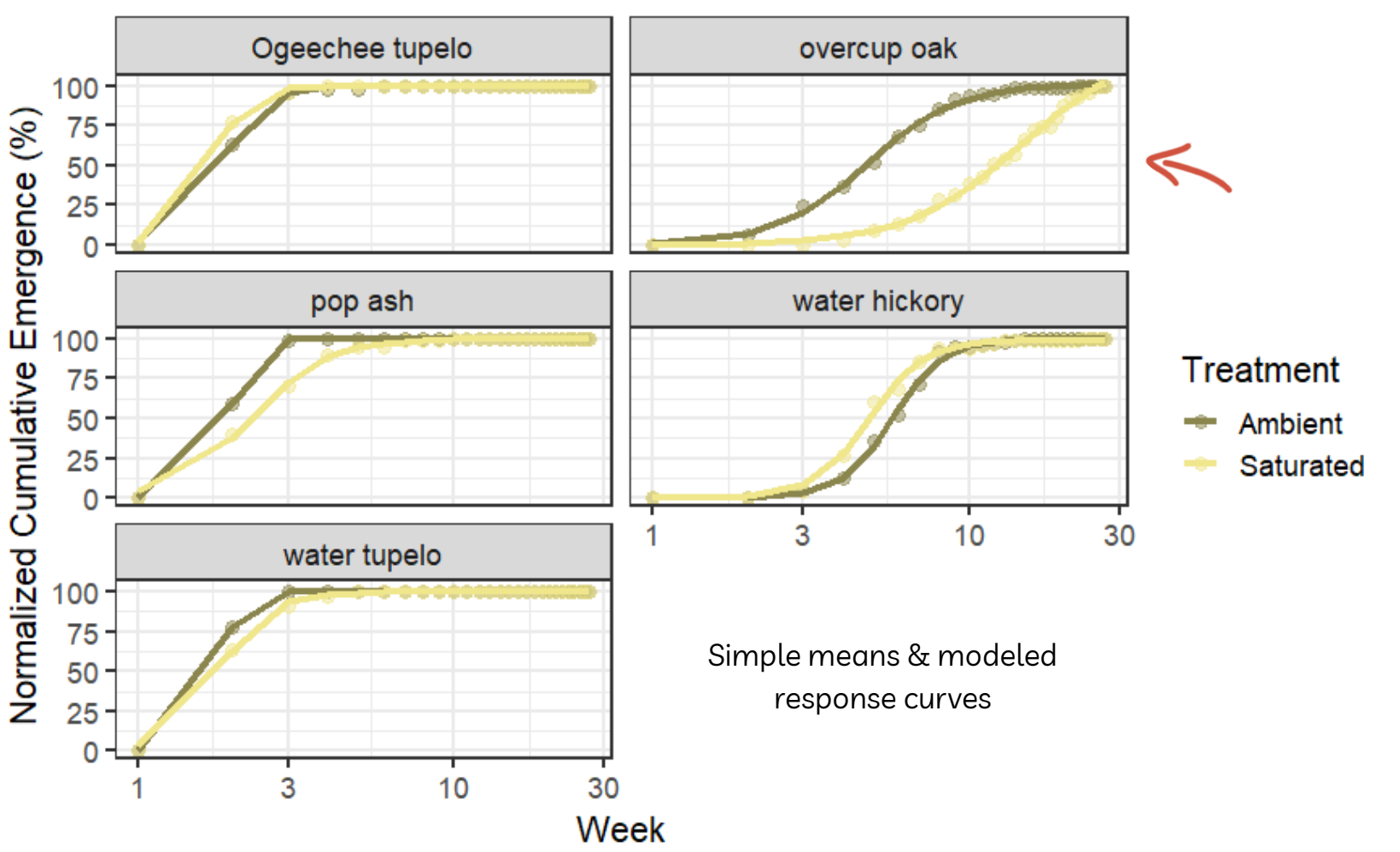
overcup oak

tupelo spp.

pop ash

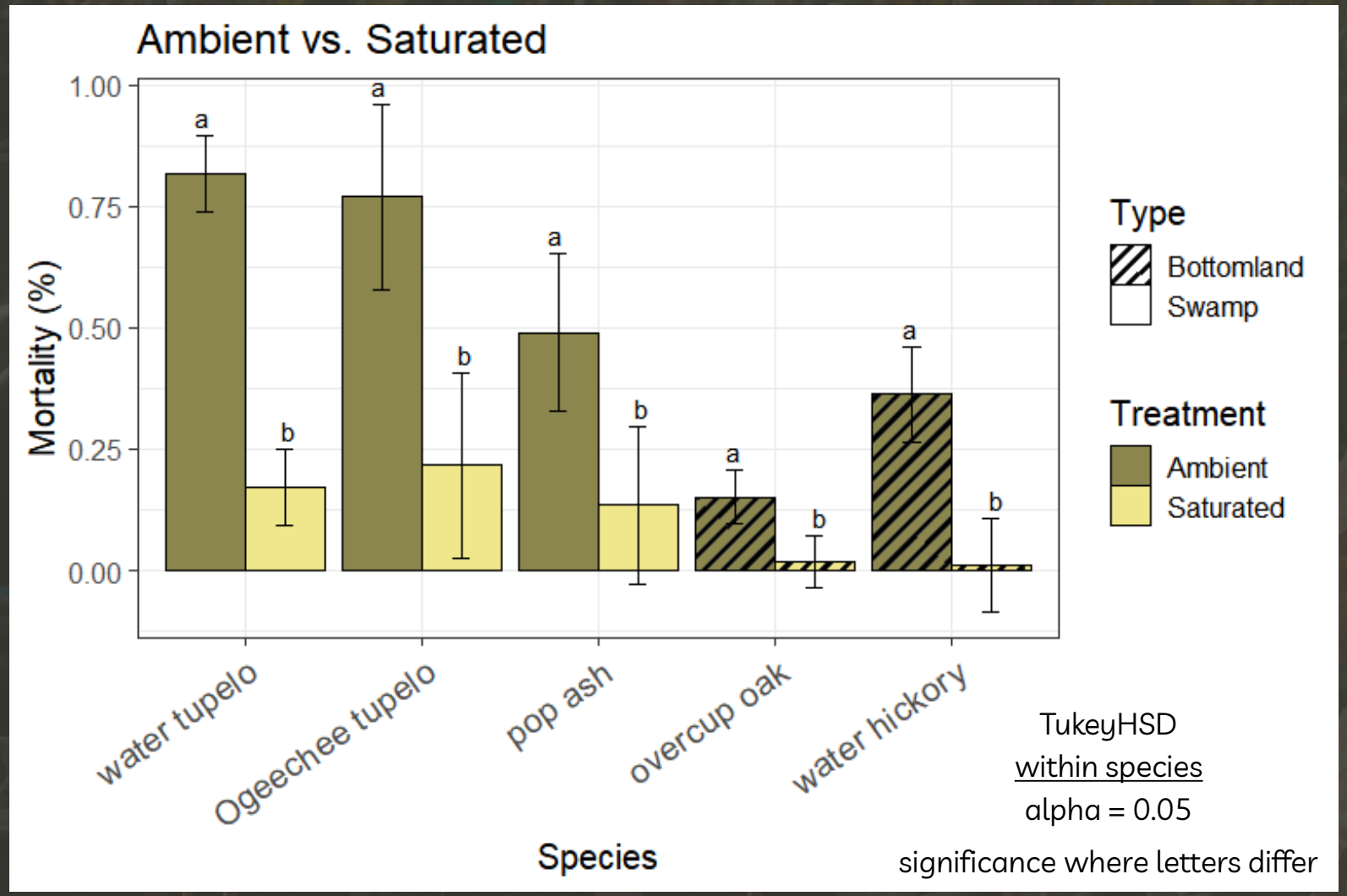
SWAMP

BOTTOMLAND COMPETITORS



Simple means & modeled response curves

Treatment period: May - November 2022



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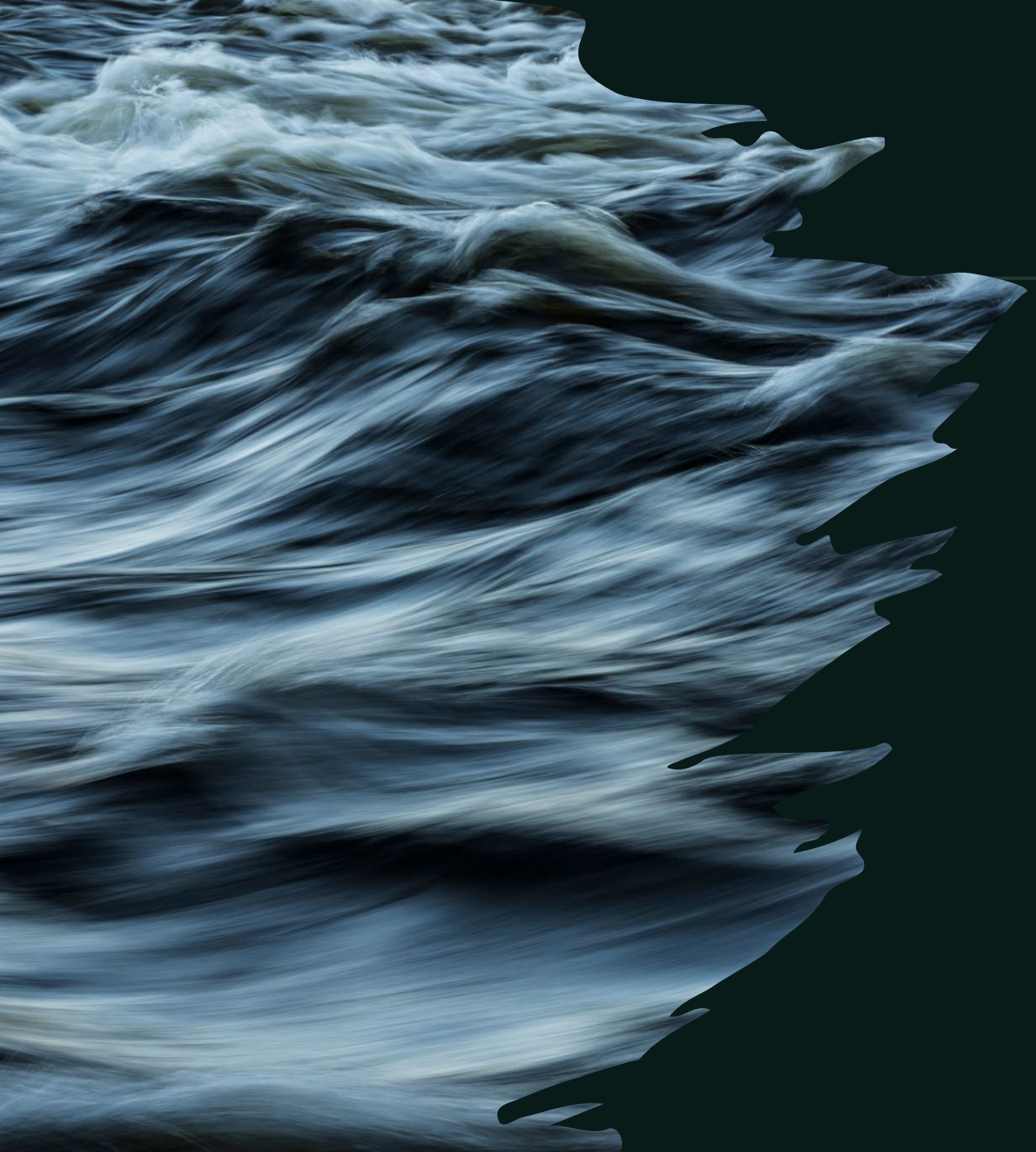
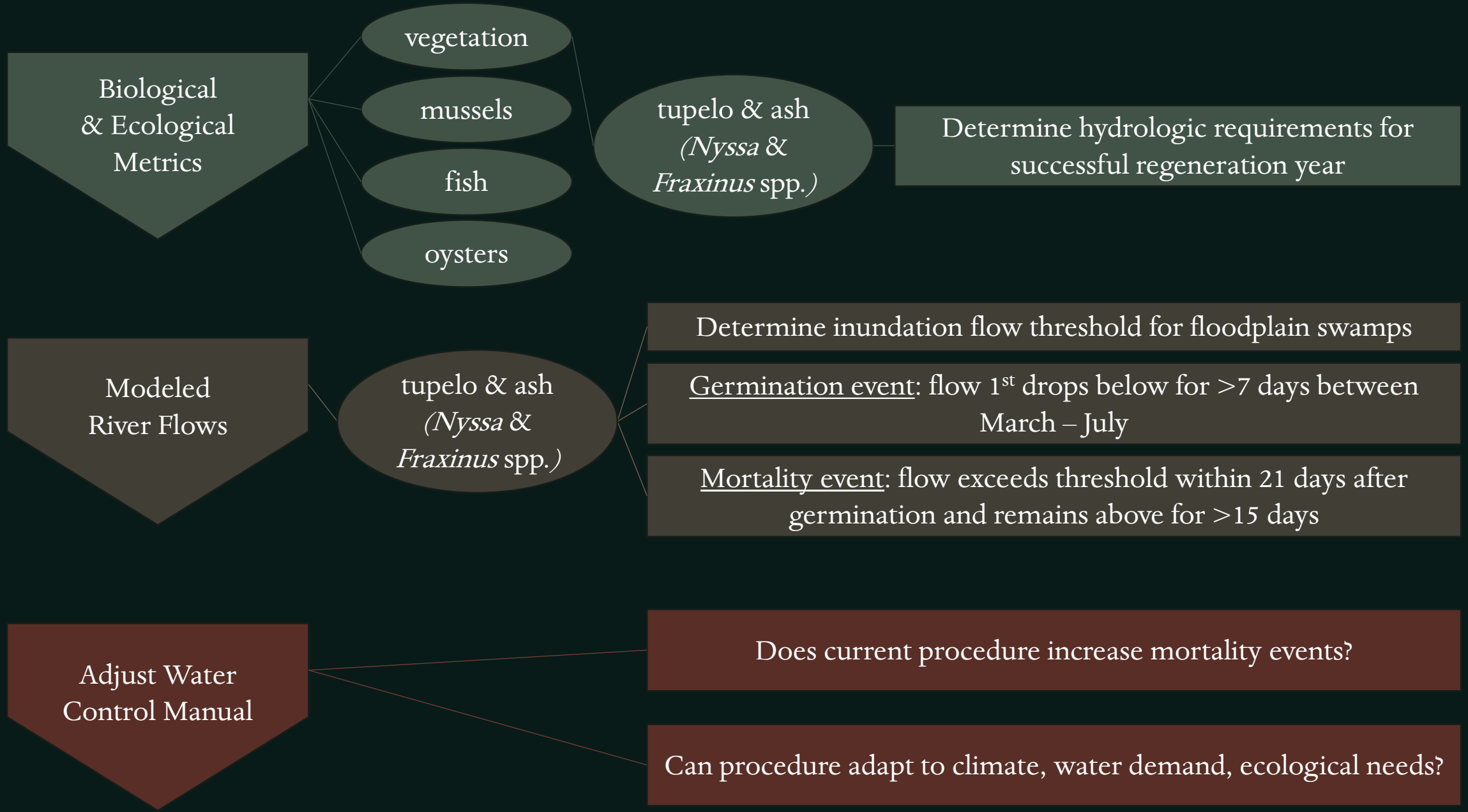


Application to restoration and management

- limiting duration of drought is important
  - limit oak establishment
- Focus more on early-season stressors for light-seeded species establishment
  - Flood pulses
  - Dam water control


Biological & Ecological Metrics
vegetation
mussels
fish
oysters
tupelo & ash (*Nyssa* & *Fraxinus* spp.)
Determine hydrologic requirements for successful regeneration year
Modeled River Flows
tupelo & ash (*Nyssa* & *Fraxinus* spp.)
Determine inundation flow threshold for floodplain swamps
Germination event: flow 1st drops below for >7 days between March – July
Mortality event: flow exceeds threshold within 21 days after germination and remains above for >15 days
Adjust Water Control Manual
Does current procedure increase mortality events?
Can procedure adapt to climate, water demand, ecological needs?