

**THE PLANNING MATANZAS STUDY AREA, NORTHERN EDGE**  
On Florida's northeast coast, a community is learning to discuss—and plan for—sea-level rise.

COURTESY GUANA TOLOMATO MATANZAS NATIONAL ESTUARINE RESEARCH RESERVE

An aerial photograph of a coastal landscape. In the foreground, there is a dense thicket of green trees and shrubs. Beyond this, a large, flat, green marshy area stretches out, with several small, winding water channels. In the middle ground, a wide body of water, likely a bay or inlet, is visible. A long bridge spans across the water. On the far side of the bridge, a small town or village is situated, with several buildings and a cluster of houses. The background shows a flat expanse of land under a cloudy sky.

# THINK OR SWIM

**COMMUNITIES ON FLORIDA'S COAST  
CONSIDER WHERE THINGS WILL GO  
AS THE OCEAN MOVES CLOSER.**

BY JONATHAN LERNER

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ATHERED AROUND TABLES, haggling over real estate they're pretending to own, aggressively protecting their presumed interests, these people might be playing Monopoly. This game, too, has a seashore location, though one at least superficially quite unlike the urbanized Atlantic City, New Jersey, that lent its place names to the Monopoly board.

And these players are not wheeling and dealing in somebody's family room for kicks. They're at the workaday headquarters of the Guana Tolomato Matanzas National Estuarine Research Reserve, near St. Augustine, Florida. This is a public workshop, part of an experiment called Planning Matanzas.

In Monopoly, everybody is a speculator with the same motivation: accumulate property, put opponents out of business. But here each player is assigned the concerns and bankroll of a different local interest: resident, official, developer, ecotourism operator, or environmental scientist. On the table are not hotels and railroads to be wrung for profit. Instead there is a range of adaptation strategies among which they negotiate. These could allow this delicate stretch of barrier islands and coastal lowlands, which has both low-density development and vast unbuilt acreage, to respond to sea-level rise. Among the choices are erecting seawalls, renourishing beaches, putting land under conservation easement, cultivating living shorelines, even relocating away from the coast. The players are having fun acting in their assigned personas, tossing around imaginary millions, making believe they have the power to make these consequential decisions. In contrast to Monopoly, though, raging competition could ruin this game. The goal here is to get the community together, talking and planning for an inevitable future of higher tides and fiercer storms. It is also to find ways to do so that are transferable to other coastal communities—perhaps even Atlantic City, which is also on a barrier island, on the vulnerable New Jersey shore.

It's one thing to react after a destructive climate event such as Hurricane Sandy—to raise houses on pilings or reconstruct stronger boardwalks after floodwaters reached where they never had been seen. People can accept that it might happen again. But proactive, long-term planning that accounts for and accommodates to the effects of climate change, which are difficult to predict with precision and almost imperceptibly slow to occur, is another matter. "It's hard to talk about," says Ed Montgomery, one of the participants in the role-play game at



that workshop this past June. "People feel this sense of, 'There's really nothing we can do. A hundred years from now, I'm not going to be here anyway.'"

Montgomery is a lifelong resident of northeast Florida, with both professional and personal interests in these issues. With a degree in forest resource management, he went to work 34 years ago for Rayonier, a forest products company that is the largest landowner in the 100,000-acre Planning Matanzas study area. He is on the board of the Conservation Trust for Florida, which works to keep intact large agricultural and forestry holdings and wildlife corridors, and he is also on the Planning Matanzas project's steering committee. Montgomery is unusual among his neighbors for his intimate familiarity



**LEFT**

Around the Matanzas Basin, rising seas will cause natural habitats to migrate, complicating where human communities might remain or relocate.

are bewildered by what it implies and flummoxed about what can be done. Planning Matanzas (an informal name for the project, which is officially called “Planning for Sea Level Rise in the Matanzas Basin”) is one of several such studies under way around the country, funded by the National Estuarine Research Reserve System Science Collaborative, that hope to get these people talking about their communities’ watery futures.

Planning Matanzas is an especially layered and complex undertaking. The three-year project’s first phase, now completed, involved vulnerability assessment and public outreach. The vulnerability assessment was based primarily on the Sea Level Affecting Marshes Model (SLAMM), which simulates wetland conversions by considering not only sea-level rise but also processes such as erosion, accretion, and barrier island overwash. At the public workshops, participants saw a time-lapse visualization of areas that the assessment projects will become inundated, to prepare them for the role-play game and a visioning exercise. It was as if they were seeing their own front yards, their favorite kayaking creeks, and the roads leading from the barrier islands and former wetlands where they mostly live vanish before their eyes.

SLAMM can indicate where habitats will migrate. Which marsh areas will become open water? Which shorelines and wetlands will become marsh? Where will wetlands take over what is now upland? The answers are unlikely to be linear; the Atlantic, with its rising tides, is to the east, but the succession of habitat change from open water to marsh to wetland, for example, will not necessarily proceed in a singular westerly direction. That’s just one of many complexities. In the project’s second phase, under way now, other projections are being overlaid on those for sea-level rise alone. Given population growth trends, what areas now devoted to forestry or agriculture are likely to become targeted for development? (A model called Land-Use Conflict Identification Strategy is used.) And with pressure coming, as it were, from so many directions, will it be possible to identify and protect wildlife corridors and conservation lands sufficiently intact and large to allow species other than *Homo sapiens* to relocate and survive?

Still more complicating variables are added to this mash-up because the different analyses use different time horizons. Modeling of future development goes to 2060, because that is how far out population projections exist. The SLAMM models, showing habitat changes and land vulnerability, go out to 2100; they also consider multiple projections of sea-level rise, up to

with the local environment and informed knowledge of how sea-level rise may affect it. But in another respect he is a rather typical Floridian. He lives at the edge of a salt marsh, on Amelia Island; that’s about 70 miles north of the study area but essentially the same environment. He says, “We’ve had times, on the full moon or during a tropical storm, where the marsh was touching our house. We’re just willing to take the risk to be where we are because it’s absolutely gorgeous.”

People love to live on the coast. Some have done so for generations. Some have worked whole careers to get there. Our society privileges individual choice and private property and resists command planning or suggestions of property taking. Not everyone believes climate change is real. Those who do

2.5 meters. But “the future is highly uncertain, and planning is a political process, so we are describing different potential scenarios,” explains Kathryn Frank, an assistant professor of urban and regional planning at the University of Florida (UF), who is the principal investigator.

In the third and final phase of the project, to be completed next year, this multidimensional analysis will be considered alongside the preferences expressed in the stakeholder workshops (and in charrettes that may be held as well). Though not now included in the scope of the Planning Matanzas study, a supporting project is envisioned to calculate the economic value of the ecosystem services such as aquifer recharge and fish propagation that the planning area’s habitats provide. All of this data will be used to generate a map of the study area indicating preferred locations for development and conservation, and to articulate adaptation policy and planning proposals specific to this locale, including estimates of the costs of each alternative. These are the tools the community can use to begin making the real choices about its future, assuming it musters the political will to do so.

The project will also document its techniques—such as the role-play game, the computerized visualization of rising water level, and this research approach that integrates predictions of population and development trends with those for sea-level-rise-induced habitat change, and with assessments of potential wildlife corridors—so that they can be adapted in other coastal locations. This will include guidelines for how “to synthesize across it and say how it works as a collection,” says Frank. “A lot of researchers and people who create tools and methods just focus on their piece, and not how everything fits together.”

Thus the project involves experts from many academic disciplines. Dawn Jourdan, now at the University of Oklahoma, who holds a doctorate in law and a master’s degree in urban planning, is the collaboration lead, principally responsible for the interface of the public and scientific research. UF’s Robert Grist, FASLA, is guiding how environmental science and planning concepts are visualized and communicated. Tom Hoctor, the director of UF’s Center for Landscape Conservation Planning, is leading the study of habitat shift and wildlife migration. Paul Zwick, a planner and environmental engineer who directs UF’s GeoPlan Center, is doing the predictive research into population growth and likely future development locations. Greg Kiker, associate professor of agricultural and biological engineering at UF, conducted the SLAMM runs.



The project is also unusual in the degree to which student work is incorporated and put to practical use. The Monopoly-like game was developed by Briana Ozor, a candidate for a master’s degree in urban planning. Jourdan says: “I told Briana, ‘We need a game that uses the adaptation strategies, prioritizes them, looks at the economic value—you figure it out.’ So it’s not just research. It’s invention, too.” The computer visualization was produced by Brad Weitekamp, Student ASLA, whose master’s thesis in landscape architecture addressed ways to develop effective visualization and communication tools for public workshops, with emphasis, he says, “on finding tools that are already free and out there, software that planning offices or designers typically use.” Other UF student efforts have contributed as well. Unlike class and thesis work

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Development on the low, narrow barrier islands is vulnerable to flooding from both ocean and estuary.

that may be based on actual places and problems but is itself conjectural, this involvement is “linked to a real project with funding and a client,” Jourdan notes. “It says, ‘We’re going to stick you in the real world and let you see the real politics of this. In the process you’ll learn things we couldn’t have possibly taught you without context.’”

Politics aside, that context encompasses a remarkably wide sampling of built and natural conditions that will call for a range of adaptation strategies. The study area centers on the Matanzas watershed. A saltwater river parallel to the coast, the Matanzas separates a string of barrier islands from the mainland. The islands—for most of their lengths, just a few hundred yards in width—are built up with beach houses

and low- and mid-rise hotels and condominiums, though at far lower density than beachfront communities elsewhere in Florida. Some stretches have already had repeated beach nourishment; in the long run, that may prove unaffordable, if not futile. A number of cities fall into the Planning Matanzas study area. At the north end, for example, is St. Augustine, the oldest continuously occupied European settlement in the United States, founded in 1565, which at its center still shows its Spanish-colonial town plan—a close grid of streets extending from a plaza—and contains significant historic structures. Cultural considerations may make seawalls or levees appropriate there. Ironically, toward the south is one of the country’s youngest cities, Palm Coast, laid out by a development company in 1969, 50-some square miles of dendritic suburban sprawl with no town center at all. Many homes, erected on former wetland, back up to canals that lead to the Matanzas; perhaps there, as along the beaches, the option of relocation will be faced as the water comes up.

Behind the barrier islands, feeding into and fed by the Matanzas, is a network of bays, creeks, tidal flats, and marshes extending inland in some places as far as a mile or two. It’s a mesmerizing, ever-shifting horizontal vista of blue water, brown mud, and wavy green spartina, with pines and moss-draped live oaks in the distance. The project study area includes a five-kilometer buffer beyond the watershed. Almost all of the land it encompasses west of the estuary is undeveloped. Some is protected as conservation areas, state forest, and parks. After that the largest part, some 20,000 acres of freshwater prairie and plantations of loblolly, longleaf, and slash pine, belongs to Rayonier. On the day after that workshop in June, Ed Montgomery is driving there in a company SUV. Narrow dirt roads raised above grade and edged with water-filled gullies crisscross the woodland. “These roads are like dikes,” he comments; they were built before their disruptive effect on the natural hydrology was understood. At an intersection, his way is blocked until workmen move a truck; they are erecting power lines for wells, dotted through the property, that tap a shallow aquifer to supply water to Palm Coast.

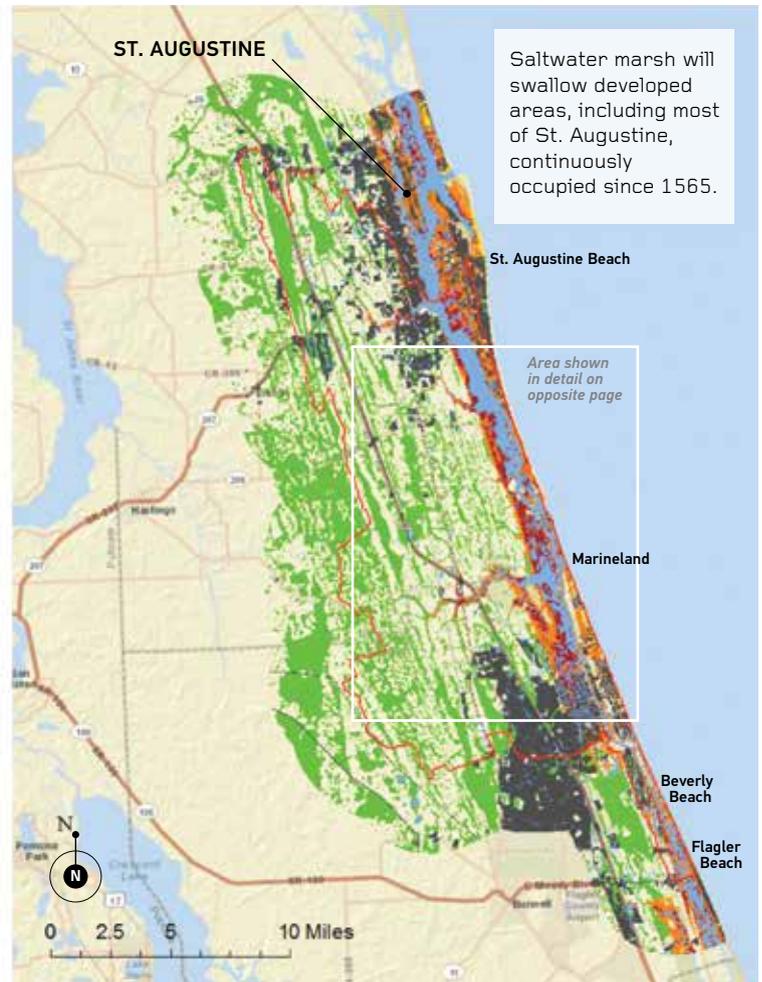
Montgomery is wiry and gravel-voiced, with a mild Southern twang, a receding hairline, and a gingery mustache. He is Rayonier’s director of real estate marketing and sales. “We know more about this property than anyone else,” he says; Rayonier has owned it since the 1940s. “If you moved, say, to Palm Coast from somewhere else, you’re probably not even aware of all

## STUDY SITE

2008



1-METER SEA-LEVEL RISE IN 2100



the forest out here, or the ecosystem services it provides, like how it impacts climate” through moderating temperatures; he mentions the benefit of water filtration, too. “It costs money to own land. Farming and forestry are risky. When you put a tree in the ground you’re not even thinking of harvesting a return for 20 years. There are natural threats, and there’s the regulatory environment.” He passes a wet stretch, where pines don’t do well, and stops again because a 20-inch alligator snapping turtle, with a frightening spiked carapace and hooked beak, is sitting in the sandy roadway. Montgomery gets out, picks the creature up by the tail, and flings it into the bog. “Maybe we let an area like this be a natural reservoir. It’s critical to maintain the ecosystem services the forest provides. But to keep these acres intact, there has to be economic viability in the enterprise for the landowner. So that’s a challenge.”

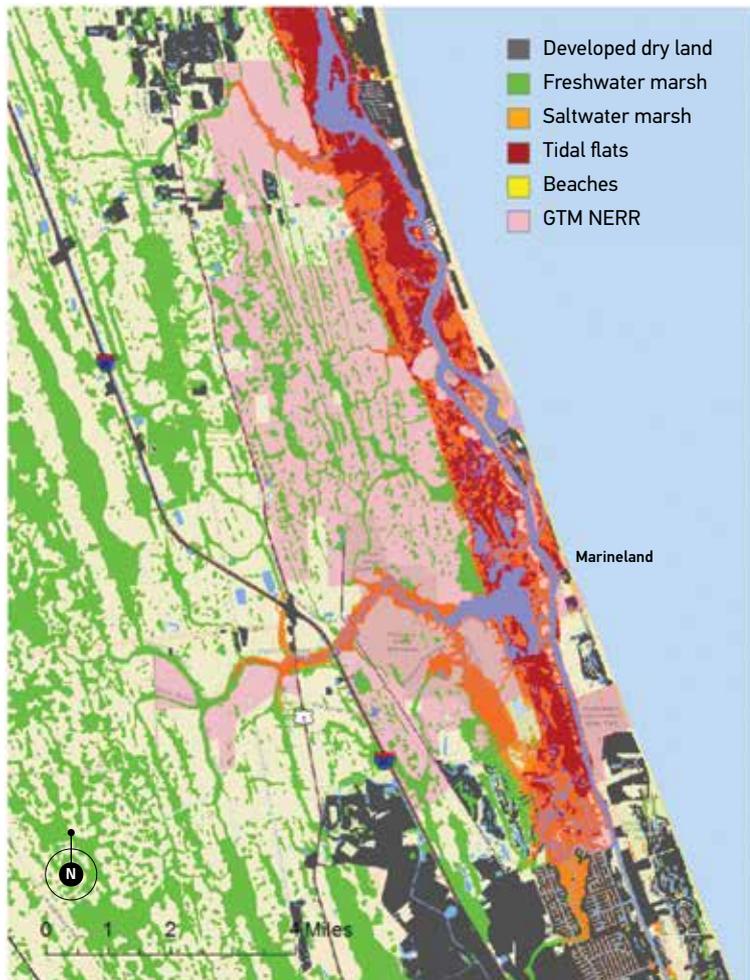
Among its ecosystem-service functions, a big forestry holding like Rayonier’s provides corridors and habitat for wildlife species. It may serve as de facto, if imperfect, conservation land, until it no longer can because its condition is altered as an

effect of climate change or its owner succumbs to economic or political pressure to break it up and sell it for development. “For the Matanzas project area,” says UF’s Tom Hctor, whose role is to calculate these equations, “any sea-level-rise impact on natural communities and focal species is going to be dwarfed by the projected development impacts. The more development you have, the more your opportunities to protect contiguous land, to allow that retreat from the coast, diminish. If you just did the development projections and forget about sea-level rise, you’d still have a big problem.”

Hctor can enumerate harrowing possibilities—the known unknowns of this war—with a fluency that suggests they keep him awake at night. “There could still be a significant loss of protected habitat because the new habitat shifts to areas that are currently unprotected.” Will there be political will and financing to protect new areas? What if habitats become more fragmented as land conditions and uses change, so that even if protected areas suffer no net loss in total area, and thus perhaps satisfy regulatory requirements, they can no

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1-METER SEA-LEVEL RISE IN 2100



longer sustain their natural communities? And “what are the chances that the areas that are currently conserved ‘in perpetuity’ become really attractive for future development, if you’re facing a massive need to relocate people and infrastructure from the coast? The chance that we’re going to actually care less about natural systems adaptation, that it’s all going to be people focused, goes up. We already have that emphasis. We struggle to get green infrastructure and biodiversity an equal footing in planning now.”

And although Hctor asserts that development pressure will be a critical factor, he knows that the population trends that inform his projections may change unpredictably. “Will bad storms discourage people from moving to the coastal areas and encourage moving inland? Especially in the first half of this century, it might not be the incremental sea-level rise that gets people’s attention; it may be the killer hurricane that hits the wrong place, like Sandy.” The prospect of flood insurance becoming more market driven and unaffordable, as already is happening, could accelerate population shift inland. Then,

what form will new development take? “Hopefully, we’re going to do more redevelopment; we’re going to densify. But the trend is business as usual. If we keep doing the same stupid stuff we’re doing today, how bad could the sprawl get?”

Planning Matanzas demands an exquisite balancing of hard, and hard to comprehend, science with hard, as in contentious, politics, in the context of hard, as in scary and uncertain, choices. “If we could come up with one positive outcome, it would be that enough dialogue is generated and enough people are thinking about it that it stays part of the conversation,” says Jourdan. “This is very citizen based. It’s very much ‘give the education to the people’—some are decision makers, but also voters, property owners, business people, and others who have long-term interests here—and see which way they want to push the system.” ●

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