

**BUILDING COMMUNITY RESILIENCE:  
FOUR CASE STUDIES FROM POST-KATRINA MISSISSIPPI**

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## ABSTRACT

This paper explores the resilience of communities on the Mississippi Gulf Coast after Hurricane Katrina. Comparing data from 2000 and 2010 (five years before and five years after Katrina), communities with high and low levels of resilience were selected for analysis. Based on these data, selected high resilience communities were Waveland and Ocean Springs and low resilience communities were East Biloxi and Pascagoula. All four communities have relatively similar walkable, mixed-use, connected urban forms. Given the importance of social networks in resilience and influence of the built environment on social networks, the research investigates the possible variables that contribute to the case study communities' relative levels of resilience: social network qualities, related built environment qualities, or other possible explanations. Interviews were conducted with residents in each of the four communities representing a diverse array of community service providers and demographic groups. Results indicate that strong local networks of support and a varied built environment tend to be associated with higher community resilience.

## BACKGROUND

Resiliency is the ability to rebound after a disturbance. With roots in ecology (Holling, 1973), it is commonly applied to communities in disaster planning and emergency management. The parallels between natural and human-made systems make this a meaningful comparison. Each include complex, interdependent systems, characterized by cycles of growth and decline, and both are vulnerable to endogenous forces such as overconsumption and exogenous outside forces such as natural disasters. With respect to disasters, human vulnerabilities have been increasing while the expectations of a prompt, effective response also have been mounting. Traditional command-and-control, protection and response strategies are still important, however, a resilience-based approach is more important than ever in protecting communities.

Social networks are a common factor understood to be important for community resilience. Strong social networks provide many benefits to individuals, households, and organizations: physical, psychological, and social well-being (Aday, 1994; Berkman, Glass, Brissette, & Seeman, 2000); employment opportunities (Granovetter, 1973; Montgomery, 1991); access to financial resources (Ben-Porath, 1980); information seeking and utilization of social services (Birkel

&Reppucci, 1983); and community mobilization (Snow, Louis A. Zurcher, & Ekland-Olson, 1980). While these features have bearing on the ability to survive and recover from a disaster, social networks also have specific properties that instill disaster resilience. In particular, social networks have been shown to reduce vulnerability in preparing for and responding to a disaster (Cutter, Boruff, & Shirley, 2003), to increase the effectiveness of response and mitigation strategies such as evacuations (Aguirre, 2006), and to increase preparedness (Paton, 2003).

Social networks are difficult to measure and understand. However, scholars have established a link between the physical layout and design of cities and social interaction. For example, Jane Jacobs' influential work argued that neighborhood parks, mixed primary land uses, small blocks, and concentrated development, and a variety of building ages increase the social and economic vitality of a city (Jacobs, 1961). More recently, these links have been empirically tested, notably in studies showing that walkable, mixed-use neighborhoods encourage the development of social capital and place attachment (Leyden, 2003) through an increase in interactions and a higher likelihood of neighborhood amenities. Recent trends such as New Urbanism claim that factors that influence social capital include density, street connectivity, design, and land uses (Talen, 1999).

Place attachment is also a significant topic in discussions of human interaction with the built environment. Place attachment is based on our past interactions and the potential for future interactions between ourselves and our physical surroundings (Milligan, 1998). The bonding of people to place occurs through personal, group, or cultural processes, notably those related to social networks. Studies of destruction of place, through natural disasters or slum clearance, have been used to illustrate the strong connection between a society or community and the specific place in which it resides. Recent work in Louisiana (Burley, Jenkins, Laska, & Davis, 2007) found that cross-generational social and economic ties inspired residents of bayou communities to fight for wetland protection in the wake of Hurricane Katrina.

Another indicator of resilience to natural disasters in particular is the occurrence of similar events. The U.S. Gulf Coast is a region well versed in many types of disasters, from war to weather. In 2005, however, Hurricane Katrina proved to be the storm of the century if not the millennium,

surpassing even 1969's Hurricane Camille (a more intense hurricane on the Saffir-Simpson Hurricane scale), and yet the population of certain areas has largely regrouped and rebuilt. Nonetheless, eight years after the storm, recovery remains uneven across the Gulf Coast. This research explores to what extent the presence of strong formal and informal social networks is the reason for varying levels of resilience and whether networks important for resilience are influenced by the built environment. In order to examine how formal and informal social networks function and support resilience, interviews were conducted in four communities. This work captures the opinions of community leaders and residents as to the importance of social networks and the built environment and other factors that account for the relative resilience of their community.

## METHODOLOGY

Previous work has pointed to the importance of social networks for resilience and of certain types of varied and integrated built environment factors in fostering social networks. This analysis was conducted to explore these links and to respond to three research propositions: 1) social networks are important factors for resilience; 2) social networks interact with and are influenced by the physical environment; and 3) communities with the strongest resilience include both strong social networks and varied and integrated physical environments.

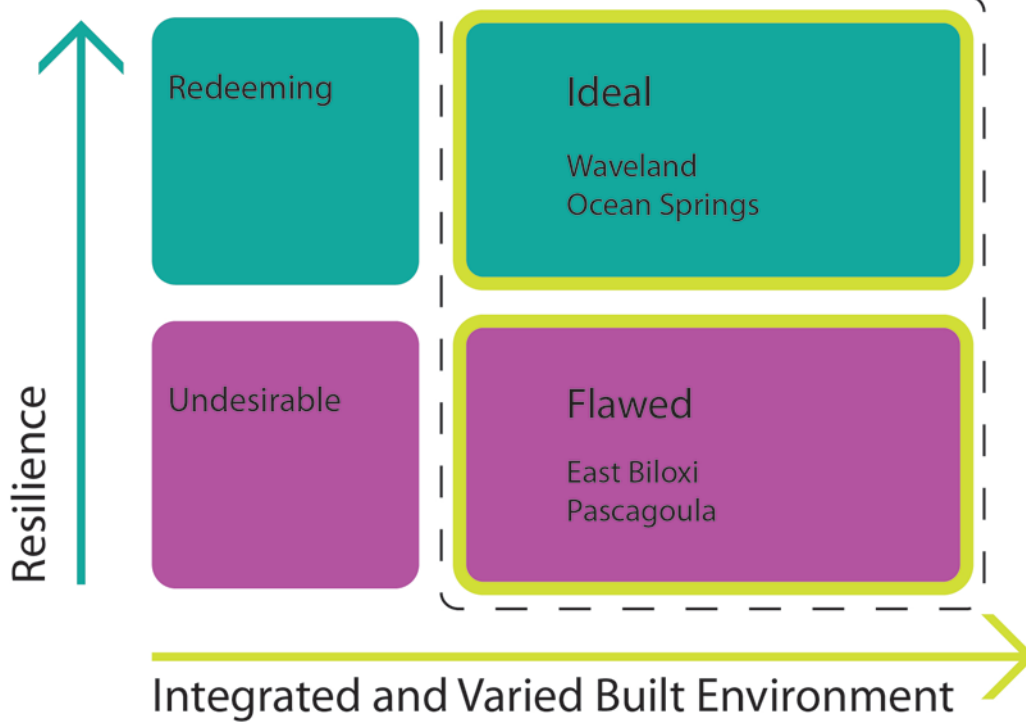
This research focused on Mississippi, although portions of Louisiana (most notably, New Orleans) and Alabama were also impacted by Katrina. There are several reasons for this decision. First, the scale and even type of disaster differed by state. The eye of the hurricane hit landfall near the Louisiana-Mississippi border, therefore Alabama and western Louisiana received unequal forces of winds and rain compared with Mississippi. Damage in New Orleans occurred primarily due to the breaching of levees, which resulted in prolonged flooding rather than wind and short-term storm surge damage. Furthermore, the strategies and levels of state support and the prioritization of funds has differed by state. Finally, the Mississippi Coast, which was brutalized by the storm, has received less attention in many circles than other areas, despite the decimation of its communities. Because of these factors, and because of the substantial population and development of the Mississippi Coast, it was determined that coastal Mississippi should be examined in isolation from the rest of the Gulf Coast for this research.

In order to select the case study communities, resilience and built environment factors were compiled at the Census block group level. Resilience was measured by the change in occupied dwelling units in block groups from 2000 to 2010 (pre- and post-Katrina), normalized by area. Reliable data is not available on who exactly has returned or remained in the area, therefore net numbers were used, assuming the returning population is predominantly original residents or households that would have moved to the area regardless of the storm. This particular metric was selected in order to capture the return of population. While an area's capacity to rebound is also witnessed in the return of businesses and generally of structures and infrastructures, the return of a resident population is even more fundamental. Since this research was focused on household social networks, it was most appropriate to examine the return of each community's human population.

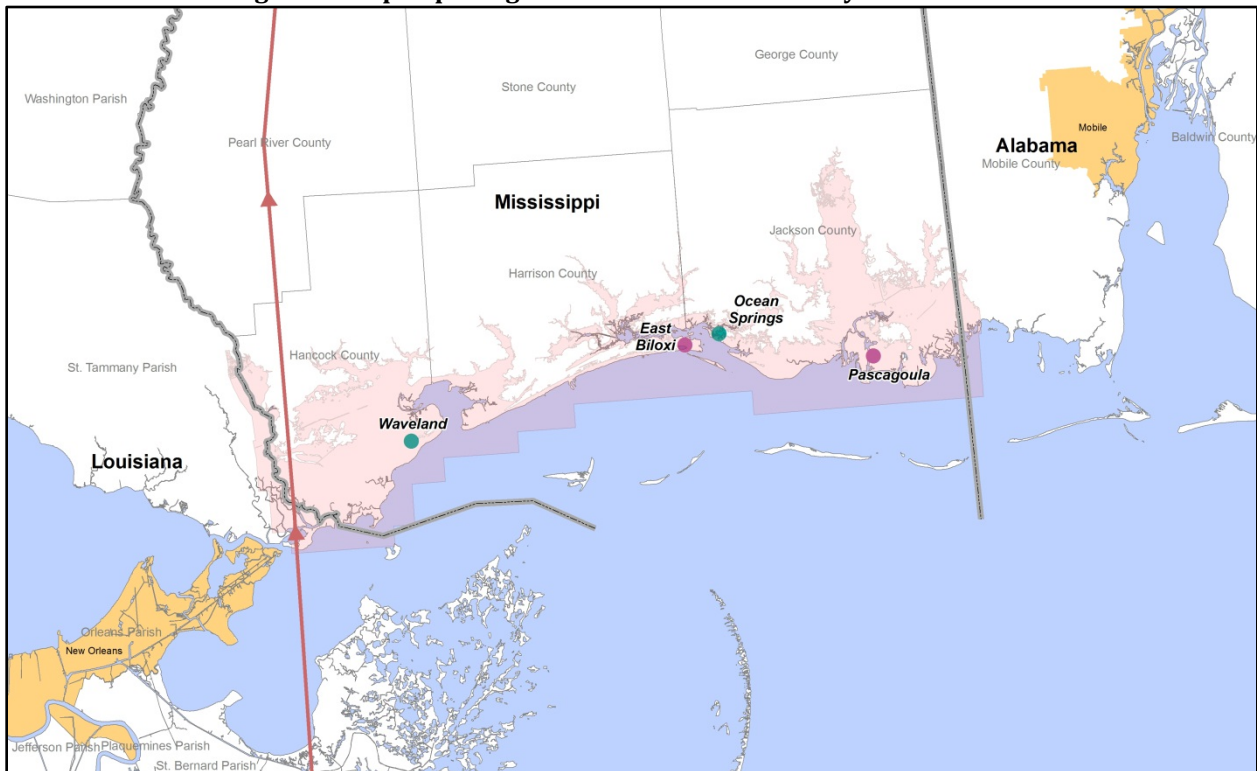
Built environment variables consisted of those qualities that are shown to support social networks. Included were land use mix, density, and connectivity. These metrics are positively associated with pedestrian traffic and social interaction. Other variables include park and open space density and social gathering place density. These measures capture access to spaces in which people are likely to gather. Finally, historical site density was used as a proxy for place attachment, as monuments and heritage sites promote a sense of local continuity.

Communities were chosen from right two quadrants of the matrix shown in Figure 1, the high resilience and high levels of integration and variation in the built environment "ideal" quadrant and the low resilience and high levels of integration and variation in the built environment "flawed" quadrant. There were 270 block groups in the study area, which consisted of three Mississippi counties abutting the Gulf of Mexico. Each block group corresponded roughly to a city neighborhood, increasing in size as population density decreases. Of these, 226 were at least partially in the surge inundation area, land that flooded due to storm surges of up to about 30 feet, and thus were most likely to have incurred some level of hurricane damage. The case study communities chosen from these 226 block groups were small cities or neighborhoods of larger cities: Waveland, Ocean Springs, East Biloxi, and downtown Pascagoula. A map showing the four communities is shown in Figure 2.

**Figure 1: Communities chosen by resilience and built environment characteristics**



**Figure 2: Map depicting locations of four case study communities**



All built environment and demographic variables were calculated for pre-Katrina conditions (data were available from 2000-2004, depending on the measure). This was meant to better capture how initial conditions impacted resilience. The communities were selected by overlaying the built environment variables with a moderate transparency, so that relative tint could be used to identify built environments that were more or less integrated and varied, based on the block group-level measures. Resilience was also mapped at the block group and a number of potential case study communities were determined by this first pass visual scan. Demographic variables and levels of damage were also calculated in order to compare the 11 contenders identified in this scan (Bay St Louis, D'Iberville, East Biloxi, Ocean Springs, Pascagoula beachfront, downtown Pascagoula, Pass Christian and Henderson Point, St Martin, Waveland, and West Gulfport). After removing high-resilience communities with relatively low levels of damage or greatly mismatched demographics, Ocean Springs and Waveland were selected as high-resilience communities. Similarly, East Biloxi and Pascagoula were selected as low-resilience communities. The Waveland and East Biloxi study areas are actually comprised of two block groups to capture a larger area with similar built environment and resilience characteristics. Communities were also selected from all three counties on the coast and alternated between high and low resilience from west to east for geographic variety.

As shown in Table 1, the four communities differ in some ways. In terms of the built environment, all four have a relatively high mix of land uses (0.75 to 0.80), although other measures tended to vary more significantly. Waveland and downtown Pascagoula have lower housing densities, social networking location densities, and parks. Ocean Springs and East Biloxi have the highest densities and mixes of amenities. Therefore, there is some variation amongst the two high resilience and two low resilience communities, respectively, but these differences average out somewhat amongst each group. Overall, Waveland is the least integrated and varied of the four, although amongst all block groups on the coast it is among the most integrated and varied. Unfortunately, it was not possible to find case study communities with greater similarities in built environment metrics along the coast.

In terms of demographics, some differences also exist. Waveland and Ocean Springs tended to have higher incomes, a lower percentage of African-American population, and higher home ownership rates. Being the two high resilience communities, this was not ideal, however, built environment measures were privileged in the selection of communities.

**Table 1: Descriptive statistics, case study communities (pre-Katrina conditions, 2000-2004 data)**

	<b>Waveland</b>	<b>Ocean Springs</b>	<b>East Biloxi</b>	<b>Downtown Pascagoula</b>
Resilience (based on return of households)	high	high	low	low
Land use mix (scale of 0-1; 1=equally mixed)	0.77	0.80	0.80	0.75
Housing density (units/acre)	1.01	1.84	2.62	0.83
Social networking locations per sq km	6.98	110.12	65.71	38.43
Parks per sq km	0.18	4.53	1.29	0.84
Historic sites per sq km	0.18	21.12	6.44	9.71
Average metric reach (1km)	13.14	18.30	30.99	21.40
Intersections per sq km	26.82	79.95	52.83	54.05
Percent African American	22%	25%	83%	56%
Median income	\$34,257	\$48,393	\$19,012	\$25,682
Percent owner-occupied housing	76%	70%	53%	53%
Median home sales	\$55,278	\$53,866	\$35,242	\$44,053
Median year homes built	1974	1952	1953	1939
Satellite data – percent damage (FEMA)	100%	79%	15%	41%
Percent houses damaged (FEMA)	77%	20%	78%	43%
Parcel-level percent damage (FEMA)	26%	13%	48%	19%
Acres	1,345	164	192	585
Population	2,977	532	991	870

Seven subjects were interviewed in each of the four communities. Subjects were identified using a purposive, respondent-driven sampling technique. After first making contact with community leaders in each study area, each leader was asked to identify other residents. In this way, subjects were from a diverse cross-section of each community in terms of age, race, and occupation. This method was used due to its ability to reach hard-to-reach populations.

The first group of interview subjects was identified through two sources. First, subjects were identified through contacts of the Federal Reserve Bank of Atlanta’s list of community and economic development contacts developed by the New Orleans branch, which serves nonprofits,



financial institutions, and other stakeholders on the Mississippi Coast. Second, interview subjects were located through the ReferenceUSA and OneSource databases that were also used to locate social networking organizations. These databases are managed by InfoGroup, a private company that culls business directory data from a large number of sources, including the Yellow Pages and Reuters. Data are rigorously monitored for quality assurance; however, such databases are known to undercount very small and marginalized businesses and organizations, particularly those that are minority-owned.

The ReferenceUSA and OneSource databases include a physical address and Standard Industrial Classification (SIC) code; therefore, all formal community organizations operating in each study area were easily identified. After removing non-verifiable or otherwise inappropriate locations, 59 organizations from industry sectors of educational services, social services, museums and cultural institutions, and membership organizations were identified among the four communities. The database also yielded phone numbers, most senior executive name, email, and websites. Contacts were then cold-called. Of those that could be directly reached, 100 percent consented to an interview. A small number had moved after Katrina but recommended other names within their organizations. Most subjects identified at least one other community member to be interviewed.

The recruited interviews were selected to represent at least one resident from the business, faith-based, education, housing, municipal government, and local nonprofit sectors, although not all interviewees fit in these categories. There were exceptions where a representative could not be contacted for a certain category. In East Biloxi, the historic African-American school that had been in the study area closed after Katrina. In Waveland, only one of four faith-based organizations identified had a valid telephone number, and that church was not responsive. In these cases, other interviews touched on the education and faith-based community response, respectively, and after several attempts over several months, efforts to locate these interviewees were abandoned. Finally, at least one interview in each community was selected due to their work with or knowledge of special needs or functional needs populations such as minority, immigrant, elderly, or homeless populations.

While many interview subjects were leaders from the sectors mentioned above (business, faith-based, education, housing, municipal government, and local nonprofit), a few could be described as laypeople who were not directly involved in organized relief or rebuilding efforts. These included maintenance workers, retirees, and teachers, for example. Despite efforts to capture the most vulnerable populations in each community, in some communities this was not accomplished. While elderly, minority, and (self-described) lower-income subjects were found in the greater sample across all four communities, this was not the case within each individual community. However, as noted above, individuals with intimate knowledge of these populations were available with very few exceptions.

Interviews were conducted in person at four locations and dates: July 9, 2012 at the Pascagoula Library, July 10 at the East Biloxi Library, July 11 at the Ocean Springs Library, and July 12 at the Waveland Library. A few were conducted at the personal offices of the subjects between July 9 and July 12, 2012. The remaining interviews were conducted via telephone. Most interviews were between 30 and 45 minutes. All subjects were asked the same core questions (Table 2) with follow-up questions, if necessary.

**Table 2: Interview questions**

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**BACKGROUND INFORMATION**

- How long have you lived in this community? With your organization [for community leaders]? Did you evacuate or stay during Katrina? If so, when did you return?

**SOCIAL NETWORK QUESTIONS**

- Think of organizations, networks, associations that you or any member of your household belong to. These could be formally organized groups or just groups of people who get together *regularly* to do an activity or talk about things. Of how many such groups are you or any one in your household a member? Please describe them.
- Which of these groups or networks were you engaged in most actively before Katrina? During? After?
- Which of these groups or networks disbanded or have been formed after Katrina?

**RESILIENCE QUESTIONS**

- Think about how your community has coped after Katrina. Resilience is the ability of a community to rebound, or to bend but not break, after a disaster. In your opinion, how resilient is your community to disasters? (1-10, 1 being not at all resilient, 10 being very resilient)
- On what factors do you base your score?
- By your estimation, what percent or proportion of your neighborhood has returned after Katrina? Of your city?
- Have vulnerable populations returned, such as the elderly or very poor? Why or why not?

**BUILT ENVIRONMENT QUESTIONS**

- Think about the physical characteristics of your community – homes, buildings, open and green space, streets and sidewalks, landmarks and monuments, historic sites, businesses, institutions, natural features. Which of these places or features are most important, memorable, or symbolic to your community in your opinion before Katrina? After?
- What locations are used by your formal and informal social networks for gathering before Katrina? After?
- With respect to the community pre- and post-Katrina, does your community offer amenities in walking distance to your home? What is the availability of parks and open space?

**RECRUITMENT**

- Who else should I talk to in your neighborhood?
-

## RESULTS

Interviews were conducted in two high resilience and two low resilience communities, each with similar built environment factors. The sample included only individuals that lived on the Gulf Coast prior to Katrina. Eight subjects, or 29 percent, had lived in their respective communities their entire life. The others resided in the area between seven and 59 years, with an average of 30 years. Many subjects remarked specifically on the tendency for generations of families to remain living along the Mississippi coast, often in the same neighborhood or even the same family home. This phenomenon was also acknowledged by newer residents to the area. Several subjects (29 percent) mentioned ties to New Orleans, more common in Waveland and Hancock County, or to Mobile (18 percent). A small number (7 percent) mentioned that the Keesler Air Force Base brought them to the area. These subjects ended up remaining in the area or retiring to the area.

In several instances, subjects described the three counties of the Mississippi Gulf Coast as a cohesive region, with residents frequently moving between these communities for work, recreation, and shopping. With the exception of political boundaries formed by bodies of water, the boundaries between the communities tend to be blurred by residents. However, most subjects highlighted community-centered nodes, such as downtown districts, shopping malls, and casinos. The blurring of boundaries occurred in part due to utilitarian necessity, as most communities lack certain amenities that residents require. Of the case study communities, Ocean Springs was commonly described as the best place to eat a meal, Pascagoula as an employment center, East Biloxi as a place for nightlife (casino gambling and a faded bar scene), and Waveland as a recreation center with points of interest such as Buccaneer State Park and a former water park. Pascagoula and Waveland are 54 miles apart, but connected by Highway 90 on the beach or Interstate 10 further inland. While there is very little public transportation, particularly between rather than within communities, many residents move between various parts of the region daily. This tended to make identification of community-specific phenomena difficult, therefore subjects were asked and reminded to remark primarily on the community in which they resided and were shown a map of the area during in-person interviews as a reference point.

When subjects were asked whether or not they evacuated for Katrina, 12 (46 percent) said they remained in their homes, two (8 percent) evacuated to a home on higher ground but still in their community, and two were not in the area at the time, either on vacation, or temporarily living elsewhere. Of the 14 that evacuated, most returned within one week and half were able to resume living in their homes (often despite major damage) within one week. Two subjects reported that it took more than one year to rebuild their homes and two additional subjects were still working on repairs, which, at that point, was seven years after the hurricane. It was suggested by an interviewee and first responder that those who did not evacuate, or who came back most quickly, were more likely to stay and rebuild. Those that evacuated, particularly those that evacuated and did not come back until more than a few weeks later, came back to nothing and ultimately were more likely to choose not to stay. However, there were some complications to returning immediately, including reports that the Mississippi State Police blocked access to the area.

After gathering these data about subjects' general history and experiences with Katrina, the next set of interview questions pertained to subjects' social networks. Subjects were asked to think of organizations, networks, associations that they or members of their household belonged to before and after Katrina. Most began with a description of their formal organizations – churches or other faith-based organizations, school groups, and professional organizations – and their core informal groups such as family, friends, and neighbors. Overall, 294 formal and informal social networks were identified by 28 interview subjects across the four case study communities. As interviews were conducted in two high resilience and two low resilience communities, each with similar built environment factors, these networks of support were first aggregated by level of resilience to determine trends in high versus low resilience categories.

The number of organizations described by interviews from high resilience communities was not significantly different and only slightly higher than the number of networks described by those in low resilience communities (Table 3). High resilience communities identified 149 networks, or 10.64 networks per person on average, while low resilience communities identified 145 networks, or 10.36 networks per person on average. When the numbers and types of social networks were aggregated by individual case study communities rather than by level of resilience, there were

additional differences in the numbers and types of networks described. First, subjects from high-resilience Waveland and low-resilience East Biloxi reported higher numbers of total and average networks. These two communities were closer to the eye of the hurricane when it made landfall, resulting in greater damage, which may have resulted in an increased amount of attention and greater activity during the recovery period.

**Table 3: Total and average number of social networks by case study community**

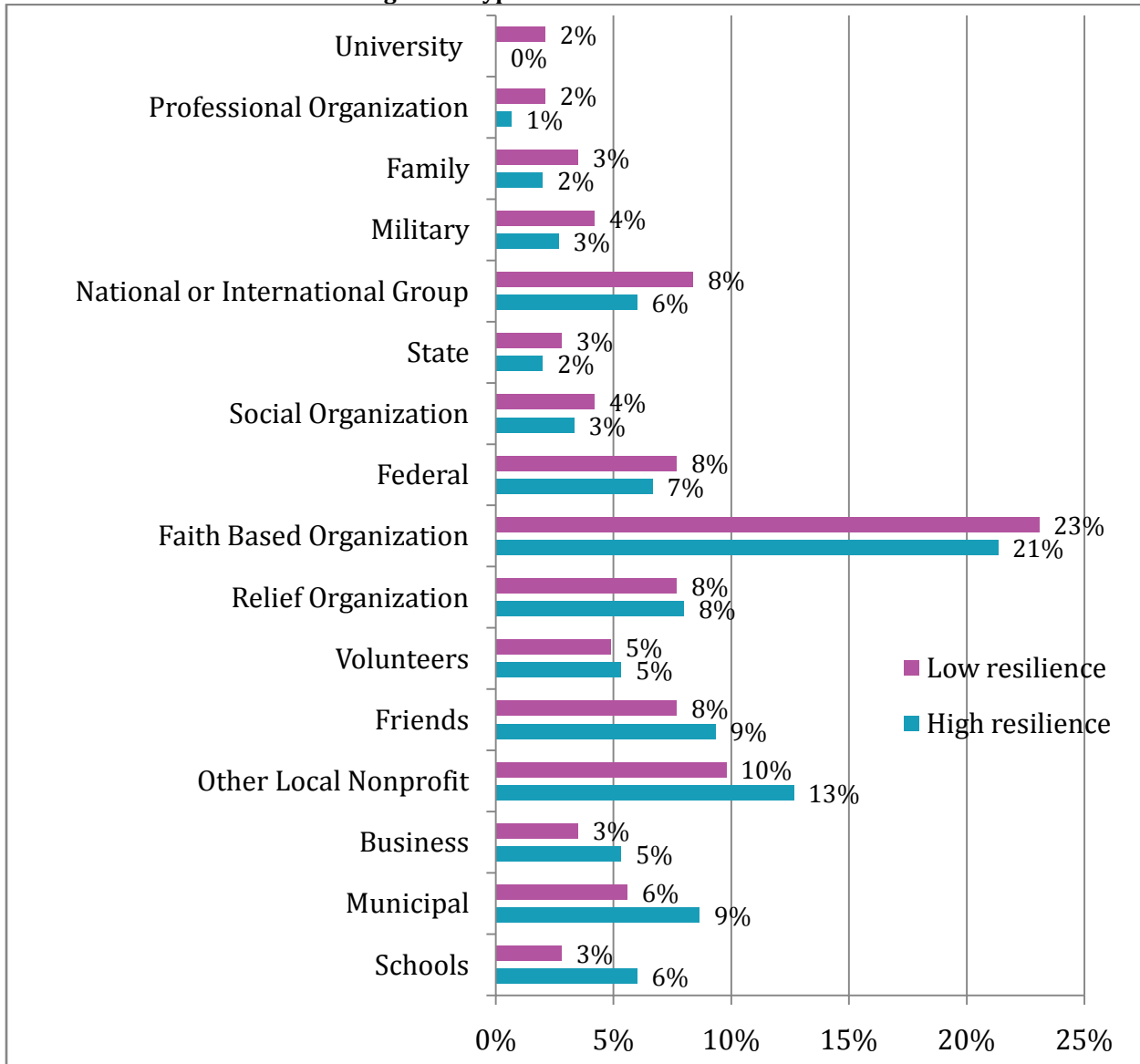
	<b>Waveland</b>	<b>Ocean Springs</b>	<b>Pascagoula</b>	<b>East Biloxi</b>	<b>Total, all interviews</b>
<b>Sum, number of networks mentioned</b>	82	67	67	78	294
<b>Average number of networks mentioned</b>	11.71	9.57	9.57	11.14	10.5

Interestingly, high resilience communities were more likely to mention organizations that had a negative impact on recovery (these organizations are not included in the above totals). Low resilience interviewees tallied seven mentions, while high resilience interviews tallied 18 mentions of organizations that were either limited in their ability to help or actually complicated response. Those 25 negative statements were comprised of only a few individual unique organizations discussed in a negative light. This includes city leadership in Biloxi and Waveland, which was seen as ineffective or working at cross-purposes with those trying to rebuild; FEMA, which was thought to be similarly ineffective and out of touch with the needs of locals; and the American Red Cross, due to long lines and extensive administrative requirements. It should be noted that there were more positive mentions than negative of FEMA and the Red Cross and that the local governments of Ocean Springs and Pascagoula were seen as quite effective post-Katrina.

While the numbers of networks that community members belonged to and sought help from was not significantly different, the types of networks were (Figure 3). In both cases, faith based organizations were the most frequently mentioned (23 percent of networks in low resilience communities and 21 percent of networks in high resilience communities). However, high resilience communities were networked with local nonprofits, schools, friends, businesses, and municipal organizations in higher numbers. Conversely, low resilience communities were networked with

state, national or international, military, and federal organizations, as well as family. The different types of organizations identified by the two groups point to the effectiveness of local networks of support, including friends and the public and nonprofit sector. While high resilience communities seemed to fall back on local networks, low resilience communities were more likely to turn to federal aid and the support of national organizations.

**Figure 3: Types of networks identified**



In addition to the accounts of personal social networks, many interviewees spoke of the generally high rates of volunteerism and philanthropy in the Gulf Coast region of Mississippi. In

fact, with one of the lowest per capita income levels in the country, the state of Mississippi was ranked first or second on the Catalogue for Philanthropy's Generosity Index from 1995 to 2005.<sup>i</sup> According to the Chronicle of Philanthropy, in 2012, the average Mississippi household donated 7.2 percent of its discretionary income to charity,<sup>ii</sup> making it the second most generous state in the country. Mississippi received a significantly smaller amount of post-Katrina funding than New Orleans and Louisiana.<sup>iii</sup> Residents were aware of the discrepancy and often pointed out the attitude among residents of taking care of oneself and one's neighbors, rather than waiting for intervention from the government or nonprofits. Those entities were very important, particularly faith-based and relief organizations, however, for many they were a last resort. Those who had the resources to help themselves or their neighbors did so willingly and immediately.

Many interview subjects spoke of their own strong faith and that of their neighbors. For a majority of the subjects, the church was their most important social network. Further, faith-based organizations were the most consistent source of support in recovery, as distribution points for supplies and in clean up and rebuilding. In fact, the percent and number of faith-based organizations are lower than they likely ought to be, as many subjects were unable to name the entire roster of churches and other organizations from around the world that came to help. Therefore, in some interviews, the catchall of "churches" was noted yet it was not clear if two or 20 churches were part of the subjects' networks. Many faith-based groups mentioned were from outside the study area (generally from non-affected U.S. states); however, these groups almost always had a local tie, pointing to a greater national network of faith-based support. For example, after seminary, a Catholic priest may retain ties with a number of classmates that are called to various points around the nation or the world. For those faith-based groups that came to the area without a local tie, in some cases a bond was formed that has continued. Interview subjects pointed to several such networks that have outlasted the recovery. Subjects also spoke of outreach conducted by Gulf Coast churches in other disaster-affected areas, such as the communities destroyed by the 2012 Alabama tornados.

The importance of faith-based organizations has been frequently examined in the field of community development. According to one source, faith-based organizations that are more active



in traditional economic development activities, including housing and social services that are important for disaster recovery and resilience, tend to have more staff and pledge income combined with lower education attainment in the area and a theological world view stressing building community and economic justice (Reese & Shields, 2000). Faith-based organizations are uniquely able to provide various types of support several reasons: because such institutions tend to remain in place no matter what kinds of disinvestment occur in a neighborhood, because the mission of most (if not all) faiths includes community building, because they have unique types of local and external networks, and because of their ability to provide valuable spiritual support even when resources are not available (Cisneros, 1996).

In addition to questions about social networks, interview subjects were also asked a series of questions about the built environment in their community. They were first asked to think about the physical characteristics of their communities, which were defined for them as homes, buildings, open and green space, streets and sidewalks, landmarks and monuments, historic sites, businesses, institutions, and natural features. They were asked which places or features are most important, memorable, or symbolic to their communities before and after Katrina. They were also asked which places are or were used by social networks for gathering before and after Katrina. Finally they were asked, in general, if their communities offer amenities such as restaurants, shopping, schools, and parks within walking distance to their homes.

First, when asked to identify physical characteristics of their communities that are most symbolic and important, residents of high resilience communities listed an average of 12.36 sites per person while residents of low resilience communities listed only 9.64 (Table 4). This difference was not significantly different based on a T test, with a p value of 0.17. However, numbers and types of places described as symbolic and important did differ among high and low resilience communities and between the four communities.

**Table 4: Sites and places mentioned by resilience category**

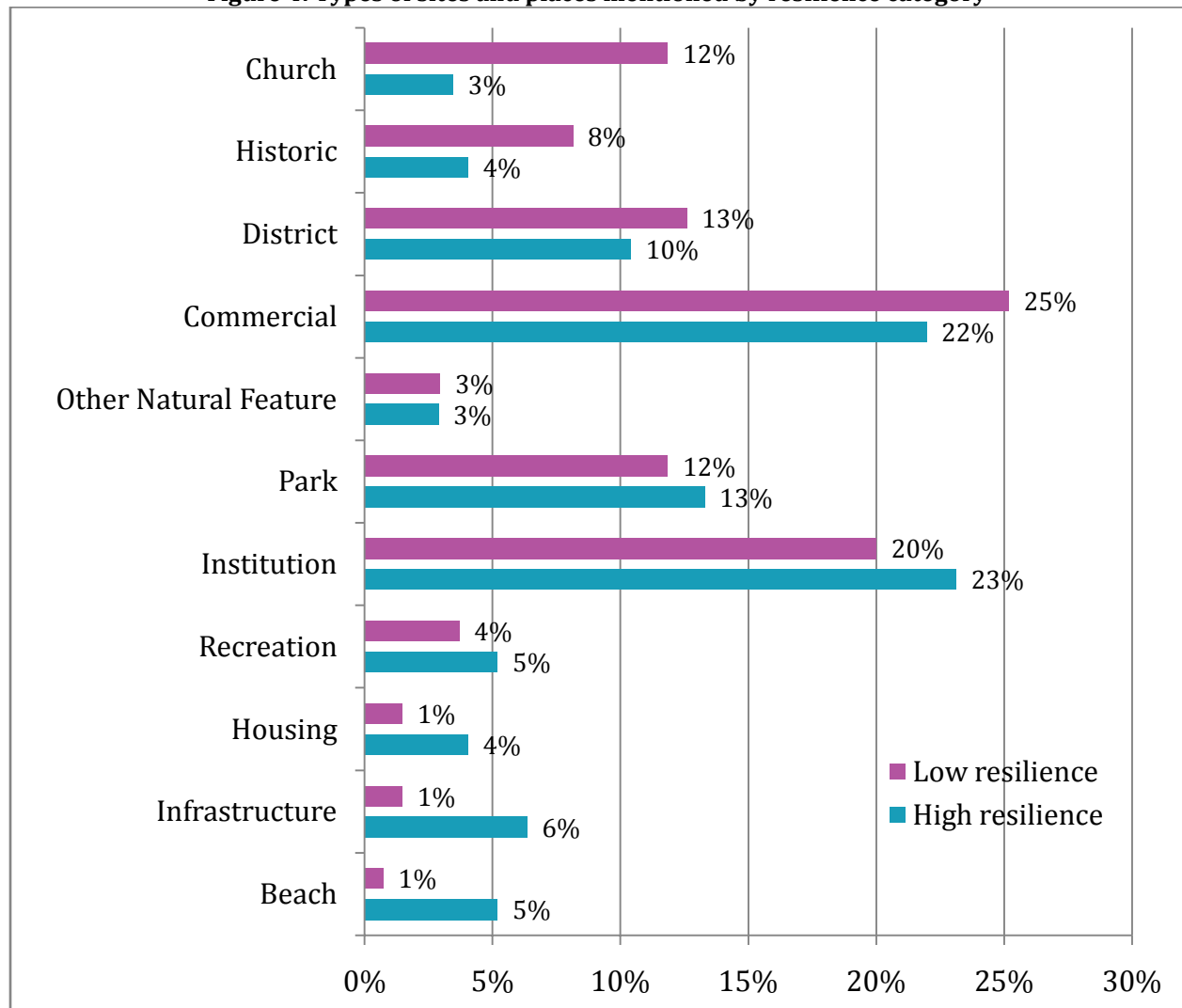
	<b>All high resilience interviews</b>	<b>All low resilience interviews</b>	<b>Total, all interviews</b>
<b>Sum, number of places mentioned</b>	173	135	308
<b>Average number of places mentioned</b>	12.36	9.64	11.00

The sites listed by subjects were categorized as institutions, commercial establishments, parks, districts, infrastructure, recreational facilities, beaches, housing, historic sites, churches and other places of worship, or other natural features. Institutions included municipal and public safety facilities, nonprofit organization headquarters, community centers, libraries, schools, and clubs such as fraternal halls. Commercial establishments were primarily retail and restaurants and bars, although casinos, barber shops, and movie theaters were also mentioned. Parks included neighborhood scale parks and playgrounds, state parks, and national parks. Districts included downtown or central business districts, other neighborhoods, and streets. Infrastructure included bridges, highways, streets and sidewalks in general, lighting, docks, and airstrips. Recreational facilities included ball parks, pedestrian and cycling trails, venues such as fairgrounds and coliseums, marinas, bowling alleys, and skating rinks. Beaches were commonly mentioned in interviews due to the prominence of the waterfront in the area. Housing included multi family, single family, and special needs housing. Historic sites included landmarks such as the remaining grand hotels, lighthouses, forts, monuments, and specific homes such as the cottage of architect Louis Sullivan. Churches and other places of worship were primarily various denominations of Christianity, with one Buddhist temple given as a response. Other natural features included bodies of water, islands, and vegetation in general, not specific to parks or recreational areas.

Of the 173 total places recognized by residents from high resilience communities, there was a greater percentage of institutions, parks, infrastructure elements, recreational sites, beaches, and housing (Figure 4). Of the 135 places recognized by residents from low resilience communities, there was a higher percentage of commercial sites, districts, historic sites, and churches. The higher number of sites identified by high resilience communities and the more even distribution of types of sites could indicate a larger and more varied number of landmarks or simply a greater pride in

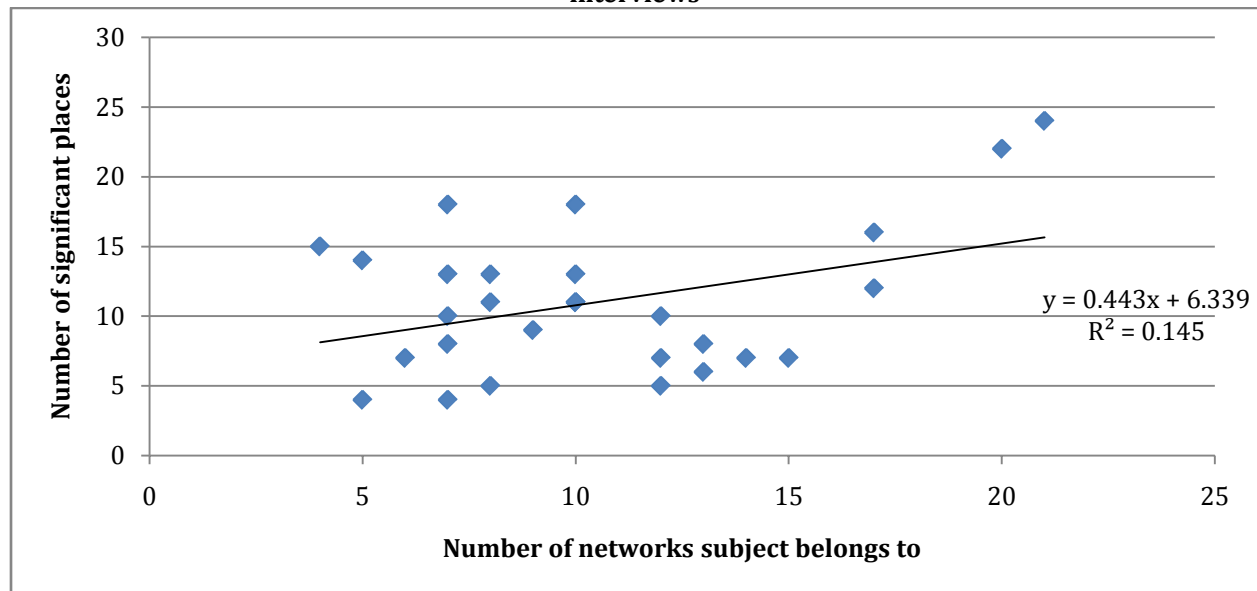
and place attachment to community in more resilient communities. Most striking was the higher number of churches singled out by low resilience communities. Both East Biloxi and Pascagoula have some of the larger congregations and places of worship, notably St Michael Parish, also known as the Fisherman’s Church, in East Biloxi and First Baptist Church in Pascagoula. East Biloxi and Pascagoula were established earlier than Waveland and Ocean Springs, therefore more places of worship have likely been founded and have remained in these communities. Historic structures were also more prominently mentioned in the low resilient communities of East Biloxi and Pascagoula, quite likely for the same reason.

**Figure 4: Types of sites and places mentioned by resilience category**



When the number of networks per interview subject was plotted against the number of places per interview subject, the relationship was weak but positive (Figure 5). This points to both the tendency for certain subjects to be more thorough than others and the tendency toward highly socially connected people having a greater connection to the built environment.

**Figure 5: Relationship between number of social networks and number significant places identified in interviews**



The most significant built environment complication post-Katrina has been the need to elevate infrastructure and structures and the loss of landmarks. A major issue for rebuilding has been the high cost of insurance and restrictions and regulations that prohibit many from rebuilding, particularly new flood insurance rate maps. Traditional ways of building are impossible in affected areas and costs are prohibitive, therefore many lost landmarks were unable to be replaced. According to the Mississippi Department of Archives and History (MDAH) and the Mississippi Heritage Trust, 354 listed historic structures were destroyed by Katrina. Of those, 254 were destroyed during the storm and 100 were demolished within four years due to extensive and irreparable damage (Malvaney, 2009).

Many interview subjects pointed to homes as the type of buildings most missed. As a result of uneven rebuilding, particularly of homes, wayfinding is now more difficult. For example, one cannot use a once-familiar direction such as “turn left at the big blue house” in what is now a sea of

empty lots. At times, post-Katrina reconstruction restricted prior customs and ways of life. For example, new parking regulations made the practice of soft-shelling difficult in East Biloxi. Residents of the area would harvest crabs in their rubbery molting state by tapping the crabs with a spear known as a flounder gig and catching those that attempt to bury themselves rather than run. Along with shrimping and fishing, soft shelling was once a local ritual and an inexpensive food source. It is now illegal to park in the area between 10 pm and 6 am; therefore residents cannot transport their gear in order to soft shell during these prime molting hours.

Despite these complications, in Ocean Springs and Pascagoula, several subjects noted that the built environment is better than before, with refreshed buildings and new amenities. There were still many vacant properties to serve as reminders of Katrina, but in the four case study communities selected, trailers were not noticeably in use as primary residences as of July 2012. A few Katrina cottages, products of the Mississippi Renewal Forum design charette, could be found, serving their intended purpose of providing permanent modular housing. There were some derelict buildings, such as the White House Hotel in Biloxi. Improvements were continuing seven years after Katrina; for example, a major wing of the badly damaged Ohr-O'Keefe Museum remained battle-scarred and awaiting repairs.

When asked generally about resilience levels in their community, those living in low resilience communities according to the resilience measure (return of households) actually tended to rate their communities higher on a ten-point scale than those in high resilience communities. Some qualified their numerical response by rating the residents' resilience very high and the city or city leadership much lower. Examples were given of individual struggles and difficult times, but there was an unwavering belief that the population of the Mississippi Coast had been and would continue to be resilient. While this was a very unscientific poll, the resilience rating demonstrated the wide range of emotions and meanings assigned to the term and the individual perspectives of subjects.

During the interviews, residents identified many additional factors for the relative resilience or lack of resilience in their communities. Factors thought to increase resilience included:

- Relatively small damage to the central business district
- Political will and leadership
- Public participation in rebuilding (for example, community-wide charettes)
- Role of major industries and employers (shipbuilding, casinos)
- Culture and spirit of people (including generosity, volunteerism, a strong family tradition, pride in their community, and a proactive population that helps one another)
- Strong faith of population and strong faith-based organizations
- Established multi-generational roots in the Mississippi Gulf Coast
- Tradition of coping with hurricanes

Factors thought to decrease resilience included:

- Large level of damage to entire community
- Geographic isolation of certain areas
- Large number of part-time residents
- Cost of rebuilding and insurance
- Depleted property values and foreclosures
- Restrictive regulations that complicate rebuilding
- Emotional impact of storm (for example, mass confusion and fear)
- Lack of media attention compared to New Orleans
- Loss of traditions

Many of these responses dovetail with theories about social networks, place attachment, and resilience. Many others, such as tradition of coping with disasters have been well documented in other fields (Adger, Hughes, Folke, Carpenter, & Rockstrom, 2005). The results of these dichotomous lists suggest a tension between the desire to reestablish a traditional way of life and the need to protect human life and property in advance of future hurricanes.

Subjects were also asked specifically about vulnerable populations, whether certain demographic or economic groups were less likely to recover. The literature would tell us that certain populations are particularly vulnerable to disaster, due to living conditions as well as a lack of resources to prepare for and recovery from a devastating event. According to interview subjects,

in Mississippi, Hurricane Katrina was an egalitarian disaster. If anything, the storm disproportionately impacted the wealthy. The most devastated areas were closest to the waterfront, and tended to be expensive real estate. Exceptions existed, including several modest high-rise apartment buildings in East Biloxi that were destroyed. However, many poor and minority households were situated on higher ground, resulting in less wind and storm surge damage. During the interviews, demographics such as income and race were not seen as major barriers to recovery, except in that the most severe damage was to expensive beachfront homes, which were wealthier households.

Although other vulnerable populations fared better in Mississippi, residents did note that the disaster was difficult for the elderly. Many were isolated and unable to physically and emotionally cope with the damage to their properties. For some elderly homeowners, taking out a loan for repairs, coordinating contractors, and other necessary steps in the recovery process were unrealistic prospects. Some left to stay with family members, often in other parts of the country, and could not or chose not to return. Many subjects also spoke about elderly neighbors who were totally disconcerted by the loss of life and destruction of landmarks. These subjects speculated that Katrina escalated existing illnesses or otherwise shortened the lives of many elderly residents.

## DISCUSSION

The tenor of the interviews was consistent. In general, residents indicated strong bonds with people and places in coastal Mississippi. However, the number and type of social networks and types of urban environments tended to differ between high and low resilience communities. Residents indicated many are better off, having higher quality housing than before and a refreshed community due to city planning and beautification efforts. It must be noted that these improvements were not consolation for the losses incurred, and that others continue to struggle to return to their homes.

The interviews demonstrated that social networks are important factors for resilience. While questions focused on social networks in general, interview subjects invariably spoke of the social networks that were most important for surviving and recovering from Katrina without prompting. More than any other factor, social networks were found to be important for resilience.

Common and simple ways of expressing this included “neighbors helping neighbors” or “people coming together” after Katrina. Other factors given by interview subjects for resilience were strongly related to social networks, such as the qualities of community spirit and commitment to family noted in the area.

The role of the faith based community and of individual faith in community resilience was more complex than expected. Faith based groups were the most common social networks that interview subjects engaged with. Churches and other places of worship were also prominent features of the built environment, though more so in the two lower resilience communities. Faith in particular was singled out in these two lower resilience communities as an alternative reason for resilience. While it is impossible to analyze the residents’ levels of faith based on these responses, it would seem that the results indicate that the faith based community is more prominent in the two low resilience communities, which may have resulted in a greater reliance on these resources after Katrina. More than anything, this demonstrates the importance of the faith based community in reaching out after disasters, particularly in those that are more vulnerable, a point which has often been made (Moore, Linnan, & Benedict, 2004; Patterson, Weil, & Patel, 2010).

The issue of internal versus external networks of support was also recurrent in interviews. Residents of high resilience communities tended to have greater ties to friends, schools, businesses and local nonprofits, networks with very concentrated local ties. In contrast, residents of low resilience communities tended to have greater ties to federal, state, university, military, and national or international nonprofits, networks that are external by nature. This is problematic in part because of the dwindling resources of these organizations. One interview subject directing a nonprofit based in the area stated that there is greater competition for fewer dollars, and a significant decrease in the local community's ability to take care of those in need coupled with a dramatic increase in the numbers of people in need who cannot basically take care of themselves.

This research also suggests that establishing and maintaining strong, redundant, interconnected local networks that interface with external and national groups will improve future resilience. The Mississippi Coast Interfaith Disaster Task Force (MCIDTF), referenced in several



interviews, is an excellent example of this strategy in action. Prior to Hurricane Katrina, the MCIDTF had only been activated immediately after a storm. Since Katrina, the organization, which fosters collaboration between public, private, and nonprofit organizations, has remained active, focusing on preparedness and mental health in addition to ongoing recovery. Based on the findings, attention to the needs of elderly residents and other vulnerable populations is necessary, including outreach before and after a disaster.

The results support the notion that a built environment encouraging social gathering, with many amenities and landmark areas, results in personal pride and attachment as well as greater fellowship among residents. Formal social networks tend to be influenced by the physical environment through virtue of having offices or other bases of operations. These included churches, schools, and local nonprofits. Informal social networks were also influenced by the physical environment, supported by parks, schools, restaurants, and gathering places such as restaurants and community centers. Cultural institutions, such as the Ohr-O'Keefe Museum in East Biloxi and the Mary C. O'Keefe Cultural Center in Ocean Springs were important to many interview subjects, although more so with upper income residents. Historically, the area has inspired many local artists, such as the potter George Ohr and the painter Walter Inglis Anderson. Galleries in Bay St Louis, Ocean Springs, and Biloxi continue to foster local artists. Institutions, galleries, and public art are features of the built environment that support a unique sense of community.

Lower resilience communities tended to have greater affinity to churches and other places of worship while higher resilience communities tended to have greater affinity for a wider range of built environment components. Places of worship in Pascagoula and East Biloxi, both lower resilience communities, had a stronger presence. The location of built environment elements that were listed in interviews was concentrated near the districts described as the "heart" or "core" of each community. While many structures were lost in Katrina, there have been efforts to rebuild in a locally and historically sensitive manner. An example is the new library in East Biloxi (Figure 6). The library was designed to recall late nineteenth and early twentieth century resort hotels from the area, which have almost completely vanished over time due to hurricane damage and economic

changes. The library also houses a climate-controlled, hurricane-resistant archive and displays various local artifacts.

**Figure 6: East Biloxi Library**



*Source: Photograph taken by author, July 2012*

This research also suggests that communities with the strongest resilience include both strong social networks and varied and integrated physical environments. The community that was the most resilient was Ocean Springs, which indeed had both strong social networks and the most varied and integrated built environment. Of the four communities, Ocean Springs was the only community in which all interview subjects stated that a wide array of amenities such as parks, schools, shopping, and community facilities existed within a short walk or drive. Ocean Springs was praised for its walkability, its sense of community, its diverse shopping and restaurant options, and its redeveloped waterfront parks. Residents in the area were very engaged in the rebuilding process, through well-attended charettes. As in the three other case study communities, faith-based organizations were the most common social networks in which residents were engaged, although various other types of formal and informal networks were also mentioned. These tended to be more locally-rooted than in less resilient communities.

According to many, the most devastated areas of Mississippi after Hurricane Camille in 1969 took more than ten years to regenerate. Based on the slow progress post-Camille, one resident estimated it might take 25-30 years to fully recover from Katrina. In that time, another major hurricane will certainly strike. Disasters have the potential to disturb every aspect of daily life. Security and stability are compromised and household resources are drained when faced with unexpected disasters. Recovery is clearly difficult in the face of these obstacles. It is increasingly apparent to the disaster management, psychology, sociology, public health, and city planning professions (among others) that the strength of preexisting social networks influences the rate of recovery at the individual and community levels by leveraging a larger pool of resources and increasing access to a means of living. Disasters can also place a significant strain on social networks; however, stronger networks are able to endure the strain more readily and actually increase the effectiveness and rate of recovery efforts. In addition, the effect of the built environment on social networks should not be discounted. While the factors influencing resilience and recovery are complex and wide-ranging, planning and policy interventions that influence the built environment can also make an impact on a community's ability to withstand and recover from a disaster.

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