3.5 RESIDENTIAL REAL ESTATE

According to the results of the previous studio, 30% of the residential areas in Darien are projected to be affected by SLR. The HAZUS results predicted that there will be 75 residential buildings affected by inundation. The total replacement costs for these buildings would be $101,599 and the inundated building value would be $10,003 (Georgia Conservancy 2012).

Coastal property is typically valued from 8% to 45% more than comparable inland property (Bin et al. 2011). A previous study by West et al. considered that SLR erodes protective coastal features which may increase the vulnerability of coastal communities to storm damage (2001). This is especially pertinent to Darien as adjacent wetlands serve as a protective barrier against hurricane and other forms in storm damage for the area.

A majority of the current literature, including the previous Georgia Tech studio report, calculate the impacts of SLR based on areas of permanent inundation. Another equally significant economic impact of rising sea levels, however, will be increasing incidence of flooding. In his article, "Measuring the impact of sea-level rise on coastal real estate: A hedonic property model approach," Bin et al. found that the costs associated with storm flood damage are much higher than inundation. As a result, previous studies may have underestimated the costs of SLR in the US. In 1736, James Oglethorpe chose the location for Darien because it sits on a bluff, offering more protection for the city. This continues to give Darien additional defense from rising waters than many other coastal cities, but flooding will likely still present an issue that Darien residents and business owners will have to face.

Historically, homeowners' insurance has not covered damages to structures due to flooding. Property owners who experienced severe flooding were often left financially unable to recover after a flood. The National Flood Insurance Program (NFIP) was created in 1968 in part to provide relief to homeowners after flooding, but also to encourage new building practices and construction standards to reduce the risk of future flood damage to properties (FEMA). The cost of flood insurance was subsidized for existing homeowners to increase accessibility to insurance coverage. Flood insurance policies are provided through private insurance agents, but they are backed by the federal government.

Recently, there were attempts to make massive legislative changes to the National Flood Insurance Program. With the Biggert-Waters Flood Insurance Reform Act of 2012, the federal government sought to phase out subsidized policy rates, which account for about 20% of all flood insurance policies (FEMA). Owners in each of these groups would have seen a 25% increase annually until their paid rates reflected the true risk of insuring their properties (FEMA). Property owners who hold flood insurance at their primary residence would keep their current rates until they sell the property, have a lapse in the policy, experience severe, repeated, flood losses, or purchase a new policy. However, on March 13, 2014, Congress amended the 2012 Biggert-Waters law because of confusion around the new rates and issues with implementation. As amended, the law will still eliminiate rate subsidies, but none of the 20% of owners will pay more than 25% a year. Flood insurance rates will transfer with the property, not the owner.

Of the 1,090 total housing units in Darien, 82 or 7.5% are seasonal homes (2010 Census). The number of these seasonal homes within the flood plain is uncertain. Increasing flood insurance costs will likely have a negative impact on the seasonal housing market, which composes a small, but important portion of Darien's housing stock. Increased housing

vacancy can also put an increased strain on Darien's local economy.

There are some ways to reduce flood insurance costs. The Federal Emergency Management Agency suggests that homeowners talk to their insurance agent about insurance options available to them. Property owners should obtain an Elevation Certificate to determine the correct rate for their property. Further, taking on an increased deductible could lower premiums. Homeowners or business owners should consider incorporating flood mitigation into remodeling or rebuilding of homes or building as well as consider adding vents or using breakaway walls (FEMA).

3.6 COMMUTE PATTERNS

Even when homes in an area are untouched by rising waters, the places where these residents work can be affected. The effects of SLR are widespread; as such, this section will analyze the commuting patterns of Darien residents as a way to measure the overall impact of SLR on the residents and the economy of Darien, and not just the physical damage inside the city limits of Darien itself.

In performing this analysis, commuting data and patterns were acquired from the U.S. Census Bureau's online commuting pattern application, OnTheMap.

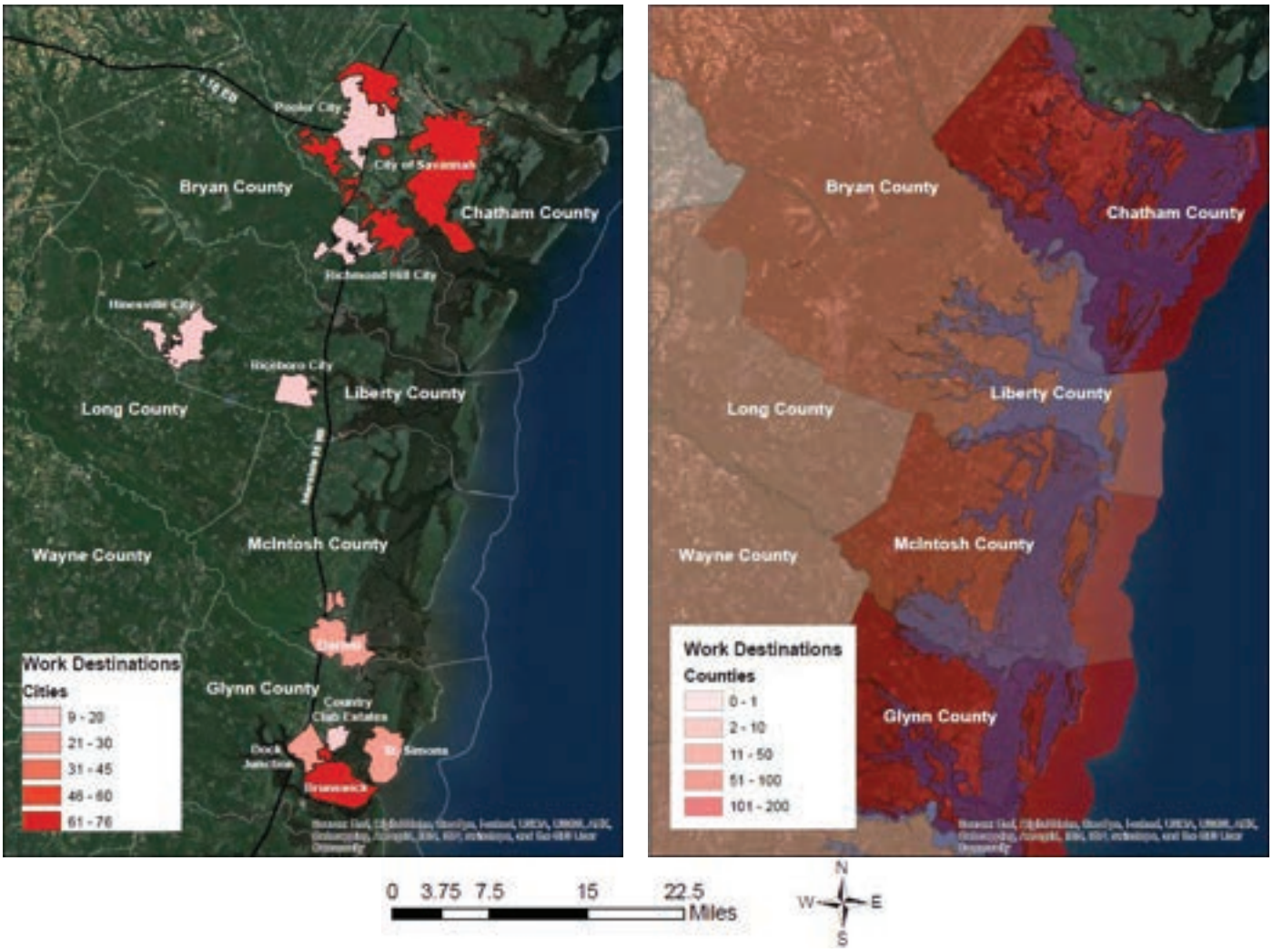

Figure 3.41: Darien Work Destinations (a) By City (b) By County

Work Destination	Number of Workers
Brunswick	76
Savannah	67
Darien	30
St. Simons	22
Dock Junction	22

Table 3.29: Top Darien Commuter Destinations

Using OnTheMap data, the analysis was conducted at the county, city and detailed location level. This data was then imported into ArcGIS 10.1 to explore spatial patterns and the impact on commuters from the SLR projections.

Figure 3.41a shows the commute destinations by Darien residents. The top 10 destinations are highlighted, with each city having at least nine workers commuting to it. The cities with the highest worker totals are Brunswick (with 76 workers), Savannah (67), Darien (30), St. Simons (22) and Dock Junction (22). These cities account for 269 of the 511 commuters that live in Darien. Visual representation of these cities can be seen in Table 3.29. Figure 3.41b shows the same commute data on a county level, following the same parameters as Figure 3.41a. Intuitively, Chatham and Glynn counties are the most affected, as they include the most affected cities.

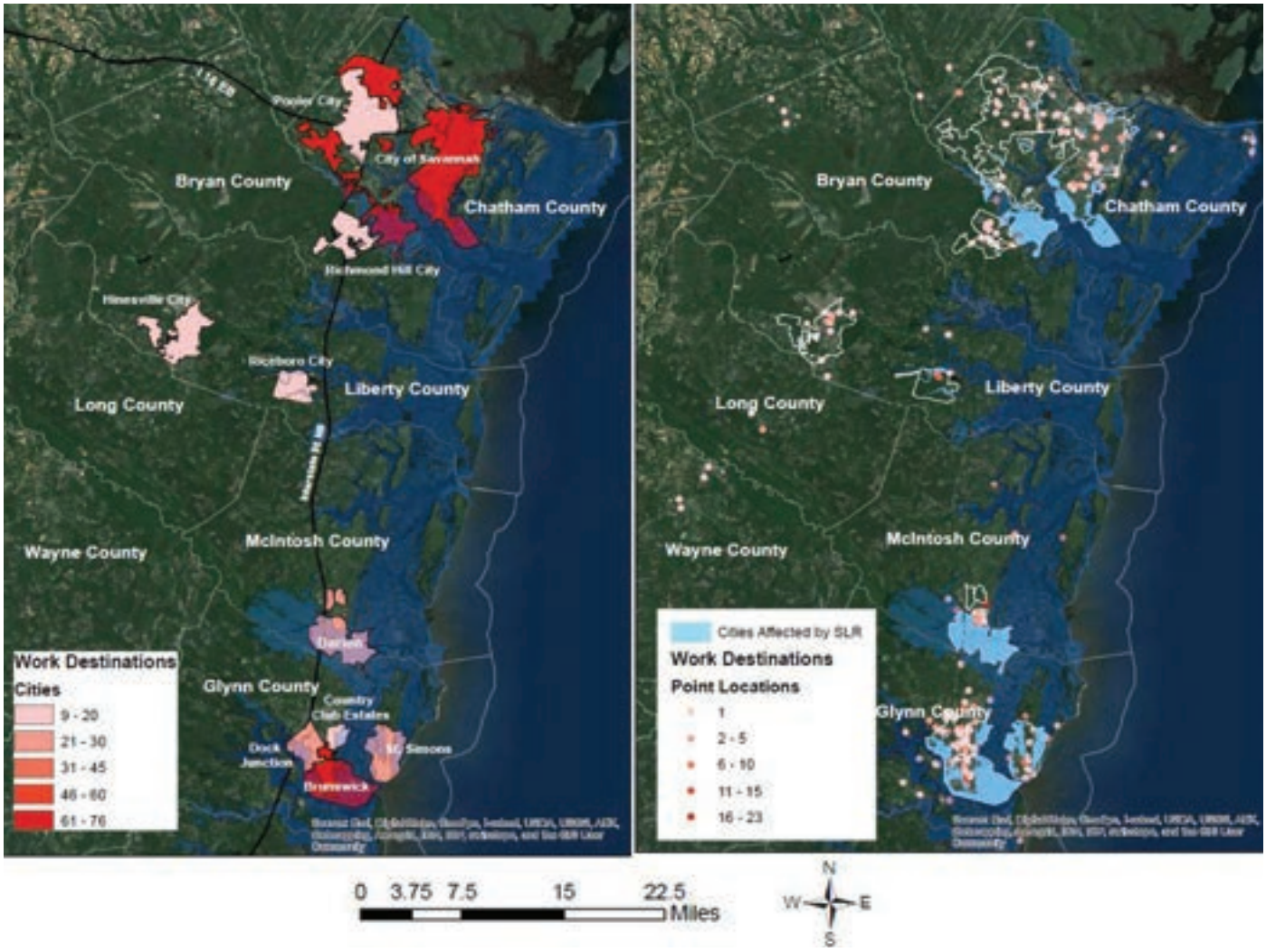

Figure 3.42: Darien Work Destinations (a) By City (b) By County

Figure 3.42a overlays the projected one meter SLR with the city commute data. In each of these cases, the SLR projection gives a visual of how much of the city land is inundated but not how many jobs are lost, as much of this land is marsh land. In Figure 3.42b, the employment data is broken down into smaller points, with each point representing 1-23 jobs. This map gives provides a clearer understanding of how many jobs are affected by SLR. Figure 3.42b further shows the city limits in a white outline; portions affected by SLR are colored in light blue.

Finally Figure 3.43 shows only the work points, representing 1-4 jobs each that will be affected by SLR.

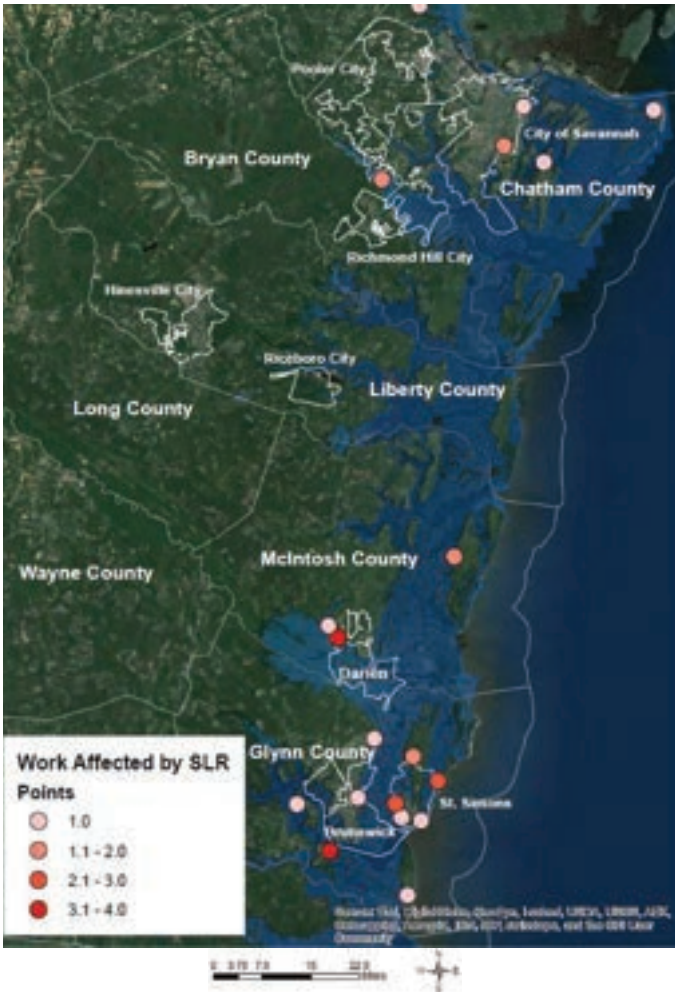

Figure 3.43: Affected Darien Work Destinations by Points

Figure 3.44a and Figure 3.44b show this same data at a finer scale for the southern and northern portions of the area of analysis.

IMPLICATIONS

From the data presented above, it can be seen that very few points fall inside areas that will be affected by SLR. Instead, points tend to cluster around those areas of cities that will be least affected by SLR. Map 3.44 demonstrates that there are no affected Darien residents working on Georgia Port Authority property in Chatham County, which is shown as brown polygons. Out of all of the workers living in Darien, only 33 workers commute to a place that will be inundated by SLR under the one meter projection.

In absolute terms, 33 workers is a very small number, however, it represent 6.5% of the entire work force of Darien. Further, this analysis indicates that the vast majority of working adults are leaving the city of Darien to work. This means that the economy of Darien is highly dependent on neighboring cities and communities, and if this trend continues, work centers may shift eventually to places more affected by SLR.

Several limiting features of this analysis deserve further consideration. The commuter analysis might not fully take into account all of the workers who live in Darien. For example, the numbers do not appear to reflect all those workers working in the fishing industry. Workers could be left out because they are paid ‘under the table’ or because the Census has had to suppress the data to protect the anonymity of a very small number of businesses. The methodology fails to account for the inundation of roadways that Darien workers might use across the coast to reach their destinations. An analysis of the major coastal roadways can be seen in Section 2.6 for the Port of Savannah analysis, found on page 43. Below is Table 2.10 taken from that section, which shows the amount or roadway that would be

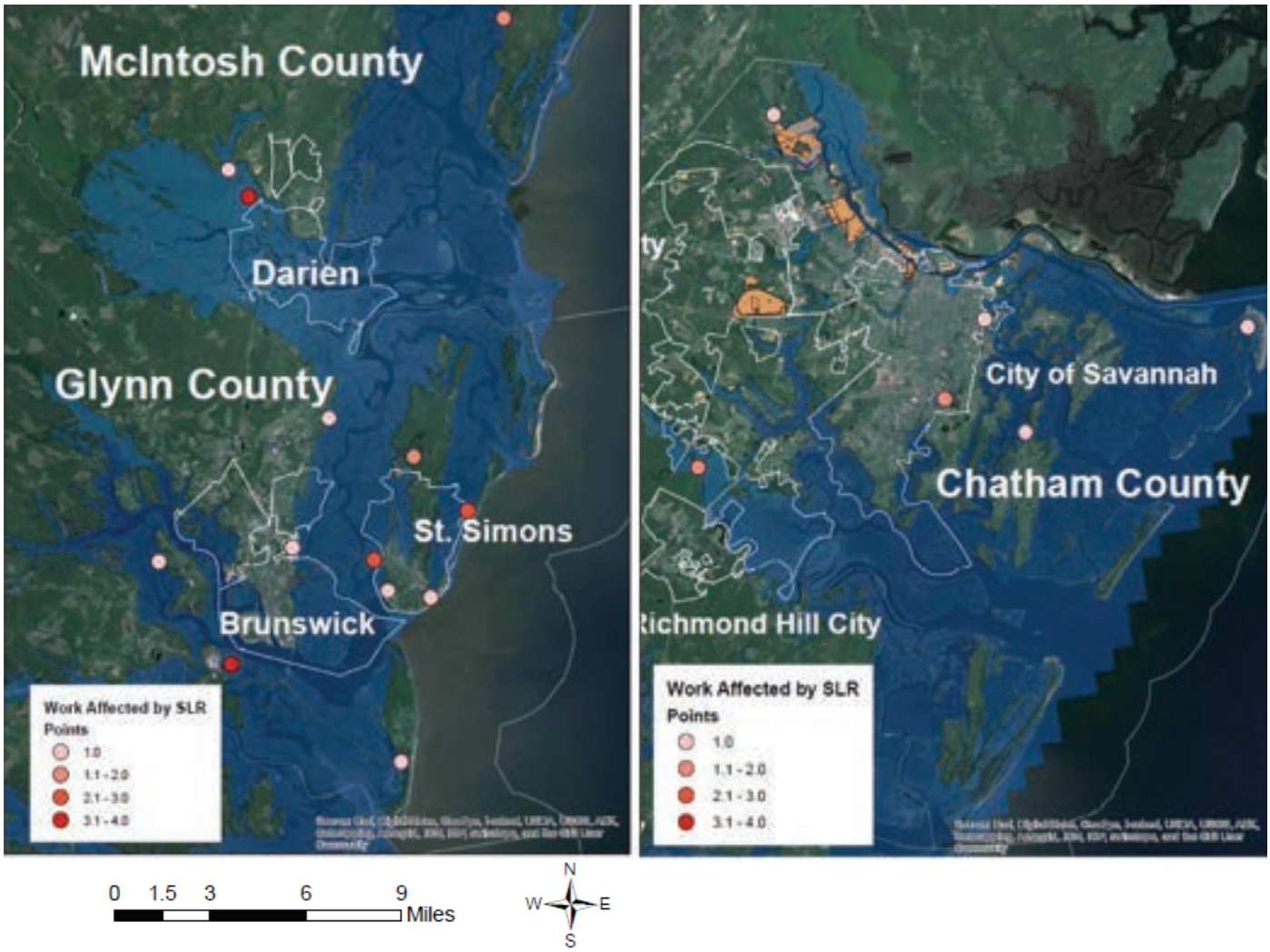

Figure 3.44: Affected Darien Work Destinations (a) South (b) North

Span	Interstate	Other Freeways and Expressways	Other Principal Arterials	Minor Arterials	Total
Short Span (including shorter span bridges) (0'-45')	0.083 mi	0.011 mi	0.194 mi	0.098 mi	0.386 mi
Medium/Long Span (45'+)	3.701 mi	1.764 mi	12.388 mi	4.351 mi	22.204 mi
Total	3.784 mi	1.775 mi	12.582 mi	4.449 mi	22.589 mi

Table 2.10: Length of Road Network Inundated Under 1.0 Meter SLR
(in miles)

damaged by SLR inundation (the majority of which would affect Darien commuters). Also, in that section can be found maps of the roadways and SLR as well as cost calculations for roadway repairs due to SLR.

3.7 ADAPTATION STRATEGIES

Damage from natural disasters often occurs suddenly and without warning, giving communities little time to prepare and make accommodations. Conversely, SLR occurs gradually. Because this change occurs slowly, however, communities are often reluctant to act on this change, instead opting to focus investment on more immediate concerns. According to the 2007 IPCC report, an 8 inch rise in the ocean level occurred between 1961 and 2003. Global sea levels rose an average of 1.8 mm (0.07 in) per year between 1961 and 2003 and at an average rate of about 3.1 mm (0.1 in) per year from 1993 to 2003. This trend leaves our coastal communities vulnerable to damage from increased flooding and inundation.

While the exact extent to which sea levels will rise is difficult to predict and subject of debate, it is certain that they are rising. For this study, we have anticipated the effects of a one meter rise in sea level over a 100 year period. One hundred years is a very long period of time to plan for, but taking precautions now will reduce the physical, environmental, and economic impacts that may be experienced as a result of SLR. This is an opportunity for leaders along the Georgia coast to help their communities prepare for the coming change.

ECONOMIC IMPACTS

The City of Darien has such a small economy that any amount of economic impact will be felt more acutely here. Their three key industries, commercial fishing, tourism and small businesses, and residential real estate, will all experience varying degrees of impact from SLR. According to the analysis performed by the fall 2012 *Blueprints* studio, 29% of all land in Darien is projected to be inundated if sea level were to rise one meter by 2100 (2012). Much of this area is wetlands or recreational land, but the wetlands are a vital component of Darien's economic vitality.

The HAZUS model estimated that 75 residential buildings will be inundated in Darien, but 32.4% of Darien's industrial buildings and 7% of commercial buildings will be inundated as well (Georgia Conservancy 2012). Though these buildings will be directly impacted, nearly all businesses and residents could feel indirect impacts from SLR. If the businesses in the commercial and industrial buildings that are expected to experience inundation decide to relocate outside of Darien in an area that is safe from SLR, this could mean a loss of employment opportunities in an area that is particularly vulnerable due to its lack of business diversity.

STRATEGIES

There are many strategies to help local communities adapt to rising sea levels. The three main traditional adaptation categories include Armoring, Retreat, and Accommodation. Each coastal area presents a unique environment with a different set of needs. It is important to choose the strategies that best fit the conditions of the community. Figure 3.45 summarizes the three categories, their main strategies and pros & cons.

RECOMMENDATIONS FROM A PLANNING PERSPECTIVE

Dwight Eisenhower once said, "In preparing for battle I have always found that plans are useless, but planning is indispensable." With so much information available about SLR, it can be daunting for communities to even know where to begin with their planning process. Good planning processes almost always begin with

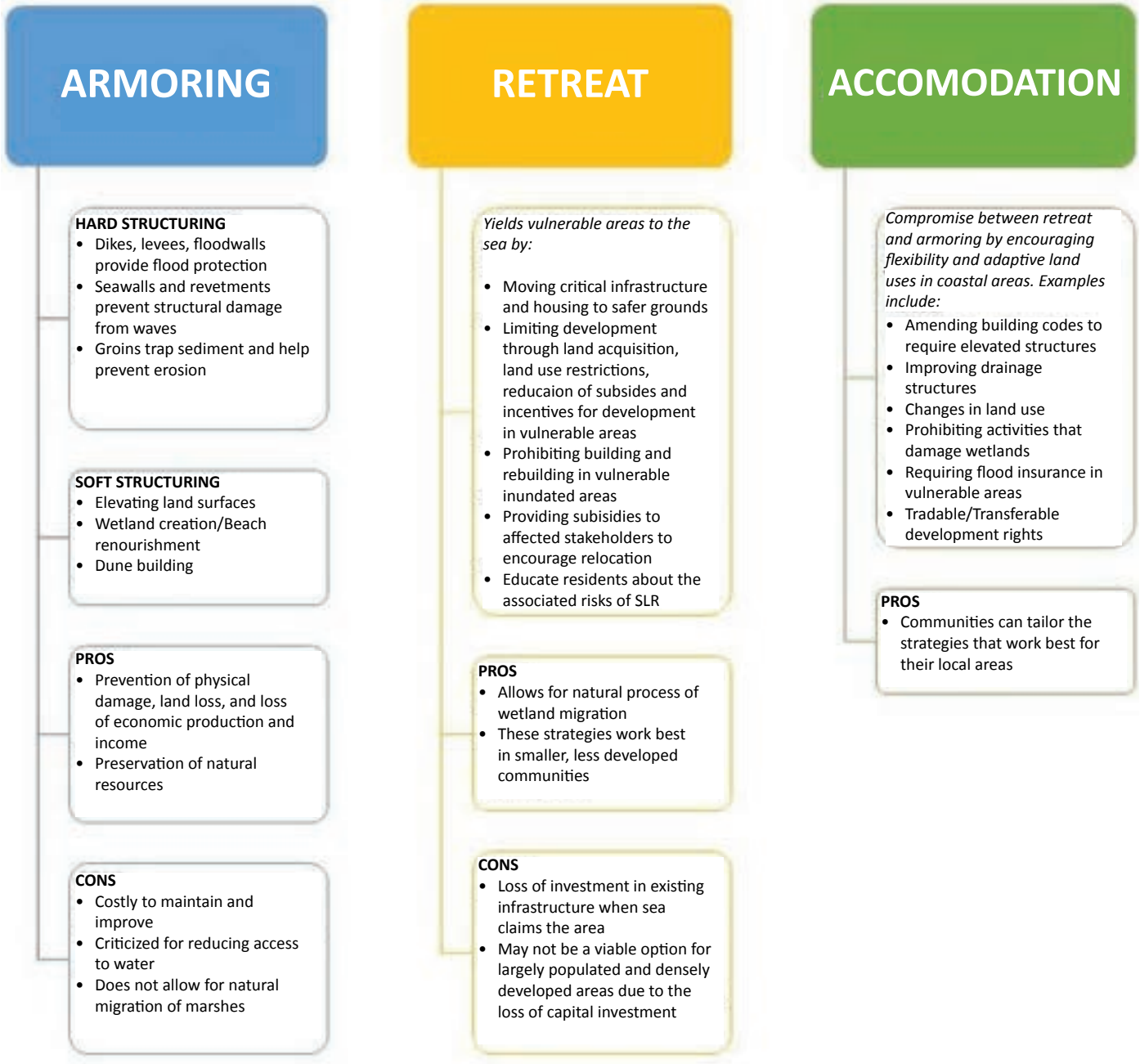

Figure 3.45: Adaptation Strategies

involvement from the community and formation of stakeholder groups. It is imperative to involve local stakeholders, including residents and business owners, in the planning process because they are often the groups most impacted. SLR could displace residents from their homes and could significantly affect local businesses.

Local governments will be responsible for implementing some of the strategies mentioned above, but property owners will decide on which actions they would like to take on an individual basis as well. Educating community members about the local risks of SLR must be a key component of the overall community strategy. Certain adaptation strategies, especially those associated with retreat, may be seen as politically unfavorable to the public when they are unaware of the risks associate with inundation (Taylor 2013). Including an educational component will help to encourage engagement and achieve local buy-in.

Cost is almost always the most important variable in deciding which adaptation strategies a community chooses. Local leaders must weigh the cost of adaptation strategies versus the cost of damage to property and economic loss incurred by SLR (Yohe 2011). Most studies lack specific damage assessment information, largely because the actual costs vary widely from place to place and modeling can be very complex (Kirshen 2012). Modeling so far into the future requires the expectation that costs will rise as the sea levels continue to rise. If the economy does not grow at the same rate as these costs, this could present a serious problem for local governments who are already lacking available resources and funding (Huntington 2012). A cost- benefit analysis would help local leaders determine how best to utilize their limited resources.

The case study in the section below gives an example of a community planning process that utilized these approaches in deciding on their strategies for adapting to SLR.

CASE STUDY: The New Hampshire Coastal Towns of Seabrook, Hampton & Hampton Falls (Merrill 2012)

In 2011, The New Hampshire Coastal Adaptation Workgroup (NHCAW) partnered with the New England Environmental Finance Center to develop a SLR adaptation plan for three towns on the coast of New Hampshire: Seabrook, Hampton, and Hampton Falls. The New England Environmental Finance Center developed a tool called COAST (COastal Adaptation to Sea level rise Tool) to help communities with the SLR planning process by assessing the social, political, and economic realities of local adaptation measures. The goals of the COAST tool are to encourage communication, educate the at-risk public about the estimated impacts, and help communities decide for themselves which strategies work best for their local area. This stakeholder-driven process encourages inclusivity and steers the direction of the overall strategy to reflect the values of the community.

In their first meeting, stakeholders were introduced to the COAST modeling process, discussed the areas that were most vulnerable to SLR, evaluated the public opinion of SLR risks, and selected the vulnerable assets in the community that they wanted to assess in their model. The stakeholders at this meeting chose to focus on the impacts to real estate. At the second stakeholder meeting, results from the model were presented to the group. These models allowed the participants to see the potential impacts on their local and familiar places. After comparing these models, stakeholders identified areas of concerns that included vulnerability of important highways, preservation of evacuation routes, important facilities, and preservation of beaches. They then chose three adaptation strategies: preservation, protection, and accommodation.

They elected to maintain natural buffer capacities and estuary habitats by ensuring that tidal flow is not restricted by marsh and road crossings. They determined that physical barriers should be used to protect vulnerable real estate. They also recommended that homes and businesses that are vulnerable to flooding should be elevated or flood- proofed. They then determined that cost-benefit analyses should be conducted for the actions to protect real estate.

In later meetings, the *Blueprints* team discussed challenges, barriers and opportunities revealed by the model results. They outlined actions that should be taken by community leaders. Overall, the group determined that the strategies for adaptation varied by location and type, but the benefits of accommodation actions consistently outweighed the costs. Other communities may benefit from key take-away points identified in discussions:

- Three-dimensional maps are very useful communication tools. (An example is found in Figure 3.46)
- It is important to frame adaptation as a relevant issue for today, and keep a positive tone.
- Individual, self-generated solutions will be the most robust – solutions must come from communities themselves.
- Groups should focus more on application of results than on the technical process (let the extension/ university/agency/consulting assistants focus on technical elements).
- Future collaborations for adaptation should be regional and multi-jurisdictional

Overall, the strategies decided on using the COAST tool and stakeholder meetings helped three cities to utilize technical information in order to facilitate communication within their community to make their region more resilient in the face of rising sea levels.

3.8 RECOMMENDATIONS FOR DARIEN

COMMERCIAL FISHING

Adaptation strategies to sea level rise for the commercial fishing industry can best be organized into short and long term strategies. Because the future of this industry is already uncertain, it will be necessary to take actions in the near future to ensure commercial fishing's continued viability along the Georgia coast. With shrimpers threatened by rising fuel costs and stiff competition from imported seafood from Asian and South American farms, expanding the Georgia Shrimp Association's "Wild Georgia Shrimp" marketing campaign to educate consumers on the merits of wild-caught Atlantic shrimp and blue crab as compared with pond-raised imports will be an important if the industry is to compete. Though Georgia caught seafood offers the freshest catch available to most Georgians, the greater costs associated with harvesting these wild Atlantic shrimp and Georgia-caught blue crab have led many restaurants, including many along the coast, to offer the less expensive pond-raised alternative. These restaurants often pick domestically caught seafood when the price disparity between domestic and imported shrimp is small, but conversation with a McIntosh County-based seafood distributor indicated that they become increasingly less willing to do so when the premium for locally caught seafood nears $0.50 per pound.[21] By helping to create a better awareness among consumers, Georgia restaurants will be more likely to pay a higher premium for the local product.

Flexibility to move between fisheries will also be essential for the commercial fishing industry to survive. Some fisherman have already begun to recognize the importance of flexibility and are diversifying their catch into shad from January to March and snapper and grouper when the fisheries are healthy and can be sustainably fished, allowing the trip limits are raised.

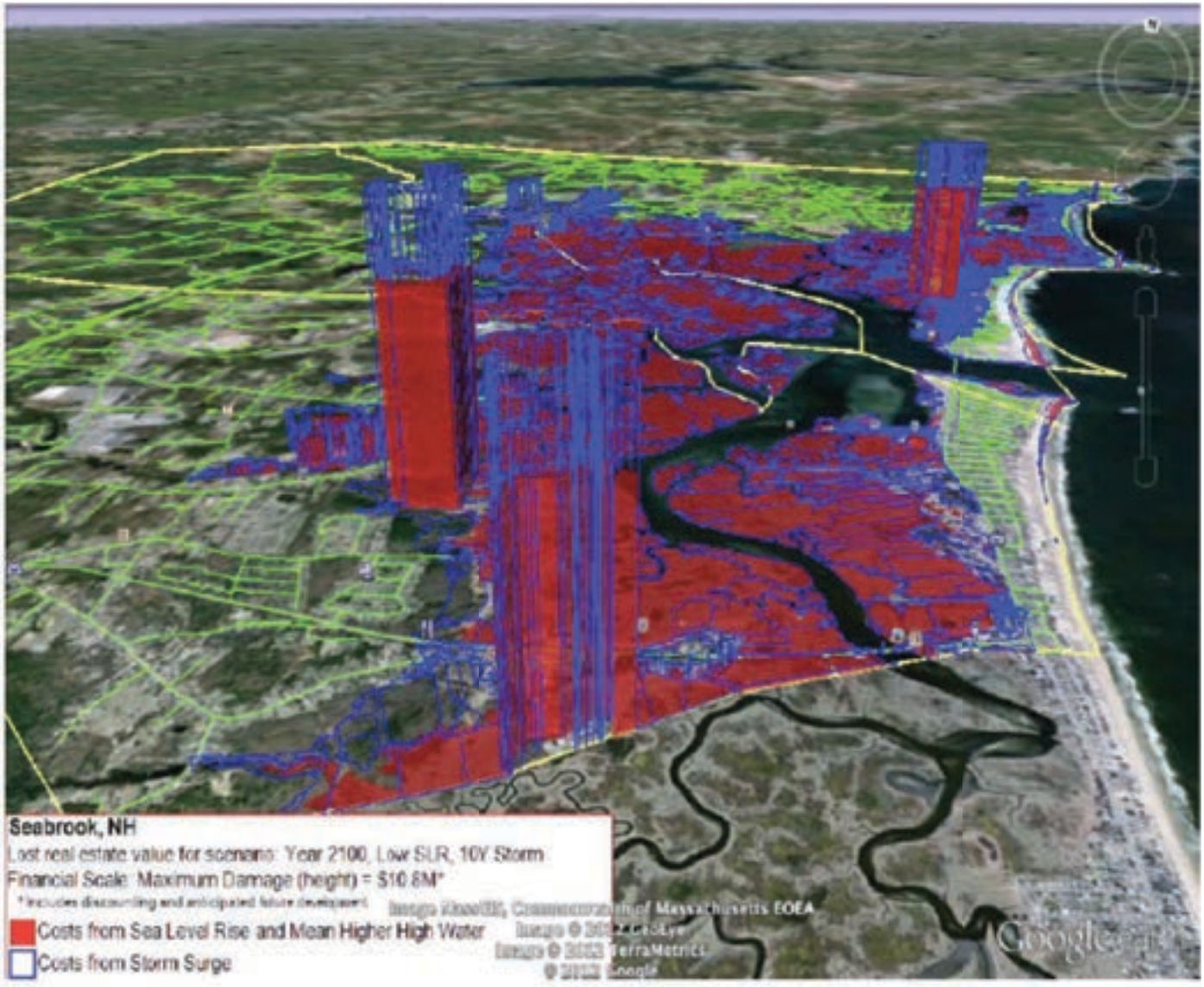

Figure 3.46: Lost Real Estate Value for the Year 2010, Low SLR, 10-year Storm in Seabrook, Hampton, and Hampton Falls, NH

The current difficulty with creating this flexibility, however, is large barriers to entry. Commercial fishing permits for some fisheries can be prohibitively expensive. In order to fish for snapper or grouper, for example, a fisherman must acquire two South Atlantic Snapper-Grouper permits and retire one, at a total cost of between $35,000 and $40,000. Permits for many other fisheries also often sell for between $5,000 and $10,000[22]. Further, many of these alternative fisheries have, themselves, experienced overfishing. The necessary equipment to move from one fishery to another can also contribute to the large financial costs of flexibility. While large freezer shrimping vessels can transition easily from one inshore species to another, it requires a significant investment in new equipment to transition to offshore species. Other fishermen have begun to explore species with fewer regulations, such as the introduction of the cannonball jellyfish fishery in the 1990s. Due to the limited processing facilities, the very low cost per pound, and potential for overfishing as has occurred in some Asian markets, there is reluctance on the part of many fishermen to enter this

fishery. A key, then, may be to explore additional new and innovative fisheries. One fisherman we spoke to, for example, was investigating the potential of three species of shellfish on which no aquaculture was currently being conducted.

Ultimately, even with such innovation, it may be necessary for many of these fishermen to transition to new industries.

From a longer-term perspective, however, estuarine environments and wetlands around the Darien coast are essential for providing healthy fishery populations. Currently, existing wetlands are protected through both federal and state regulations, including Georgia's Coastal Marshlands Protection Act, Shore Protection Act, 401 Water Quality Certification, and the Water Quality Control Act (Water Quality in Georgia 2006-2007 2008). The state has also engaged in a land acquisition strategy, in combination with public education programs that has protected more than 200,000 acres through Preservation 2000 and RiverCare 2000 acquisition initiatives and program expansions (Water Quality in Georgia 2006-2007 2008). As demonstrated through SLAMM, however, these wetlands will not remain static over the next century. Land use controls need to account for not only existing wetlands, but also adjacent parcels, which may face future inundation and wetland migration. In order to protect these vital habitats and nursery grounds communities should examine in greater depth the impacts of wetland migration.

Local governments along the Georgia coast, including the town of Darien and McIntosh County, could best prepare for rising sea levels by tying their land use decisions not to static assumptions about the land cover make up across time, but under a dynamic model of wetland creep. SLAMM utilized in this report examined 30 meter by 30 meter cells across a wide geography calculated through SLAMM version 5.0.1. In 2010, Warren Pinnacle Consulting, through funding provided by the Nature Conservancy, updated and released a Beta version 6.0, which includes dynamic accretion, an updated salinity component, elevation analyses, and increased flexibility in parameterization (Clough 2010). By partnering with experts on wetland habitat and sea level rise, such as the Skidaway Institute of Oceanography, and running the updated model at the finer grain 5 x 5 meter cell size, local governments would provide themselves with a valuable tool in setting land use controls that protect not only existing wetlands, but by preventing development in future wetland sites, which could prevent migration of the valuable wetland habitat.

TOURISM AND SMALL BUSINESS

Tourism sites in Darien face significant danger from sea level rise. The most important sites, Fort King George and the Butler Island Rice Plantation, are both located in inundation zones where they will likely suffer severe damage from sea level rise over the next 100 years. Drastic changes in the surrounding environment will impact how visitors experience these sites as the histories of both Fort King George and the Butler Plantation are closely intertwined with their surroundings. Additionally, wetlands and other natural areas are likely to be affected by sea level rise within Darien, which will impact ecotourism in the area. Fauna and flora in the area that provide sources of tourist attraction should be evaluated closely to determine any impacts of sea level rise on them. The uniqueness of these tourism-related concerns suggests that besides the traditional methods of sea level rise protection like accommodation, armoring and retreat, directors of tourist attractions in Darien should consider other methods to protect their sites from sea level rise and to educate the public on its effects.

It would be prudent to determine to what extent the three traditional methods can help protect the coastal tourist areas. Fort King George consists of several structures,

Figure 3.47: Darien Wetlands

including replicas of pre-Revolutionary blockhouses, enlisted soldiers' barracks, guardhouse, and officers' quarters. The Butler Island Rice Plantation consists of a residence, a 75-foot brick chimney that used to power a rice mill, and a dike system. The possibility of protecting these structures through armoring (whether hard or soft restructuring) should be investigated by the directors of the site. Retreat may initially seem implausible, but reconstructing these buildings further inland may be a requirement to protect these historical treasures. Accommodation mostly refers to future development, and is not particularly relevant to protecting these historical sites.

Another appropriate measure to help protect these historical sites would be education about the effects of sea level rise. Education is already an important part of historical site visitation; educational lectures and material distributed at these sites should also place emphasis on how people can limit their impacts on these environments. Employees of these historical attractions could also educate visitors about the surrounding environment, and how human interaction with the environment can potentially exacerbate issues related to sea level rise.

Teaching visitors about their personal impacts on sea level rise is even more important in the ecotourism sector. While many ecotourists may already be more educated than the average traveler regarding the impacts of sea level rise, seeing the impacts of sea level rise up close and personally in the Georgia marshlands (which make approximately one-third of all of the marshlands found on the east coast), and seeing

the unique beauty of the wildlife may encourage them to better appreciate the consequences of sea level rise.

Business activity in Darien might also be heavily impacted by sea level rise. In addition to the impact of sea level rise on commercial fishing, sea level rise poses a significant threat to other industries located in Darien such as lodging, real estate, and restaurants. Though very few physical structures occupied by small businesses will be directly affected by sea level rise, their operators may be affected by impacts on different industries or different geographic regions. For example, lodging is an important industry in Darien. Ten hotels/ lodging facilities exist in the town. Many visitors to ecotourist sites in the surrounding county, including nearby Sapelo Island, depend on lodging in Darien for their visitations. Business plans for the coming years should take into account possible declines in business as sea level rise begins to have substantive effects on activities beyond Darien's city limits.

Businesses that are in the direct path of future inundation from sea level rise, such as the Super 8 motel on I-95 at exit 45, will need to relocate further inland if the motel is to remain open. Other businesses that are sensitive to changes in the soil and beach, like the Altamaha Coastal Tours, may also be forced to relocate.

Figure 3.48: Fort King George in Darien
Source: http://upload.wikimedia.org/wikipedia/commons/0/0f/GA_Darien_Fort_King_George09.jpg

Other measures focus on mitigation rather than simply adaptation, including converting building structures into “green” facilities, should also be considered. This means constructing buildings that efficiently use water, energy, and other resources and reduce waste, pollution, and environmental degradation. While these goals do not have immediate impacts on small business’s battle against sea level rise, they do provide long term benefits that will help stem the tide of increasing in sea levels.