

Gulf Coast Disaster Resilience

The Gulf Coast region of the United States is an ideal setting for the study of resilience. The region's history tells a story of people and communities able to withstand adversity, rebuild after devastation, and navigate uncertainty. Woven into this narrative is a series of focusing events that contributed to the development of emergency management in our nation, including the Hurricane of 1900 in Galveston, Hurricane Andrew in Florida, and Hurricane Katrina, which affected the entire Gulf Coast region. Most recently the region has managed the biggest environmental disaster in history—the BP *Deepwater Horizon* oil spill. These events have not only defined and reframed the role and purpose of our federal government in disaster management; they have shown that if resilience is to be found in tangible, meaningful forms, it is in the Gulf Coast.

DEFINING RESILIENCE

Broadly, disaster resilience can be defined as *a set of adaptive capacities that imbue a community with the strengths needed to respond, cope, and recover from a disaster event as well as a process of collective action enabled by these capacities to adapt to the post-disaster environment*. Measuring resilience in a meaningful way requires that we assess a community's adaptive capacity or its *collective strengths and abilities to prevent, withstand, and manage a disaster event*. Adaptive capacities largely entail tangible products and observable characteristics of a community.



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OVERVIEW OF ADAPTIVE CAPACITY FOR DISASTER RESILIENCE

Measuring resilience in a meaningful way requires that we assess a community's adaptive capacity or its *collective strengths and abilities to prevent, withstand, and manage a disaster event*. Adaptive capacities largely entail tangible prod-

ucts and observable characteristics of a community. These can be broken into six components: social capacity, community capital, economic capacity, institutional capacity, infrastructure capacity, and ecological capacity. These are detailed below.

Adaptive capacity for disaster resilience are a community's collective strengths and abilities to prevent, withstand, and manage a disaster event.

Adaptive capacity for disaster resilience is the collective strengths a community has to be able to prevent, withstand, and manage a disaster. This collective ability, however, can be broken into several parts—all of which are critical for building a community that is able to effectively manage disasters. These include:

Social capacity for resilience is the aggregation of a community's characteristics including age, education levels, wealth, and language capacity that translate to able, mobile, and resource-enabled individuals in the event of a disaster.

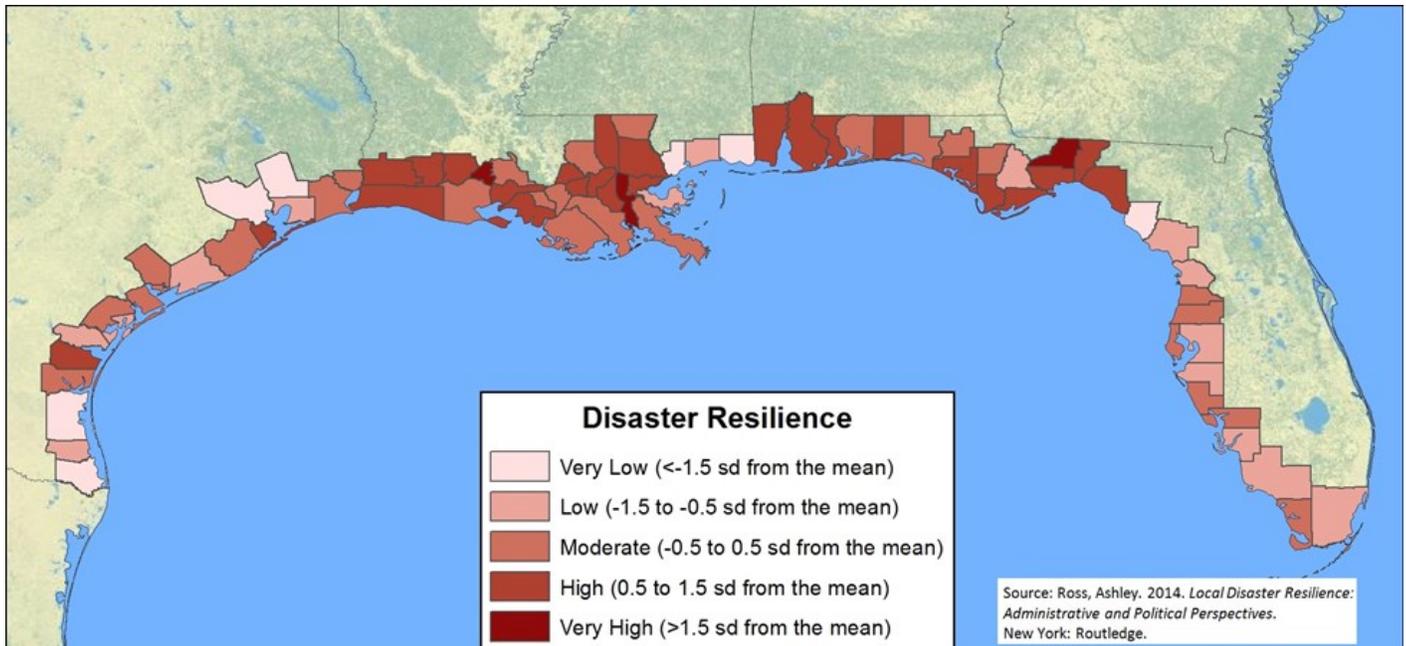
Community capital refers to the connectedness of community members that enable cooperation and collaboration in disaster planning, response, and recovery.

Economic capacity for resilience refers to the robustness and diversity of a community's economy including employment, labor sectors, and distribution of wealth.

Institutional capacity for resilience concerns the plans and preparations a community has made for disasters.

Infrastructure capacity for resilience refers to a community's basic public service capacity in terms of shelter, roads, and medical facilities that may be needed in the event of a disaster.

Ecological capacity for resilience speaks to how community development has affected natural coastal barriers such as wetlands.



Adaptive Capacity for Disaster Resilience across the Gulf Coast

COMPARING GULF COAST DISASTER RESILIENCE

The disaster resilience index measuring county adaptive capacities was calculated by summing six resilience component indices—social capacity, community capital, economic capacity, institutional capacity, infrastructure capacity, and ecological capacity. Each component index contained multiple indicators so that the aggregate index reflects 37 measures of adaptive capacities. The disaster resilience index is presented spatially in the above map. The map reports categories of resilience based on transformed disaster index scores (z-scores). Note that the scores rank each county and parish in relation to the others in the sample. The categories of resilience shown are: very low (less than 1.5 standard deviation units below than the mean), low (between 1.5 and 0.5 standard deviation units below than the mean), moderate (between 0.5 standard deviation units lower than the mean and 0.5 standard deviation units above the mean), high (between 0.5 and 1.5 standard deviation units above the mean), or very high (greater than 1.5 standard deviation units above the mean). Darker shading indicates higher resilience.



Baldwin County, Alabama scored high on the adaptive capacity for disaster resilience index. Among the components of adaptive capacity measured, Baldwin County scored very high on social capacity, moderate on community capital, moderate on economic capacity, high on institutional capacity, moderate on infrastructure capacity, and low on ecological capacity. The measures used to create these rankings and the data collected for Baldwin County are shown on the following pages.

ADAPTIVE CAPACITY FOR DISASTER RESILIENCE INDICATORS

Indicator	Definition (+/- Effect on Resilience)	Data Source
SOCIAL CAPACITY		
education	Percent of the population with a college degree (+)	American Communities Survey 2010
transportation access	Percent of households with a vehicle (+)	American Communities Survey 2011
communication capacity	Percent housing units with a telephone (+)	American Communities Survey 2011
language competency	Percent of the population over 5 years of age that speak English "very well" (+)	American Communities Survey 2010
non-vulnerable pop	Percent non-elderly population (+)	USA Counties 2009
	Percent population without a physical disability (+)	US Census 2000
health care coverage	Percent population with health insurance (under 65 years of age) (+)	USA Counties 2007
COMMUNITY CAPITAL		
place attachment	Net international migration per 1,000 population (-)	American Communities Survey 2009
	Percent of the population born in the state that resides in the state (+)	American Communities Survey 2010
political engagement	Percent voter turnout in 2008 presidential election (+)	Secretary of State/Dept. of State 2008
	Religious adherents per 1,000 (+)	ASARB 2010
social capital	Civic organizations per 10,000 (+)	County Business Patterns 2009
	Social advocacy organizations per 10,000 (+)	County Business Patterns 2009
ECONOMIC CAPACITY		
housing capital	Percent owner occupied housing (+)	US Census 2010
employment	Percent of the population that is employed (+)	American Communities Survey 2010
	Percent of labor force that is female (+)	American Community Survey 2010
income equality	Quintiles of Gini Index (higher values = more equal) (+)	American Communities Survey 2012
economic diversity	Percent of the pop not employed in farming, fishing, forestry, or extractive industries (+)	US Census 2012
business robustness	Ratio of large to small business employees (+)	US Census 2009
health care access	Total physicians per 10,000 (+)	USA Counties 2009
INSTITUTIONAL CAPACITY		
mitigation plans	Percent population covered by a multi-hazard mitigation plan (+)	FEMA 2012
	Percent population participating in Community Rating System (+)	FEMA 2012
mitigation organizations and activities	Percent population covered by Citizen Corps council (+)	Citizen Corps 2012
	Percent population in Storm Ready communities (+)	NOAA 2012
emergency services	Percent local government expenditures for health/hospitals, fire and police (+)	USA Counties 2002
admin decentralization	Number of municipalities, school districts, and special districts (-)	US Census 2007
disaster experience	Number of Presidential disaster declarations, 2002-2011 (+)	FEMA 2012
INFRASTRUCTURE CAPACITY		
housing vulnerability	Percent of housing not mobile homes (+)	American Communities Survey 2010
	Percent housing units built 1970-94 (-)	American Communities Survey 2010
evacuation capacity	Primary and secondary road miles per square mile (+)	US Census 2010
medical capacity	Number of hospital beds per 10,000 (+)	County and City Data Book 2007
	Percent vacant rental units (+)	US Census 2010
shelter capacity	Number of hotels/motels per square mile (+)	County Business Patterns 2009
	Number of public schools per square mile (+)	FEMA Hazus 2.0 2011
ECOLOGICAL CAPACITY		
wetland preservation	Net change in percent wetland area between 1996 to 2006 (+)	NOAA 2010
impervious surfaces	Percent impervious surface in square miles of land area (-)	National Land Cover Database 2006
floodplain development	Index of severe repetitive loss properties (higher values = more loss) (-)	FEMA 2007

ADAPTIVE CAPACITY FOR DISASTER RESILIENCE

BALDWIN COUNTY, ALABAMA DATA

Indicator	Definition (+/- Effect on Resilience)	Data
SOCIAL CAPACITY		
education	Percent of the population with a college degree (+)	18%
transportation access	Percent of households with a vehicle (+)	83%
communication capacity	Percent housing units with a telephone (+)	97%
language competency	Percent of the population over 5 years of age that speak English "very well" (+)	97%
non-vulnerable pop	Percent non-elderly population (+)	98%
	Percent population without a physical disability (+)	92%
health care coverage	Percent population with health insurance (under 65 years of age) (+)	82%
COMMUNITY CAPITAL		
place attachment	Net international migration per 1,000 population (-)	0.97
	Percent of the population born in the state that resides in the state (+)	54%
political engagement	Percent voter turnout in 2008 presidential election (+)	77%
	Religious adherents per 1,000 (+)	531.74
social capital	Civic organizations per 10,000 (+)	1.17
	Social advocacy organizations per 10,000 (+)	0.39
ECONOMIC CAPACITY		
housing capital	Percent owner occupied housing (+)	73%
employment	Percent of the population that is employed (+)	93%
	Percent of labor force that is female (+)	47%
income equality	Quintiles of Gini Index (1 to 4 scale; higher values = more equality) (+)	2
economic diversity	Percent of the pop not employed in farming, fishing, forestry, or extractive industries (+)	98%
business robustness	Ratio of large to small business employees (+)	0.62
health care access	Total physicians per 10,000 (+)	26
INSTITUTIONAL CAPACITY		
mitigation plans	Percent population covered by a multi-hazard mitigation plan (+)	100%
	Percent population participating in Community Rating System (+)	100%
mitigation organizations and activities	Percent population covered by Citizen Corps council (+)	0%
	Percent population in Storm Ready communities (+)	100%
emergency services	Percent local government expenditures for health/hospitals, fire and police (+)	34%
admin decentralization	Number of municipalities, school districts, and special districts (-)	33
disaster experience	Number of Presidential disaster declarations, 2002-2011 (+)	10
INFRASTRUCTURE CAPACITY		
housing vulnerability	Percent of housing not mobile homes (+)	86%
	Percent housing units built 1970-94 (-)	39%
evacuation capacity	Primary and secondary road miles per square mile (+)	0.66
medical capacity	Number of hospital beds per 10,000 (+)	32.06
shelter capacity	Percent vacant rental units (+)	25%
	Number of hotels/motels per square mile (+)	0.02
service restoration	Number of public schools per square mile (+)	0.04
ECOLOGICAL CAPACITY		
wetland preservation	Net change in percent wetland area between 1996 to 2006 (+)	-1.5%
impervious surfaces	Percent impervious surface in square miles of land area (-)	6%
floodplain development	Index of severe repetitive loss properties (0 to 4 scale; higher values = more loss) (-)	4

Excerpt from Chapter 6 “Exploring the Adaptive Process of Resilience across the Gulf Coast” in Local Disaster Resilience: Administrative and Political Perspectives (Routledge, 2014) by Ashley D. Ross

“Disaster recovery is the least understood aspect of emergency management among both scholars and practitioners,” noted hazards scholar Gavin Smith in his book *Planning for Post-Disaster Recovery*.¹ Some of our lack of understanding is due to the inherent qualities of the recovery process. It is not linear, does not occur within specific bounds of time or physicality, and is overall a messy process. Resilience promises, however, that despite the complications posed by this process, we can create positive changes in a community following a disaster event. To accomplish these changes on a local level requires commitment to the adaptive process of resilience. This process is exemplified by four attributes: improvisation, coordination, engagement of the community, and endurance.

The adaptive process takes place after a disaster has occurred. The initial response to a disaster largely relies on pre-developed plans and arrangements for emergency response to the event. A community’s adaptive capacities—its social, economic, institutional, infrastructure, and ecological strengths—determine how well it is able to respond to a disaster. Often disasters wipe out, at least temporarily, a community’s capacity. Therefore, the adaptive process takes place once the initial shock of the event dissipates and community capacity is somewhat restored. In this space, there is the opportunity for coordination to meet short-term demands brought on by the event by connecting resources with needs through collaborative networks, not command-and-control. It also invites citizen and private partners to participate in long-term recovery planning and efforts, seeking to create a new and possibly improved environment.

There are four attributes that characterize the adaptive process. The first is *improvisation*. The adaptive process of resilience begins when local solutions are initiated to meet local needs post-disaster. Impromptu action to restore func-

tioning and rebuild the community tends to be more flexible and needs-driven. The second is *coordination*. Connecting resources to meet response and recovery needs post-disaster is an imperative part of the adaptive process. Coordination is needed to meet basic needs following a disaster event, and collaboration among stakeholders is imperative in the recovery process for positive, sustainable solutions to be implemented.

The third attribute of the adaptive process is *engagement of the community*. Involvement of the community and key stakeholder groups in decision making related to recovery projects is needed to create outcomes that are sustainable and that adapt to—ideally, improve upon—the post-disaster environment. Engagement of broad community groups should help produce better solutions as a diverse set of interests is represented. The fourth is *endurance*. Recovery solutions created in the post-disaster context are often put together piecemeal over extended periods of time. To ensure that the outcomes created continue beyond the disaster event, the lessons learned must take on some quality of endurance. Formalizing programs and plans into policy is one way that endurance can be achieved. In other circumstances, a lesson learned may be so profound that it becomes part of the community’s collective memory, and thus part of social norms and behavior in the post-disaster environment.

Not all of these attributes may be evident; certainly there is not “one size fits all” in terms of how the adaptive process unfolds. It works on multiple levels, horizontally across citizen groups and vertically connecting municipal governments to state and federal agencies. It also is a dynamic process unfolding over time and to varying degrees. This means that it is a process that can be difficult to trace. Nonetheless, it is important that we study how it manifests within communities so that we may better understand how resilience develops. The following case study looks at an example of the adaptive process that occurred in Baldwin County, Alabama following the BP *Deepwater Horizon* explosion and oil spill.

A CASE STUDY IN RESILIENCE: THE COASTAL RESILIENCY COALITION

On April 20, 2010 the BP-operated Macondo 252 oil well exploded off the coast of Louisiana, spewing crude oil into the Gulf of Mexico.² The well's drilling rig, *Deepwater Horizon*, caught fire later the same day killing 11 of its 126 person crew. Two days later the rig sunk, and oil continued to gush into the Gulf for a total of 87 days until the well was successfully capped on July 15. By that time, nearly five million barrels or over 200 million gallons of crude oil had been released into the Gulf; this was nearly 20 times the volume associated with the Exxon *Valdez* tanker accident of 1989. The BP oil spill contaminated 250 square miles of the ocean affecting the states of Texas, Louisiana, Mississippi, Alabama, and Florida including 53 counties and parishes. The spill had also captured national and international media attention as the long struggle to cap the well threatened the ecological and economic health of the region.

In the days following the BP *Deepwater Horizon* explosion concerned elected officials and business leaders from Baldwin County, Alabama met together at a local realty office to brainstorm ideas of how to manage this unprecedented event; of particular importance for this group were the economic and health impacts of the spill. This meeting included “the mayors of Gulf Shores, Orange Beach and Foley, as well as representatives of the Alabama Gulf Coast Chamber of Commerce, South Baldwin Chamber of Commerce, Gulf Shores/Orange Beach Tourism, Faulkner State Community College and the Baldwin County Economic Development Alliance.”³ From this gathering emerged the Coastal Resiliency Coalition (CRC); the meeting place became known as the “War Room” as this organization led a fight for the survival of local businesses and economies.

The primary focus of the CRC was initially to help businesses withstand the economic shock of the oil spill and ultimately to restore economic well-being and growth to the tri-city area including Gulf Shores, Foley, and Orange Beach. Businesses in Baldwin County rely directly or indirectly on tourism;⁴ the county generates a quarter of the state's tourism revenue.⁵ This revenue dropped significantly following the oil spill. Bald-

win County reported a 9 percent drop in tourist/travel related employment in 2010 compared to 2009—the equivalent of 2,532 jobs. In addition, overall tourism earnings decreased by 8 percent totaling over \$76 million in the same year.⁶ The oil spill coincided with the economic downturn that negatively affected the entire nation. From the perspective of a Gulf Shores city council member, already vulnerable businesses that had “scrimped and saved and hung on” during the recession were ready for the summer tourist season only to “open their doors for business to find no customers because of this oil spill.”⁷

To address this economic loss, the CRC met in the War Room twice a week, and in between meetings, focus groups were held with local stakeholder groups including restaurateurs, small business owners, and realtors. According to the one city council member, these meetings exposed that local businesses “don't communicate with each other, even restaurants don't communicate with other restaurants about what problems they may be having in common. From a city's point of view, you don't usually hear from the business community unless you're doing something they don't like. Then they ban together. They go to a meeting. But they don't ban together and become proactive.”⁸ The CRC provided a forum for local businesses to join together and make plans to address the economic impact of the oil spill. It also connected businesses to important resources that facilitated economic recovery.

In the aftermath of the oil spill, multiple business and employment assistance groups set up local offices in the Baldwin County area. These included the Small Business Association, the Alabama Career Center, and the University of South Alabama's Small Business Development Center.⁹ The CRC in conjunction with the South Baldwin Chamber of Commerce brought these groups together to form the Baldwin Business Support Center (BSC). The BSC was focused on helping small business owners file claims with BP and learn strategies for expanding their product line, training employees, and finding new markets in an effort to recover from economic loss associated with the oil spill.¹⁰

A CASE STUDY IN RESILIENCE: THE COASTAL RESILIENCY COALITION

The BSC operated “on faith” initially with limited support from various revenue streams;¹¹ more substantial funding was secured in 2011 with a \$50,000 grant from BP and \$200,000 award from the Community Foundation of South Alabama.¹² A year into operations, BSC began to intently focus on promoting business sustainability by offering assistance with the development of business plans and providing programs to teach techniques for running a “lean enterprise.”¹³

These programs continued to expand in the following years to the present with a focus on three “C’s—counseling, connecting and competing—all with the goal of making the coastal business community more resilient before the next crisis comes,” according to director Rick Miller.¹⁴ The BSC counsels business owners to develop business and marketing plans in efforts to improve their operations.¹⁵ The center also works to connect local businesses with banks for financing as well as state and federal governments for assistance programs, and it offers workshops on financial modeling and budgeting that help local businesses increase their competitiveness and profit margin. The BSC continues its operations today supported through a partnership between Alabama Gulf Coast Area Chamber of Commerce, South Baldwin Chamber of Commerce, Faulkner State Community College, and Baldwin County Economic Development Agency.¹⁶

Beyond its efforts with the BSC, the CRC worked with local groups in the region to rebrand the Gulf Coast. Developing marketing strategies and taking an active role in communications was a critical activity of the CRC as a flurry of media attention was focused on the Gulf Coast and on Alabama beaches in particular. One CRC activist and Gulf Shores city council member reflected: “The spill was in late April; the press kept on saying that oil would be on Alabama beaches that weekend. But it wasn’t. There was not anything here until after Memorial Day. But the media damaged and cost us business in May.”¹⁷ Oil did wash ashore in Baldwin County in June, and the beaches were spotted with tar balls. This raised serious health concerns that the CRC monitored carefully. Those active in the coalition, however, became

frustrated with the proliferation of mixed messages circulated by national media; in particular, tensions were high over those that focused on environmental and health testing conducted by outside experts reporting directly to research entities or media outlets without first communicating with local leaders.¹⁸ Instead of relying on these sources, the CRC took cues from local leadership that sought out the expertise and guidance of state health officials.¹⁹

One big health concern was the safety of Gulf seafood. These concerns were quickly answered with scientific testing. In late August of 2010 state marine scientists reported that Gulf fish and shrimp were safe to eat.²⁰ Two months later the Federal Department of Agriculture and the National Oceanic and Atmospheric Administration released a statement that all Gulf seafood samples tested within safety thresholds.²¹ Despite these reports, negative perceptions of Gulf seafood lingered. In an effort to recast the Alabama coast, the CRC in conjunction with Gulf Shores and Orange Beach Tourism hosted “Supper on the Sand” on April 17, 2011, a date marking the one year anniversary of the oil spill.²² The event took place at Gulf State National Park Beachside Pavilion to highlight the clean beaches and safe waters. It was a celebration of recovery from the spill and featured Gulf seafood, which was praised by attendee celebrity chef Guy Fieri. As tourism increased the following summer, the CRC breathed a sigh of relief but knew there was still work to be done.



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A CASE STUDY IN RESILIENCE: THE COASTAL RESILIENCY COALITION

Much of the continuing efforts of the CRC have involved addressing mental health issues of the community related to the oil spill. In the months following the spill, local fishermen and businessmen were under acute stress; this was linked to the suicide of one local boat captain.²³ The CRC recognized that this was an issue as critical as and tangential to economic recovery. The coalition teamed up with the Alabama Department of Mental Health's Project Rebound, an organization established after Hurricane Ivan, to offer crisis counseling to communities following a disaster.²⁴ The CRC kept track of call-ins to Project Rebound²⁵ and brought together mental health officials and experts in the region to help supplement counseling efforts;²⁶ this included extending counseling services to local schools to address stress experienced by children of families that were experiencing financial and emotional issues following the oil spill.²⁷ The coalition also remained focused on helping those economically displaced by the spill to find jobs. "The best way you can relieve somebody's stress is to get them a good-paying job. And that gives them confidence in the future," remarked Bob Higgins the CRC chairman in 2011, a year after the spill.

In 2012 the CRC gained status as a 501(C)(3) nonprofit organization.²⁸ Its efforts to help local businesses survive and rebound from the oil spill have largely been realized. Tourist revenue set record highs in 2012 generating \$40 million more in taxable lodging revenue than 2011.²⁹ Retail sales were also 8 percent higher in 2012 than 2011. Additionally, Baldwin County has experienced recent population growth according to the latest census.³⁰ It is also the focus of new development projects to restore part of a 1.6 mile section of the shoreline and to rebuild and expand the convention center at the Gulf State National Park.³¹ These projects were announced by Alabama's governor in May 2013 and will be funded with BP oil spill fines distributed through the Restore Act passed by Congress in 2012.³² In all, the economic future of Baldwin County looks bright. But if it were to encounter challenges, another economic shock or downturn, the CRC will mobilize again. Donna Watts, president of the South

Baldwin Chamber, characterized the coalition's role as: "It's like a family having a crisis plan. If the house catches on fire, where are we going to meet? Everybody knows that when the crisis happens, the CRC or the War Room is where we go to help each other and to communicate thoroughly and find resources."³³

The Four Attributes of the Adaptive Process as Related to the Coastal Resiliency Coalition

The establishment and ongoing operations of the Coastal Resiliency Coalition (CRC) is an example of the adaptive process of resilience at work. The CRC emerged in the aftermath of the BP *Deepwater Horizon* oil spill. The spill was an unforeseen and unprecedented disaster. The establishment of the CRC in the early days of the spill was the product of improvised action on part of local business and elected leadership. No local plans existed on how to deal with a disaster event of this type and scale; existing emergency response frameworks were better suited for hurricane events. Therefore, the simple act of calling an impromptu meeting to identify local issues and brainstorm local solutions was the first step in building a resilient response and recovery to the spill.

The CRC also exhibited a high degree of coordination and collaboration. It had the primary goal of connecting local businesses with the resources needed to help them survive the spill. The coalition coordinated the establishment of the Baldwin Business Support Center which effectively linked existing state and local employment and business assistance agencies and programs in a central location. It also collaborated with mental health agencies to expand local services to schools and parts of the community in need and coordinated with local chambers of commerce, businesses, and municipal governments to promote economic diversity and new marketing strategies for the region. The strength of the coalition has been its ability to facilitate collaboration by uniting resources and services with common goals to address the needs of the local community.

A CASE STUDY IN RESILIENCE: THE COASTAL RESILIENCY COALITION

The coalition engaged the community in multiple ways in its efforts to address local economic well-being. Leaders of the coalition were assigned to meet with stakeholder groups including restaurateurs, realtors, and hotel owners to determine what the community needed. It also invited the input and expertise of local academic institutions and brought together multiple local and statewide business associations. The CRC also relied on its active members to represent citizen needs; given that leaders of the group included elected city council members, chamber and economic development organization presidents, much of its community engagement took place outside coalition meetings.³⁴

Finally, the CRC has exhibited endurance. It gained status as a nonprofit organiza-

tion, and the Business Support Center continues its operations today. While the coalition has tapered off its activity, meeting less and no longer issuing a newsletter, its presence in the community is still felt.³⁵ It continues to promote economic growth and small business sustainability. Moreover, there is an understanding among community members that the CRC can be mobilized again to coordinate local efforts in the event of a future crisis.³⁶ Its lasting legacy, therefore, is more a method of collaboration among concerned local citizens and leaders than an organizational structure. Its membership may change; its War Room may even move to another physical location, but its mission to connect resources to meet local needs will endure.

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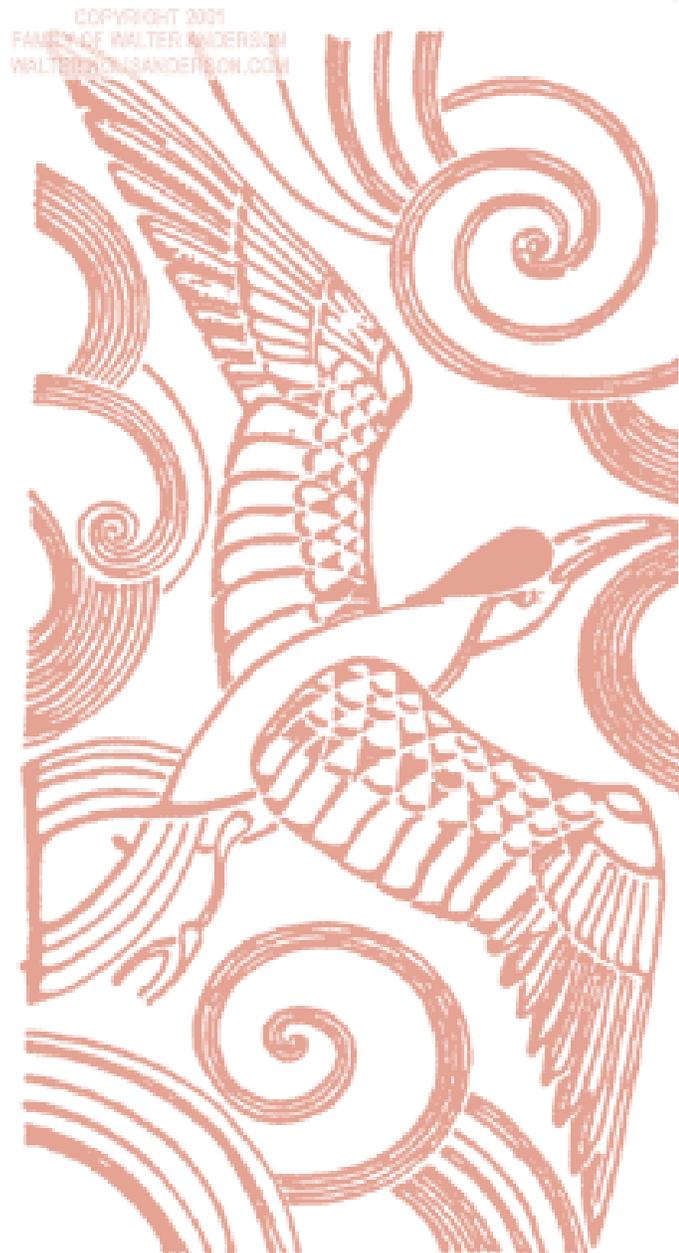


A NOTE REGARDING THIS REPORT

The findings presented in this report are part of a larger research project and book titled *Local Disaster Resilience: Administrative and Political Perspectives* (Routledge, 2014). This project explores how disaster resilience is perceived and practiced through secondary data sources as well as original surveys of county emergency managers and elected municipal officials. A measure of capacity for disaster resilience is presented and analyzed for 75 Gulf Coast counties. Additionally, perceptions and experiences of local officials across 56 counties and 122 municipalities in the Gulf Coast region are assessed. These findings of these analyses shed light on how resilience is understood by local officials and on the attributes and circumstances that facilitate the development of resilience on the local level. To learn more about this research, please visit localdisresilience.com.

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