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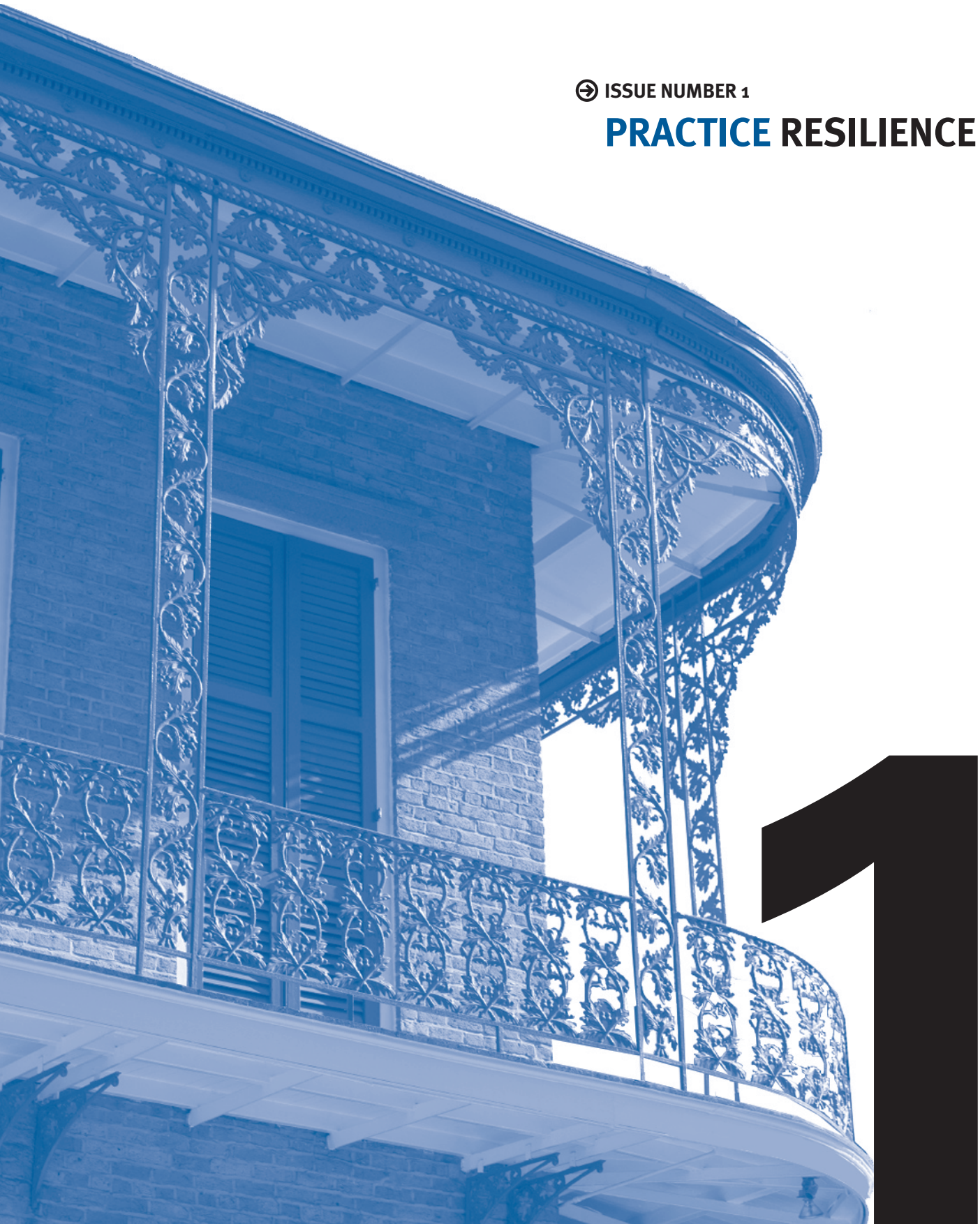


ISSUE NUMBER 1

PRACTICE RESILIENCE

1

Coastal Hazards and Smart Growth

By John Jacob and Tommy Pacello

Peirce Lewis, author of *New Orleans: The Making of an Urban Landscape*, called New Orleans the "inevitable city in the impossible place."

INEVITABLE COMMUNITIES

Every coastal city or town to one degree or another faces the dilemma of having to be in a place that no city should be in. According to Richard Campanella in *Bienville's Dilemma: A Historical Geography of New Orleans*, if Bienville—the person who originally sited and laid out New Orleans in the early 1700s—had followed environmental planning prescriptions in use today, New Orleans would have been placed far upstream, in a much better location, but in a far worse situation. New Orleans would have been on much higher ground and subject to much less flooding (the better location), but it would have had much less access to coastal traffic (a far worse situation). Bienville sited New Orleans in just about the best available location to take advantage of the premier situation on the Gulf Coast: the mouth of the largest river in North America. Every coastal city faces Bienville's dilemma as they consider where and how to grow.

After Katrina it was common to hear calls for the abandonment of New Orleans. Why should we spend public money on resuscitating a city in such a wretched location? Good planning, after all, would avoid such places from the get-go. The problem is there is no avoiding a place like the mouth of the Mississippi. There is going to be a city there no matter what: The question is what kind of city. And the same goes for most coastal cities to one degree or another. They are by necessity in a hazardous location. That is the starting point when thinking about planning for coastal cities.

New Orleans is a city on its way back, in part because of its situation and in part because of the unique evolution of culture and landscape that resulted in one of the great cities of the world. It is a place worth defending, but perhaps *not every inch*. Perhaps there are parts more defendable than others. The neighborhoods of New Orleans that are in some ways most representative of its character are for the most part in the best locations—on the highest ground, low though it is. The character of these places is defined by a unique architecture and urban pattern, a pattern defined first and foremost by walkability and by a compact mix of residential and commercial uses. This pattern is what defines smart growth today: compact form, mixed uses, and a distinctive and vibrant urban character. We argue here that this compact urban pattern conveys not only character to a city but that it also endows coastal cities with a certain amount of resilience to coastal hazards.

THE 10 PRINCIPLES OF COASTAL SMART GROWTH

1. Mix land uses, including water dependent uses.
2. Take advantage of compact building design that enhances, preserves, and provides access to waterfront resources.
3. Create a range of housing opportunities and choices to meet the needs of both seasonal and permanent residents.
4. Create walkable neighborhoods with physical and visual access to and along the waterfront for public use.
5. Foster distinctive, attractive communities with a strong sense of place that capitalizes on the waterfront's heritage.
6. Preserve open space, farmland, natural beauty, and critical environmental areas that characterize and support coastal and waterfront communities.
7. Strengthen and direct development towards existing communities and encourage waterfront revitalization.
8. Provide a variety of land- and water-based transportation choices.
9. Make coastal development decisions predictable, fair, and cost-effective through consistent policies and coordinated permitting processes.
10. Encourage community and stakeholder collaboration in development decisions, ensuring that public interests in and rights of access to the waterfront and coastal waters are upheld.

From the National Oceanic Atmospheric Administration's 2009 report, *Smart Growth for Coastal and Waterfront Communities* (EPA-231-K-09-001). http://coastalsmartgrowth.noaa.gov/report.html

THE COASTAL HAZARDS WE FACE

Tropical storms are the preeminent coastal hazard along the Gulf of Mexico, where most of our experience as authors is. All tropical storms bring a strong risk of flooding on the flat coastal plain that extends inland from the Gulf from less 25 to more than 75 miles, and hurricanes bring the devastating force of storm surges to the near-shore areas. In fact, this flooding and surging, including tsunamis, represents the primary hazard to all coastal communities, regardless of location.

In addition to the "acute" issues of storms and surges, flat-lying areas like the Gulf Coast are also subject to more "chronic" issues such as subsidence, sea level rise, and coastal erosion. For the most part the same planning principles apply.

DURABILITY AND SENSE OF PLACE—SMART GROWTH ON THE COAST

Smart growth is about vibrant places that use less energy and materials. It is about designing for people and then accommodating cars, a hierarchy ignored by most postwar community planning in the United States until quite recently.

ASK THE AUTHOR JOIN US ONLINE!

Go online during the month of January to participate in our "Ask the Author" forum, an interactive feature of Zoning Practice. *John Jacob and Tommy Pacello will be available to answer questions about this article. Go to the APA website at www.planning.org and follow the links to the Ask the Author section. From there, just submit your questions about the article using the e-mail link. The authors will reply, and* Zoning Practice *will post the answers cumulatively on the website for the benefit of all subscribers. This feature will be available for selected issues of* Zoning Practice *at announced times. After each online discussion is closed, the answers will be saved in an online archive available through the APA* Zoning Practice *web pages.*

About the Authors

John Jacob is a professor and extension specialist at Texas A&M University. He is the director of the Texas Coastal Watershed Program, and holds a joint appointment with the Texas A&M Sea Grant Program and with Texas AgriLife Extension Service through the Department of Recreation, Parks, and Tourism Sciences. His current project, Coastal CHARM (Community Health and Resource Management), focuses on enabling coastal communities in Texas to improve quality of life in cities and towns while preserving and enhancing the natural coastal environment.

Tommy Pacello is an attorney and a planner from Memphis, Tennessee. He is an associate with the Austin, Texas, firm Code Studio, where he specializes in implementing plans using innovative zoning and form-based codes. Pacello has most recently been working on the Louisiana Land Use Toolkit, a model development code for the state of Louisiana, the second phase of which will include a set of Louisiana specific coastal development ordinances. Follow this project at www.landusetoolkit.com.

John Jacob

The unique urban character and durability of its construction have made Venice, Italy, into a very resilient coastal city, in spite of permanent flooding over much of the city as a result of subsidence.

There are 10 often-cited principles that define smart growth (see sidebar for the "coastal" list). In our view, the first two principles underlie all the rest: compact form and mixed uses. Without some minimum amount of density, there is no walkability, and there are no distinctive, attractive communities with a sense of place that are not walkable. A mix of uses characterizes vibrant places and is a key element of walkability. Density alone does not endow vibrancy to a place. Think of large apartment complexes with no commercial streets or districts nearby. A mix of uses is what makes a place interesting.

Virtually all of our most loved and vibrant coastal cities exemplify the 10 smart growth principles, in large part because they were laid out and established well before the advent of the automobile. They had no choice but to be walkable. A Charleston or a Savannah could not emerge where separation of uses was mandated. We would find New Orleans completely uninteresting if it were nothing more than a collection of big box stores in a sea of parking lots separated from residential districts.

Density and mixed use have endowed pre-automobile coastal cities with character and durability, two important attributes that give the best cities a lasting sense of place. Venice, Italy, for example, has been subject to coastal subsidence that would have destroyed a lesser city. It is a city with such an outstanding sense of place and character that its citizens have long been dedicated to its defense. The durability of its construction gives them something to *defend* across the centuries. Its character gives them something they *want* to defend at all costs.

Contrast Venice with the Brownwood subdivision in Baytown, Texas, just east of Houston. The scale is quite different from Venice's, but the reaction to a similar amount of subsidence is illustrative. Brownwood was a very neat and tidy 500-unit subdivision of comfortable suburban homes. Brownwood is the poster child in the Houston region of what happens when subsidence results from excessive withdrawals of groundwater. Brownwood was abandoned in the early 1980s as it subsided and was inundated by the adjacent Galveston Bay. In the end

Jim Olive and Lighthawk

The Brownwood Subdivision in Baytown, just east of Houston, was inundated as a result of subsidence, but had neither the durability of construction to withstand the flooding nor the sense of place that would have enabled its citizens to rise to its defense, although some attempts at diking were made.

John Jacob

These structures on the Galveston, Texas, "Strand" were all built before the Great Storm of 1900.

Brownwood did not have enough of a sense of place nor the durability of construction to engender any kind of lasting defense.

Galveston, Texas, however, provides another example of durability and sense of place. The most damaging storm ever to hit the United States in terms of loss of life destroyed all of Galveston, except the iconic Strand. The Strand is the original business district of Galveston, an impressive and beautiful group of buildings all dating to the period before the Great Storm of 1900. This remnant from the storm appears to have been enough to rally the hardy citizens of Galveston to rebuild their otherwise destroyed community, a herculean effort that involved raising substantial portions of the city and the construction of a massive seawall. Contrast Galveston with a sister city just down the coast: Indianola in Lavaca Bay. Indianola was a thriving, albeit somewhat smaller, city competing with Galveston. Two storms about 10 years apart devastated the city between 1875 and 1886. There was much less loss of life from these storms than from the later Galveston storm, but after the one in 1886, Indianola packed it in and left, never to be rebuilt again. There just didn't appear to be enough remaining structures to want to rebuild and start again, in contrast to Galveston, where a durable sense of place had formed around the Strand.

A sense of place, something that smart growth should foster, appears to endow some resiliency to coastal communities in terms of the additional desire coastal citizens might have to defend or restore these places after a storm. But might not the principles of smart growth result in safer growth as well? We argue that they do, and further, that density is a key predictive characteristic of resilience in terms of coastal hazards.

DENSITY, WALKABILITY, AND HAZARD RESILIENCE

The discussion below highlights six postulated ways that density or compact form in the context of a walkable place could result in a greater resilience to coastal hazards. Some items on the list are self-evident—less area to protect, for example. But little research has been conducted on the specific issue of density and walkability in the context of hazard resilience. We hope this article will spur more research.

COMMUNICATING DENSITY—DECODING DENSITY

1. ***Drop the planning jargon.*** When engaging in the planning process it can be difficult for non-planning professionals to understand density when it's being talked about as units per acre or floor area ratio.
2. ***Illustrate density.*** A more effective approach to communicating density is by using pictures or illustrations, or better yet, a local example of a neighborhood where density was done right.
3. ***Connect density with real benefits.*** Density can afford greater engineered protection from flooding and storms, making places safer. It also contributes to quality of life issues by encouraging neighborhood coffee shops or restaurants to open within walking distance of residents

Less Area to Protect

A city of 500,000 people at 4,000 people/square mile (a common suburban density in Houston) will occupy 125 square miles, while the same population at 15,000 people/square mile (the density of the French Quarter in New Orleans) will occupy only 33 square miles, a considerably smaller area needing protection. If each of these areas were arranged in a square and needed protection all the way around, the first city would require 45 miles of levees, whereas the second city would only require 23 miles of levee protection. At $5 to $10 million per mile for levee construction, a savings of close to $200 million could be realized; or more importantly, much better levees, maintained to a higher degree, could be built to protect the smaller area occupied by the same amount of people. Most of the levees built in New Orleans were built to protect and to enable development at suburban densities, areas nowhere close to the French Quarter in terms of density (or livability).

Less area to protect can be significant at much lower densities than those described above. Even for a smaller coastal town or village, the difference between large-lot development (e.g., 1,500 people/square mile) and a more compact form consistent with a small town (e.g, 8–10 units/acre, or about 7,000–8,000 people/square mile) can be considerable. For a 500-person community, that difference would be 40 versus about 200 acres, potentially a very significant difference in low-lying country.

More Choices of Where to Locate

The smaller area of the denser city described above obviously enables a greater ability to choose and stick to the higher or more protected ground, affording much greater opportunity for limiting settlement to the safer but scarcer locations where the situation is better, as described above.

Sturdier Buildings

More compact growth enables the construction of sturdier buildings in two ways. First, people living in compact cities are much less dependent on automobiles and all the costs associated with them, and consequently could have more money to spend on housing (and could therefore build sturdier houses if they wished to or were required to do so for affordable insurance). Secondly, where buildings share walls, such as in town houses, the cost of masonry construction per building is much less, making that kind of construction

much more affordable. Masonry construction is inherently much more floodproof than conventional stick-built homes.

Proximity of Refuge

Mixed use is a hallmark of smart growth. Modern conventional diffuse growth dictates the separation of uses, with miles and miles of suburban residential developments unbroken by business districts. Smart growth practitioners design communities where residential and commercial areas are in close proximity, if not intermixed. Commercial buildings can be built to much more rigorous standards than residential single-family buildings, no matter what the type of construction. The nearby presence of substantial commercial buildings could provide very real refuge when storms approach with little time for evacuation. But to be bona fide refuges, they must be nearby—not miles away as they were in most of the Lower Ninth Ward and elsewhere in New Orleans. This idea of refuge on a community scale is the "safe room" writ large.

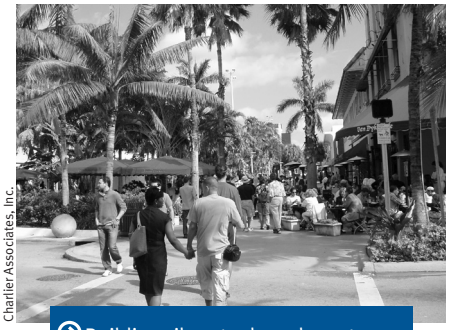
Galveston provides a good example of how such a refuge could work. During the 1900 hurricane the highest rate of survivorship was of people who took refuge in the Strand. The only way to have substantial buildings within walking distance of residential areas is to build an area compact enough that pedestrian traffic could be a significant part of the retail business. Most municipalities along the Gulf Coast have codes that proscribe this kind of mixed use, and most places prescribe such large lots for single-family homes (greater than 7,000 square feet) that walkability is out of the question.

Greater Social Cohesion

An urban pattern that facilitates and promotes more walking perforce promotes and facilitates more social interaction. More social interaction should lead to a greater amount of social capital or social cohesion. Networks of mutual assistance on a neighborhood scale can only occur where there is interaction. Interaction is likely to be less in car-dependent neighborhoods than walkable neighborhoods. Where people can walk to the corner store or coffee shop, they are much more likely to frequently encounter their neighbors and know more about the details of their lives (e.g., who might need assistance making it to a shelter or evacuating).

Transit and Evacuation

Denser cities will have far fewer cars per capita than diffuse cities. Mass transit enables the transport of many more people over equivalent distances than cars can. Whether or not a mass transit system could move more people out of harm's way than the equivalent population in private automobiles is an open question. The debacle of the Rita-inspired Houston evacuation, with its clogged freeways, is still fresh. The state of Texas and Houston, however, have taken extensive measures to ensure that contra flow is put in place early, such that the next evacuation could be much smoother. How well a mass-transit-aided evacuation would work depends on a number of factors, including the number of buses and trains available, the lead times involved, and how far the transit system extend beyond the areas of immediate danger. It is conceivable that hurricane-safe refuges or sanctuaries could be built at the inland termini of major coastal metropolitan transit systems.



Charlier Associates, Inc.

Building vibrant urban character into coastal communities may also lead to greater urban resilience in the face of coastal hazards.

PLANNING AND CODING FOR COMPACT, MIXED USE PLACES

Just building compact, mixed use, and vibrant places will not cure all that ails coastal development. To a certain extent, smart growth in a "stupid" place should not be considered smart. But as previously discussed, just about anywhere on the coast could be considered hazardous, so we are at a disadvantage from the beginning. Coastal communities must address three fundamental questions about development along the coast: Where do we build? What do we build? And how do we build?

WHERE DO WE BUILD?

Advocating for compact, mixed use, and vibrant places on the coast does not eliminate the need to examine the lay of the land for the best possible location. During a storm event, a difference of a foot or two in elevation on a flat coastal plain can mean the difference between a community suffering severe flooding damage and escaping relatively unscathed. Ultimately, this question of where to build is a planning question.

Building behind coastal dunes is obviously better than in the dunes or in front of them. Likewise, building outside of the floodplain or surge zone or behind an engineered levee is clearly better than building in one of these zones or in an area outside some community-scaled protection. Even in a hazardous coastal environment, there are still choices to be made. These choices will usually be of the "Bienville Dilemma" type discussed above, but some effort can be taken to decrease vulnerability.

This idea of allowing the natural, or in some cases manmade, features of the land to tell us how to plan and code for development is nothing new. This type of approach was advocated by landscape architect Ian McHarg in his influential book, *Design with Nature* (1969) and more recently refined by architect Douglas Farr in his book *Sustainable Urbanism: Urban Design with Nature* (2008).

There are multiple approaches to planning that are rooted in McHargian theory and smart growth principles. Your community's approach may vary, but objectively mapping the natural and built environment to identify the following areas of your community can help answer the question of where to build:

- Low resiliency (undeveloped): areas that are too environmentally sensitive, too vulnerable to hazards to develop
- Low resiliency (developed): areas that have been repeatedly destroyed by storms or flooding and are infeasible to protect through engineered defensive strategies
- High resiliency (infill): developed areas with proven resiliency that can become more compact
- High resiliency (undeveloped): undeveloped areas that are elevated or protected by multiple layers of defense and could be targeted for future compact, mixed use development

High and low resiliency are relative terms. For example, an unprotected mound three feet above sea level might be an area of high resiliency in the porous Delta Plains of Terrebonne Parish, Louisiana, but may be considered low resiliency in Gulfport, Mississippi, where the engineered seawall generates safer places. In Terrebonne Parish this mound might be the safest place for a small hamlet-style rural settlement, while in Gulf-

port, where there are safer places to develop, this mound would remain undeveloped.

WHAT DO WE BUILD?

As discussed above, compact communities with a sense of place are the most enduring coastal communities anywhere. First and foremost, then, we want to build great communities. The principles of smart growth enable us to build great as well as safe and resilient coastal communities.

Generally, in areas of high resiliency, development codes should generate compact, mixed use, and vibrant places, but in areas of low resiliency, these same codes should limit growth and density. Strategies for getting the right rules in the right areas are discussed below.

Zoning for Areas of High Resiliency

Development codes for areas of high resiliency must have zoning districts that allow compact, mixed use development. But simply setting high-density thresholds and allowing a wide mix of uses will not generate the vibrant and loveable places that make New Orleans and Venice impossible to abandon.

NOAA

The relatively high topographic ridges (shown in white over this Katrina flood zone map) in New Orleans could accommodate all of the pre-Katrina population at roughly French Quarter densities. The edges of these ridges would have had at most about two feet of floodwater during Katrina. Some adaptation in terms of durable structures and elevation would still be necessary in these areas. The kind of construction found in the French Quarter would be consistent with the lower edges of the ridges.

Coastal communities must also consider how their regulations help build neighborhoods, not just subdivisions. The community is likely to be more tolerant of density in infill settings if the form of the density fits with their neighborhood. Development codes can help shape this form in a more predictable manner.

Building Types. Developing a palette of building types or development types that are available in each zoning district can help in a number of ways. It can allow a community to influence the types of buildings on given streets or blocks. Areas intended for three to eight-story mixed use or apartment buildings could be mapped to only allow these building types, while areas where compact cottages or row houses are desired may be mapped to reflect this pattern. Ideally, this more prescriptive approach will be coupled with a more streamlined approval process.

In addition to placemaking qualities, building type regulations also provide communities with the ability to require building-specific hazard defense strategies, depending on the zoning district where the building is located. Buildings in high-resiliency areas that still may be prone to occasional flooding might be required to address their ground floors differently than buildings that are less likely to be flooded.

Lot Size. Zoning for reasonable minimum lot size is essential in generating compact form. Recent residential patterns through much of the coast consist of 7,000- to 9,000-square-foot lots or larger. This is a recipe for sprawl, not compactness.

Historically, we didn't build this way. Some of the most loved and resilient neighborhoods in New Orleans mix detached homes on lots averaging around 3,500 square feet to achieve densities of 12 or more units/acre. Streets of detached cottages, mixed with larger homes, can create compact residential pattern that allow coastal communities to become resilient and loveable places.

Development codes can promote this pattern by allowing smaller lot sizes or by averaging lot sizes, with upper and lower thresholds.

Lot Coverage. Maximum lot coverage is another regulatory device that must be addressed if compact development is to occur. The tendency in some coastal areas is to discourage compact development by applying low lot coverages of 20 to 40 percent. The idea is that by spreading development out the large pervious lot areas will absorb stormwater.

While this approach may at first seem reasonable, there is no amount of pervious lot area that can absorb the storm surge associated with a major storm event. The "safe" land is too valuable for this approach. A more appropriate approach is to allow much higher lot coverage (70 to 90 percent) in areas of high resiliency. By building compactly in the high-resiliency areas, communities are able to leave the less resilient land open for stormwater.

Street Setbacks. As with lot size and lot coverage, large minimum setbacks can lead to difficulties in building compactly. Allowing, or in some conditions requiring, a built-to environment where the buildings are placed at the street can help in two ways. It makes building compactly more efficient and helps activate the streetscape by reorienting the street toward the pedestrian scale.

Building Compactly in Rural Areas?

It may seem counterintuitive, but even in coastal areas that are perceived as "rural" in character, compact, mixed use, and vibrant development patterns can contribute to improved resiliency. Fundamentally, the same policy applies. If density is clustered into small rural nodes it shrinks the area to be protected and can make certain defense strategies more affordable. An example of this development type can be seen in the clustered density of Hallig Hoog, Germany.

The settlements on this rural island are on a handful of elevated *terpen*, or earthen mounds. The top of each one- to three-acre terpen is developed with a small number of compact farmsteads, homes, shops, restaurants, hotels, or civic buildings. Several times a year, storms flood the lowlands, but the elevated terpen and their associated development are out of harm's way. Each terpen has a compact design, with a clustered density of around eight to 12 units per acre, but maintain a low overall gross density of less than one unit/40 acres. This settlement pattern provides the two benefits noted above. The compact, mixed use, walkable clusters maintain a rural form while shrinking the area that must be protected from storms and flooding, and it allows the community to pool their resources to elevate and maintain the terpen.

A similar development pattern is achievable along the United States coast through the use of innovative zoning and subdivision rules. Alternative subdivision types, such as cluster or conservation subdivisions, along with mixed use zoning districts that allow for consideration of gross density in rural areas, can work together to allow this pattern. The zoning districts should respect the rural character using building type or other form controls to promote hamlet-style settlements in "rural"

Sandra Buhmann

At Hallig Hooge in Germany, density is clustered on individual mounds, leading to a compact, yet rural, pattern.

high-resiliency areas. Further, these clusters may eventually grow into the coastal towns and cities of tomorrow.

Zoning for Areas of Low Resiliency

The most difficult issue a community is likely to face in managing coastal growth will be limiting development in low-resiliency areas. To effectively do this there must be a concerted effort by the community to coordinate all of the growth management tools at their disposal. Policies addressing zoning as well as targeting investment in infrastructure and public services toward areas of high resiliency must work together to make this a successful strategy. In some cases the concept of transfer of development rights might be a viable option to quiet opposition or legal challenges to any perceived downzoning.

From a zoning perspective, the main objective is to minimize development or, at a minimum, rethink redevelopment. Zoning districts should be rural in nature with gross densities no higher than one unit/20 acres. Rural and agricultural uses, along with resource extraction and other non-development-focused land uses, may continue.

Inevitable Structures. The reality of the coast is that even in areas of the lowest resiliency, where no one should build anything, there will still be a need for certain structures. Ice houses for coastal fishermen, oil and gas staging areas, and other inevitable structures will exist. These structures may build on stilts, use floating building designs, temporary structures, or other building-specific defense strategies to deal with such hazardous environments. Zoning codes should accommodate such uses and building strategies in these areas of low resiliency.

Built Areas of Low Resiliency. Areas of low resiliency that have already been built require a different approach. Communities may be forced to choose whether to abandon or to fortify. Some communities may rezone the area so that if destroyed in future storms the existing structures must be rebuilt applying building specific defense strategies. Other communities may choose to relocate remaining residents to safer places. The Center for Planning Excellence in Baton Rouge, Louisiana, will soon publish a "Coastal Best Practice Manual" that will help coastal communities think through many of these challenging issues.

HOW DO WE BUILD?

Once a community has answered the questions where to build (e.g., in high-resiliency areas) and what to build (e.g., compact, mixed use, vibrant places), it must finally address the question of how to build.

Clearly, the answer is structures that are built to the best and latest building codes with local amendments that consider the caliber of storm events in your community. Buildings in hazardous coastal areas should be able to withstand stronger winds than buildings further inland. In most coastal areas concrete houses are going to be better at withstanding surges and occasional flooding than stick-built houses. See the discussion above about how compact form could enable more investment in better buildings.

A TIME TO REBUILD: SEIZING THE OPPORTUNITY AHEAD OF TIME

Very often the best opportunity to correct some of the mistakes of the past is right after a disaster. But that is also just about the worst possible time to plan for redevelopment. Unless some prior thinking and planning has gone into how to redevelop destroyed areas after a catastrophic storm, these areas will likely redevelop just as they were before the storm. Not only is good planning necessary, public buy-in to the process will be critical to developing the political will to make the necessary changes. The Florida Division of Community Planning has just released a publication and website on post-disaster redevelopment planning (www.dca.state.fl.us/fdcp/dcp/PDRP/toolbox.cfm).

CONCLUSION

Building a vibrant and walkable (and therefore compact) coastal community is the first and most important step toward building a safe and resilient coastal community. But it is far from the only step. Communities must be committed to focusing compact growth in areas of high resiliency while limiting growth in areas of low resiliency. Development codes are another very important part of the battle. Coastal communities must also make policy decisions about where they invest in infrastructure and public services. Providing sewer, water mains, or high-capacity roads in areas of low resiliency will work against even the most stringent development codes.

Our oldest and most beloved coastal cities provide us with some of the best models to follow: the least hazardous location for the best possible situation, and a town form worth defending. These communities have weathered coastal hazards for generations. Where they have failed, it is because they ceased to follow the model, such as the lower parts of New Orleans. If we build for people first, respecting the limits of nature, our coastal communities will indeed be enduring.

Architectural detail of a balcony in New Orlean's French Quarter. © iStock.com/Paul Giamou; design concept by Lisa Barton.

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ZONING PRACTICE
AMERICAN PLANNING ASSOCIATION

205 N. Michigan Ave.
Suite 1200
Chicago, IL 60601–5927

1030 15th Street, NW
Suite 750 West
Washington, DC 20005–1503

HOW RESILIENT IS YOUR COMMUNITY?

1