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My short bio:

BS, MS and PhD in Geography

Past: endangered species mapping (1980s), remote sensing prediction of snow melt (1988-90), urban growth modeling (1990-96), ESI oil spill sensitivity mapping (1994-99)

Recent (2000-2010): Crane migration patterns (Asia), Foraging behavior of boobies (Peru), Confined Animal Feeding Operations (NC), Coastal land cover change (SE NC), deep water reef habitat mapping (FL), land use development and coral reefs (Philippines), spatial patterns of dolphins (SE NC), salt marsh change (SE NC), flushing times of estuaries (NC)

Current projects:

- Commercial fishing patterns in the Carolinas
- Sea turtle nesting predictive model (NC)
- Relationship between red fox and sea turtle nests & recreation (Masonboro Island)
- High resolution mapping of small tidal creeks (NHC)
- Hydrologic nature of the coast (classification of estuaries and tidal creeks) (US)
- Classification and movement of barrier islands (NC)
- Flood potential and population demographics (US)
- Painted Bunting habitat modeling (US)
- Emergency shelter capacity & risk (Eastern NC)

"Geospatial analysis of coastal environments"

Regional Engagement

Confined animal feeding operations: Coastal Federation, River Keeper

Land cover change & water quality: Friends of Lake Waccamaw

NC GICC (Geographic Information Coordinating Council): Board Member

NC Assoc. of Soil & Water Conservation Districts: GIS workshop

INSTAR (Investigating Science Through Active Research): NSF funded middle school science teacher education

Local Schools: yearly visits to demo geography & geospatial technology

Internship program: both undergrad and graduate

Lots of GIS & SLR at UNCW!

BA in geography

MS in Geoscience

Dr. Narcisa Pricope, Dr. Eman Ghoneim, and Dr. Joanne Halls: Geography & Geology

Dr. Devon Eulie, Environmental Studies

Center for Marine Science: several faculty doing sea level rise, climate change, etc.

Please contact me to get more info....

Field work



Effective Emergency Sheltering: A GIS Approach to Shelter Location Analysis and Population Allocation for Eastern NC



Coastal communities face unique challenges:

- Increased vulnerability to weather phenomena
- Population growth

Red Cross is committed to sheltering needs of those affected by disasters:

- Small minority of evacuees use shelters (7% - Drabek 2001; 5.5% - Whitehead et al. 2000)

Application of GIS to relief efforts has been limited (Lue 2013)

Project Questions?

Given the need for community emergency planning to:

1. Reduce overall evacuation time
2. Minimize network (transportation) burden
3. Establish many shelter locations rather than one mass emergency shelter (Tufekci 1995)

There is limited research on whether shelters are effective based on surrounding population demographics

Therefore, in eastern NC:

1. Do populations who are more likely to utilize a shelter have easy access to such facilities?
2. Based on the distribution of shelters and population demographics, are there areas that are over served or under served?

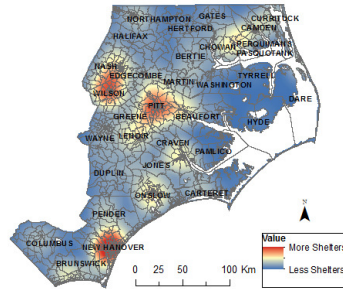
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Hot Spot Analysis: Shelters

More shelters operate in urban areas

Correlates with:

- Higher renting pop
- Non-white
- Less education
- Lower income



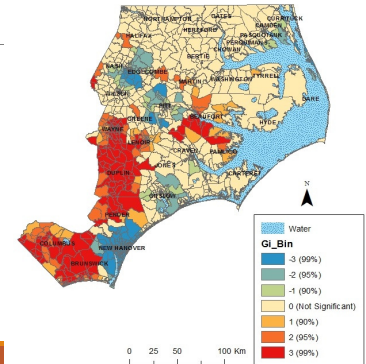
Hot Spot Analysis: Mobile Homes

Hot spot:

- Brunswick
- Duplin
- Wayne
- Beaufort
- Pender

Cold spot:

- Edgecombe
- New Hanover
- Onslow
- Pitt



Hot Spot Analysis: Renters

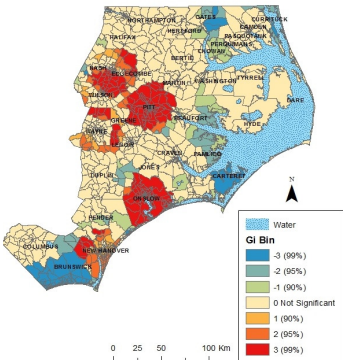
Hot Spot:

- New Hanover
- Onslow
- Pitt
- Wayne
- Wilson

Cold spot:

- Brunswick
- Carteret

Increased renting in Onslow (military) & Pitt (ECU)



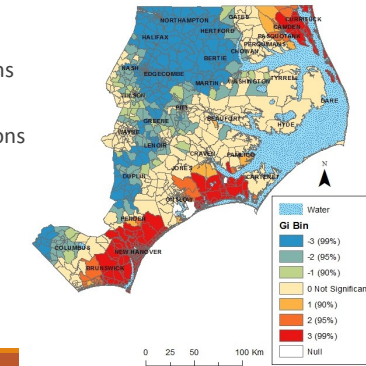
Income

Hot spot:

- Coastal portions

Cold spot:

- Western portions
- NW corner



Race/Ethnicity

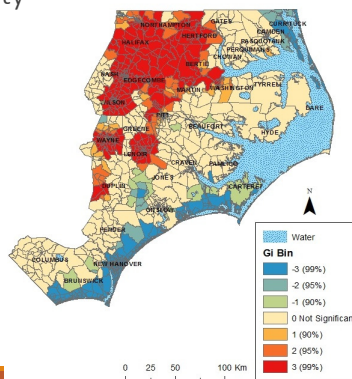
Hot spot: Significant higher percentage of non-white pop:

- NW area
- Lenoir
- Wayne
- Portion of Duplin

Cold spot:

- Coastal areas

Pattern is similar to income and education maps



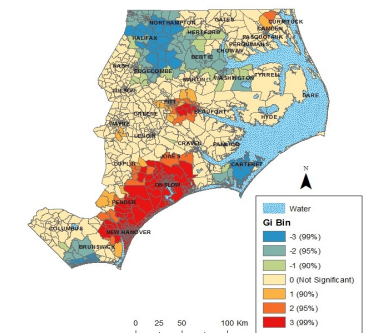
Total Male Population

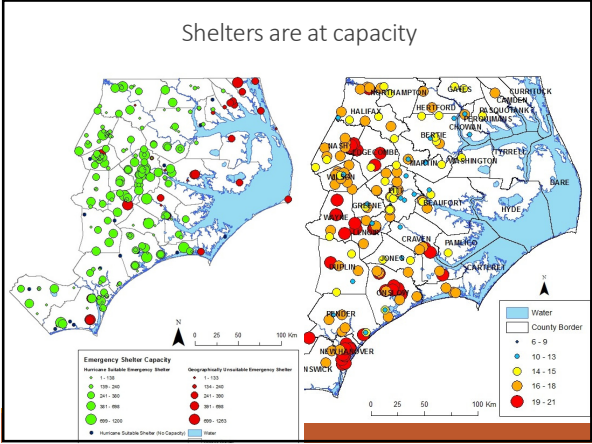
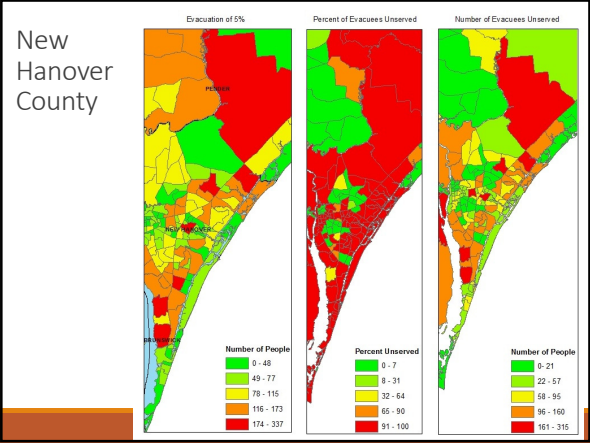
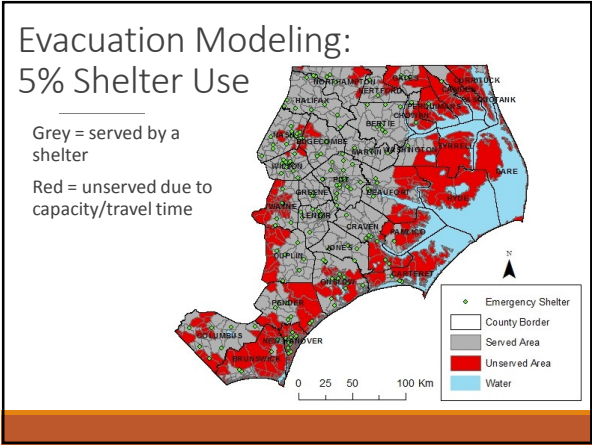
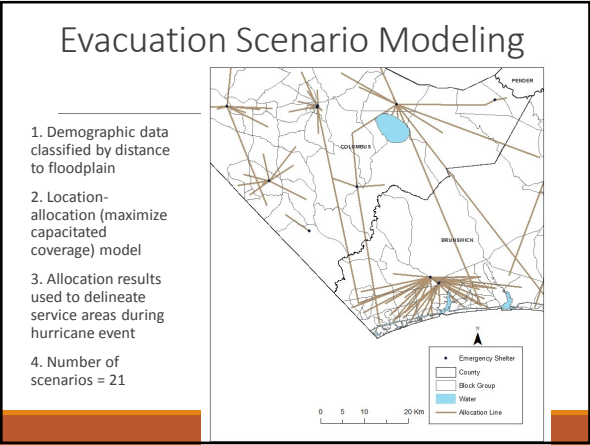
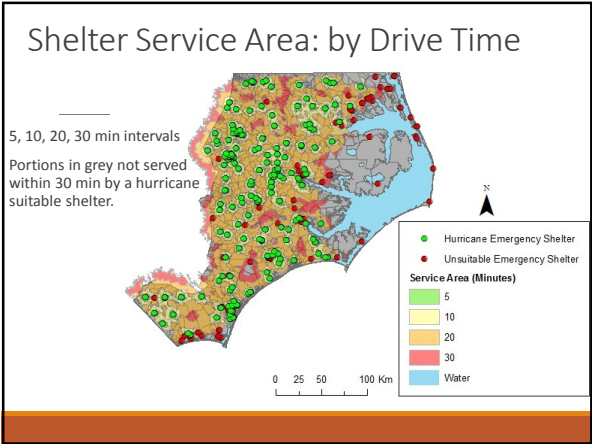
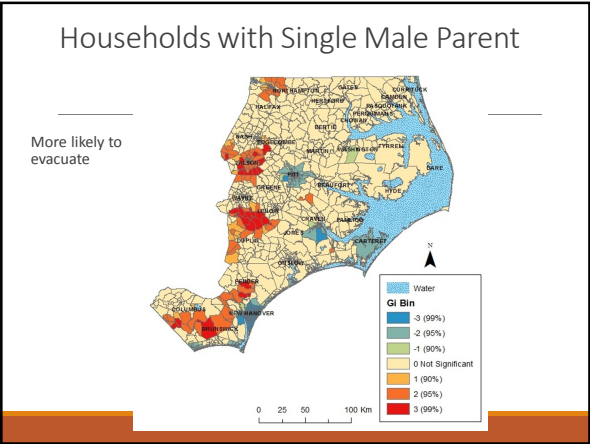
Hot spot:

- New Hanover
- Onslow
- Pender

Cold spot:

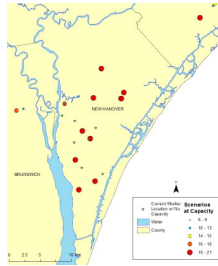
- Brunswick
- Carteret
- Portions NW





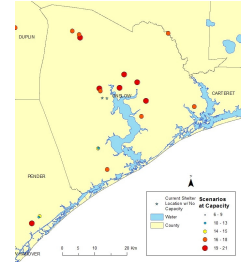
Areas of Poor Service

New Hanover County



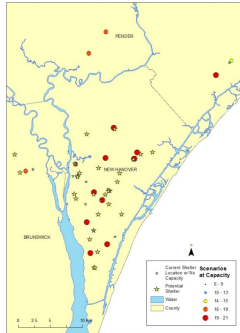
Areas of Poor Service

Onslow County

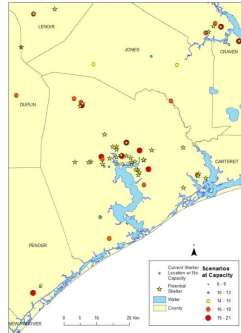


Potential Shelters

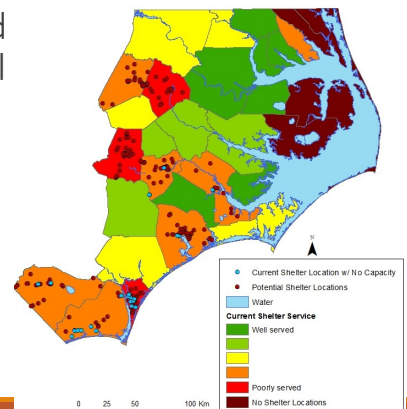
New Hanover County



Onslow County



Suggested Additional Locations



Conclusions

Current shelters are clustered in urban areas and many are not suitable for hurricane evacuations.

Demographic data is clustered over space.

When populations are allocated to their best fit shelter without a time constraint, shelters are typically at capacity.

New Hanover and Onslow County shelters are most likely to be at capacity and would benefit from additional shelters.

Nash, Lenoir, Wayne counties would benefit from additional shelters.

Assumptions

1. Evacuation population is determined by census data
 - Does not consider social cohesion or role of evacuation order (Horney 2009; Quarantelli 1961)
2. Assumed shelters with '0' capacity are not available during evacuation
 - Perhaps data quality is a concern?
3. Census demographics does not include tourism population

Contributions

Application of GIS to model Shelter capacity

- Demonstrated a way to model evacuation scenarios and allocations to determine shelter effectiveness based on surrounding demographics

Identified which portions of the study area may require additional attention

- Assessing demand may assist with resource allocation
- Identify areas that may benefit from additional shelters and perhaps deactivate shelters
- Reduce transportation network load

How does this work relate to SLR?

1. Must thoroughly understand source data.
2. Emergency management/planning must adapt to changing conditions and include assessing the both social vulnerability and location risk. This study evaluated the shelter locations within floodplains to identify risk.
3. Should investigate scenarios from multiple viewpoints.
4. Test models in order to see the pattern: confirm predictions, measure uncertainty, perform sensitivity analysis, and test several spatial statistical techniques.
5. Rerun analysis when new data and techniques become available.

Future Work

1. Analyze hurricane shelter use over time
2. Are these demographics consistent predictors of shelter use?
3. Analyze other census characteristics and other socio-economic data
4. Apply to other storm events in other parts of the country