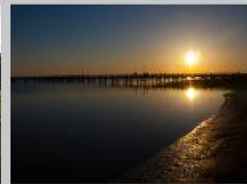
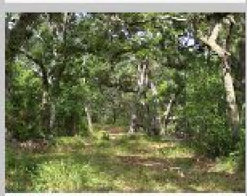
All | Beaches & Barrier Islands | Birds | Fish | Human Use & Economy | Dolphins, Sea Turtles, & Wildlife | Oysters

31 Weeks Bay Land Acquisition Harrod Tract

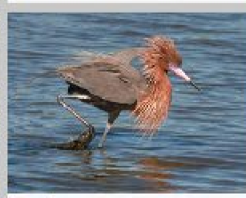
32 Weeks Bay Land Acquisition East...



33 Bayfront Park Restoration and...



34 Bon Secour National Wildlife Refuge Trail...



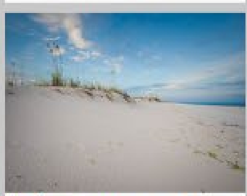
35 Dauphin Island Eco-Tourism and...

36 Fort Morgan Pier Rehabilitation

37 Gulf State Park Enhancements

38 Gulf State Park Lodge and Associated Public...

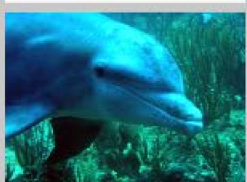
39 Laguna Cove Little Lagoon Natural...



40 Mid-Island Parks and Public Beach...

41 Alabama Oyster Clutch Restoration

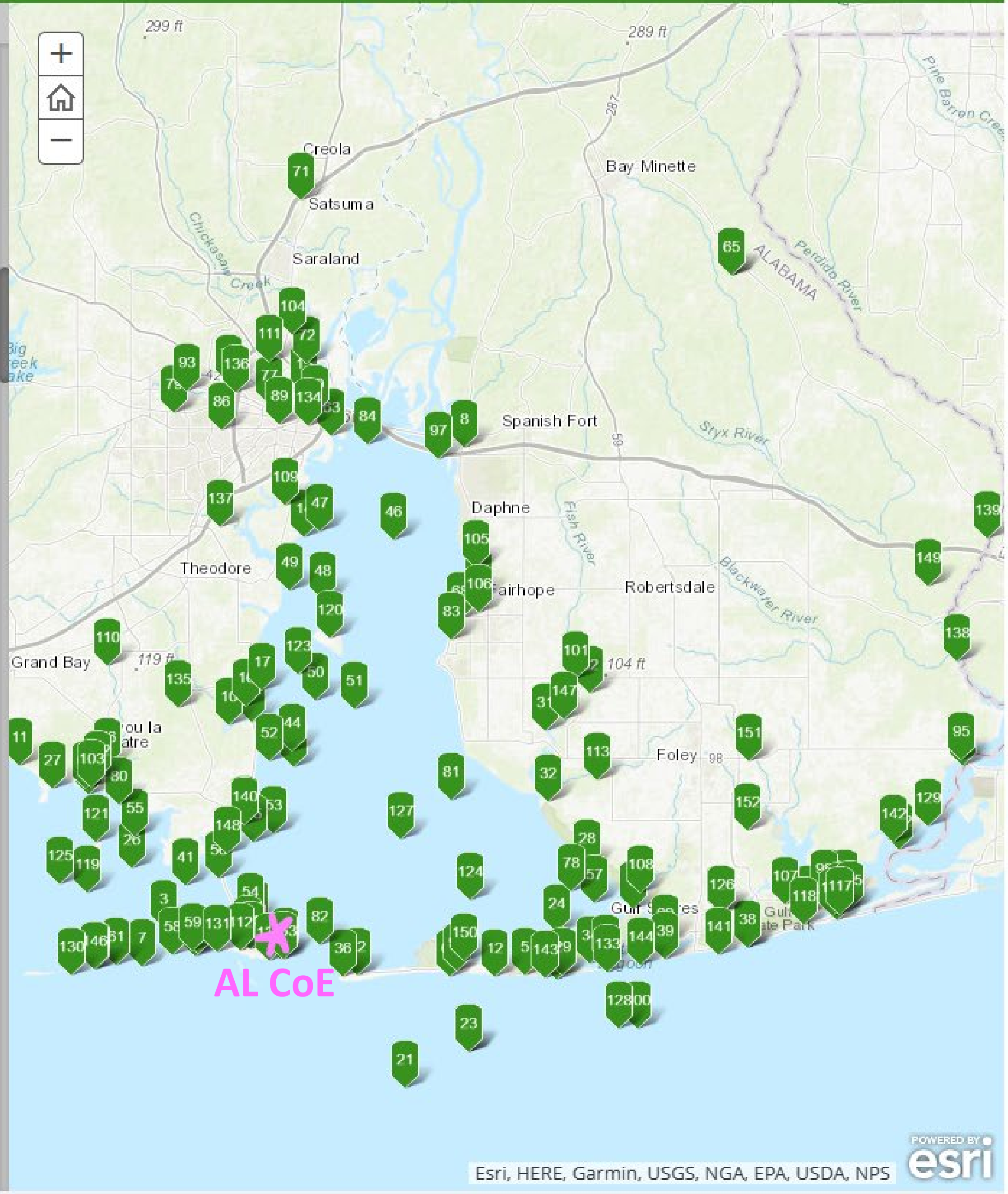
42 Osprey Restoration in Coastal Alabama

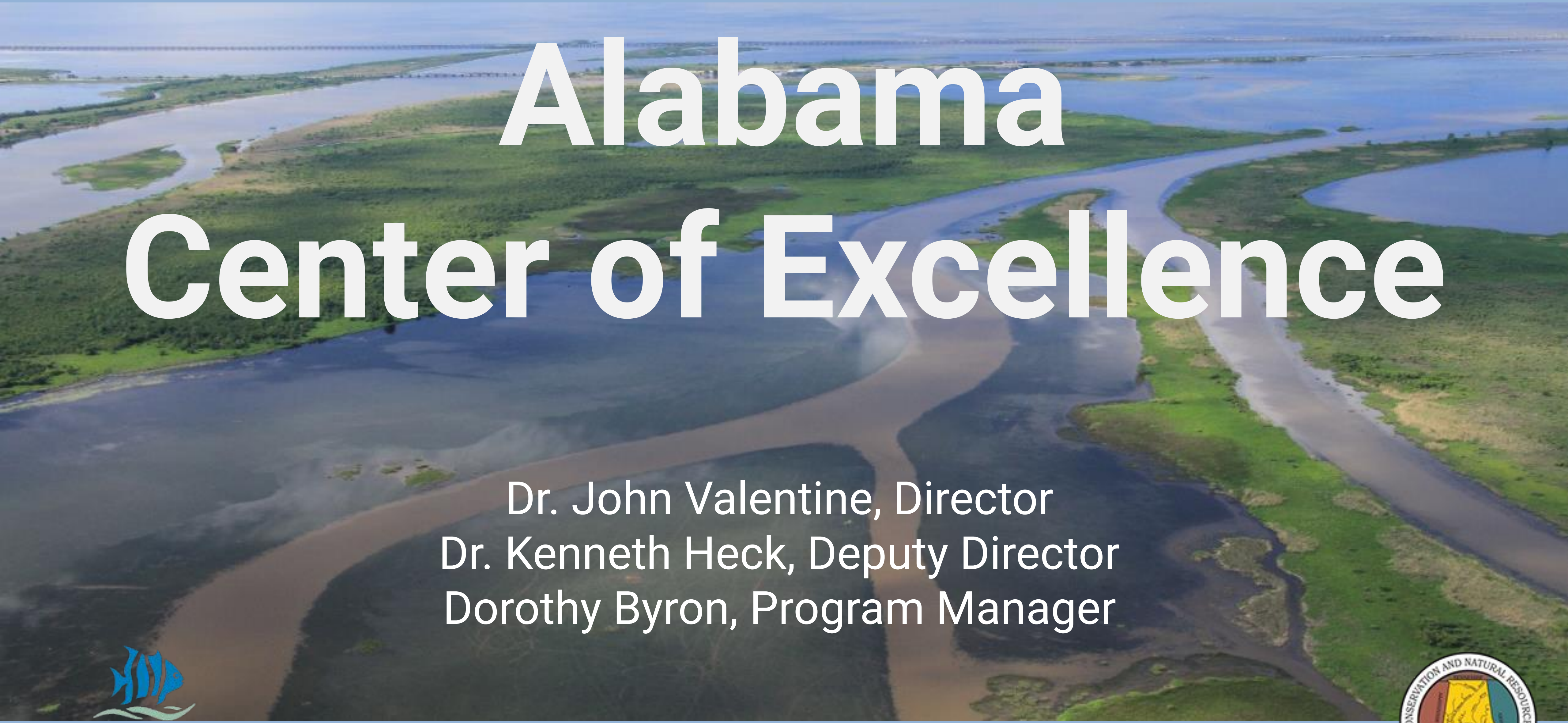


43 Enhancing Capacity for the Alabama Marine...

44 Side-scan Mapping of Mobile Bay Relic Oyste...

45 Alabama Estuarine Bottlenose Dolphin...





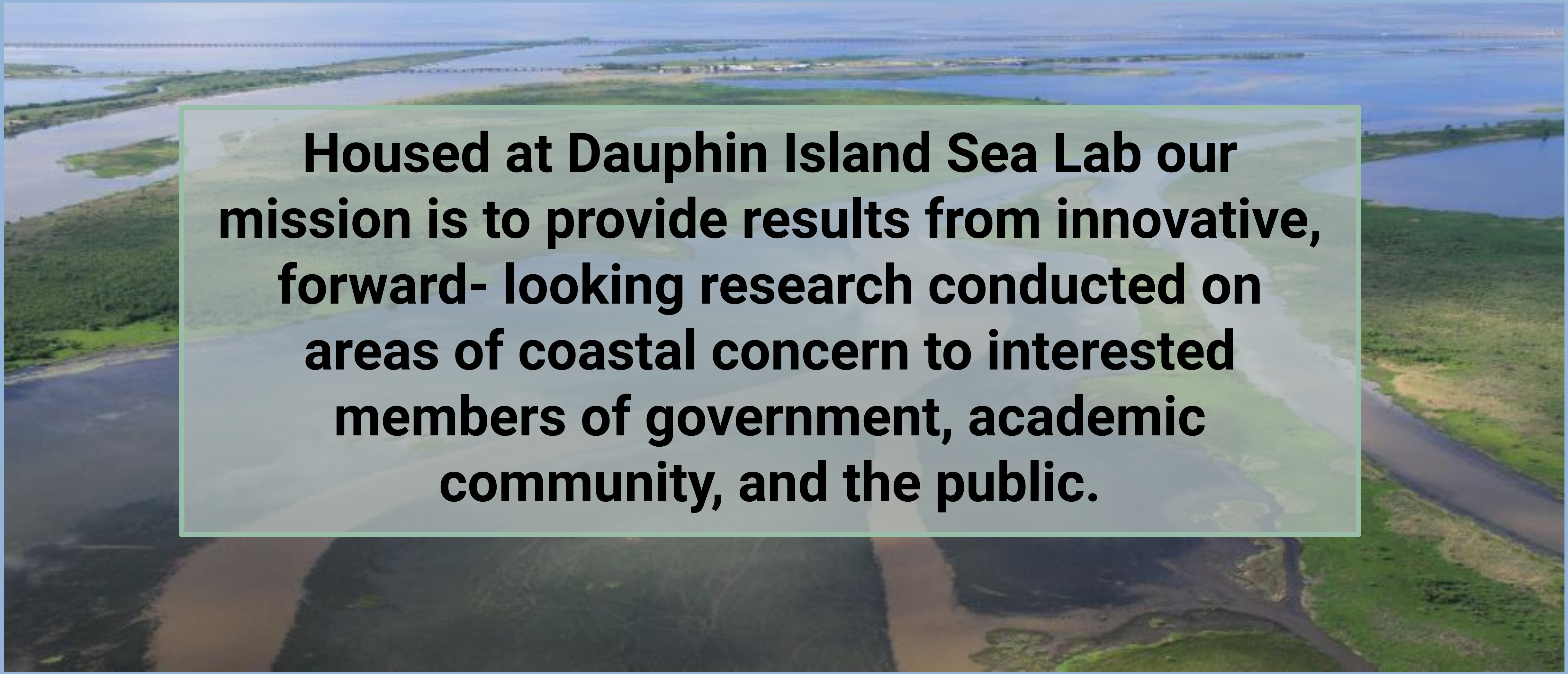
Alabama Center of Excellence

Dr. John Valentine, Director
Dr. Kenneth Heck, Deputy Director
Dorothy Byron, Program Manager

Dauphin Island Sea Lab
Alabama Center for Marine Education and Research

CONSERVATION AND NATURAL RESOURCES
ALABAMA

AL-CoE: Who we are

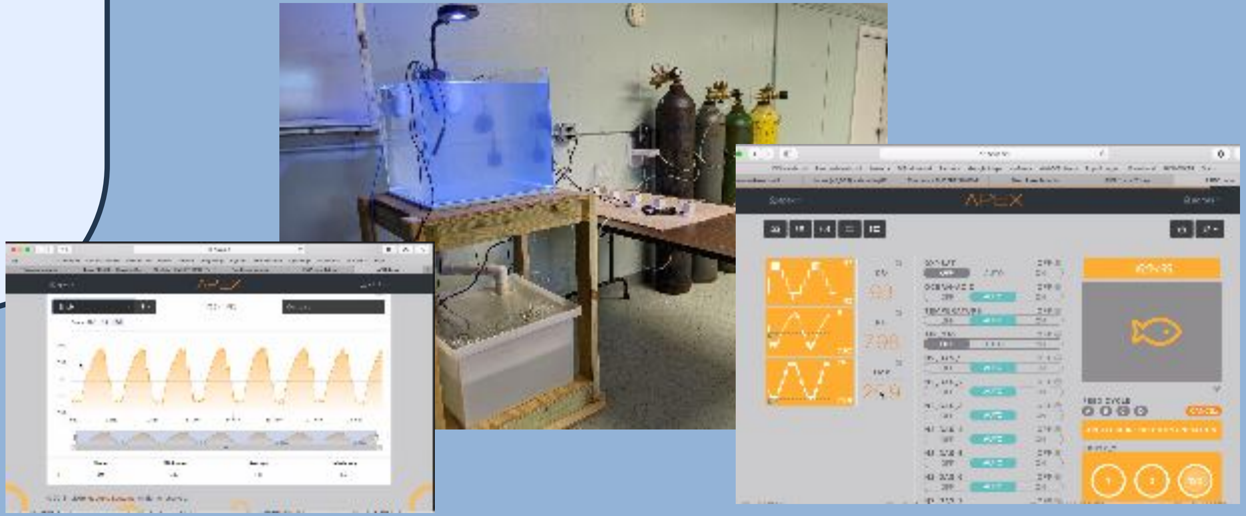


Housed at Dauphin Island Sea Lab our mission is to provide results from innovative, forward- looking research conducted on areas of coastal concern to interested members of government, academic community, and the public.

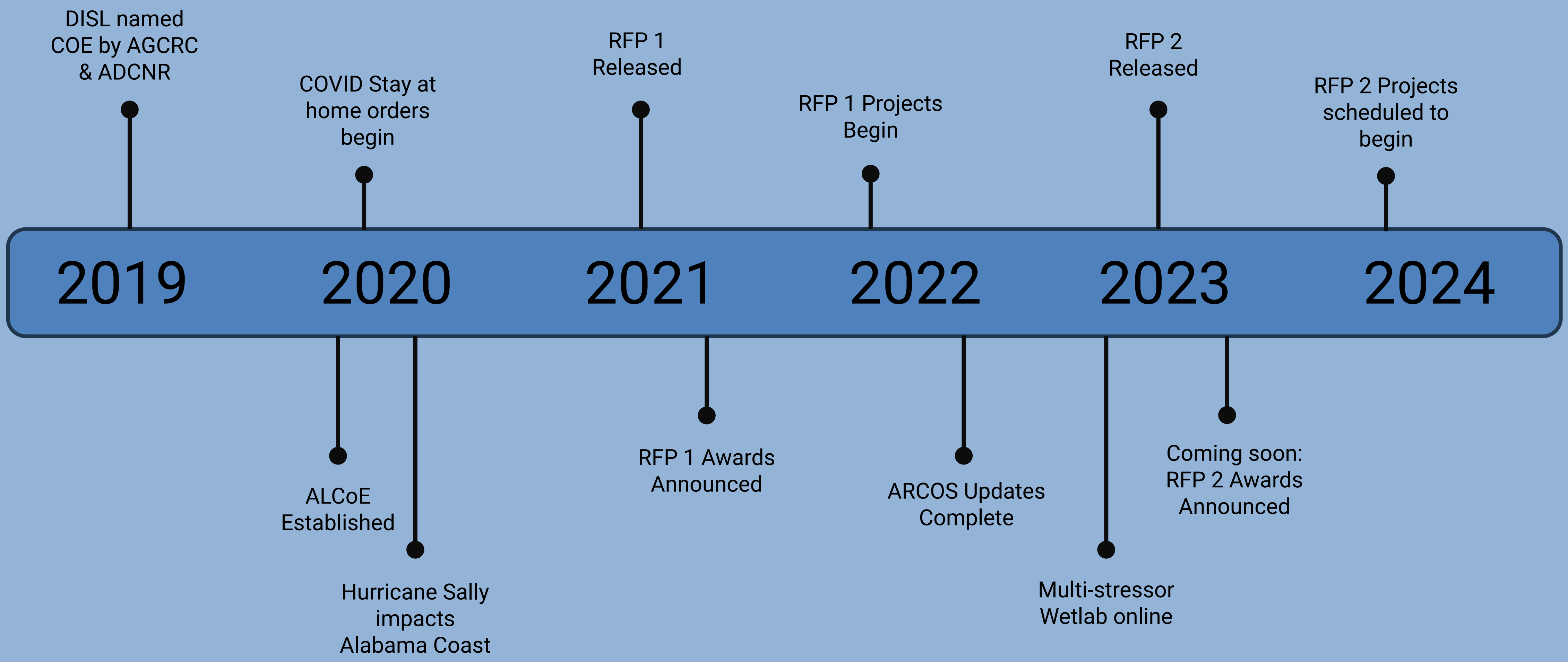
AL-CoE: Where we work

Multi-layered Approach: Updating Scientific Capacity

- ❖ Improve core infrastructure for experimentation and ocean observation
  - ❖ Upgrades to the Alabama Real-Time Coastal Observation System (ARCOS) (www.arcos.disl.edu)
  - ❖ State of the Art Wetlab Facility for multi-stressor experiments
- ❖ Innovated Monitoring Approaches



AL-CoE: Timeline



Competitive Grant Program: RFP1 Focus

Fund research investigating on the effects of multiple stressors, influenced by our changing climate, as they affect the natural resources of the northcentral Gulf of Mexico

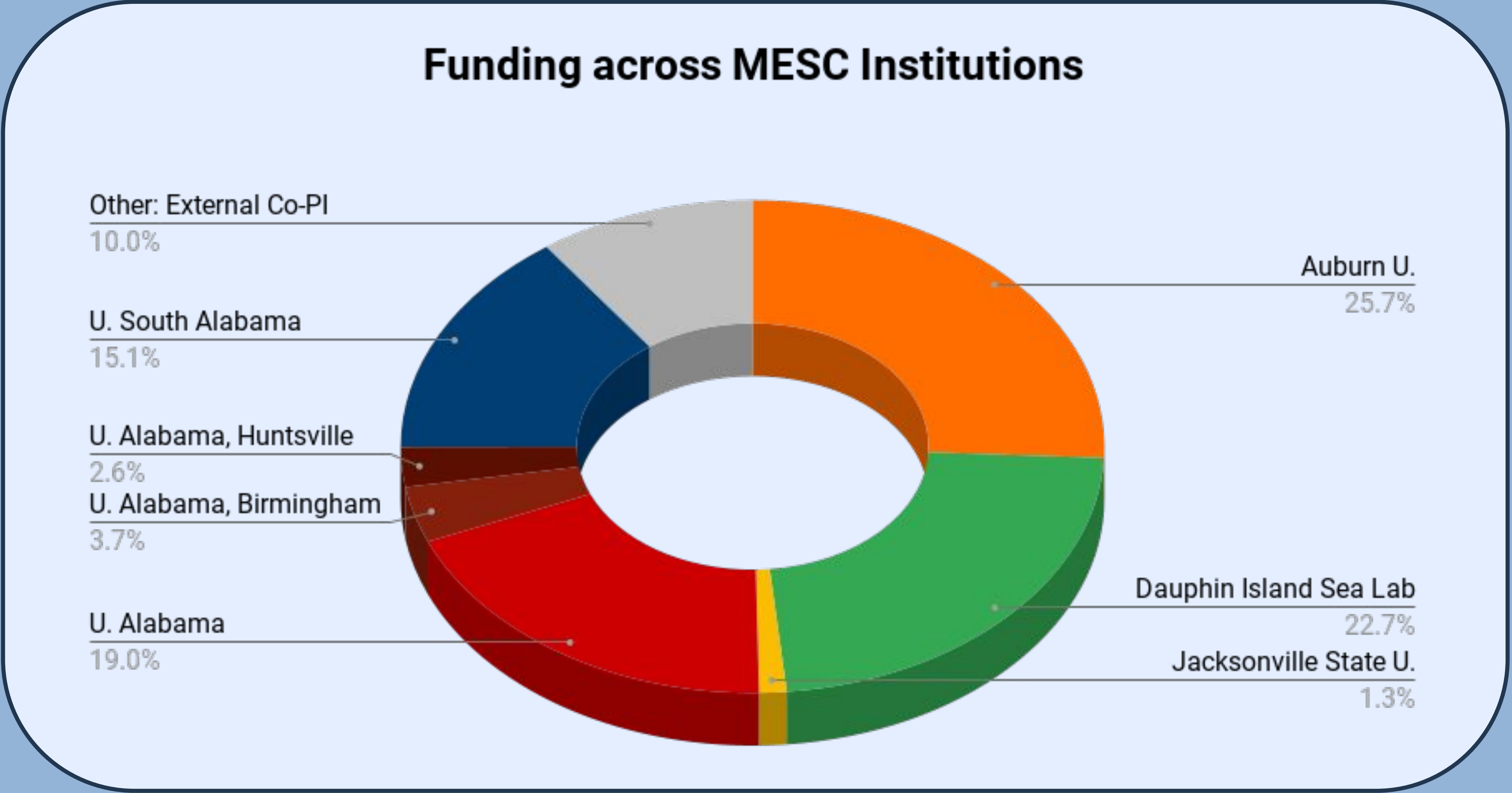
Multi-layered Approach: Grant Program

- Using MS/AL Sea Grant Technical Review Panel approach
  - Fund research focused on coastal vulnerability, resilience and sustainability - looking at the past and current conditions to inform predictions for the future (RFP1)
  - Fund ‘proof of concept’ research that pushes the limits of current research technologies (RFP2)

Competitive Grant Program: RFP1

- Amount of funding distributed = ~$4.4 million
- Average project cost: $435,000
- Total number of awards: 10

RFP1: Distribution of Funds



Projects funded

- Groundwater quality/quantity
  - Citizen Science project using domestic well owners to collect data to understand groundwater quality
  - Impacts of Sea Level Rise on Aquifer condition and coastal resilience
- Modeling ecosystem health, water resources and social resilience using a holistic platform that integrates multi-scale observations, machine learning and systems modeling using the past 30 years to predict the next 30 years.

Projects funded

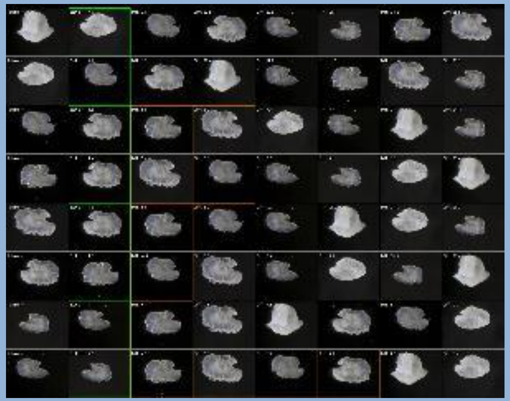
- Oyster fisheries under changing climate, specifically ocean acidification and warming
  - Changes in quality and quantity of food source
  - Changes in oyster growth, survival and energetic trade offs
- Impacts of Sea Level Rise on the Condition and Function of Tidal Freshwater Forested Wetlands of the Mobile-Tensaw Delta

Projects funded

- Living Shorelines & Nature-based Barriers Sustainability with Sea Level Rise
- Impacts of coastal warming on manatee distributional patterns and habitat use
- Physical Determinants of Hypoxia on the Alabama Shelf

Competitive Grant Program: RFP2 Focus

Fund projects that use emerging technologies to improve our efforts in support of integrated research, developing predictions, forecasting change and improving the affordability of data collection and monitoring in coastal Alabama.



Competitive Grant Program: RFP2

- Amount of funding available = ~$1.5 million
- Average project cost: $150,000
- Total number of awards: up to 10

Featured Speakers

Dr. Ann Ojeda
Auburn University
Geosciences

Dr. Yong Zhang
University of Alabama
Geological Sciences

Dr. Wanyun “Abby” Shao
University of Alabama
Department of Geography

Thank you

This project was paid for [in part] with federal funding from the Department of the Treasury under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act). The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the Department of the Treasury or ADCNR

Modeling Alabama's Groundwater Sustainability and Vulnerability: Connecting Past and Future

Yong Zhang (University of Alabama)
Chaloemporn Ponprasit (UA student)
Hossein Gholizadeh (UA student)
Olaoluwa Oluwaniyi (UA student)
Bahareh Karimidermani (UA student)

Co-PIs: Geoffrey Tick (UA)
Natasha Dimova (UA)
Erkan Nane (Auburn)

Ponprasit, C., Zhang, Y., Gu, X., Goodliffe, A.M. and Sun, H., 2023. Assessing vulnerability of regional-scale aquifer-aquitard systems in East Gulf Coastal Plain of Alabama by developing groundwater flow and transport models. *Water*, *15*(10), 1937. https://doi.org/10.3390/w15101937

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Dauphin Island Sea Lab

Goal: Groundwater Sustainability & Vulnerability

***Objective 1*: Southern Alabama groundwater sustainability**

- ❑ Model 1: GMS/MODFLOW
- ❑ Model 2: Machine Learning Model (Neural Hydrology Network)
- ❑ Model 3: Statistical Model (WTF & Wavelet Analysis)

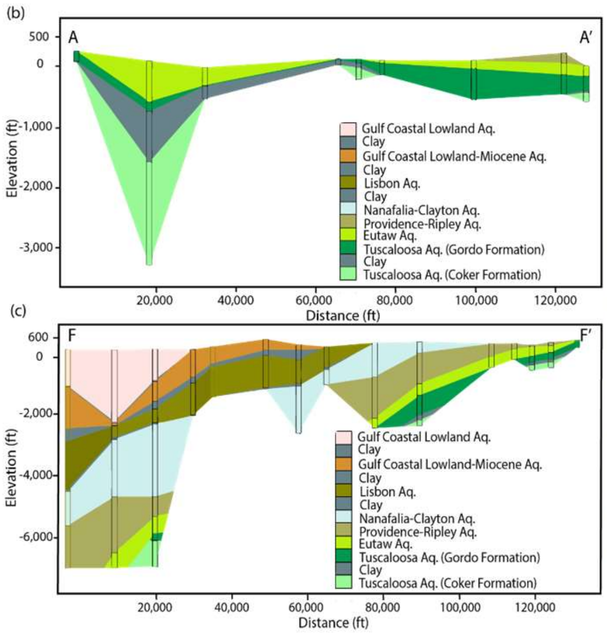
***Objective 2*: Evolution of Alabama coastal groundwater quality**

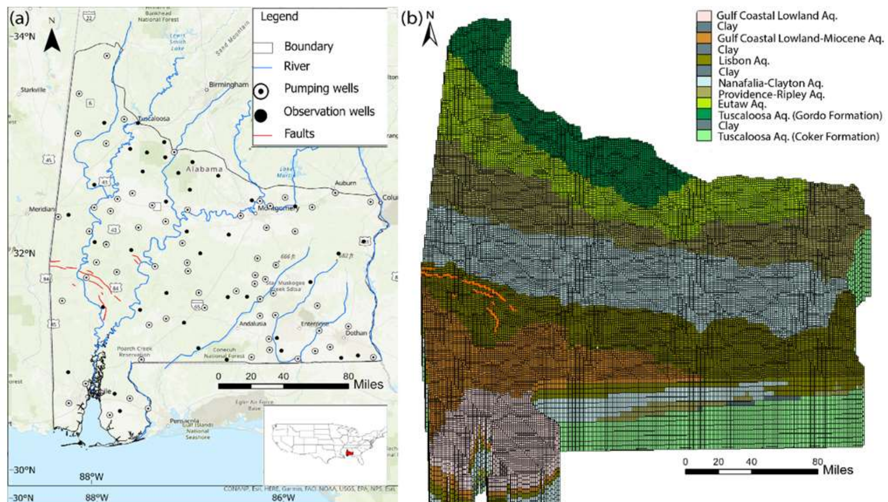
- ❑ Model 4: Seawater Intrusion Model (HGS)
- ❑ Model 5: Groundwater Quality Model (LSTM vs WRTDS)

***Objective 3*: Southern Alabama groundwater vulnerability**

- ❑ Model 6: Backward Particle Tracking Model (from ADE to fADE)
- ❑ Model 7: Vulnerability (Aquifers vs. Vadose Zone)

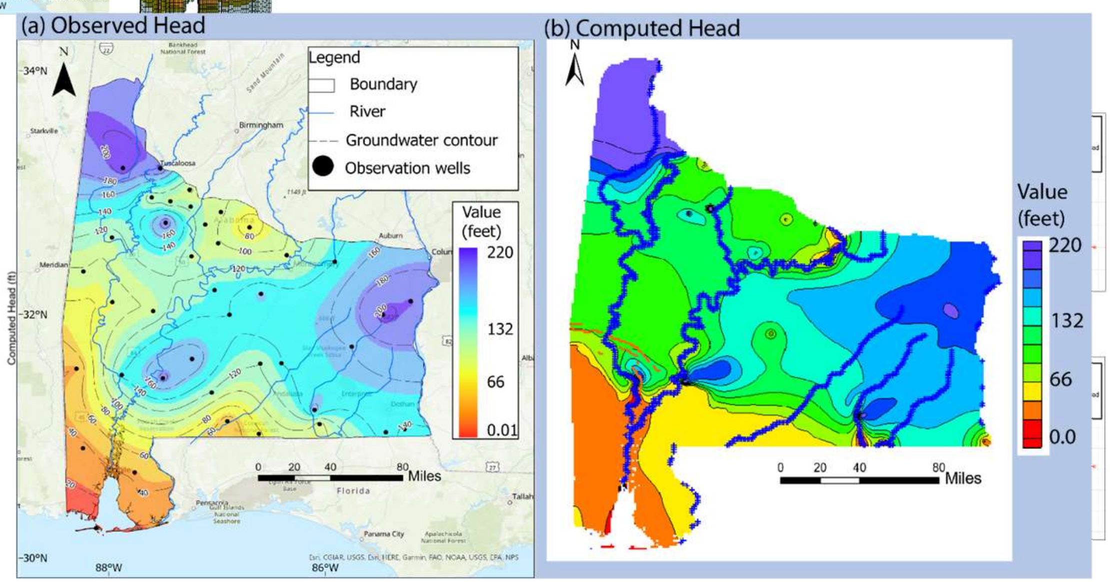
❑ Model 1: Groundwater Flow (GMS)





EGCP in Alabama with 41 observation wells and 74 pumping wells (a). The 3-d geology model for EGCP is shown in (b).

East Gulf Coastal Plain (EGCP), Alabama: 6 cross-sections from 48 boreholes (a). Cross section A-A' (b). Cross section F'-F (c).



The reference groundwater head contour map during 10/2020 (a) vs. the simulated groundwater head contour map using MODFLOW (b) (units: feet)

Ponprasit, Zhang, Gu, Goodliffe, and Sun [*Water*, 2023]

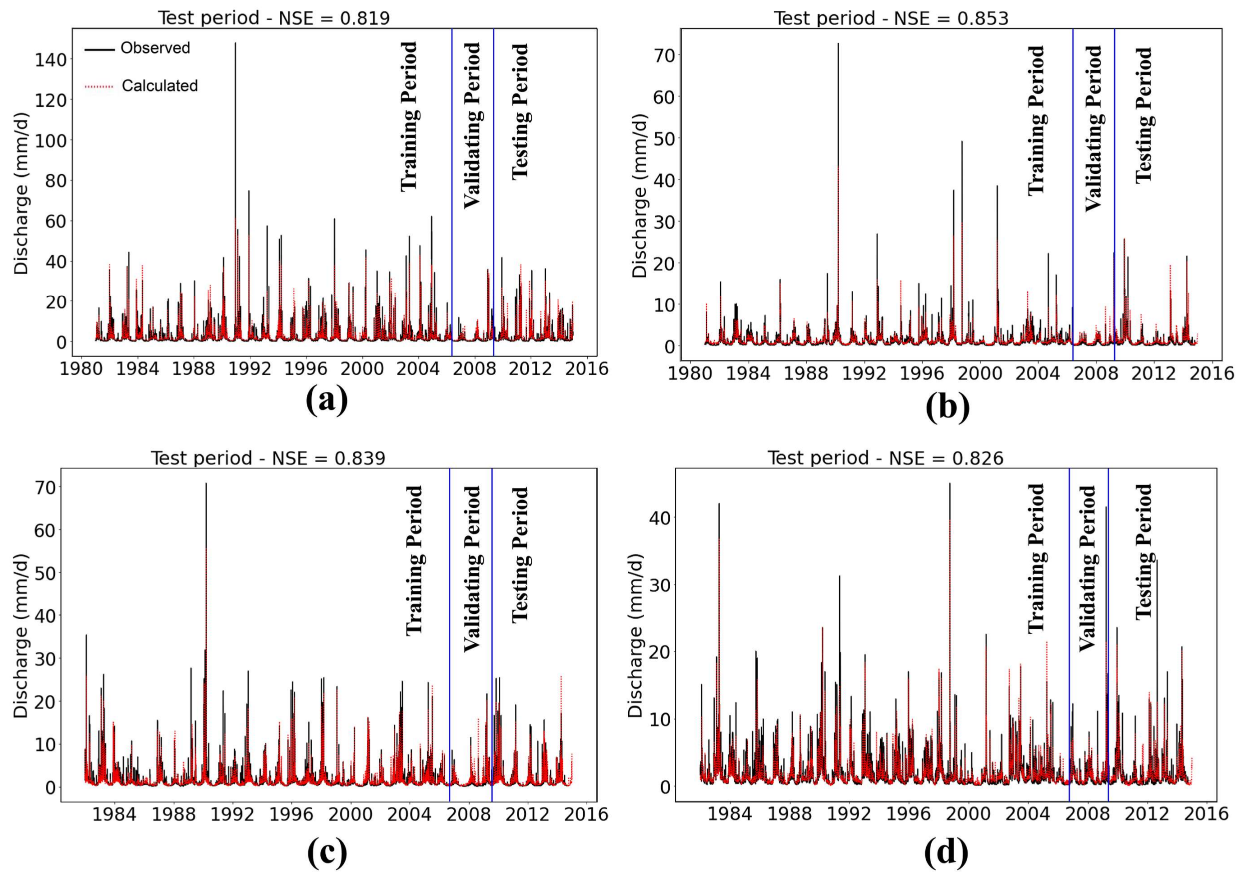
❑ Model 2: Machine Learning Model (Neural Hydrology Network/LSTM)

❑ Surface water using the Neural Hydrology Network

Surface water LSTM inputs
Precipitation
Solar radiation
Maximum temperature
Minimum temperature
Vapor pressure
Mean basin elevation
Mean basin slope Basin area
Forest fraction
Maximum leaf area index (LAI)
Minimum LAI
LAI difference
Maximum green vegetation fraction (GVF)
Minimum GVF
Soil depth
Soil porosity
Soil conductivity
Maximum water content
Sand fraction
Silt fraction
Clay fraction
Carbonate rocks fraction
Permeability
Mean potential evapotranspiration (PET)
Aridity
Snow fraction

Rank (top 10)

Surface water LSTM
1. Precipitation
2. Permeability
3. Maximum temperature
4. Solar radiation
5. Vapor pressure
6. Maximum water content
7. Minimum temperature
8. Soil depth
9. Carbonate rocks fraction
10. Forest fraction

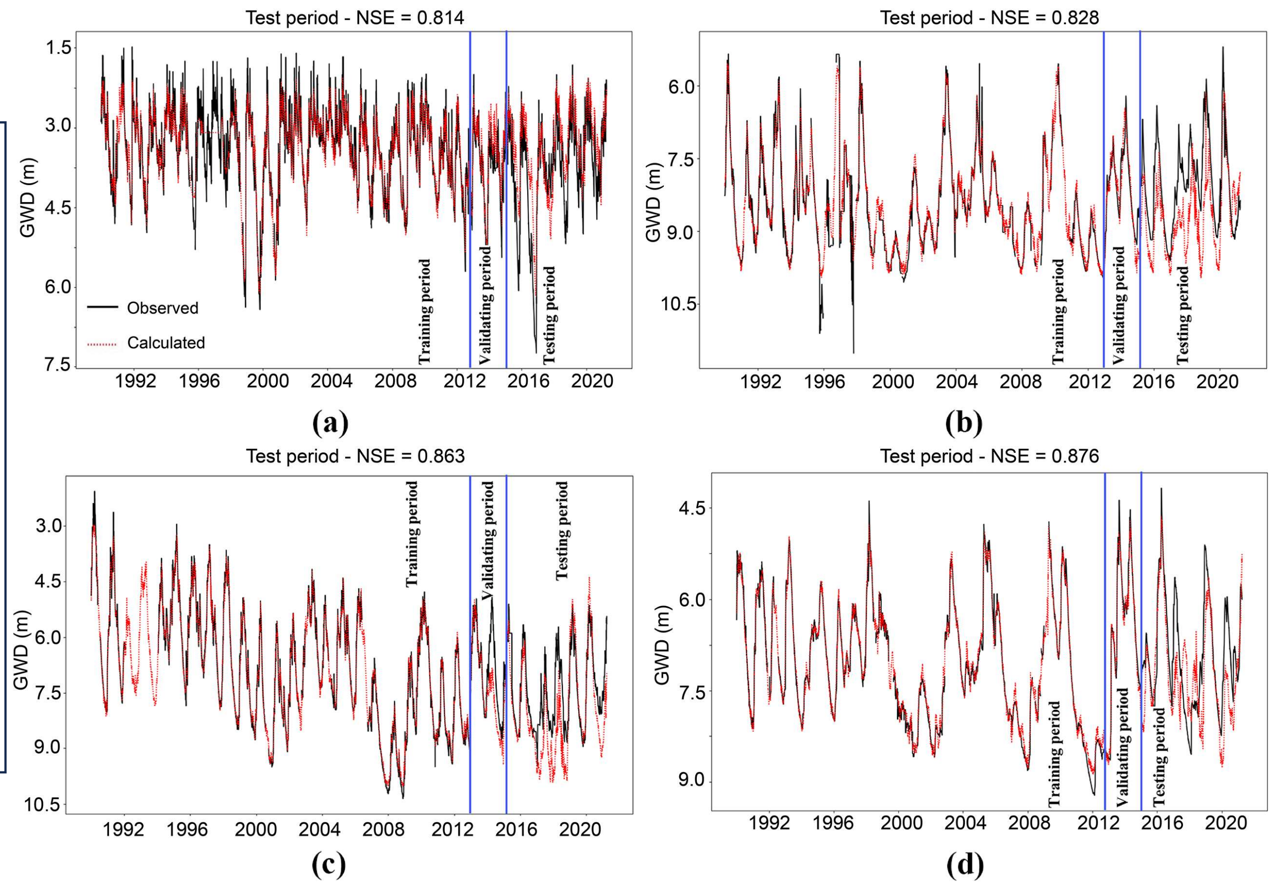


Gholizadeh, Zhang, Frame, Gu, and Green [*Science of the Total Environment*, 2023]

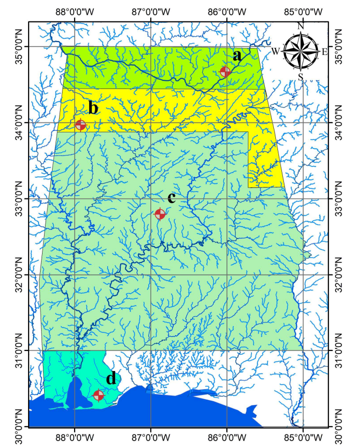
GW-LSTM

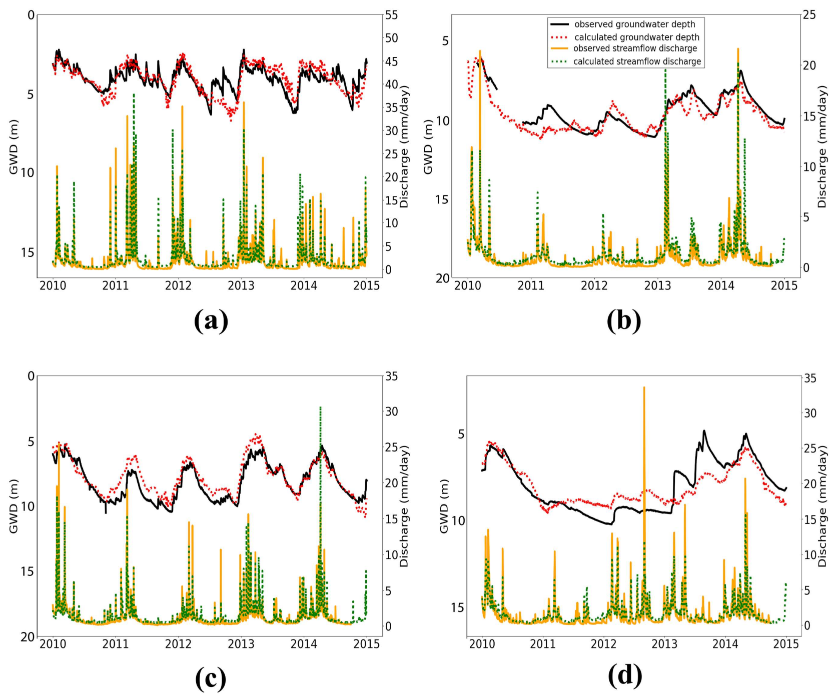
Groundwater hydrograph

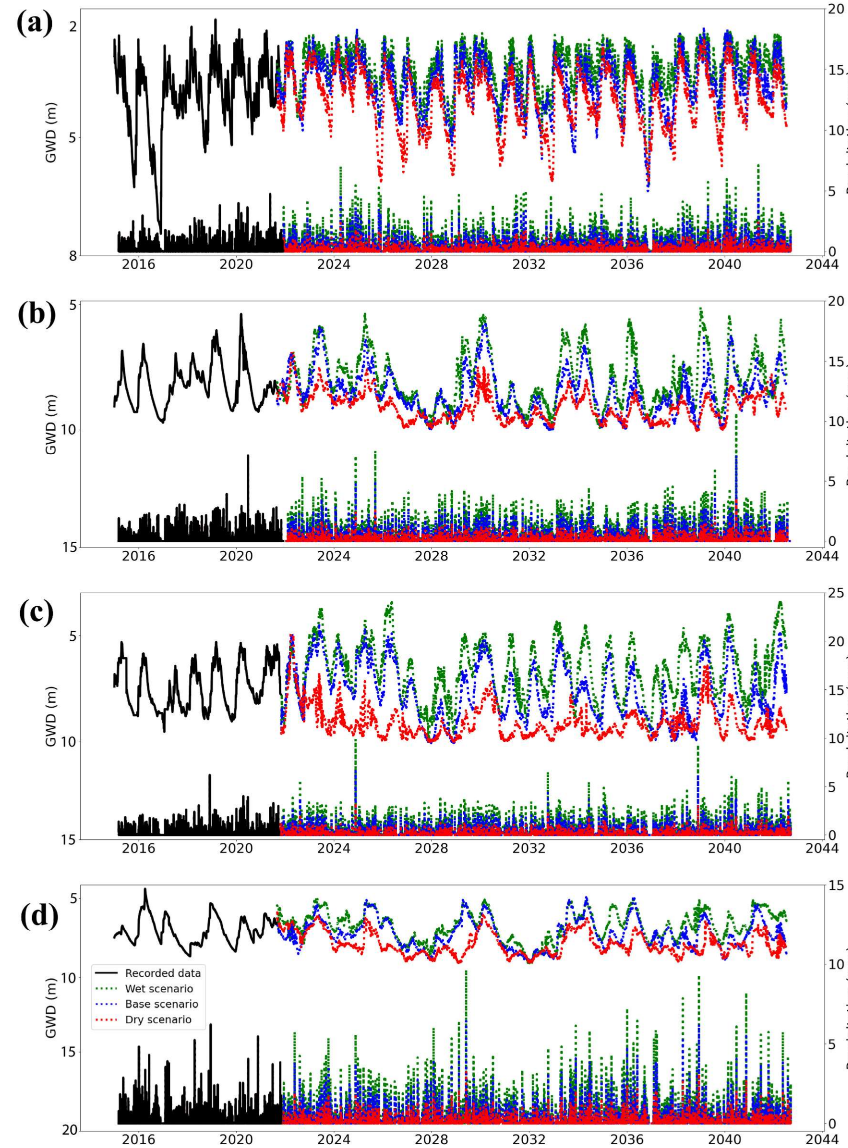
GW-LSTM inputs	Rank (top 5) *GW-LSTM*
Precipitation	1. Precipitation
Temperature	2. Hydraulic conductivity
Soil depth	3. Soil depth
Porosity	4. Maximum water content
Maximum water content	5. Leaf area index (LAI)
Leaf area index (LAI)	
Mean potential Evapotranspiration (PET)	
Sand fraction	
Silt fraction	
Clay fraction	
Carbonate rocks fraction	
Hydraulic conductivity	



Impact of climate change on groundwater head fluctuations: GW-LSTM

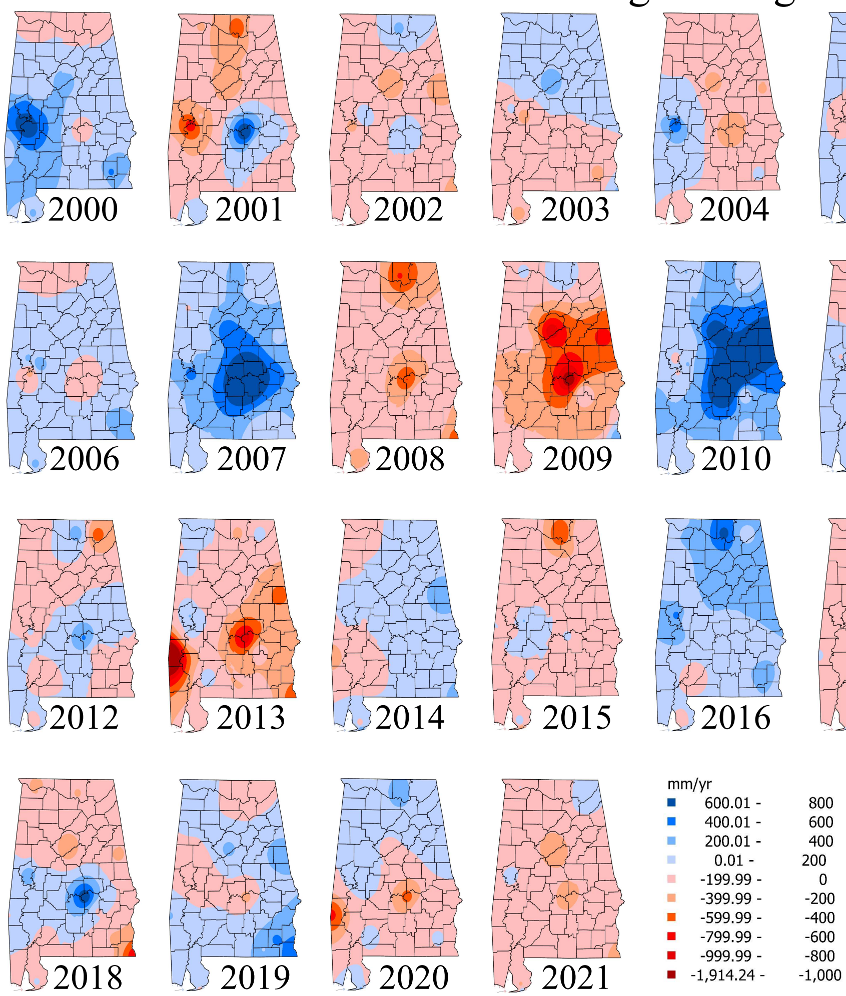




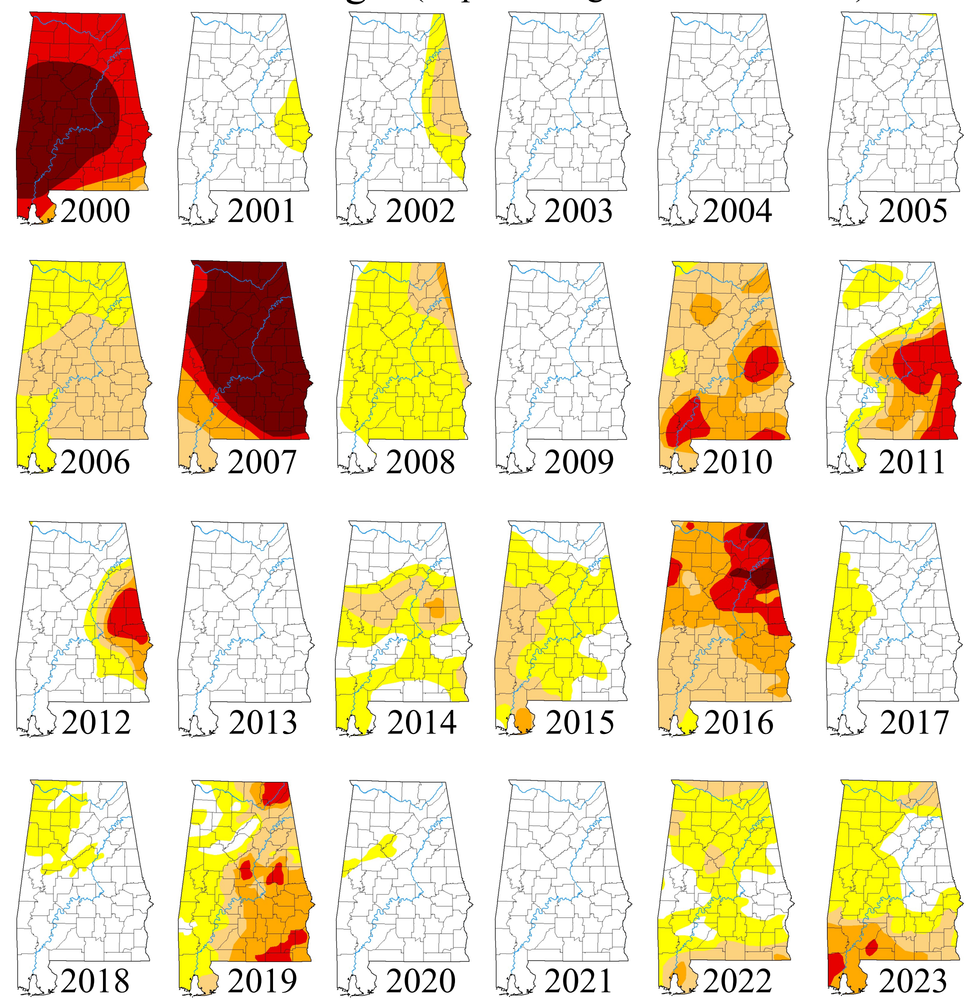


❑ Model 3: Statistical Model (WTF)

Alabama Groundwater Storage Change

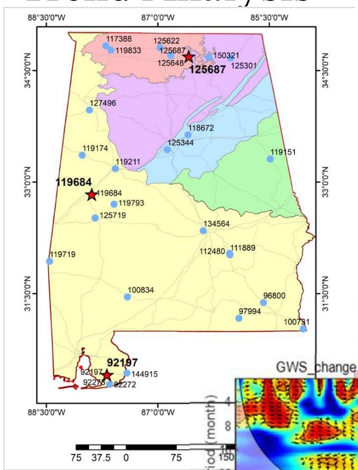


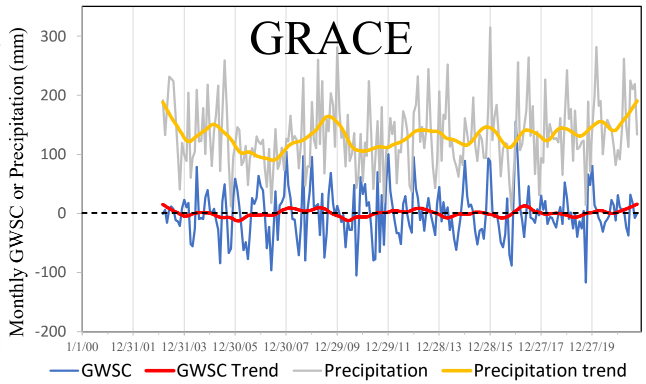
U.S. Drought (https://droughtmonitor.unl.edu)

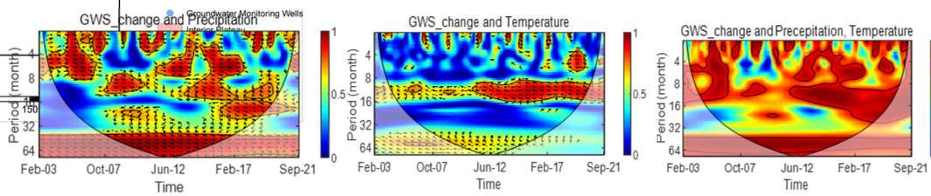


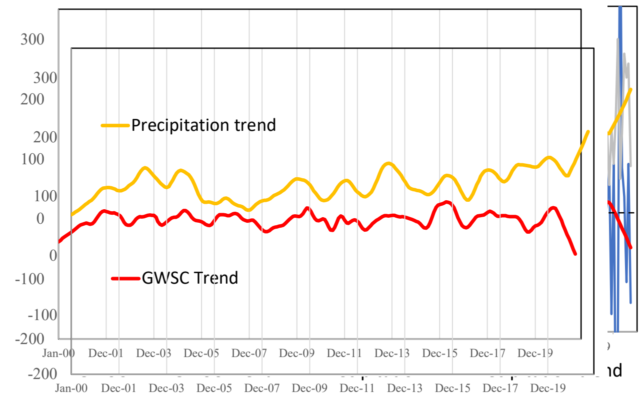
Oluwaniyi, Zhang, Gholizadeh, Li, Gu, Sun, & Lu [*Sustainability*, 2023]

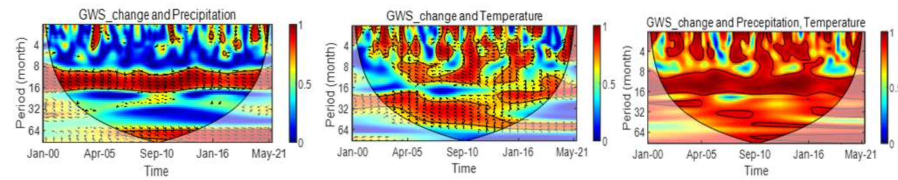
Trend Analysis

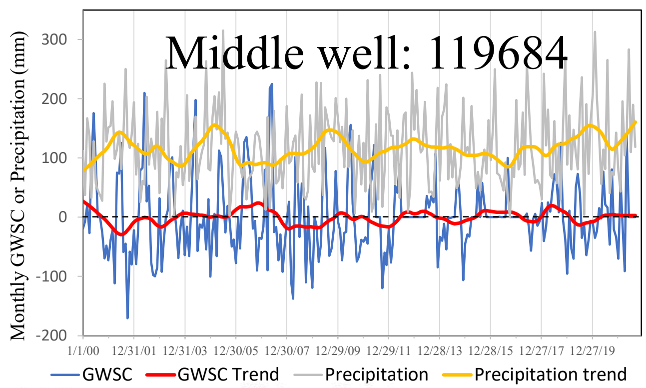


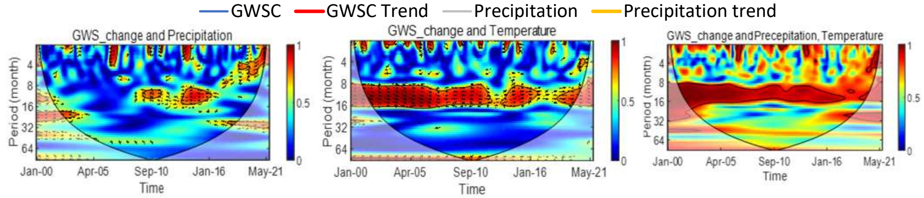


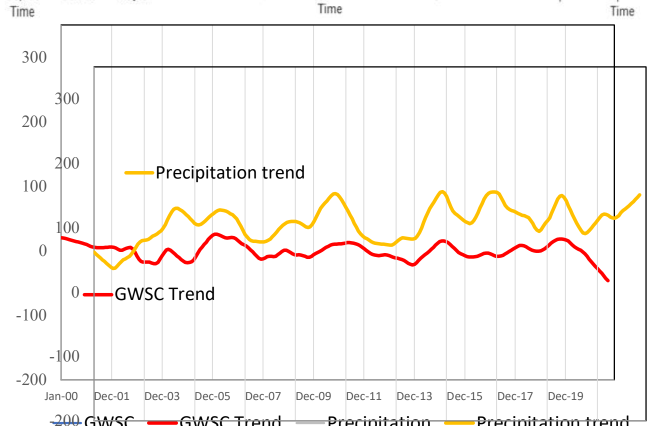


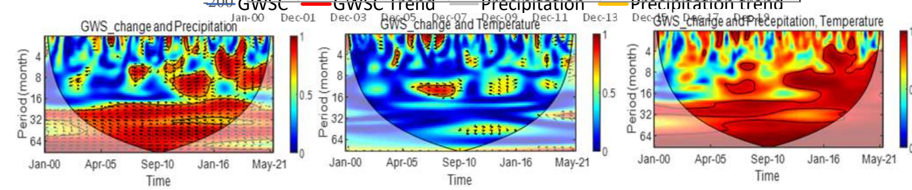




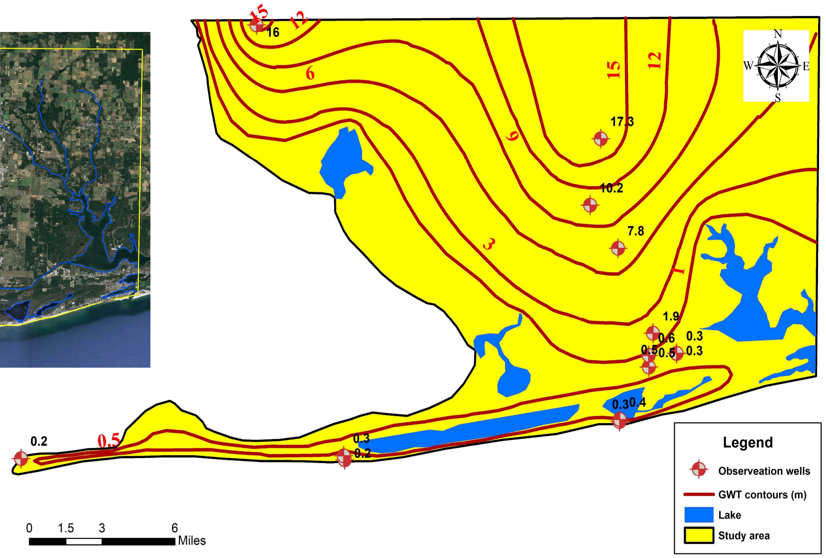


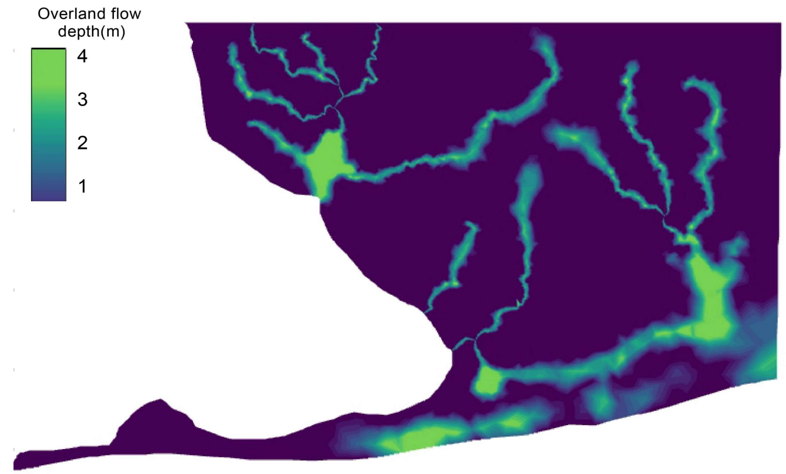


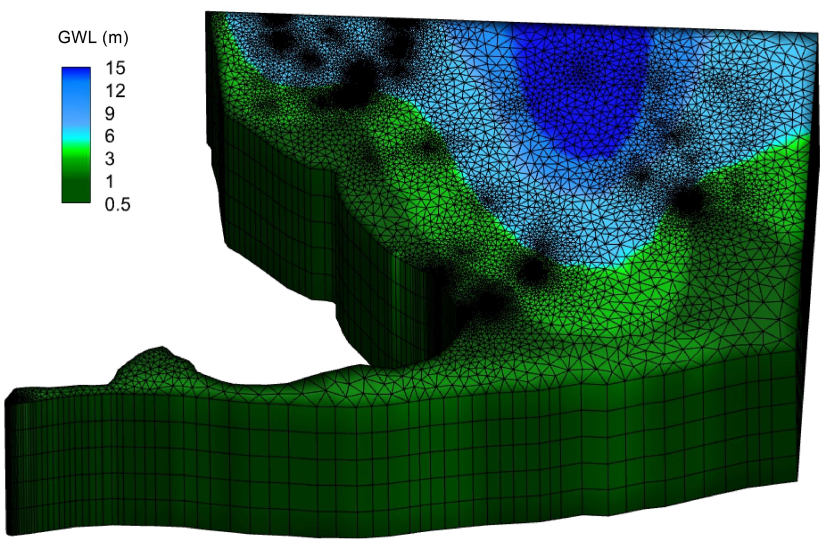


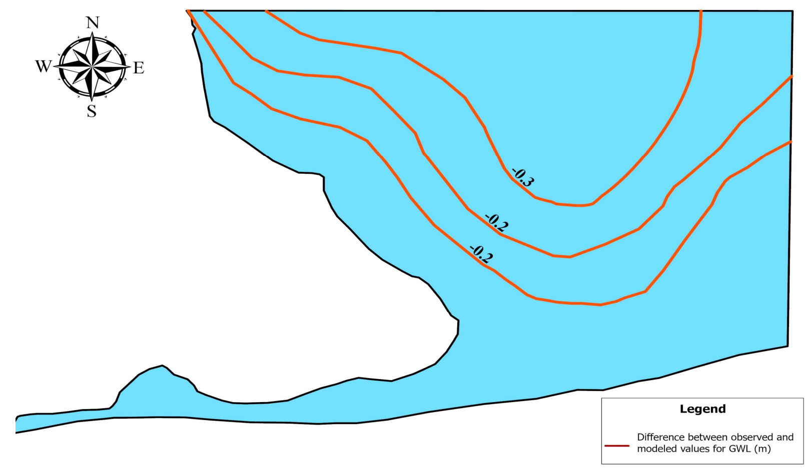


❑ Model 4: Seawater Intrusion Model (HGS)



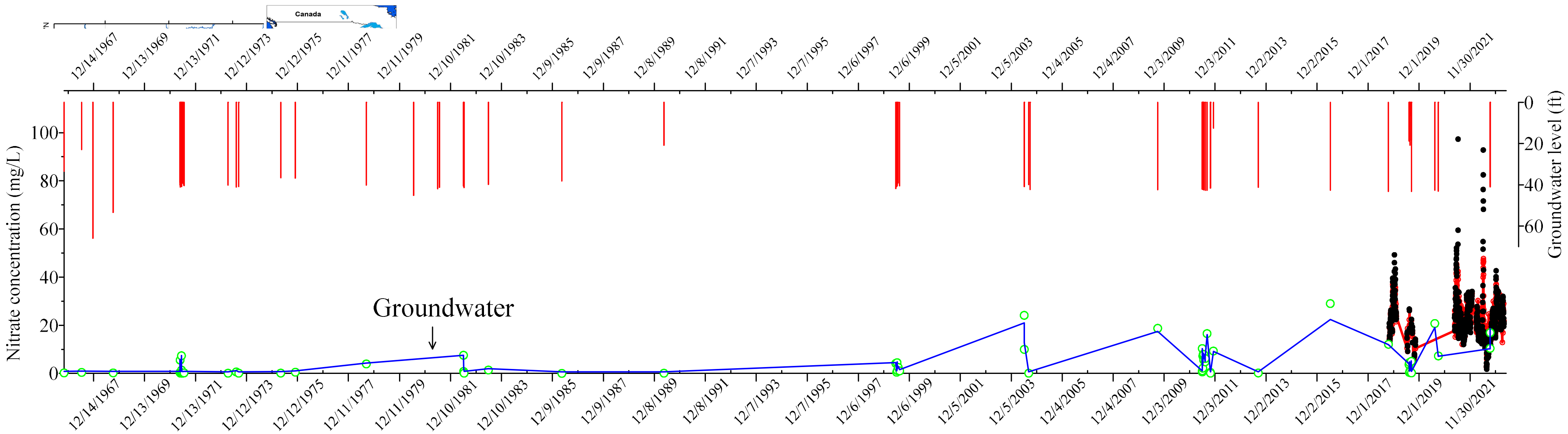


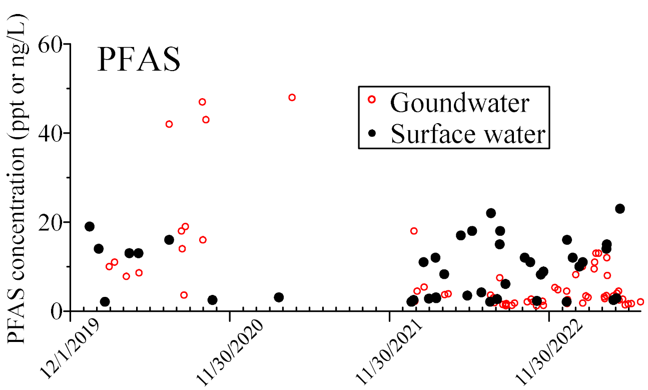


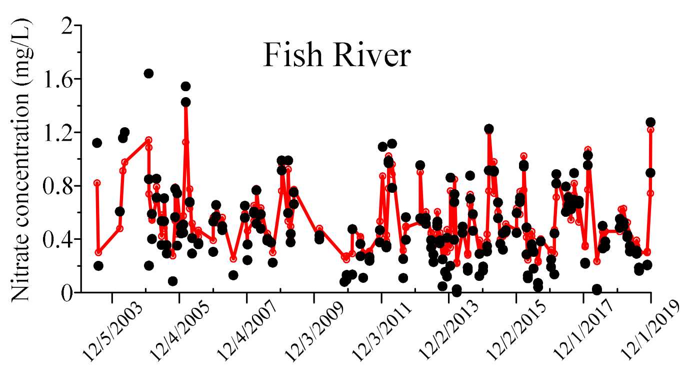


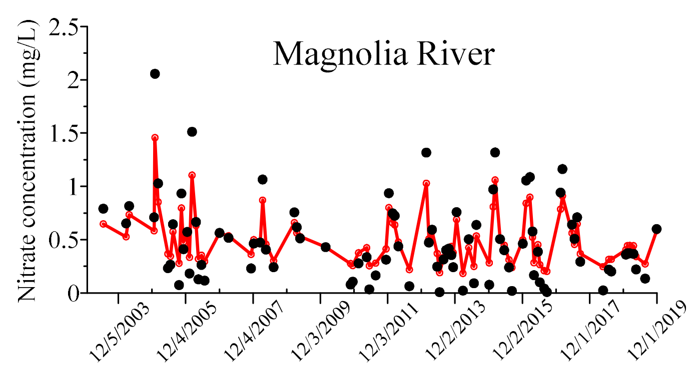
❑ Model 5: Groundwater Quality Model (LSTM vs WRTDS)

Nitrate concentration: calculated by the LSTM model (red line) vs. the observed data (symbols) at Tombigbee River and a well nearby.

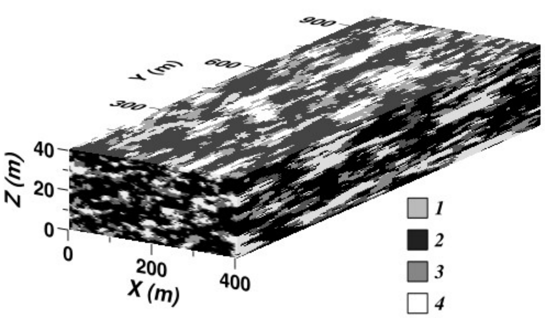


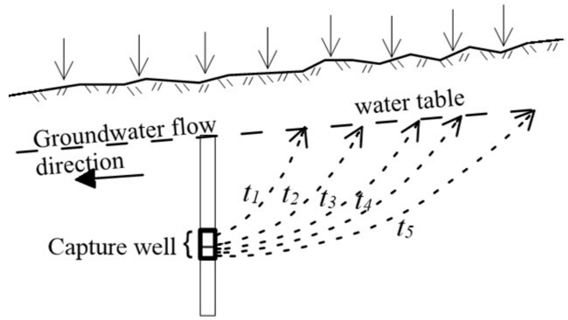






❑ Model 6: Backward Particle Tracking Model (from ADE to fADE)





$$\frac{\partial(\theta'_m C_m)}{\partial t} + \beta \frac{\partial^{\gamma,\lambda}(\theta_m C_m)}{\partial t^{\gamma,\lambda}} = -\frac{\partial}{\partial x}(\theta_m V C_m) + e^{-\kappa x}\frac{\partial^{\alpha-1}}{\partial x^{\alpha-1}}\left[\theta_m D \frac{\partial(e^{\kappa x} C_m)}{\partial x}\right] - \theta_m R_m^i \frac{\partial C_m}{\partial t}$$

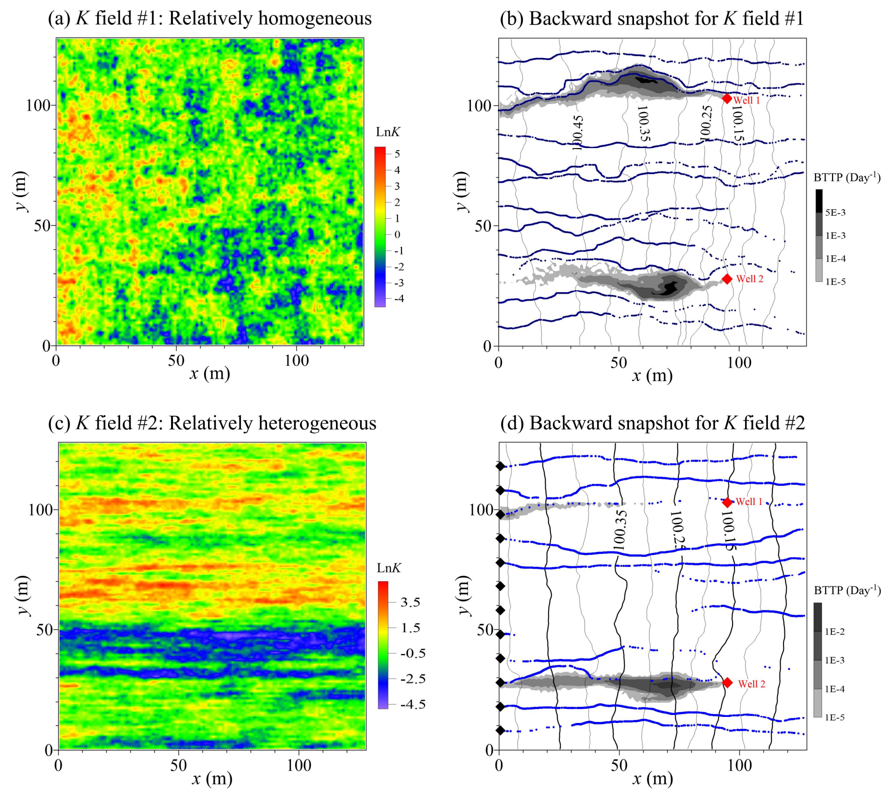
$$\frac{\partial\left(\theta_{im} C_{im}^i\right)}{\partial t} = f(t) * \frac{\partial(\theta_m C_m^i)}{\partial t} + f(t)\left(\theta_m C_{m,0}^i - \theta_{im} C_{im,0}^i\right) - \theta_{im} R_{im}^i \frac{\partial C_{im}^i}{\partial t}$$

$$C_m^i(x, t=0) = C_{m,0}^i(x)$$

$$C_{im}^i(x, t=0) = C_{im,0}^i(x)$$

$$\left\{d_1 \theta_m V C_m^i - d_2 e^{-\kappa x} \frac{\partial^{\alpha-2}}{\partial x^{\alpha-2}}\left[\theta_m D \frac{\partial}{\partial x}\left(e^{\kappa x} C_m^i\right)\right]\right\}\Big|_{x=L} = g_1(t)$$

$$\left\{d_3 \theta_m V C_m^i - d_4 e^{-\kappa x} \frac{\partial^{\alpha-2}}{\partial x^{\alpha-2}}\left[\theta_m D \frac{\partial}{\partial x}\left(e^{\kappa x} C_m^i\right)\right]\right\}\Big|_{x=R} = g_2(t)$$



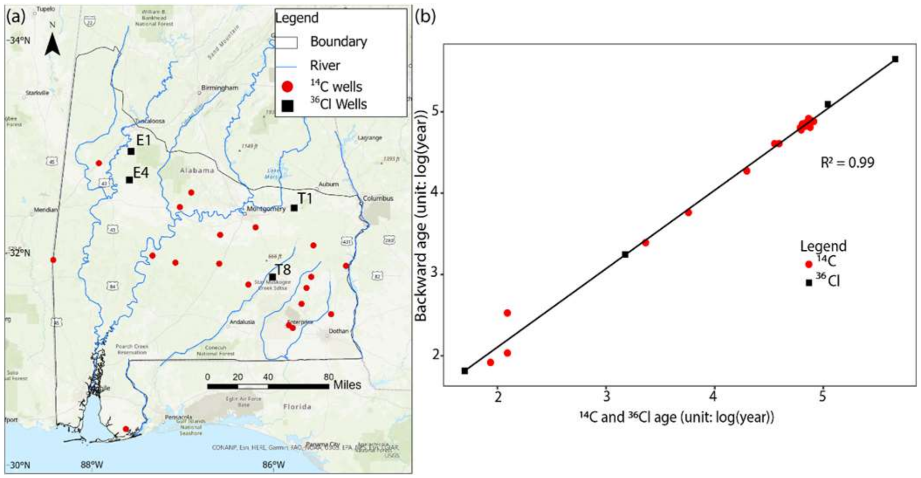
Zhang [*Water Resources Research*, 2022]

Zhang, Brusseau, Neupauer, and Wei [*Environmental Science & Technology*, 2022]

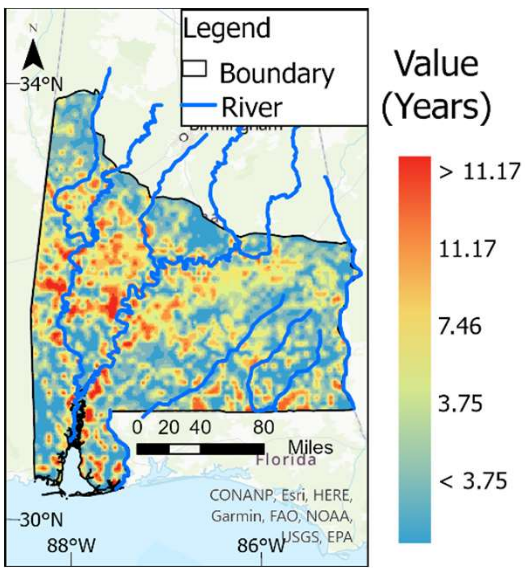
Zhang [*Journal of Hazardous Materials Advances*, 2023]

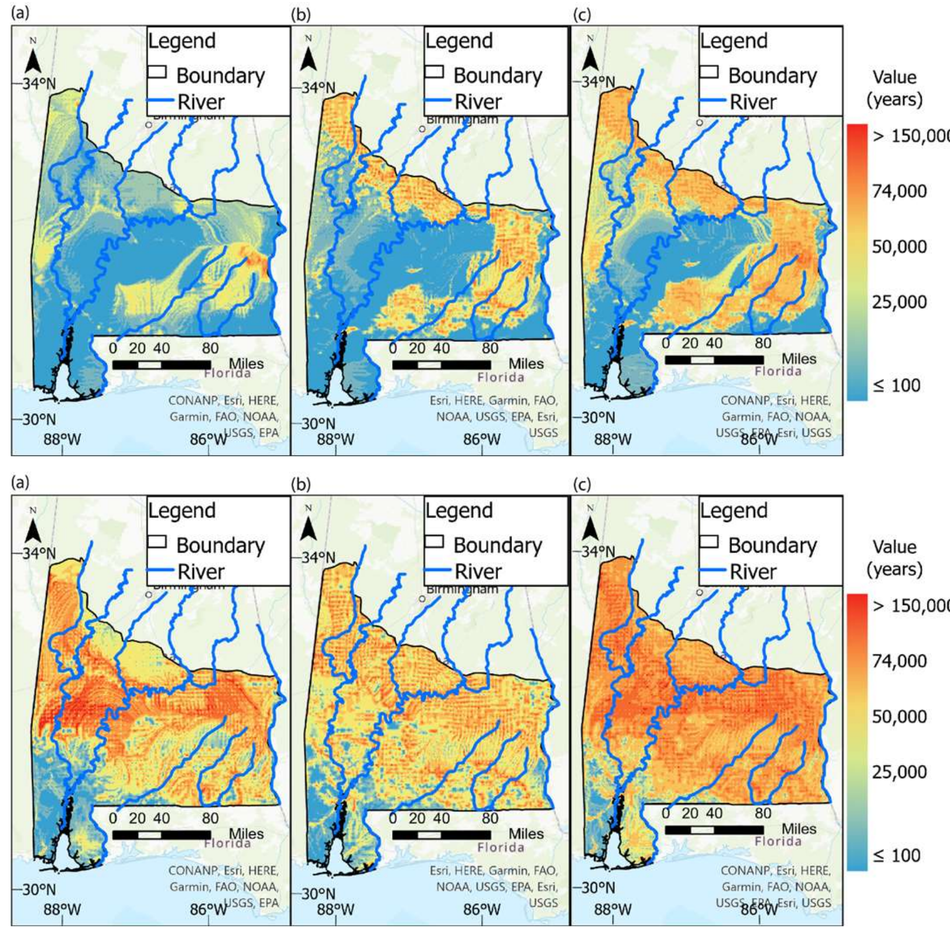
Zhang, Fogg, Sun, Reeves, Neupauer, and Wei [*Hydrology and Earth System Sciences,* 2023]

❑ Model 7: Vulnerability (Aquifer & Soil)



24 wells of ^{14}C samples from Solder (2020) (red dots) and 4 wells of ^{36}Cl samples from Penny and Lee (2003) (black squares) (a). Comparison between the isotopic-dated ages and MODPATH (units: year) (b).





Aquifer Vulnerability: (a) Groundwater age. (b) Residence time (c) Total travel time at 300 (top) and 700 (bottom) ft below GW table.

Ponprasit, Zhang, Gu, Goodliffe, and Sun [*Water*, 2023]

Acknowledgement

This project was paid for in part with federal funding from the Department of the Treasury under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act). The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of the Department of the Treasury or ADCNR.

THE UNIVERSITY OF ALABAMA
College of Arts & Sciences
Department of Geography

EXPLORING DIFFERENT APPROACHES TO MEASURING COMMUNITY VULNERABILITY IN MOBILE BAY

PRESENTER: WANYUN SHAO, PH.D
ASSOCIATE PROFESSOR OF GEOGRAPHY
UNIVERSITY OF ALABAMA

THE UNIVERSITY OF ALABAMA
College of Arts & Sciences
Department of Geography

THE SPATIOTEMPORAL PATTERNS OF COMMUNITY VULNERABILITY IN MOBILE BAY FROM 2000-2020

AUTHORS: *HEMAL DEY, WANYUN SHAO, SHUFEN PAN, HANQIN TIAN

*STUDENT COAUTHOR

BACKGROUND

- THE COASTAL REGION IS CONFRONTED WITH HEIGHTENED RISKS POSED BY CLIMATE CHANGE (IPCC 2022)
- MOBILE RIVER BASIN (MRB) PROVIDES CRITICAL ECOSYSTEM SERVICES TO THE COUNTRY
- THE COASTAL ECOSYSTEM OF MRB AND ITS ADJACENT COASTS ARE VULNERABLE TO ENVIRONMENTAL STRESSORS INDUCED BY LOCAL HUMAN ACTIVITIES AND GLOBAL CLIMATE CHANGE.
- COMMUNITY VULNERABILITY REFERS TO THE SUSCEPTIBILITY OF A COMMUNITY TO THE DAMAGING EFFECTS OF A HAZARD (TATE, 2012)
- EFFECTIVE MEASURE OF COMMUNITY VULNERABILITY IS COMPLICATED DUE TO THE COMPLEXITY OF THE SELECTION AND WEIGHTING OF THE INDICATOR (BIRKMANN ET AL. 2013; CUTTER ET AL. 2008; 2012).

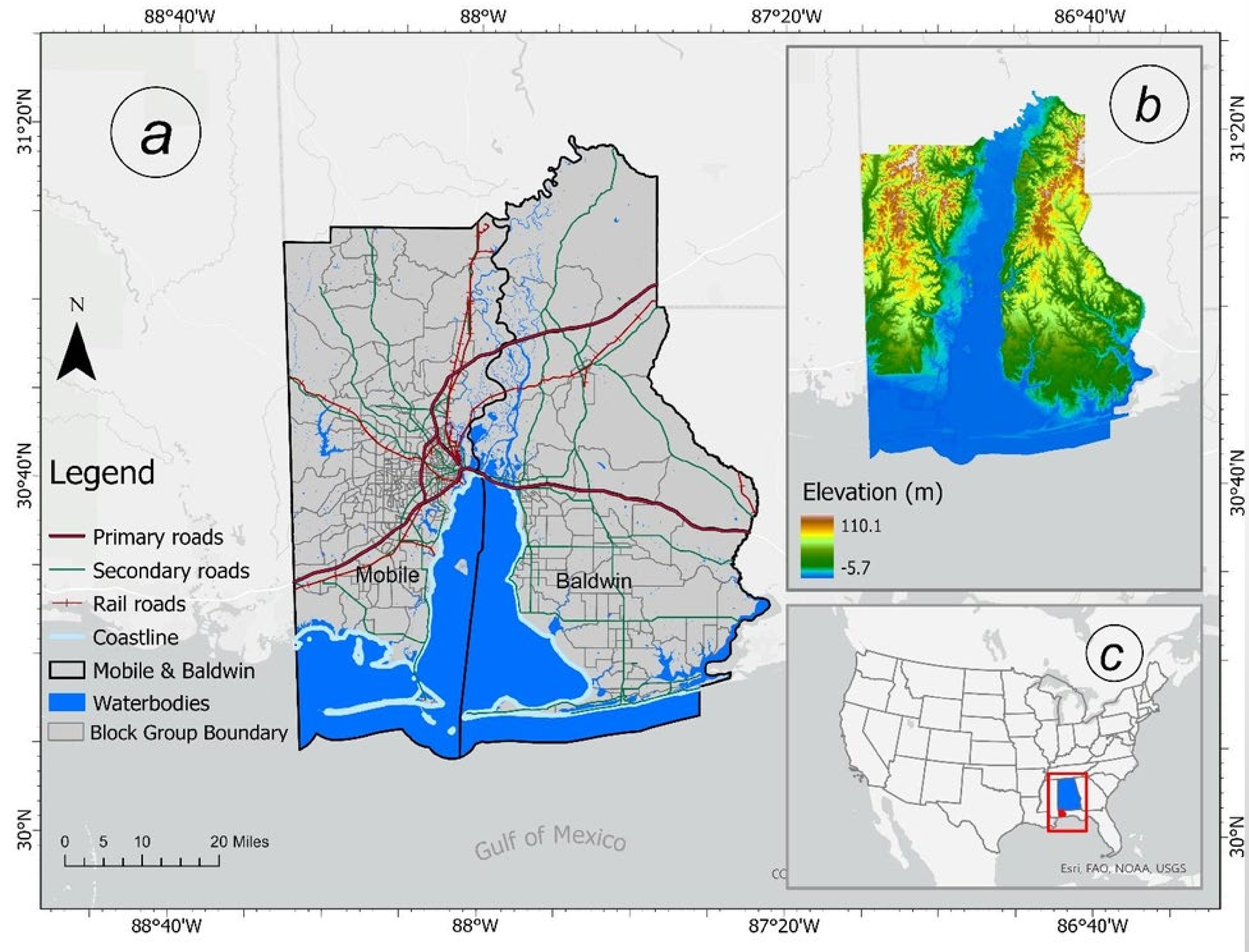


FIG. 1: STUDY AREA MAP (A) ADMINISTRATIVE MAP OF MOBILE BAY (B) ELEVATION MAP OF MOBILE BAY (C) LOCATION OF STUDY AREA AND ALABAMA STATE IN CONTEXT OF CONUS

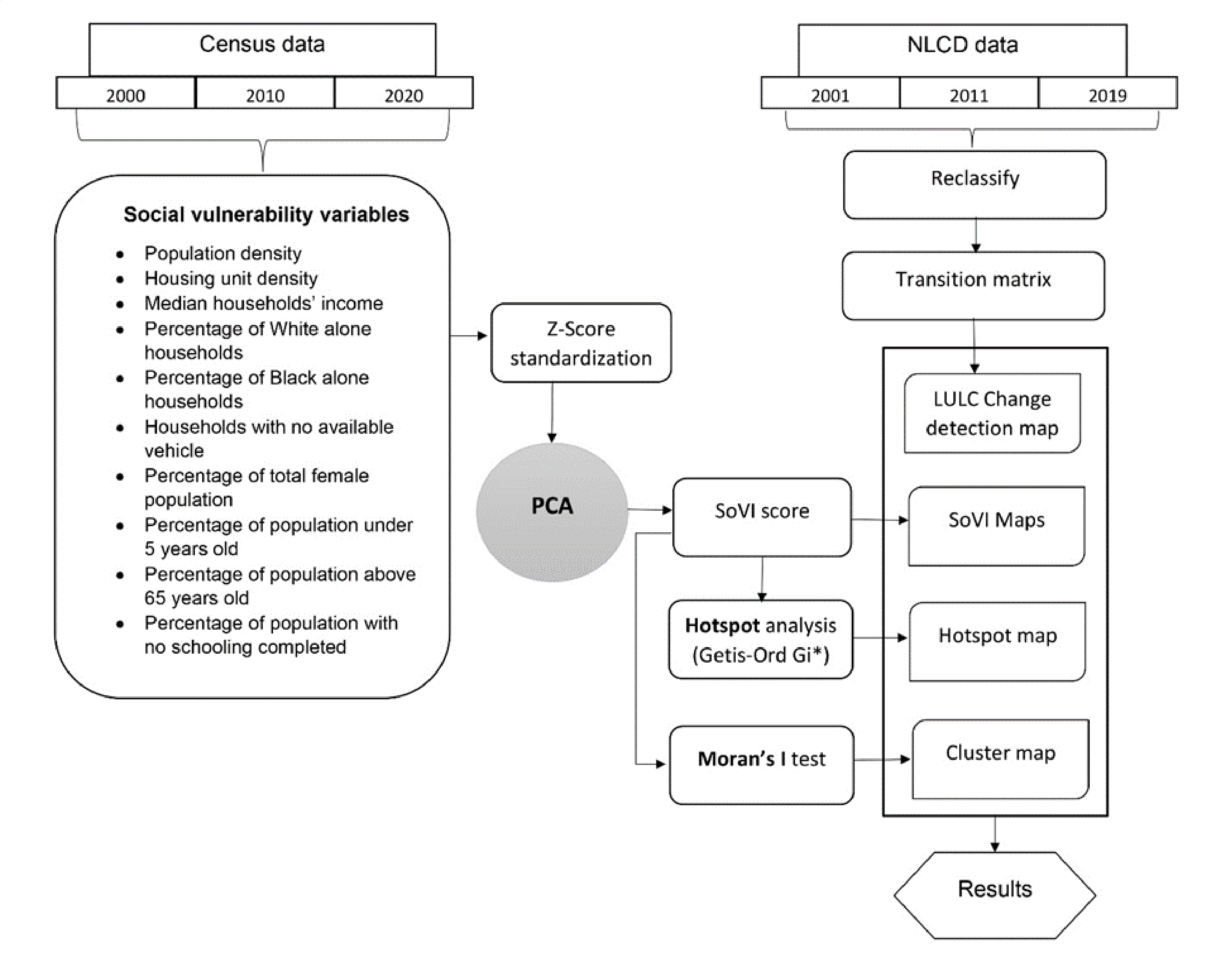


FIG. 2: METHODOLOGICAL FLOWCHART OF THIS STUDY

TABLE 1: SOCIAL VULNERABILITY COMPONENT SUMMARY

Census year	Factor	Cardinality	Name	% Variance explained	Dominant variables	Factor loading
2000	F1	+	Population & Housing	43.11	Z_PopDen	0.864
					Z_HousingDen	0.861
	F2	+	Wealth, Race & education	15.03	Z_Income	-0.745
					Z_WhitePop	-0.731
					Z_BlackPop	0.705
					Z_NoSchoolC	0.795
	F3	+	Age	10.7	Z_Under5	-0.814
					Z_Above65	0.826
2010	F1	+	Wealth & Race	33.88	Z_Income	-0.842
					Z_WhitePop	-0.697
					Z_BlackPop	0.713
	F2	+	Population & Housing	13.36	Z_PopDen	0.931
					Z_HousingDen	0.936
	F3	+	Age	12.58	Z_Above65	0.840
	F4	+	Gender (Female)	10.22	Z_FemalePop	0.902
2020	F1	+	Wealth & Race	31.79	Z_Income	-0.782
					Z_WhitePop	-0.780
					Z_BlackPop	0.827
	F2	+	Population & Housing	14.73	Z_PopDen	0.891
					Z_HousingDen	0.883
	F3	+	Age	12.61	Z_Under5	-0.813
					Z_Above65	0.767
	F4	+	Gender (Female)	10.75	Z_FemalePop	0.840

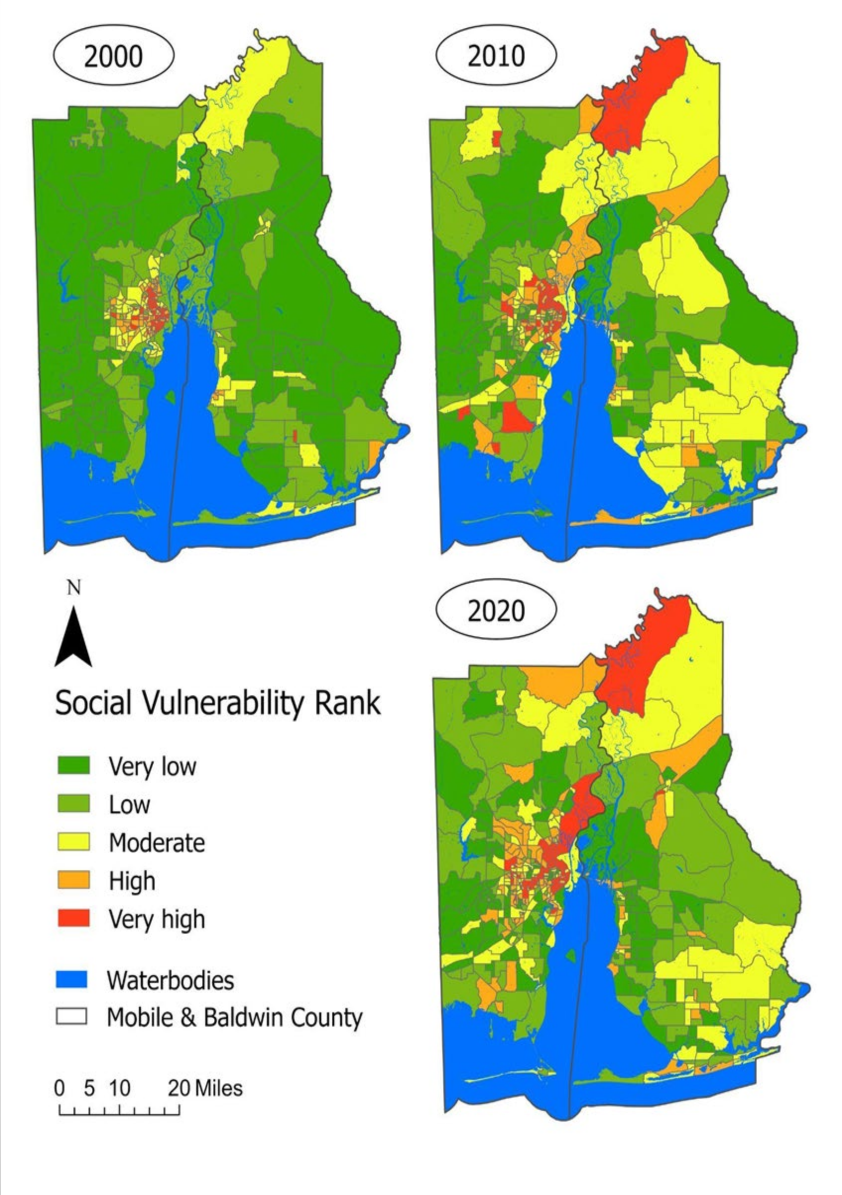
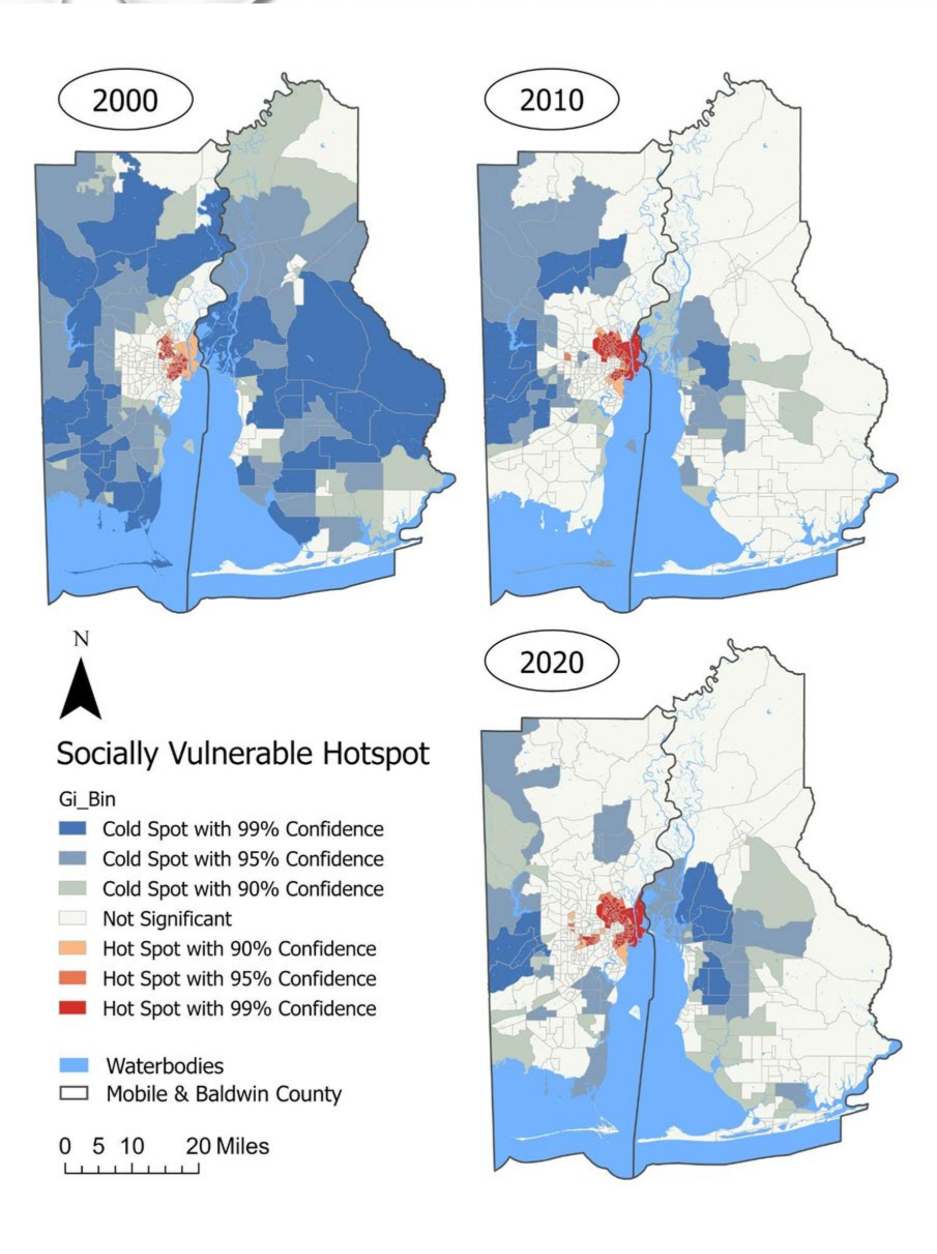


FIG. 2: SPATIAL DISTRIBUTION OF SOCIAL VULNERABILITY IN MOBILE BAY



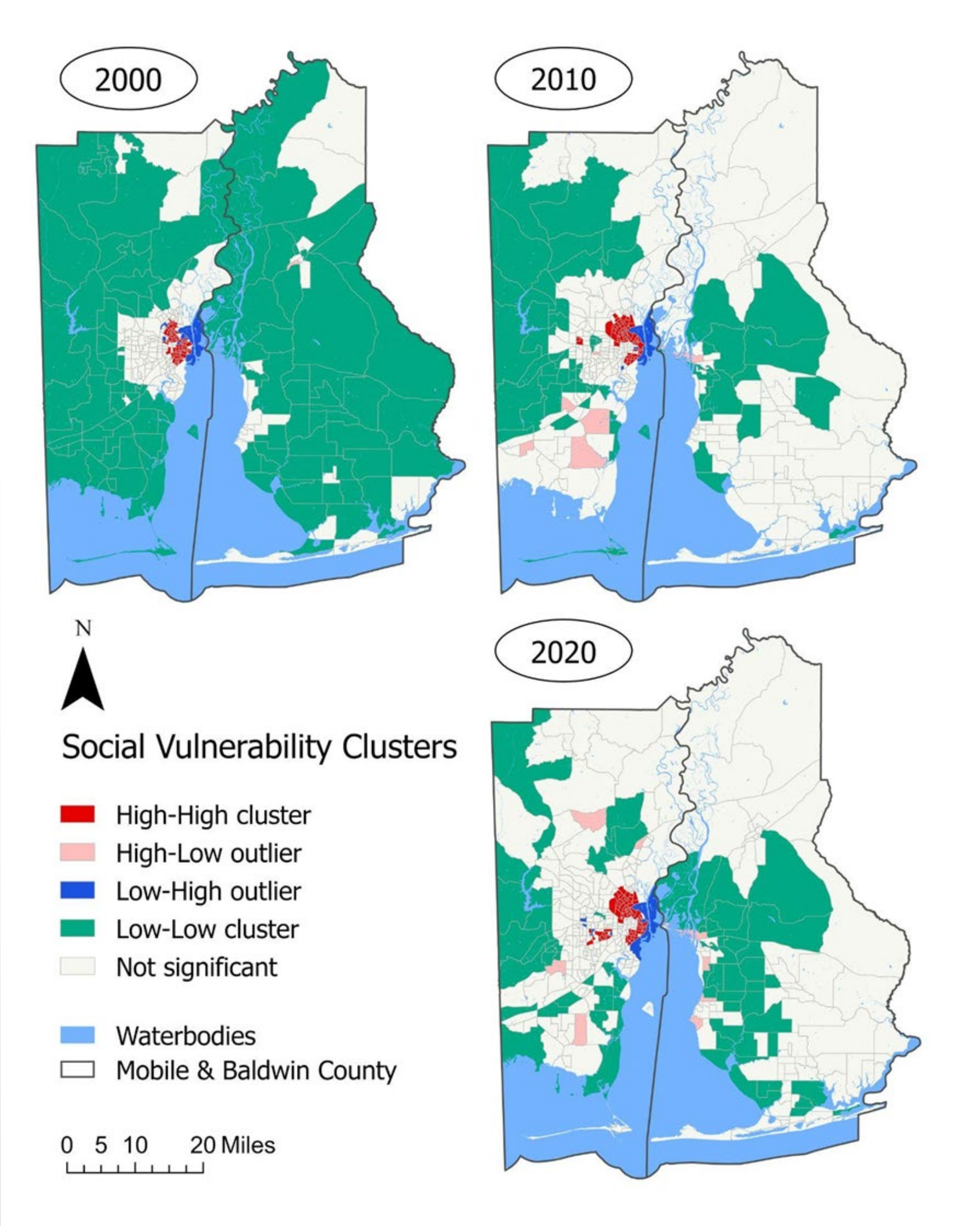


FIG. 3 (A) SOCIALLY VULNERABLE HOTSPOTS (B) SOCIAL VULNERABILITY CLUSTERS

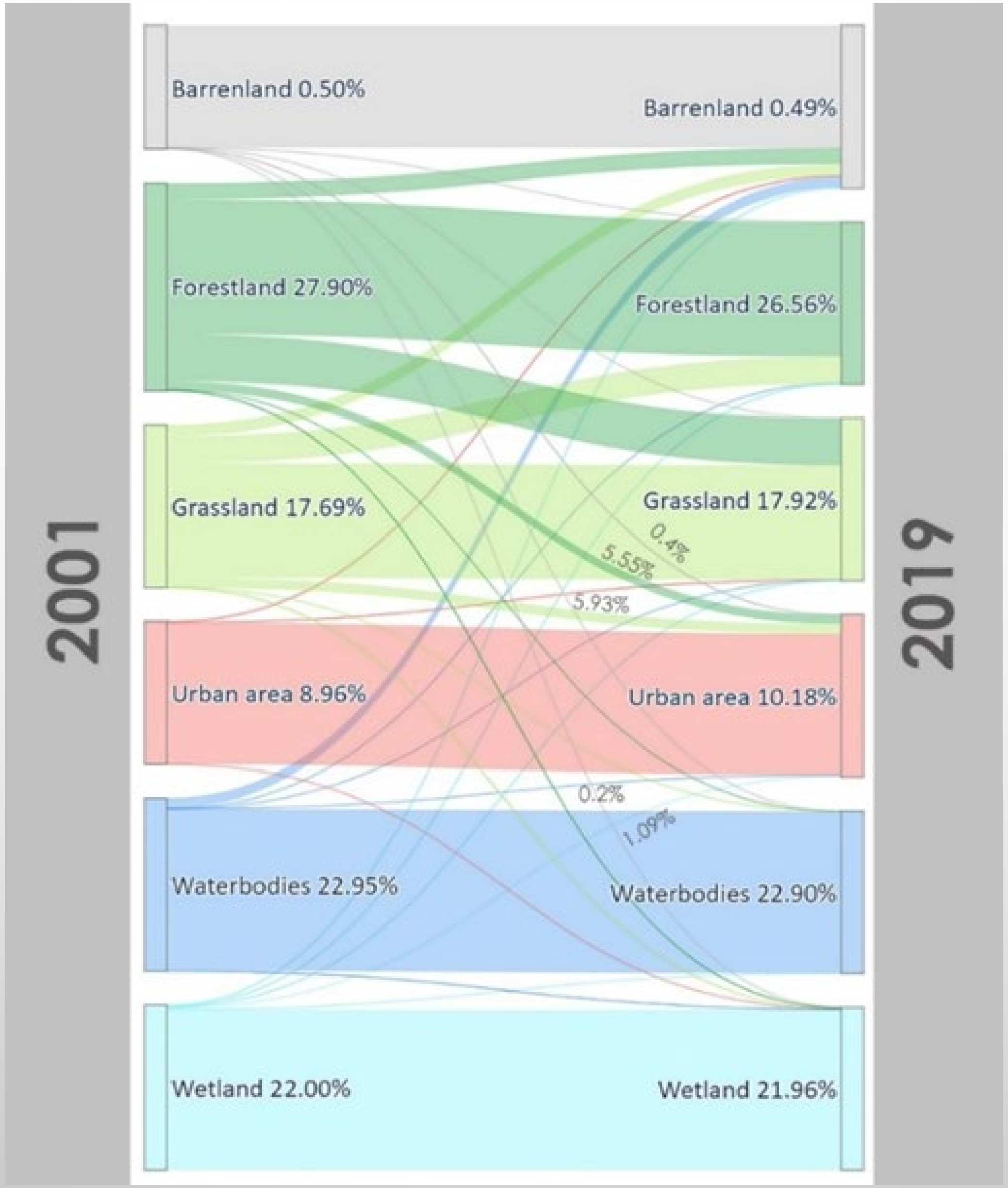


FIG. 4 SANKEY DIAGRAM OF LULC CHANGES IN MOBILE BAY FROM 2001 TO 2019

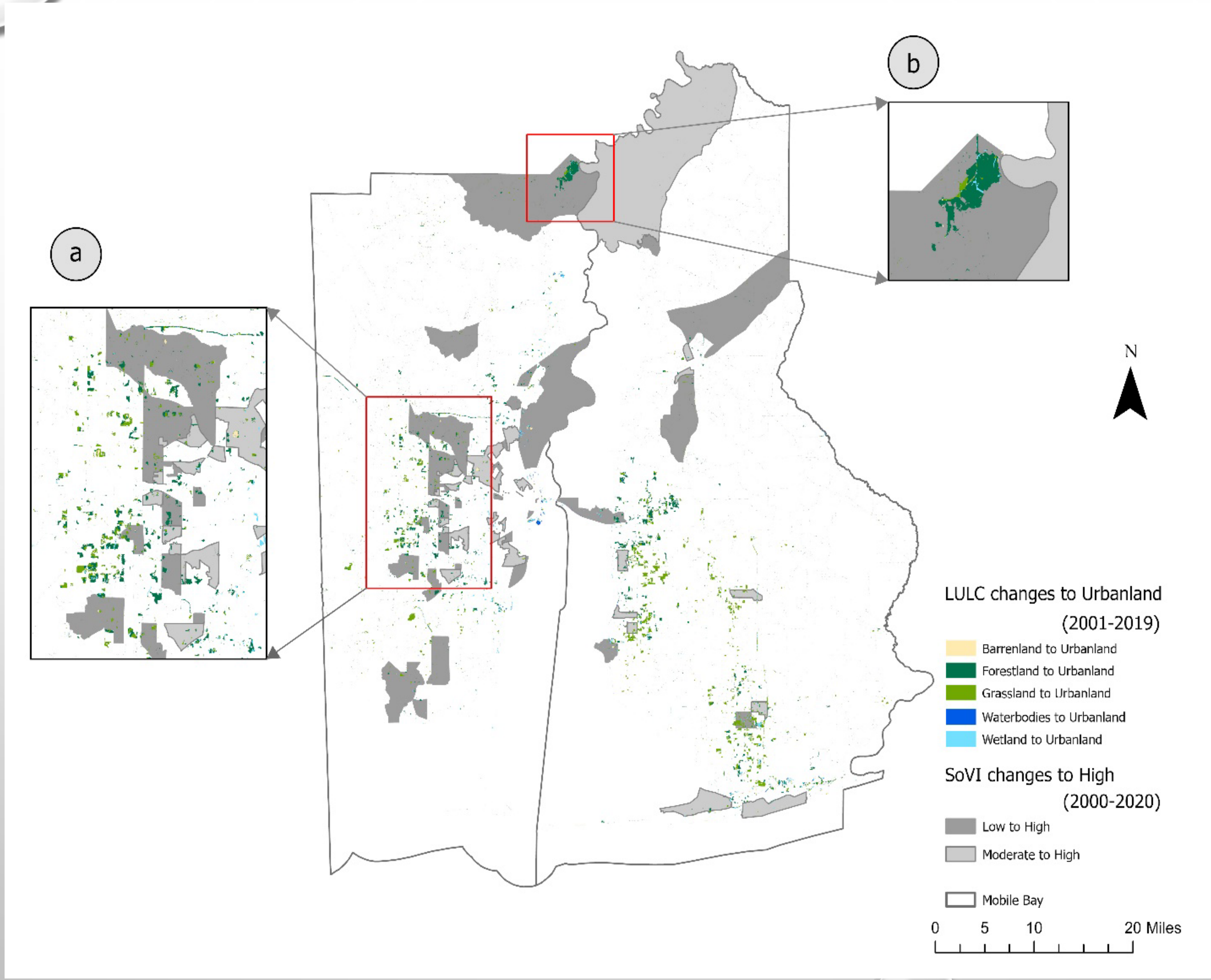


FIG. 5 THE LINK BETWEEN LULC CHANGES AND SOCIAL VULNERABILITY CHANGES

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EXPLORING THE INFLUENCE OF STAKEHOLDERS' OPINIONS ON SELECTING AND WEIGHTING SOCIAL VULNERABILITY INDICATORS IN FLOOD RISK MANAGEMENT

AUTHORS: *MD MUNJURUL HAQUE, WANYUN SHAO, *HEMAL DEY

*STUDENT COAUTHOR

BACKGROUND

- THE PROCESS OF SELECTING AND ASSIGNING WEIGHTS TO INDICATORS IN DISASTER MANAGEMENT VARIES AMONG STAKEHOLDERS AND HAS A DIRECT IMPACT ON THE EFFECTIVENESS OF MEASURES (RECKNER AND TIER, 2023).

RESEARCH QUESTION

- HOW DO STAKEHOLDERS' OPINIONS INFLUENCE THE SELECTION AND WEIGHTING OF COMMUNITY VULNERABILITY INDICATORS?

SURVEY DESIGN

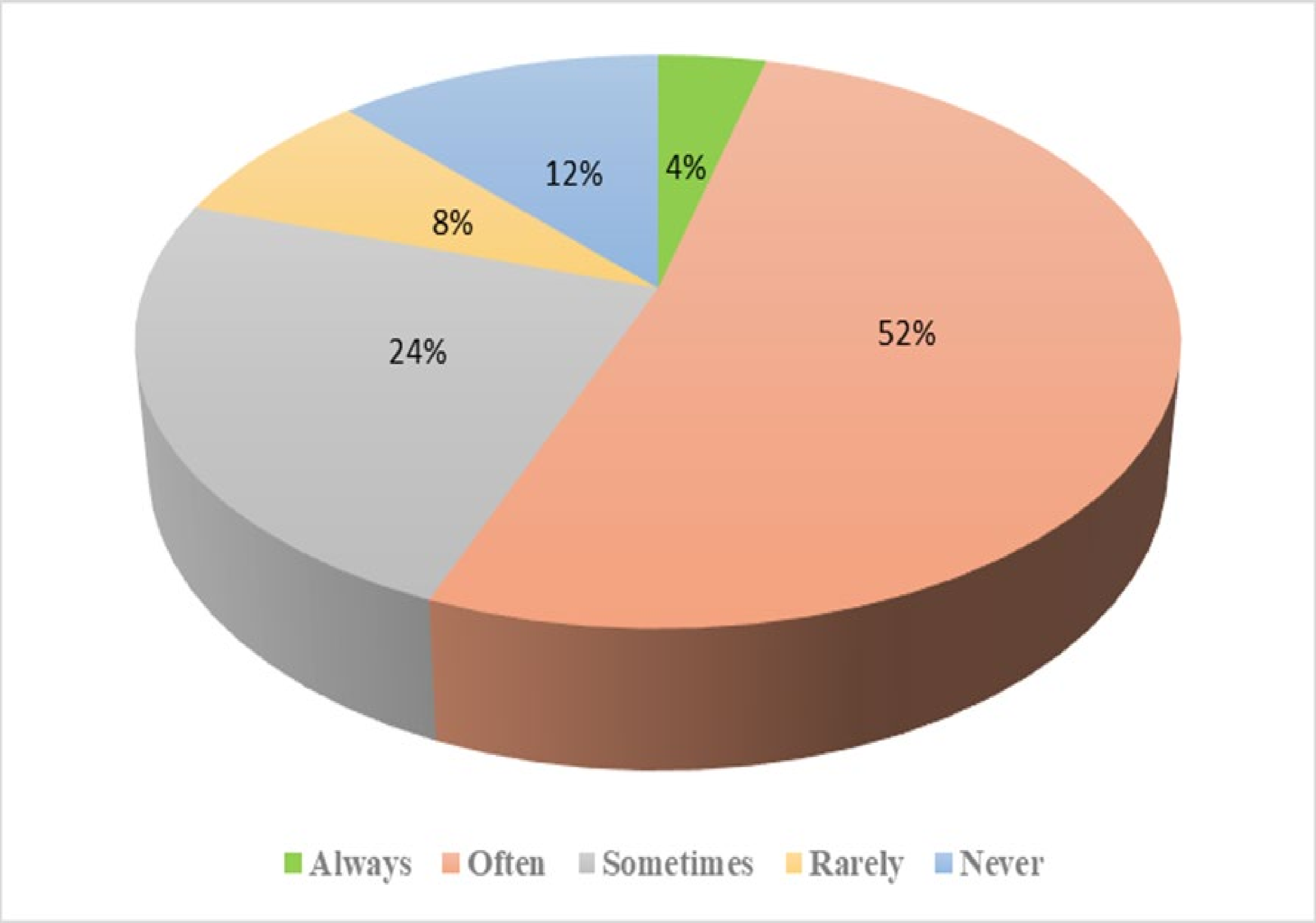
- THE QUALTRICS SURVEY PLATFORM WAS USED TO COLLECT PRIMARY DATA FOR THIS STUDY.

- THE PURPOSIVE SAMPLING TECHNIQUE WAS DEPLOYED AS THE TARGETED RESPONDENTS WERE EMERGENCY MANAGERS, NGO STAFF, RESEARCHERS, METEOROLOGISTS, ECOSYSTEM MANAGERS.

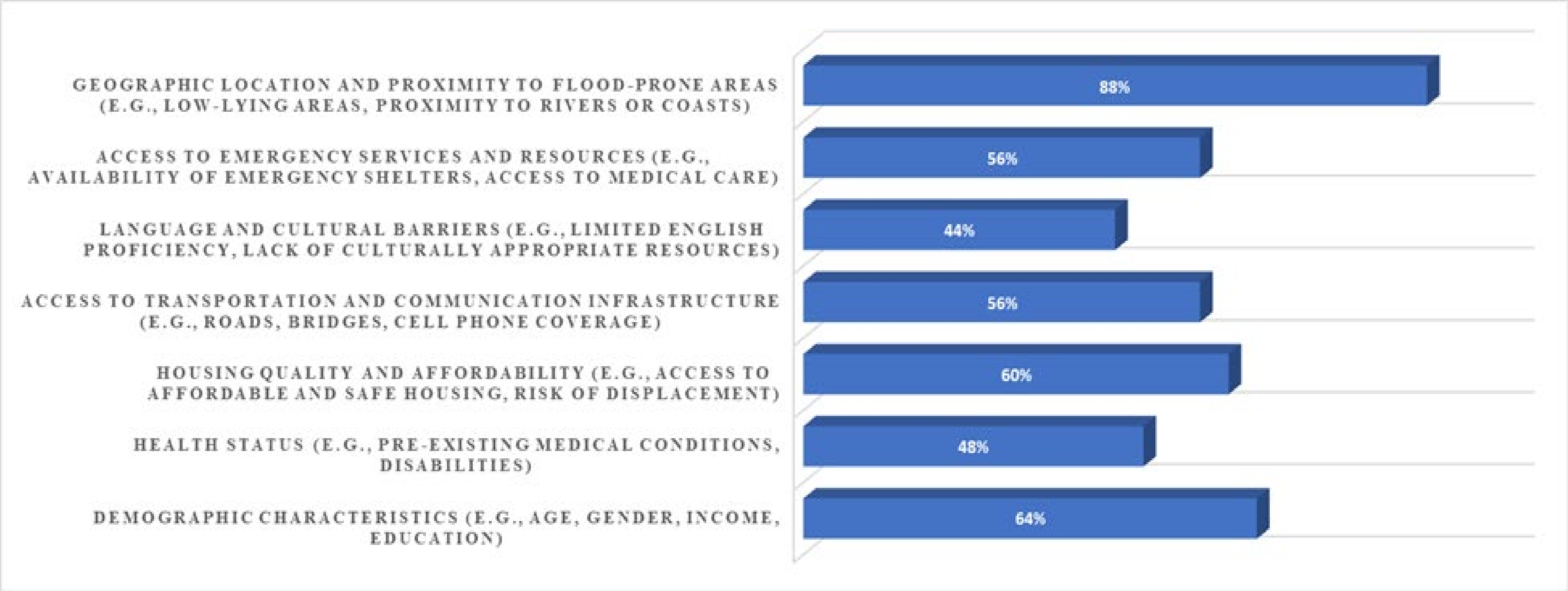
- THE TARGETED RESPONDENTS HAVE THE MOST UPDATED AND COMPETING KNOWLEDGE REGARDING FLOOD MANAGEMENT IN THE SELECTED AREA.

- A TOTAL OF 47 RESPONSES WERE RECORDED FROM FEBRUARY TO MAY 2023.

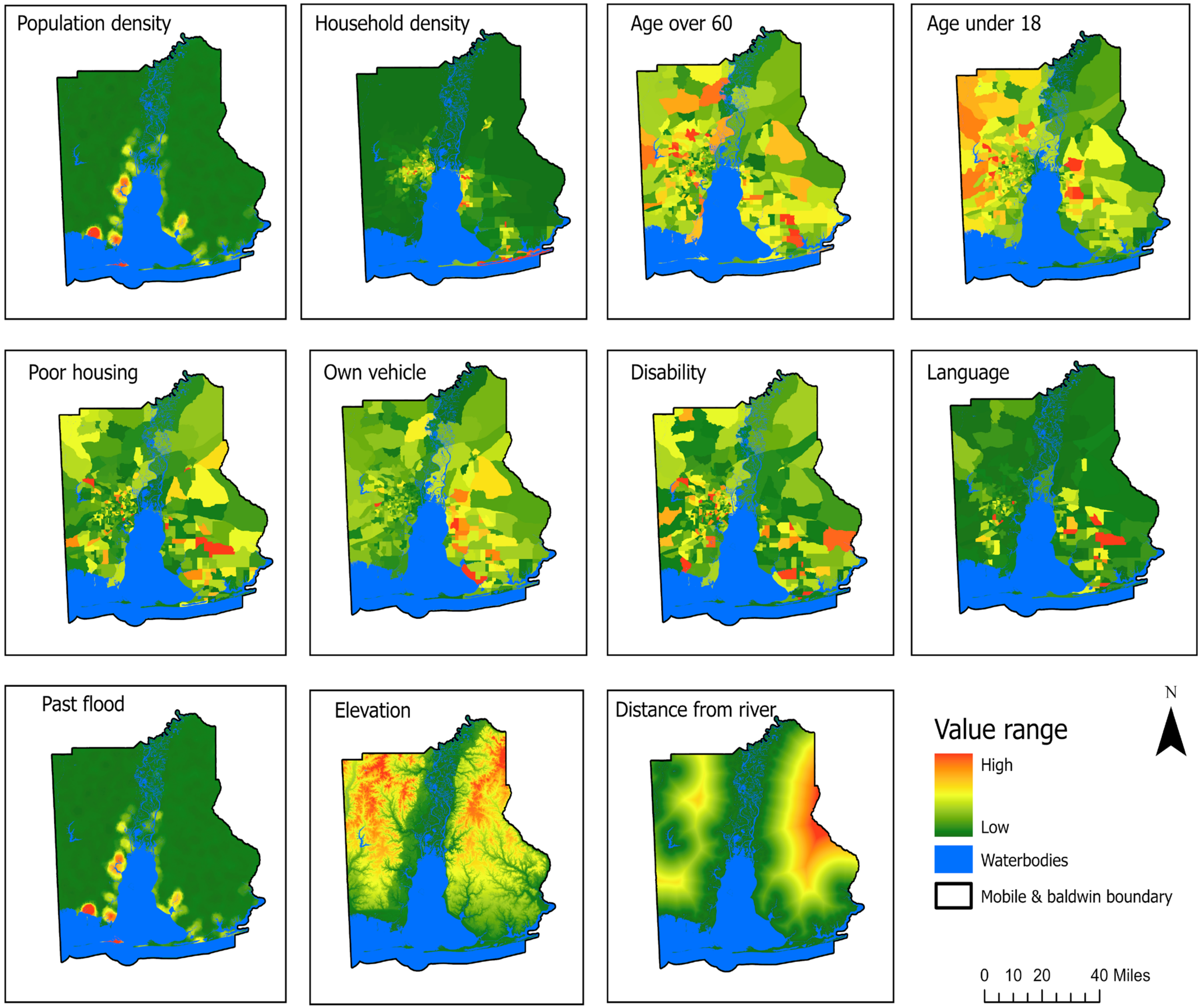
CONSIDERATION OF SOCIAL VULNERABILITY DURING DECISION MAKING

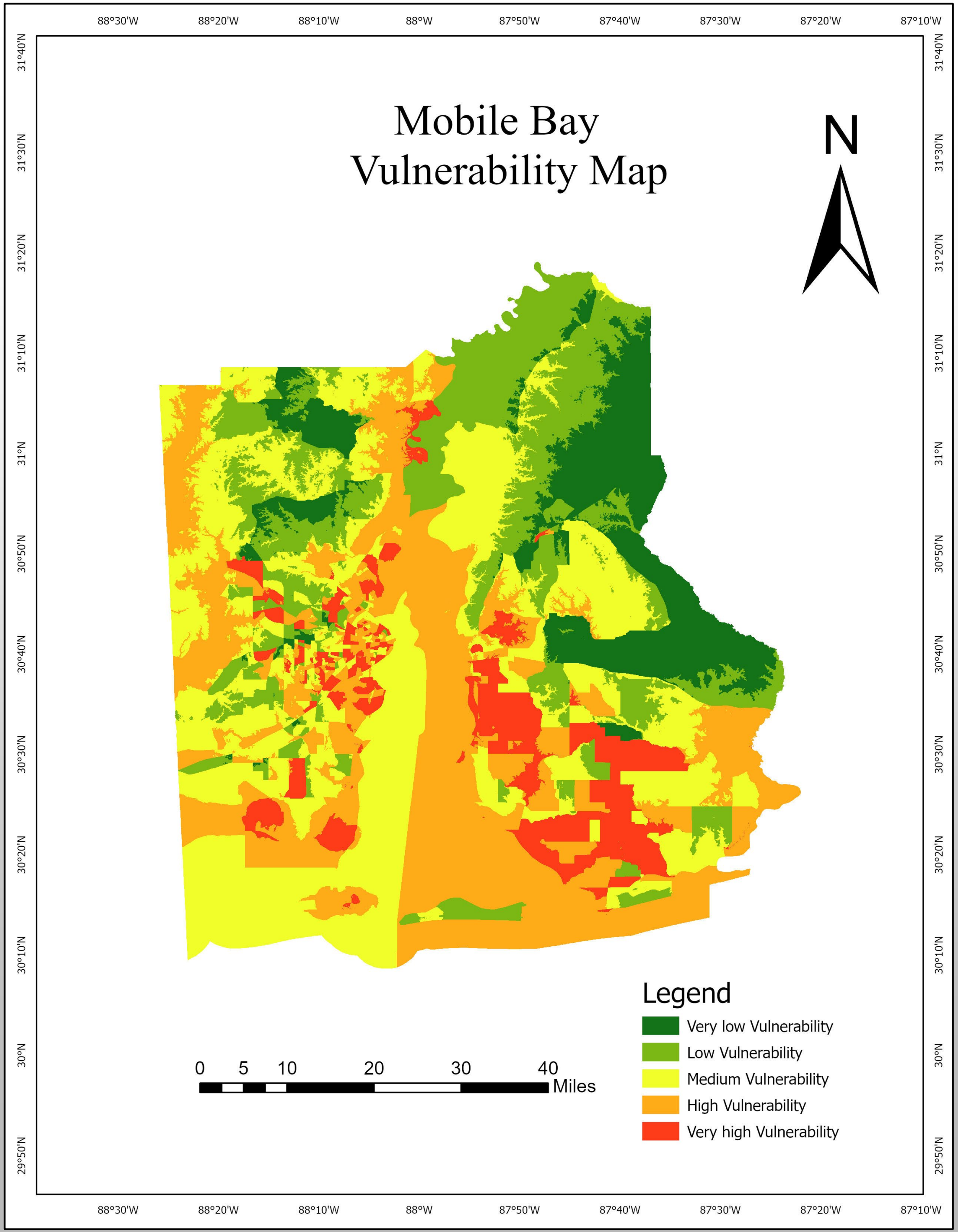


SOCIAL VULNERABILITY INDICATORS WITH THEIR IMPORTANCE



VULNERABILITY MAPPING FACTORS





BLOCK GROUP-LEVEL VULNERABILITY MAPPING

FINDINGS

- A TOTAL OF 90% OF RESPONDENTS STRONGLY AGREED THAT INDICATOR-BASED VULNERABILITY ASSESSMENT MIGHT BE AN EFFECTIVE FLOOD MANAGEMENT TOOL.

- 88% OF STAKEHOLDERS PRIMARILY HIGHLIGHTED PAST HISTORIC FLOOD EXPERIENCES AND GEOGRAPHIC LOCATION AS THE MOST CRUCIAL. THIS UNDERSCORES THEIR MEANINGFUL IMPACT ON INDICATOR SELECTION.

- GEOGRAPHIC LOCATION AND PAST HISTORIC EVENTS WERE THE MOST IMPORTANT SOCIAL VULNERABILITY INDICATORS.

FUTURE RESEARCH

- COMPARATIVE STUDIES ACROSS REGIONS OR COMMUNITIES MAY OFFER INSIGHTS INTO DIVERSE STAKEHOLDER OPINIONS, ENABLING TAILORED APPROACHES TO FLOOD MANAGEMENT.

- LONG-TERM RESILIENCE.

- HOW DO POLICIES AND GOVERNANCE FRAMEWORKS AFFECT STAKEHOLDER INVOLVEMENT AND DECISION-MAKING? WHAT ARE THE BEST WAYS TO INCORPORATE STAKEHOLDER OPINIONS INTO POLICY DEVELOPMENT?

- INTERDISCIPLINARY RESEARCH CAN HELP US TO GAIN A HOLISTIC UNDERSTANDING OF HOW STAKEHOLDER OPINIONS INFLUENCE FLOOD RISK MANAGEMENT.

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THANK YOU!

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