Flooding, Migration, and the Coastal Master Plan: Linking small areas and regional dynamics to big events, long-term stressors, and planning **processes**

Introduction and Relevance The overarching goal of the 2023 Coastal Master Plan is to better support the communities in and around Louisiana's coast, as it adapts to the pressures of environmental change. One of the ways we can support coastal communities is to understand how climate related hazards interact with the movement of people into, out of, and within the state. The 2017 Coastal Master Plan mentions the importance of studying population migration in Louisiana, and the 2023 plan will include these estimates as part of its CLARA and planning models. We propose this assistantship project to help continue and develop outputs from our current RESTORE Center of Excellence project, *Past and future migration in coastal Louisiana: Modeling the impact of flood exposure and economic change with microdata on households and businesses*, with the Data Center of Southeastern Louisiana (2021-2023). The project involves using novel consumer microdata (Infotur) to build a model of neighborhood level migration after disaster events by appropriately matching longitudinal environmental hazard data and social variables at the Census block group tract geographical levels.

The broader scope of our work empirically models how disaster events have influenced decisions to migrate, as we see billion-dollar disasters accumulate as acute shocks, and coastal land loss and sea level rise operate as long-term stressors. Our study aims to understand how disaster events cause migration independently and intersect with existing migration patterns, and how the sensitivities to event-based migration may vary. Revealing long-term trends allows us to understand how the accumulation of risk and exposure to storms the neighborhood level. In addition, neighborhoods' socio-demographic and economic status can reveal risks not previously considered, due to data limitations on migration patterns, which frequently offer data at a parish level or annually. The RESTORE COE project hopes to provide specific event-study models, a gravity origin-destination model, and recommendations to inform the CLARA model or other CPRA planning activities. The project will create a monthly longitudinal Census Tract data set of past-disaster exposure, small area population change, origin-destination tract flows, land cover (NLCD), flood hazard, and socio-economics for the Gulf South. This can inform discussions about ecosystem services, regional change, and links from the Coastal Master Plan to decisions around transportation, housing, land use, and other adjacent planning issues that influence CPRA decisions. The project team has worked on outreach with regional planners, and other data consumers. We propose this assistantship as a means to leverage the data investment in partnership with CPRA and Sea Grant for more specific environmental models (e.g., patterns of migration by land cover change), triangulation with other data (e.g., loads commuting flows), and more specific analysis and data communication at a regional scale (e.g., Development Districts) in Louisiana's coastal zone.

Methods We are presently constructing a monthly longitudinal data set to model of reoccurring events that can cause migration. We are interested in census tract-level data for our dataset. This dataset will include measures of storm events between 2000 and 2021. We have collected data from federally declared disasters. FEMA (Federal Emergency Management Agency) provides open data that includes when and where these events occur at the level of interest, and FEMA NFIP (National Flood Insurance Program) claims datasets and hazard exposure data provided by NOAA (National Oceanic and Atmospheric) are intended to provide storm-based flood exposure and wind exposure data at county

and Census Tract levels. Additionally, socio-economic, flood risk, and land cover variables, as well as economic data for counties, and "commuting zones" complete the data set.

These measures will build unique longitudinal data sets with "treatments" at both county/parish and Census tract level to build better empirical foundations for models to predict future population migration flows and economic activity. This dataset is important for studies aiming to develop causal and explanatory models of the effects of disasters on migration based on small-area and community-level exposures and, ultimately, to develop predictive methodologies for neighborhood-level storm displacement vulnerabilities. This project will complement the previous work with Dr. Marla Nelson by contributing data that is longitudinal and monthly and provides origin-destination flows.

- We will construct specific origin-destination migration models for both "within" and "in and out" of each Development Region in the state, and for "commuting zones." These models will help relate the CLARA model and plans with explanatory models of place-based change, in relationship to land-loss, hazards, and other drivers of population change.
- Relating environmental data to migration, and CLARA risk projections, to flows of population change. Our current work focuses on building causal models of how disaster events impact migration patterns, and how that might be used to predict future migration patterns, and the kind of small area population change now being projected for the 2023 Master Plan. This student can help translate and triangulate that work, but also build models of migration and:
    - How coastal migration is associated with environmental change related to ecosystem service areas important for long-term resilience. This will be done by using land use change among National Land Cover Data sets (2001, 2004, 2006, 2008, 2011, 2013, 2016, and 2019) summarized at the Census Tract level as a response variable, with migration patterns in the previous period, and long-term environmental stressors.
    - How different Environmental Justice indicators from our socio-economic data set are associated with patterns of migration and environmental quality and risks in coastal zones; How regional migration patterns of EJ populations vary from other groups in terms of the hazard risk of their origins and destinations, as well as land-cover variables (e.g., impervious surface) associated with other climate stressors, such as heat.

Output Applications : The framework of our model can potentially produce many relevant outputs that the CPRA may be interested in to support the Master Plan's goals. Applicable to goals with the 2023 Coastal Master Plan include reducing the scientific uncertainty around future population scenarios and applying this migration data to different local contexts and as a compliment to the CLARA model. Our comprehensive dataset can be used when making policies and constructing management plans in line with the Coastal Master Plan that will better support the community. For example, the 2017 Coastal Master Plan calls for a focus on adaptive management. Our dataset can provide the environmental and social data on a scale fit to execute adaptive management planning custom to the trends of region. This assistantship will educate the student on CPRA and its processes, as well as provide greater access and ability to communicate the outputs of our research with other CPRA partners, such as the CLARA team, and the population modeling team. We will also work with Niki Pace, Esq., of Sea Grant to consider the public policy implications of these migration data related to issues concerning state and local disaster response and recovery, long-term access to affordable flood insurance policies, the State's Climate Plan, and relevant environmental justice mandates such as Justice 40.