La catastrophe de la Nouvelle-Orléans (ouragan Katrina, 29.08.2005)

FASCICULE DE DOCUMENTS

Bibliographie

L'essentiel de ces documents sont tirés de sites officiels de diverses institutions des Etats-Unis. Les sites prospectés sont les suivants :

-Le site de référence est celui de la banque de données de la **Communauté urbaine du Grand New Orleans** (http://gnocdc.org/index.html)

> diverses cartes de synthèses sont proposées sur les carctéristiques de l'inondations, et la géographie socio-économique de la ville.

> Rapport au Congrès sur les conséquences démographiques et sociales (Gabe, T. et ali. 2004. Hurricane Katrina: Social-Demographic Characteristics of Impacted Areas).
http://www.gnocdc.org/reports/crsrept.pdf

> Rapport sur les caractéristiques ethniques et sociales des personnes touchées. Logan, J. *The Impact of Katrina: Race and Class in Storm-Damaged Neighborhoods*.
http://www.s4.brown.edu/Katrina/report.pdf

-**Organisme chargé des systèmes d'information géographique du gouvernement de Louisiane** (Louisiana Gis Council). Cet organisme a mis en ligne un atlas des impacts des deux cyclones qui ont touché la Louisianne en 2005, Katrina et Rita.

> Atlas des impacts (Atlas).
http://lagic.lsu.edu/lgisc/publications/2005/LGISC-PUB-20051116-00_2005_HURRICANE_ATLAS.pdf

> Etude de la diaspora post-ouragan. Kent & Underwood. 2006. Southern Louisiana diaspora.
http://lagic.lsu.edu/lgisc/publications/2006/Southern_Louisiana_Hurricane_Diaspora_20060404.pdf

-Le site du satellite NOAA propose divers documents en ligne.

> une synthèse du déroulement de l'aléa (Synthèse NOAA)
http://www.ncdc.noaa.gov/oa/climate/research/2005/katrina.html

> un rapport détaillé (Rapport NOAA)
Graumann, A. Et ali. Octobre 2005. Hurricane Katrina. A climatological perspective. Preliminary report. 28 p.
http://www.ncdc.noaa.gov/oa/reports/tech-report-200501z.pdf

-L'USGS propose également de nombreuses données sur Katrina.

> article sur la subsidence du delta du Mississipi (USGS-subsidence). Burkett, V. et ali. *Sea-Level Rise and Subsidence: Implications for Flooding in New Orleans, Louisiana.*
http://www.nwrc.usgs.gov/hurricane/Sea-Level-Rise.pdf

-Rapport du corps d'ingénieurs de l'armée à la commission du Congrès états-unien (Government Accountability Office) : ARMY CORPS OF ENGINEERS, 9 novembre 2005. **Testimony Before the Committee on Environment and Public Works, U.S. Senate. History of the Lake Pontchartrain and Vincinity Hurricane Protection Project**.
http://www.gao.gov/new.items/d06244t.pdf

Doc 1 – L'échelle de Saffir-Simpson

Category 1	**Sustained Winds:**	74 - 95 mph	119 - 153 km/h
	Estimated Storm Surge:	4 - 5 ft	1.2 - 1.5 meters
	Central Pressure:	28.94 inHg	980 mbar
	Potential Damage:	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs. Also, some coastal road flooding and minor pier damage.	
	Examples:	Hurricane Lili (2002) - landfall on the Louisiana coast. Hurricane Gaston (2004) - landfall along the central South Carolina coast.	
Category 2	**Sustained Winds:**	96 - 110 mph	154 - 177 km/h
	Estimated Storm Surge:	6 - 8 ft	1.8 - 2.4 meters
	Central Pressure:	28.50 - 28.91 inHg	965 - 979 mbar
	Potential Damage:	Some roofing material, door, and window damage to buildings. Considerable damage to shrubbery and trees. Considerable damage to mobile homes, poorly constructed signs, and piers. Coastal and low-lying floods. Small craft in unprotected anchorages break moorings.	
	Examples:	Hurricane Frances (2004) - landfall over the southern end of Hutchinson Island, Florida. Hurricane Isabel (2003) - landfall on the Outer Banks of North Carolina.	
Category 3	**Sustained Winds:**	111 - 130 mph	178 - 209 km/h
	Estimated Storm Surge:	9 - 12 ft	2.7 - 3.7 meters
	Central Pressure:	27.91 - 28.47 inHg	945 - 964 mbar
	Potential Damage:	Some structural damage to small residences and utility buildings. Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Some flooding in low-lying areas. Flooding near the coast destroys small structures with larg structures damaged by battering from floating debris.	
	Examples:	Hurricanes Jeanne and Ivan (2004) were Category Three hurricanes when they made landfall in Florida and in Alabama, respectively.	
Category 4	**Sustained Winds:**	131 - 155 mph	210 - 249 km/h
	Estimated Storm Surge:	13 - 18 ft	4.0 - 5.5 meters
	Central Pressure:	27.17 - 28.88 inHg	920 - 944 mbar
	Potential Damage:	Some complete roof failure and structure failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying flooding. Major damage to lower floors of structures near the shore.	
	Examples:	Hurricane Charley (2004) - landfall in Charlotte County, Florida with winds of 150 mph. Hurricane Dennis (2005) - struck the island of Cuba as a Category Four hurricane.	
Category 5	**Sustained Winds:**	≥ 155 mph	≥ 250 km/h
	Estimated Storm Surge:	≥ 19 ft	≥ 5.5 meters
	Central Pressure:	< 27.17 inHg	< 920 mbar
	Potential Damage:	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage.	
	Examples:	Only 3 Category Five Hurricanes have made landfall in the United States since records began: The Labor Day Hurricane of 1935, Hurricane Camille (1969), and Hurricane Andrew (1992).	

Source : http://lagic.lsu.edu/hurricanes/saffir-simpson.htm / NOAA - National Hurricane Center (NHC).

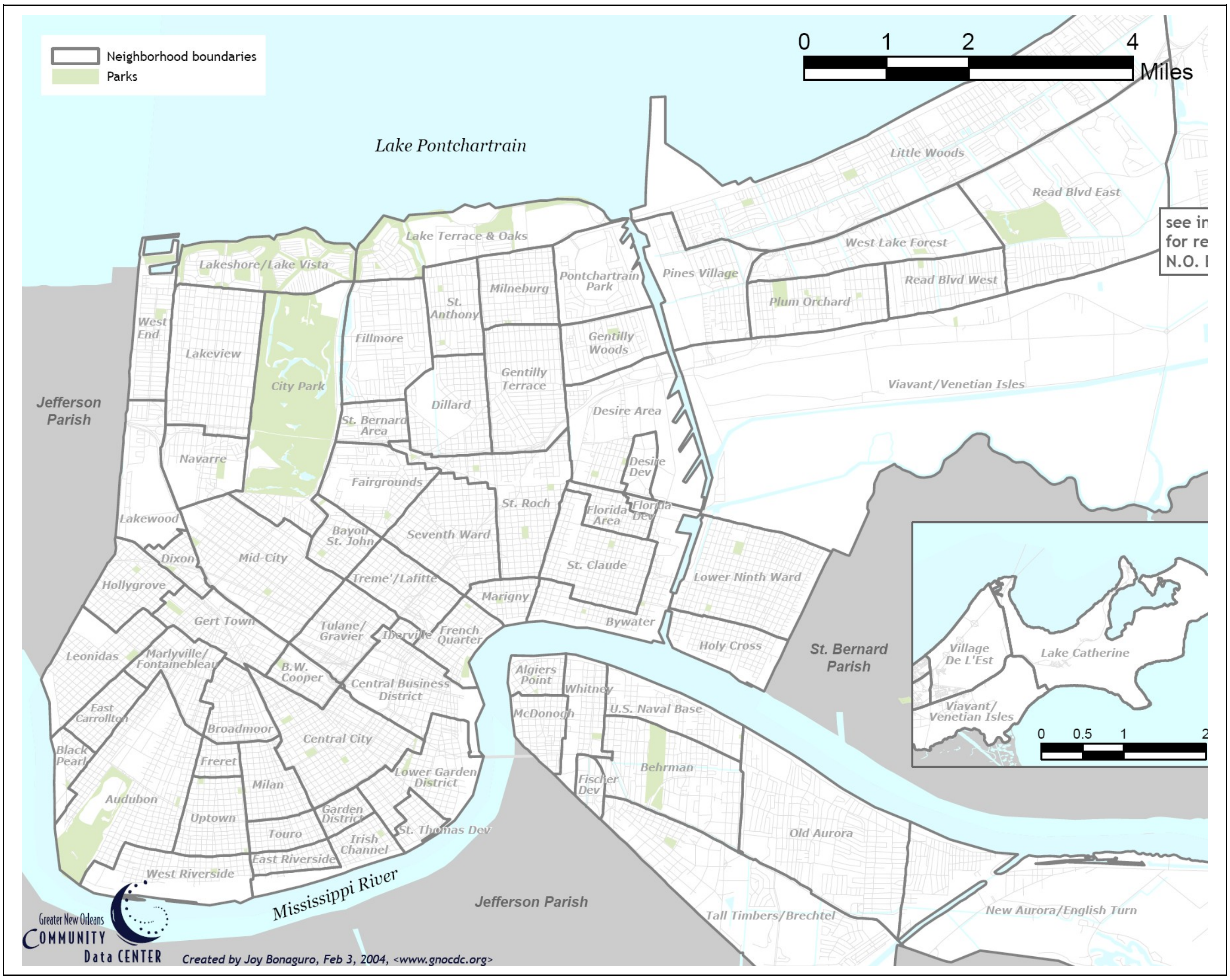
Doc 2 - Cadre synoptique : caractéristiques du cyclone Katrina

SOURCES: *NOAA, FEMA, LAGIC, LDHH, LDOL, LDED, & ISO*	**HURRICANE KATRINA** August 23 – 30, 2005	**HURRICANE RITA** September 17 – 25, 2005
US STATES IMPACTED	Florida, Louisiana, Mississippi, Alabama, and Tennessee.	Louisiana and Texas
STRENGTH *at landfall*	Category 3	Category 3
MINIMUM BAROMETRIC PRESSURE	902mb (923mb at landfall)	897mb (915mb at landfall)
WINDS *at landfall*	~130 mph	140+ mph
RAINFALL	10in – 12in	6in – 12in
STORM SURGE	4 – 30 feet 27'+ in Hancock, MS, 15'+ in Plaquemines, LA	4 – 15 feet 15' Storm Surge estimated in Cameron, LA
AREA IMPACTED	Total: 108,456 sq. miles	Total: 85,729 sq. miles
CASUALTIES	Total: 1,800+ Louisiana: 1,500+, 1800+ missing	Total: 119 Louisiana: 0
PEOPLE IMPACTED	1.37+ million Louisiana households request Individual Assistance.	310,000+ Louisiana households request Individual Assistance
LEFT HOMELESS	Total: ~450,000 Louisiana: ~200,000	Total: ~75,000 Louisiana: ~75,000
BUSINESSES IMPACTED	71,000+ in Louisiana	10,000+ in Louisiana
JOB LOSSES	300,000+ in Louisiana	45,000+ in Louisiana
DAMAGE ESTIMATES	$105 Billion in Federal Funds for Region $34.4 Billion Total; $22 Billion in Louisiana *(source: ISO Properties Report 10/7/05)*	$105 Billion in Federal Funds for Region $4.7 Billion Total; $ 2.4 Billion in Louisiana *(source: ISO Properties Report 10/7/05)*

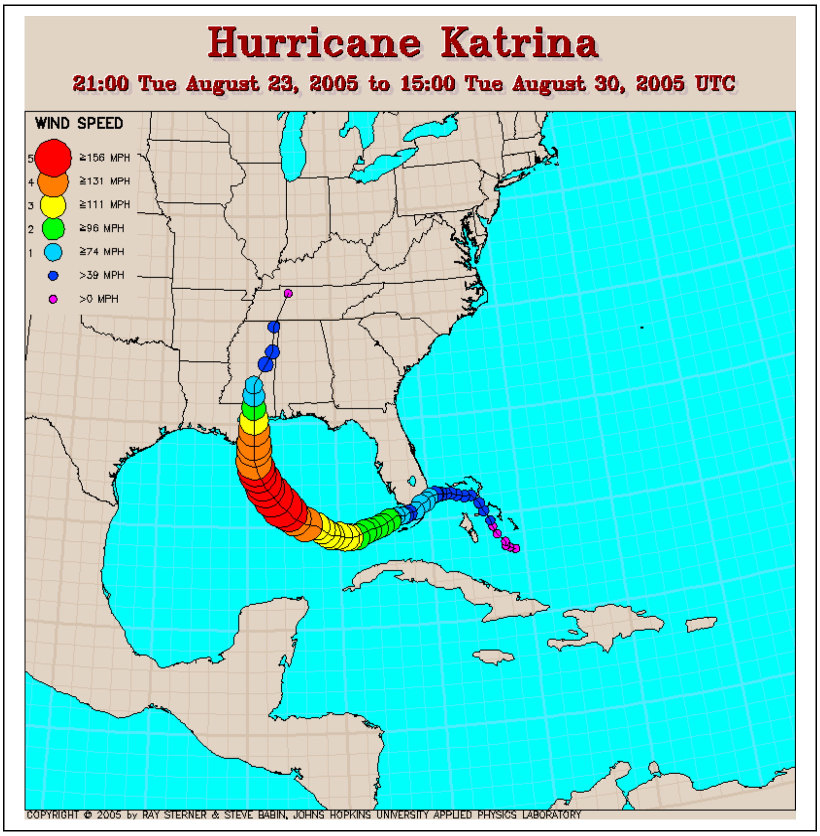
Doc 3 – Cartes de la Louisiane


Crossett
Junction City
The Pines
Bastrop
Yazoo City
Kosciusko
Philadelp
Black
Canton
Minden
Shreveport
Ruston
Monroe
Bossier City
Driskill Mtn
535
Tallulah
Ross Barnett Res
Forest
Vicksburg
Jackson
MISSISSIPPI
Yazoo
Big
Mansfield
Red River
Winnfield
Hazlehurst
Magee
Leaf
Tullos
Collins
Laurel
Natchitoches
Ferriday
Brookhaven
Monticello
Natchez
Mississippi
Augustine
Toledo Bend Reservoir
Alexandria
McComb
Columbia
Pearl River
Hattiesb
Leesville
LOUISIANA
Jasper
De Ridder
Oakdale
Bunkie
Bogalusa
Ville Platte
Picayune
Hammond
Gulfport
Kinder
Eunice
Opelousas
Baton Rouge
Slidell
Lake Pontchartrain
Sulphur
Jennings
Lafayette
Orange
Lake Charles
Crowley
Kenner
New Orleans
Calcasieu Lake
Grand Lake
Graves
Abbeville
New Iberia
Metairie
Chalmette
ort Arthur
Franklin
Thibodaux
Breton Sound
White Lake
Morgan City
Houma
Vermilion Bay
Marsh I
Atchafalaya Bay
Barataria Bay
20
49
55
59
12
10

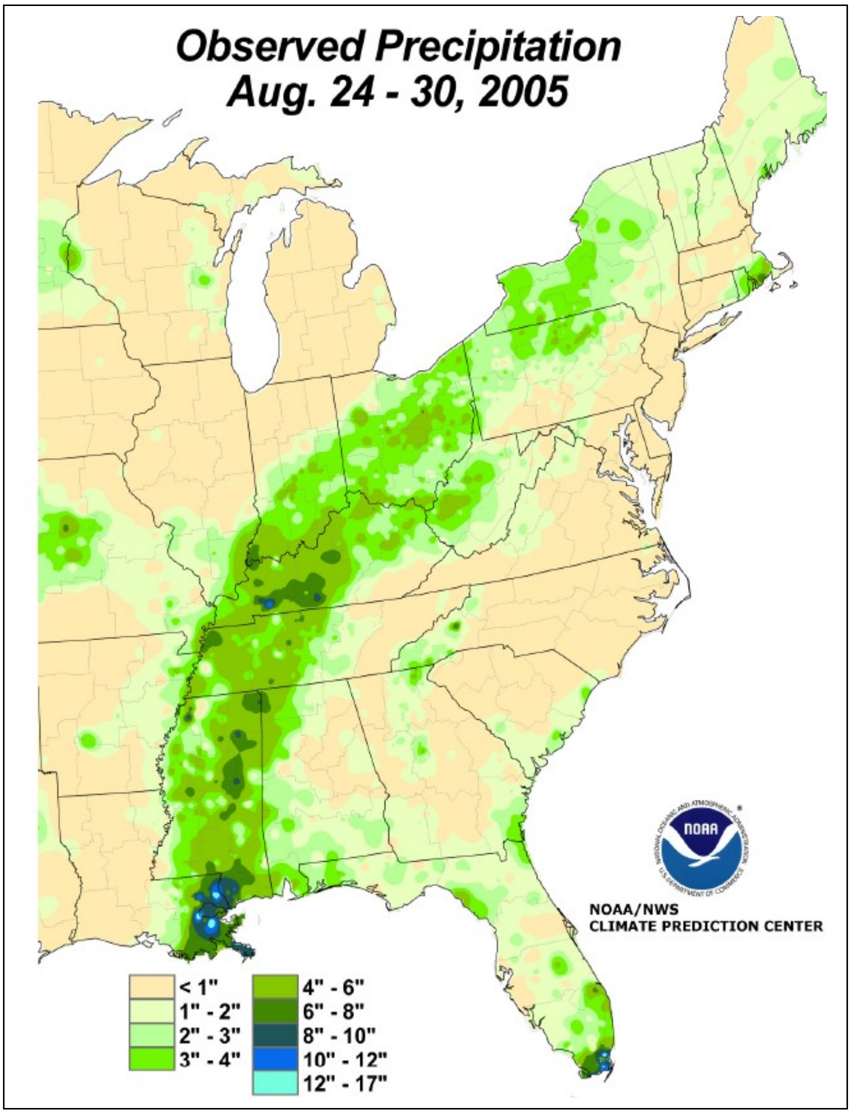
Doc 4 - Carte de la Nouvelle-Orléans (quartiers). Source : Communauté urbaine du Grand New Orleans.



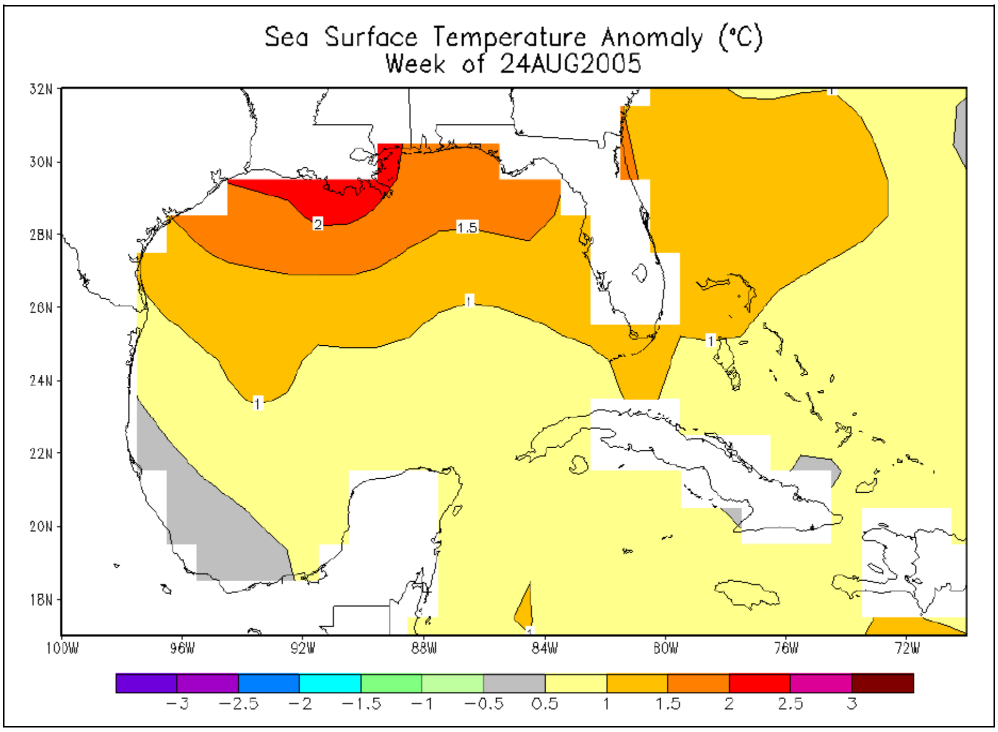
Doc 5 – La trajectoire de Katrina. Source : Synthèse NOAA.



Doc 6 – Les conséquences pluviométriques (en inches). Source : Rapport NOAA.



Doc 7 - Anomalies thermiques de la surface de la mer (Golfe du Mexique, semaine du 24 août 2005). Source : rapport NOAA (2005)

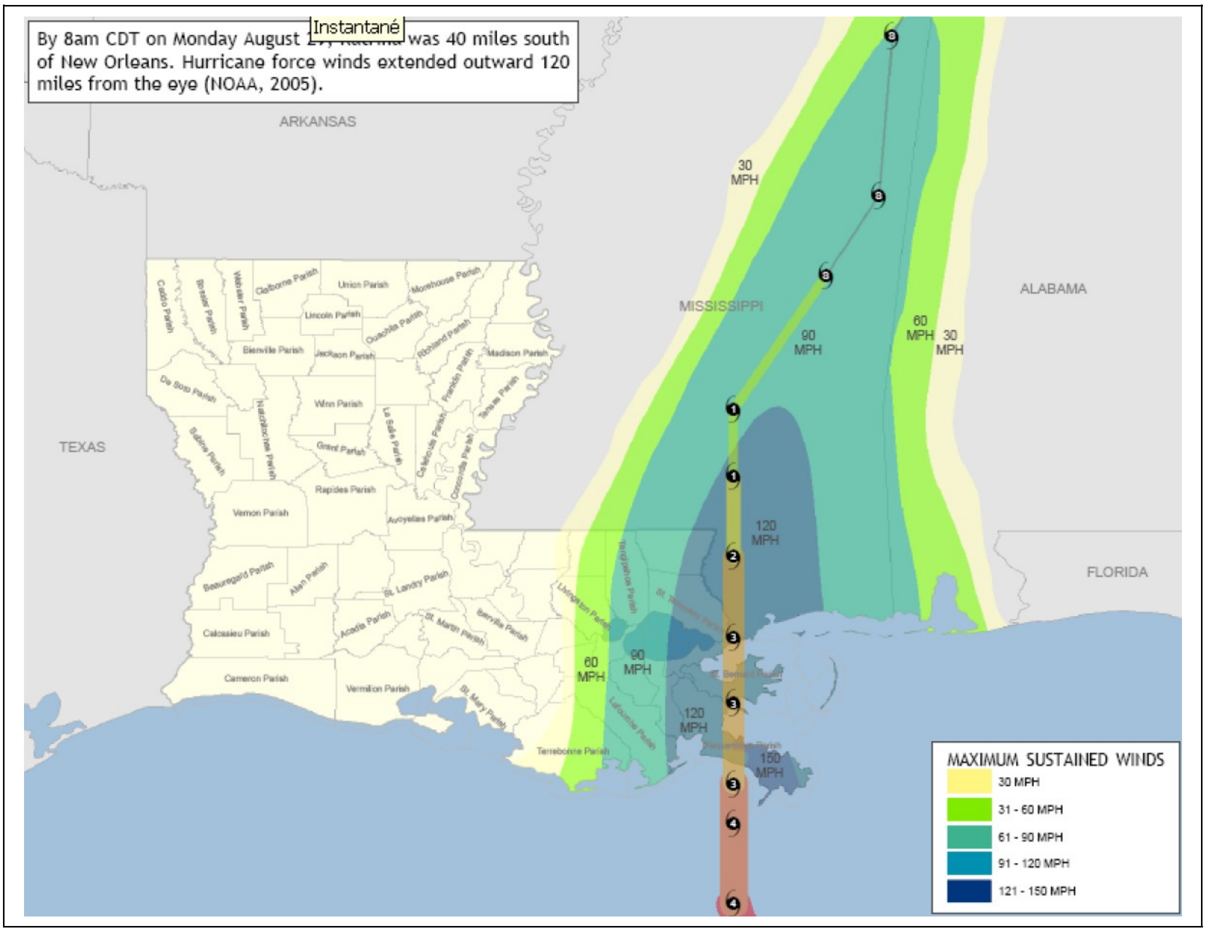


Doc 8 – Historique des ouragans ayant touché terre (landfalling) entre 1722 et 2005.
Source : rapport NOAA (2005)

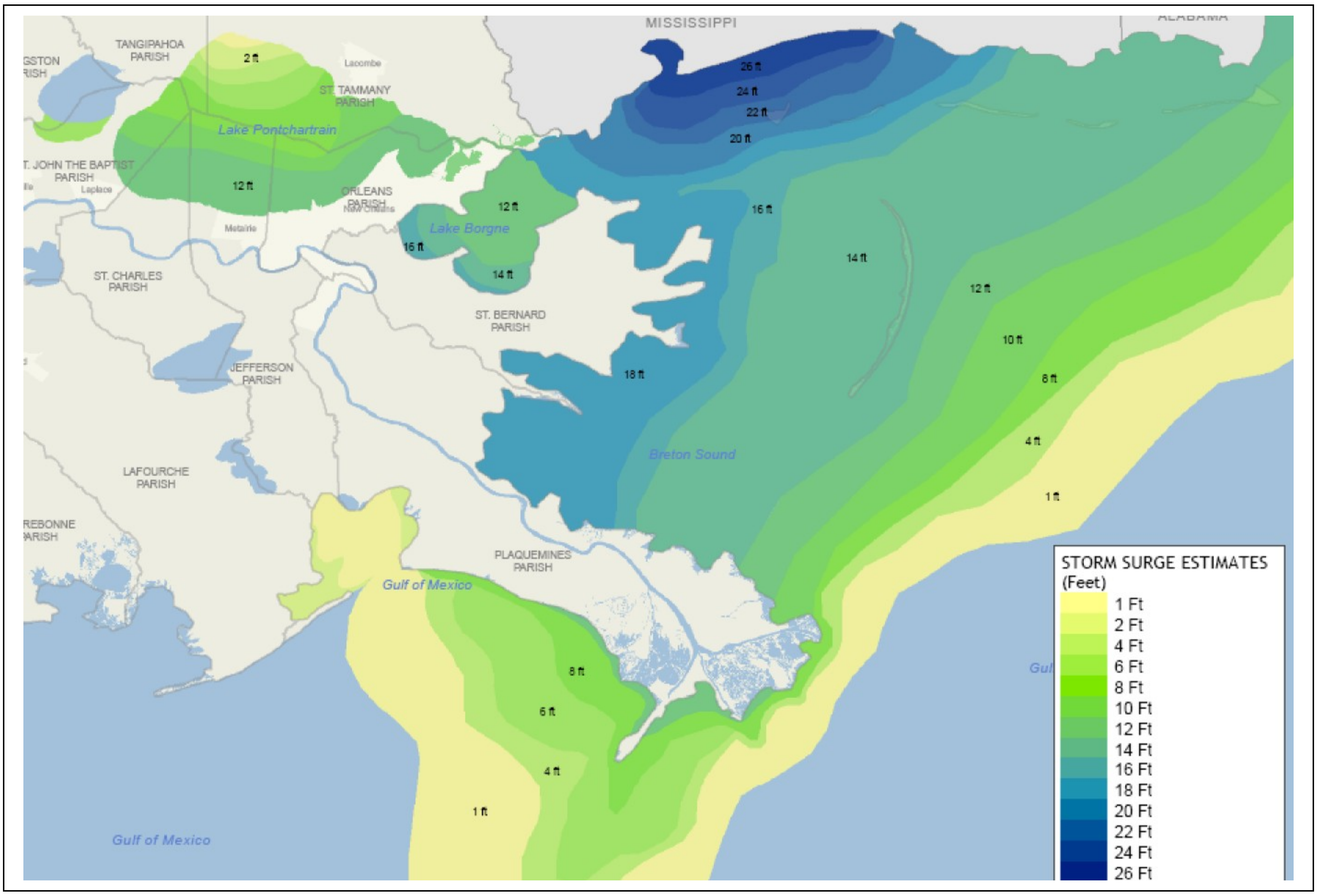
Hurricanes that have made landfall between Houma, LA and Mobile, AL, 1722 to 2005

Date	Category	Hurricane Name
September, 1722		
September, 1740 (Mid-month)		
September, 1740 (A week later)		
Fall, 1746		
August/September, 1772		
October, 1778		
August, 1779		
August, 1780		
August, 1794		
August, 1812		
July, 1819		
September, 1821		
August, 1831		
August, 1848		
August 19-30, 1852	Major Hurricane	
September 15-17, 1855	Major Hurricane	
September 15-18, 1859	Hurricane	
August 8-16, 1860	Major Hurricane	
September 11-16, 1860	Hurricane	
October 2-9, 1867	Hurricane	
July 30, 1870	Hurricane	
September 14-21, 1877	Hurricane	
October 9-22, 1887	Hurricane	
September 11-26, 1889	Hurricane	
September 27 – October 5, 1893	Major Hurricane	
August 2-18, 1901	2	
September 19-30, 1906	3	
September 10-21, 1909	4	
September 11-14, 1912	1	
September 22 – October 1, 1915	4	
June 29 – July 10, 1916	3	
August 26 – September 3, 1932	1	
September 4-21, 1947	3	
September 1-6, 1948	1	
August 20 – September 1, 1950	1	Baker
September 21- 30, 1956	2	Flossy
September 14-17, 1960	1	Ethel
August 26 – September 12, 1965	3	Betsy
August 14-22, 1969	5	Camille
July 9-16, 1979	1	Bob
August 29 – September 14, 1979	3	Frederic
August 27 – September 4, 1985	3	Elena
September 7-11, 1988	1	Florence
July 16-26, 1997	1	Danny
September 15 – October 1, 1998	1	Georges

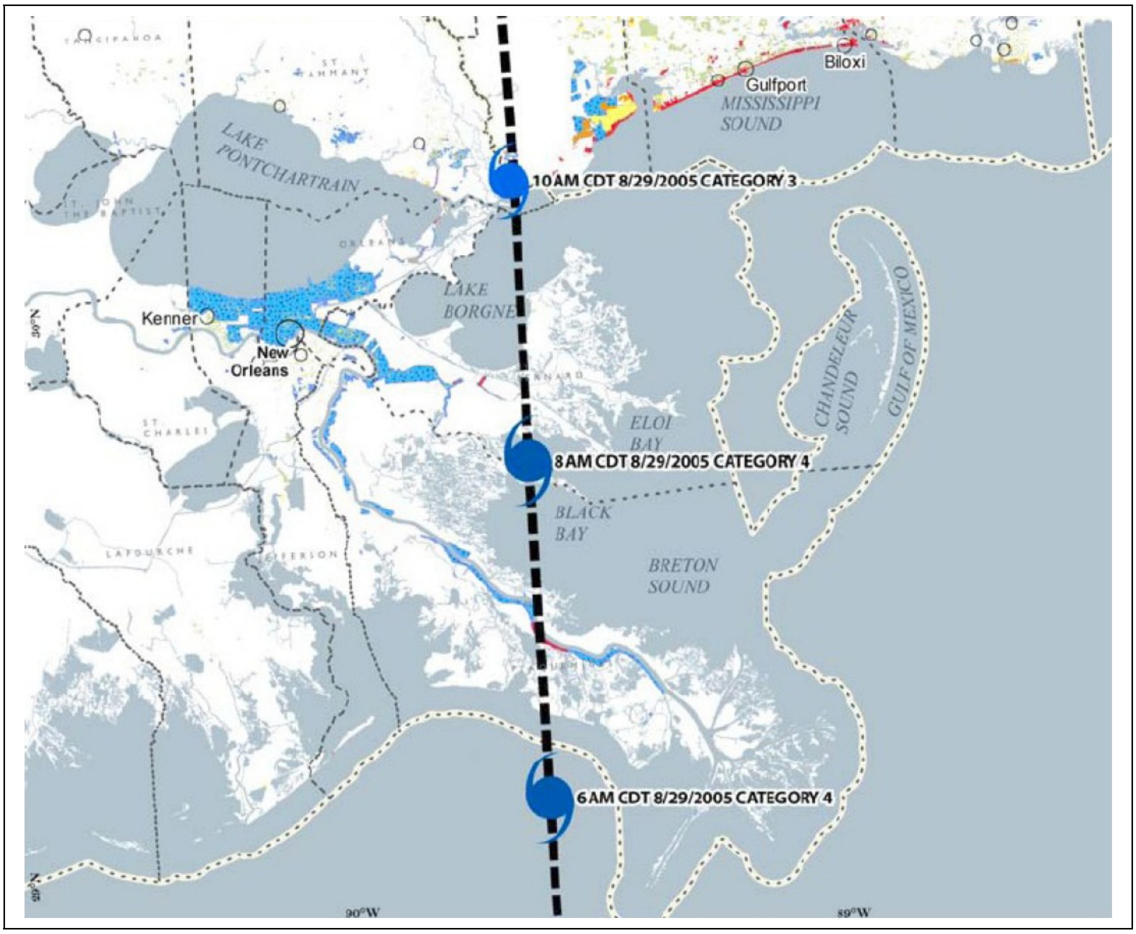
Doc 9 – Vitesses maximales de « vents soutenus » sur la Louisiane. Source : Atlas.



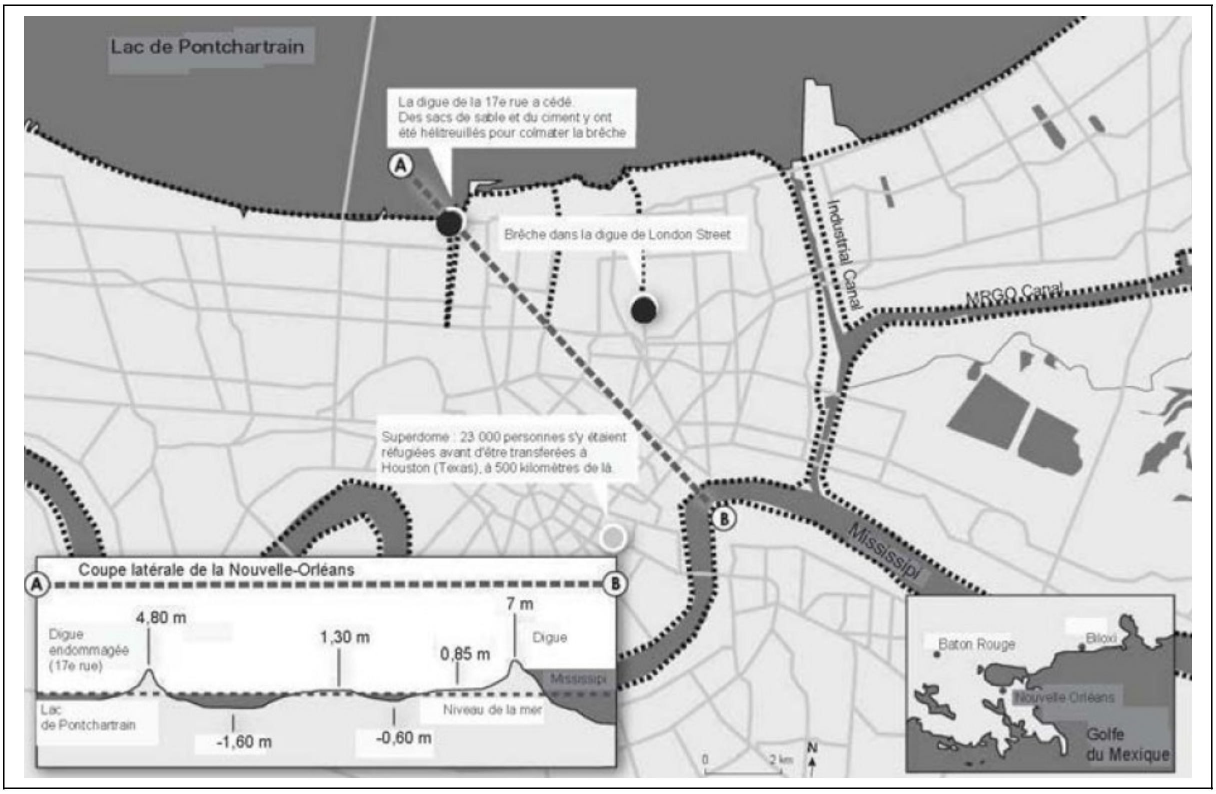
Doc 10 – Surcotes enregistrées dans le Golfe du Mexique, côtes de la Lousiane. Source : Atlas.



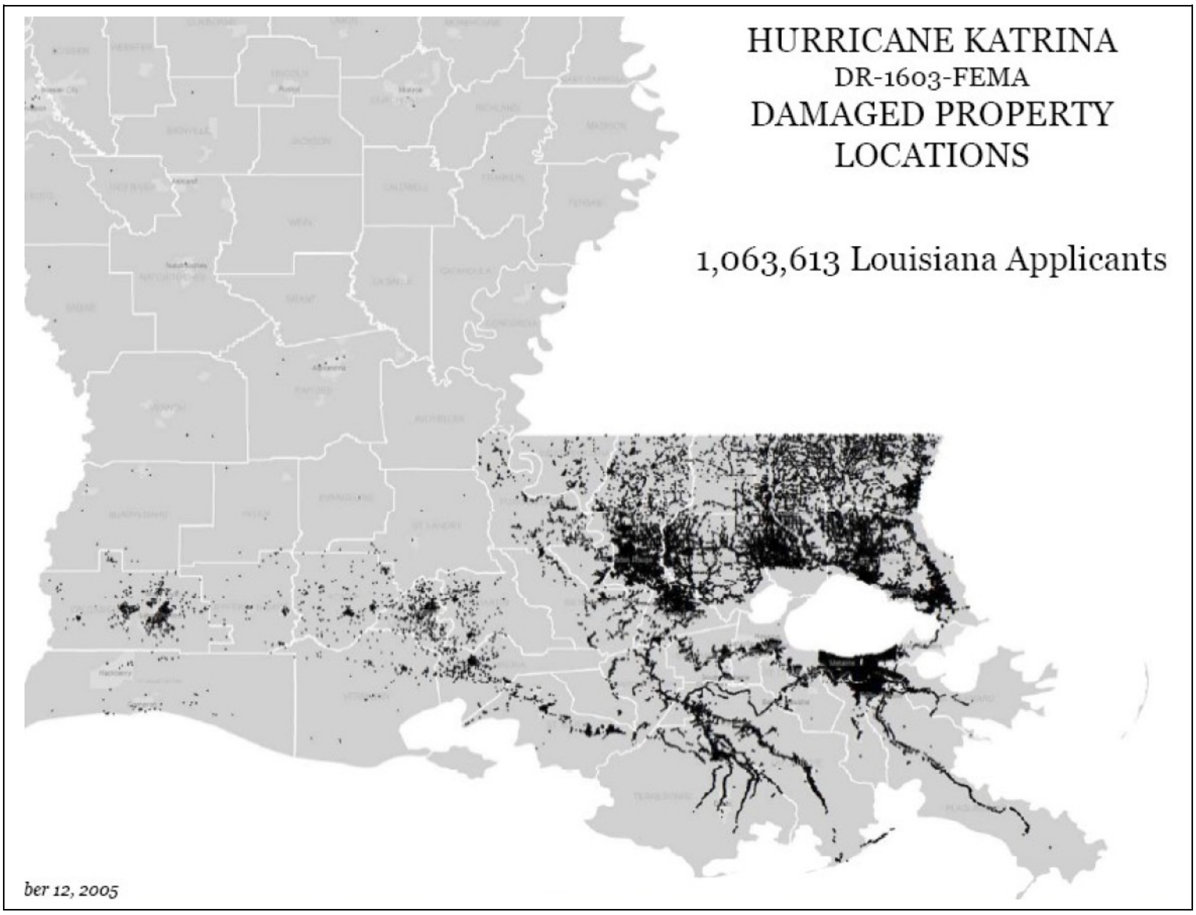
Doc 11 - Les zones inondées du delta du Mississipi. Source : Rapport au Congrès sur (Gabe,2004).



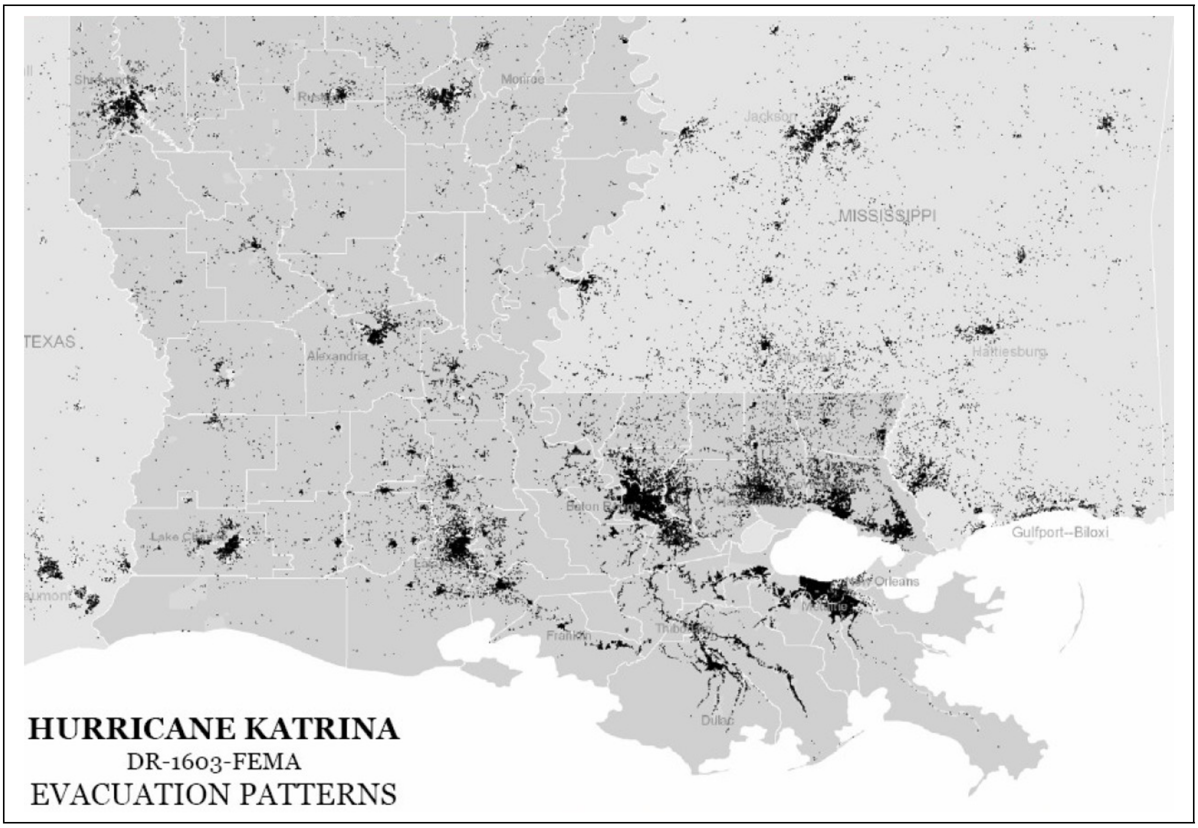
Doc 12 - Coupe de la Nouvelle-Orléans et rupture des digues.



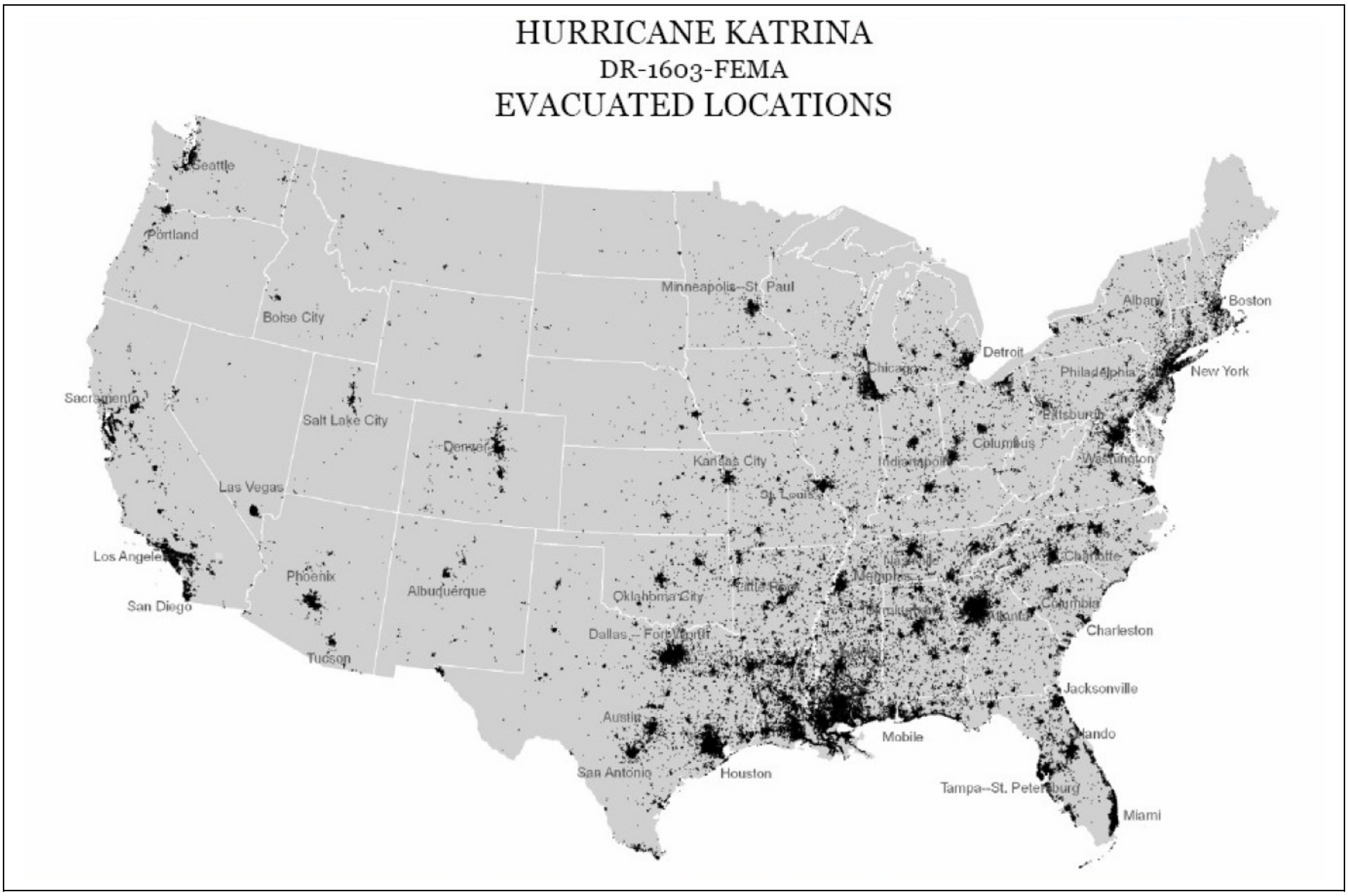
Doc 17 – Propriétés endommagées en Lousiane. Source : LAGIC (Kent & Underwood. 2006)



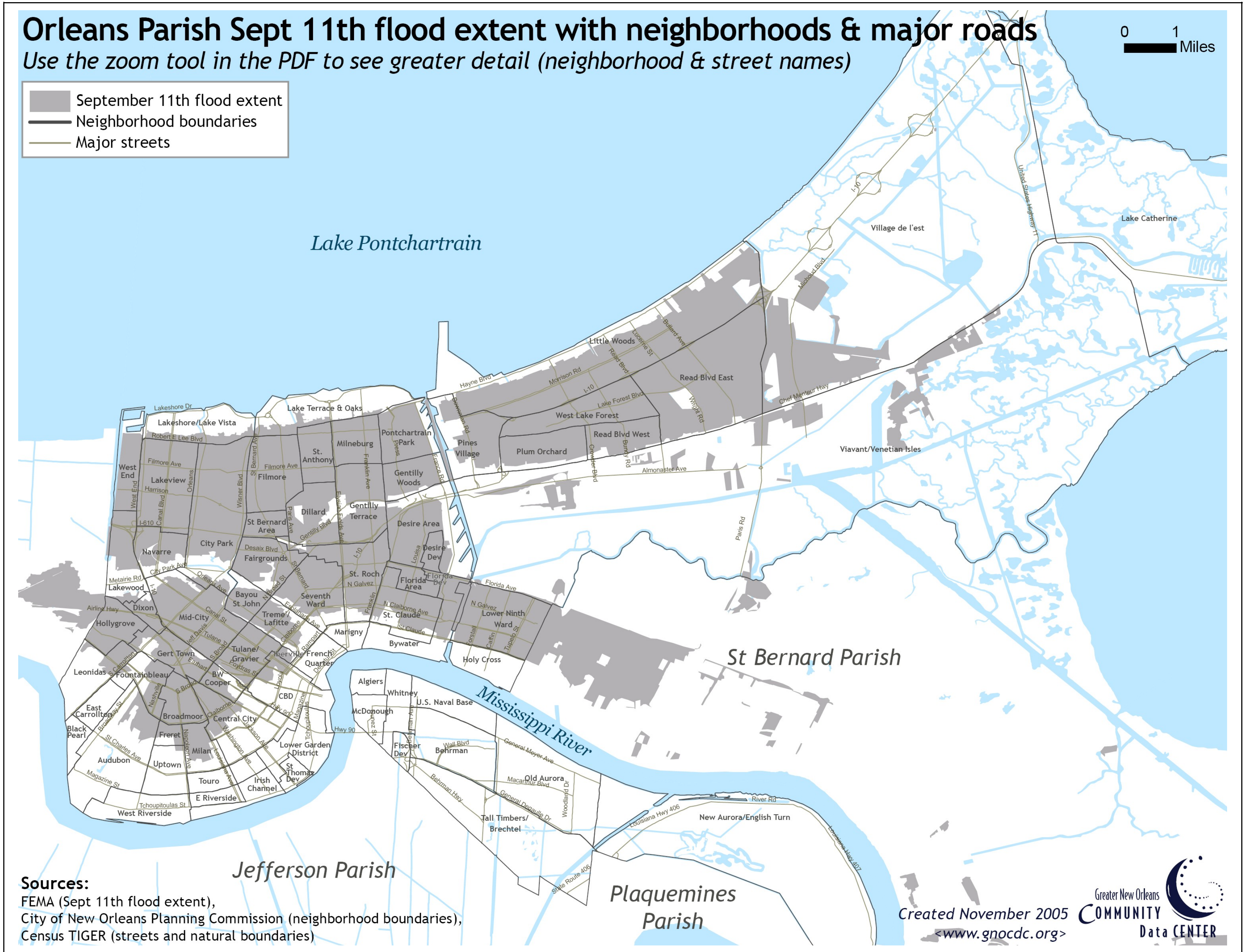
Doc 18 – Localisation des évacués à l'échelle de la Louisiane. Source : LAGIC (Kent & Underwood. 2006)



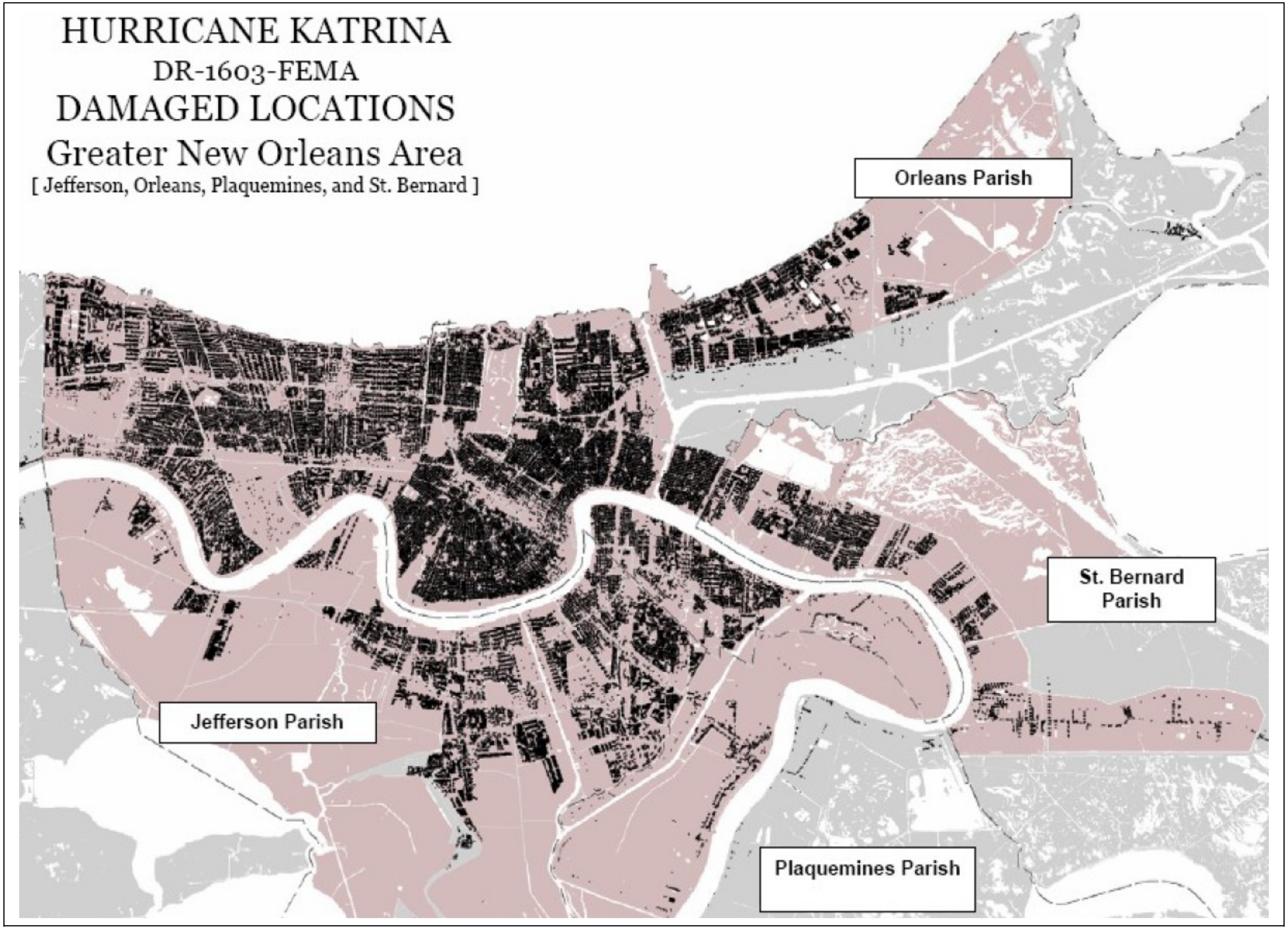
Doc 19 – Localisation des évacués à l'échelle du pays. Source : LAGIC (Kent & Underwood. 2006)



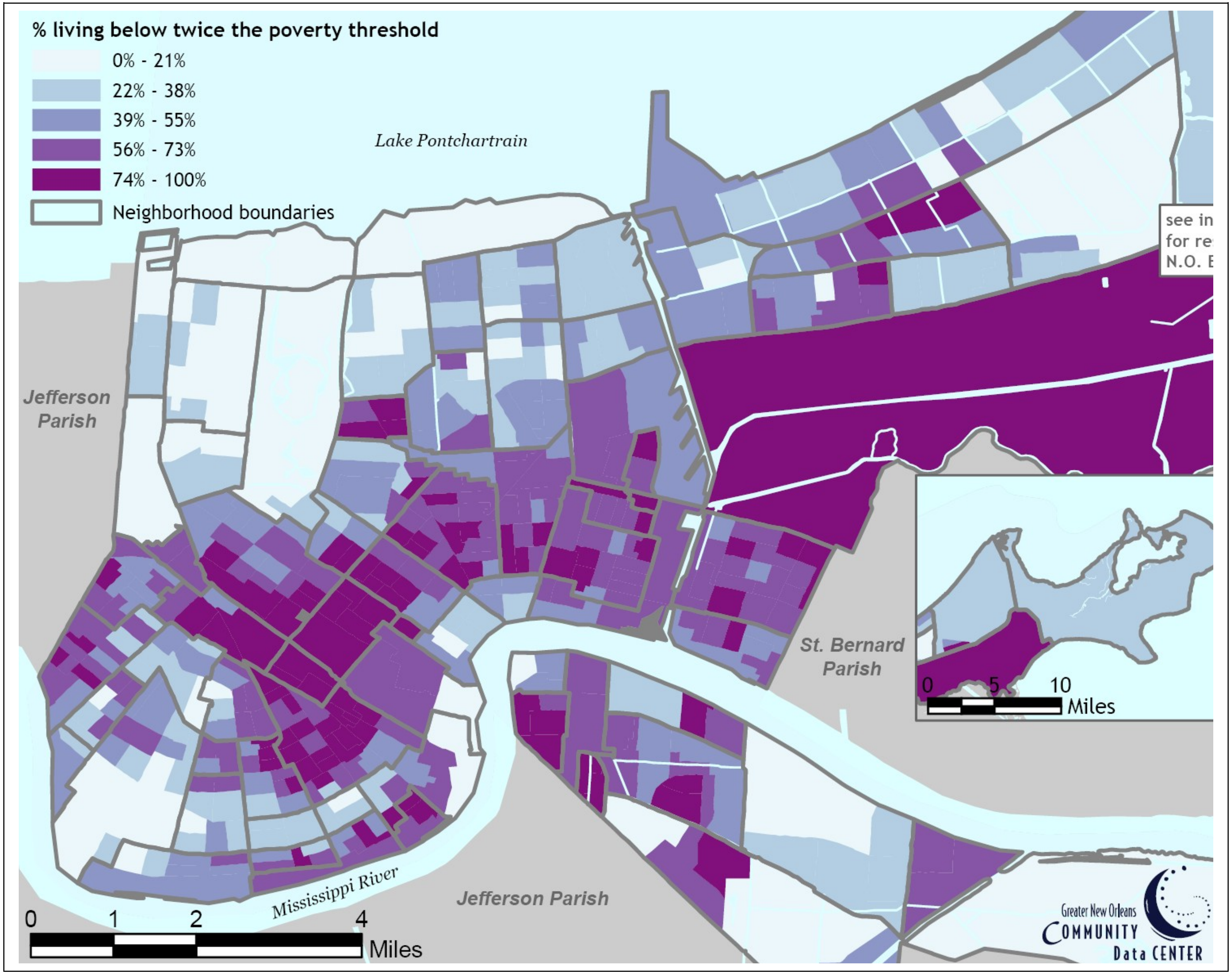
Doc 13 – Extension des zones inondées au 11 septembre (Ville de la Nouvelle-Orléans). Source : Communauté urbaine du Grand New Orleans.



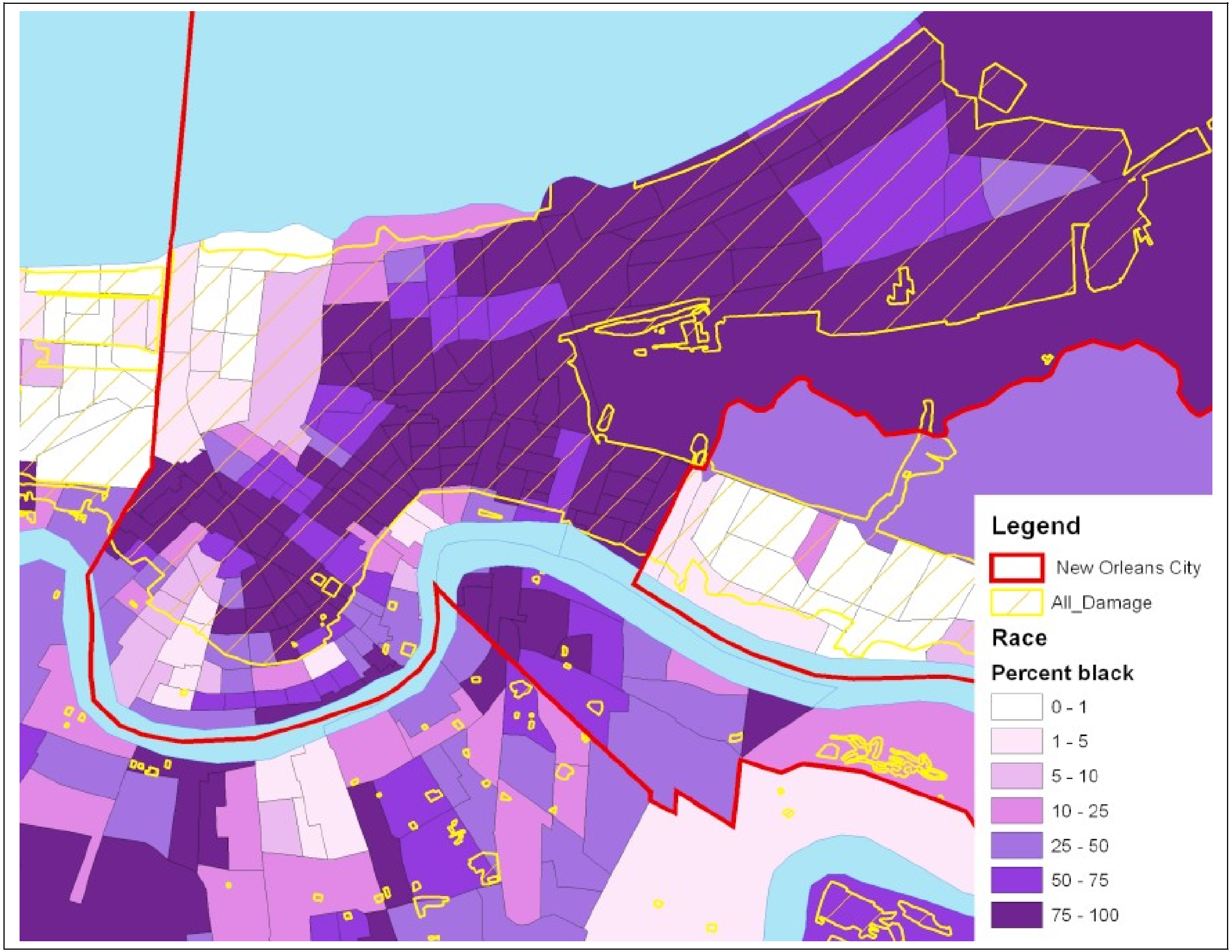
Doc 14 – Dégâts aux installations urbaines. Source : LAGIC (Kent & Underwood. 2006)



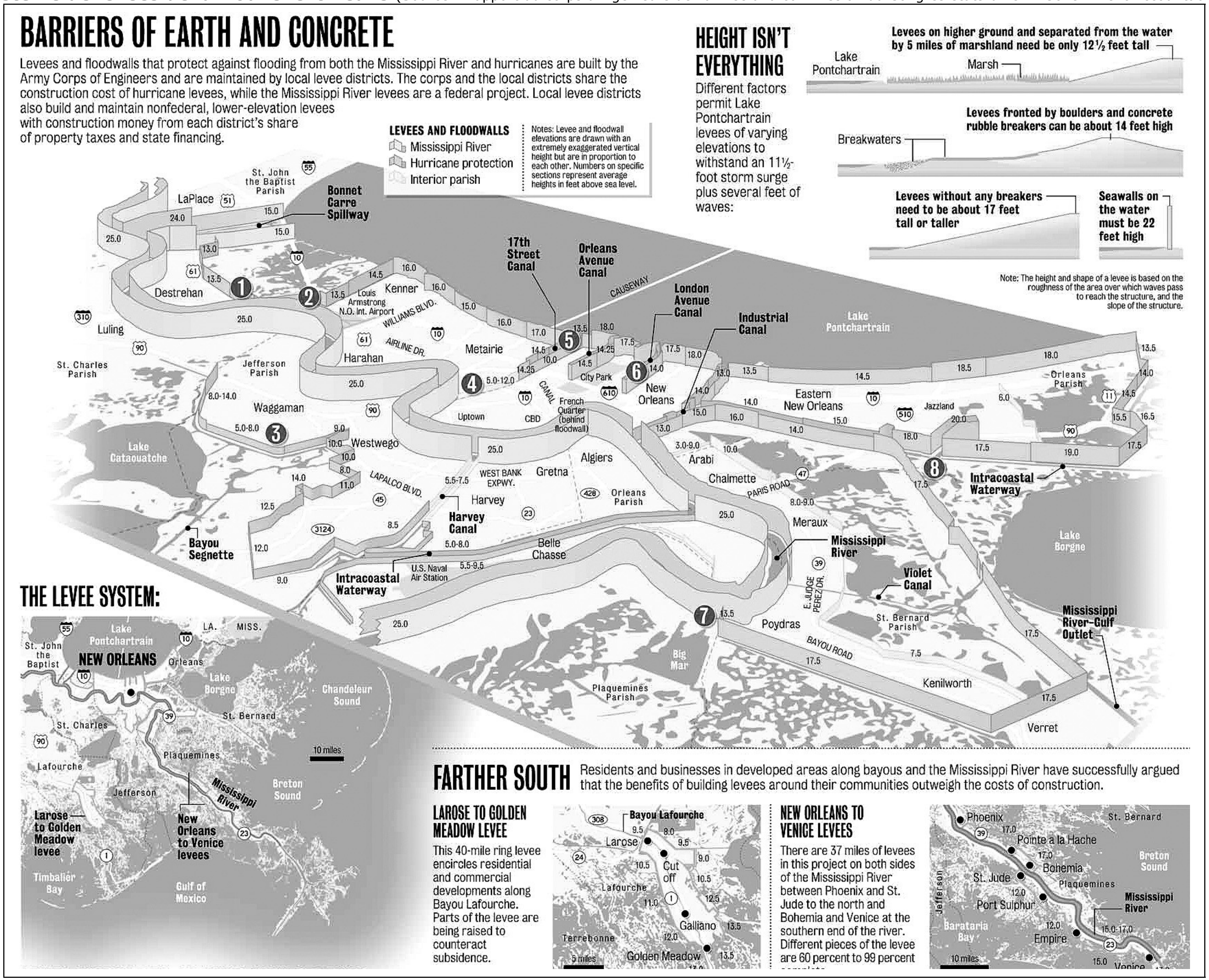
Doc 15 – Pourcentage de la population vivant sous le seuil de pauvreté. Source : Communauté urbaine du Grand New Orleans.



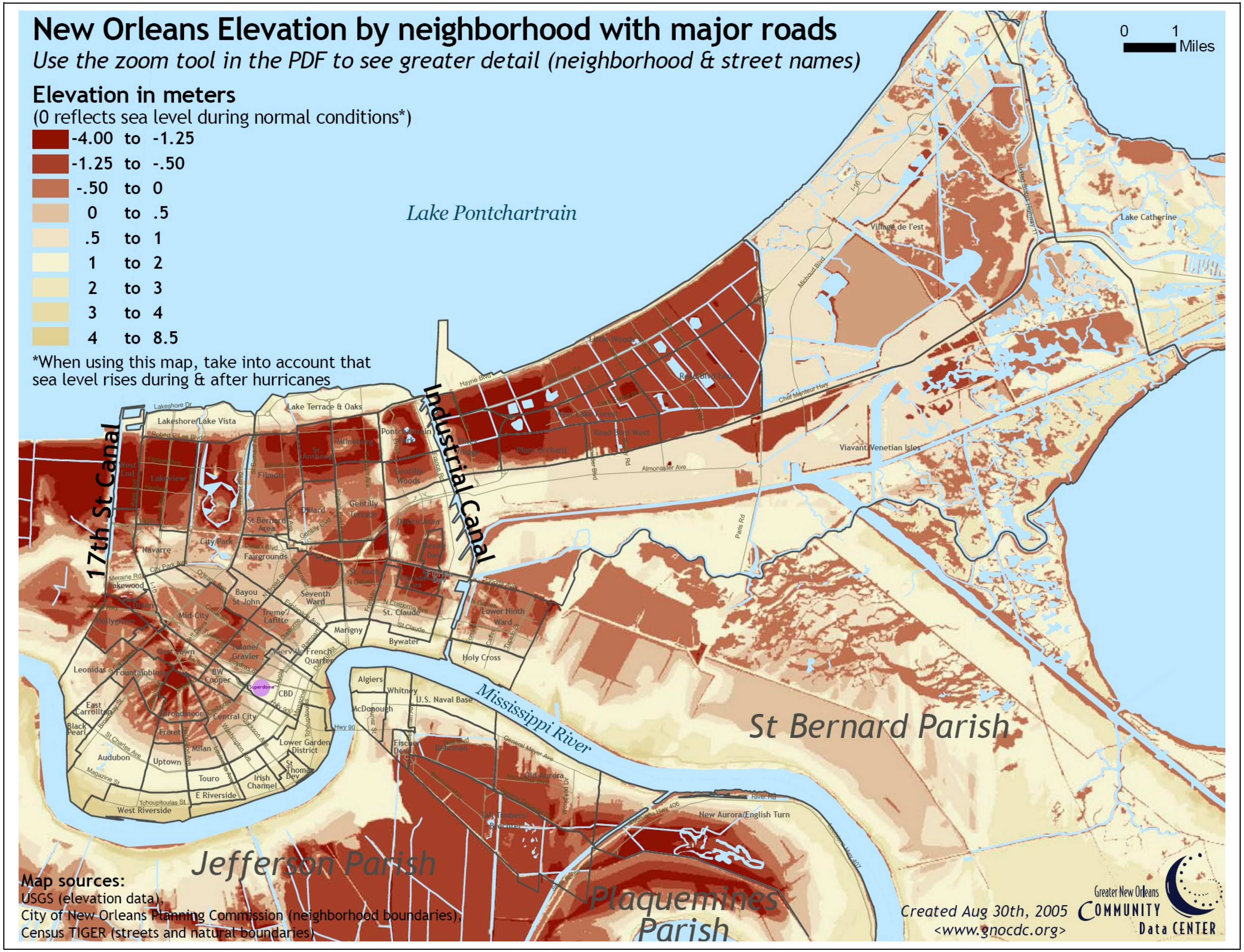
Doc 16 – Pourcentage de personnes noires dans la population des quartiers. Source : Communauté urbaine du Grand New Orleans (Rapport Logan).



Doc 20 – Le système de levées de la Nouvelle-Orléans (Source : Rapport du corps d'ingénieurs de l'armée à la commission du Congrès états-unien - Government Accountability Office)



Doc 21 – Altitude en m (Ville de la Nouvelle-Orléans). Source : Communauté urbaine du Grand New Orleans.



Doc 22 – Subsidence moyenne annuelle sur la période 1951-1995.

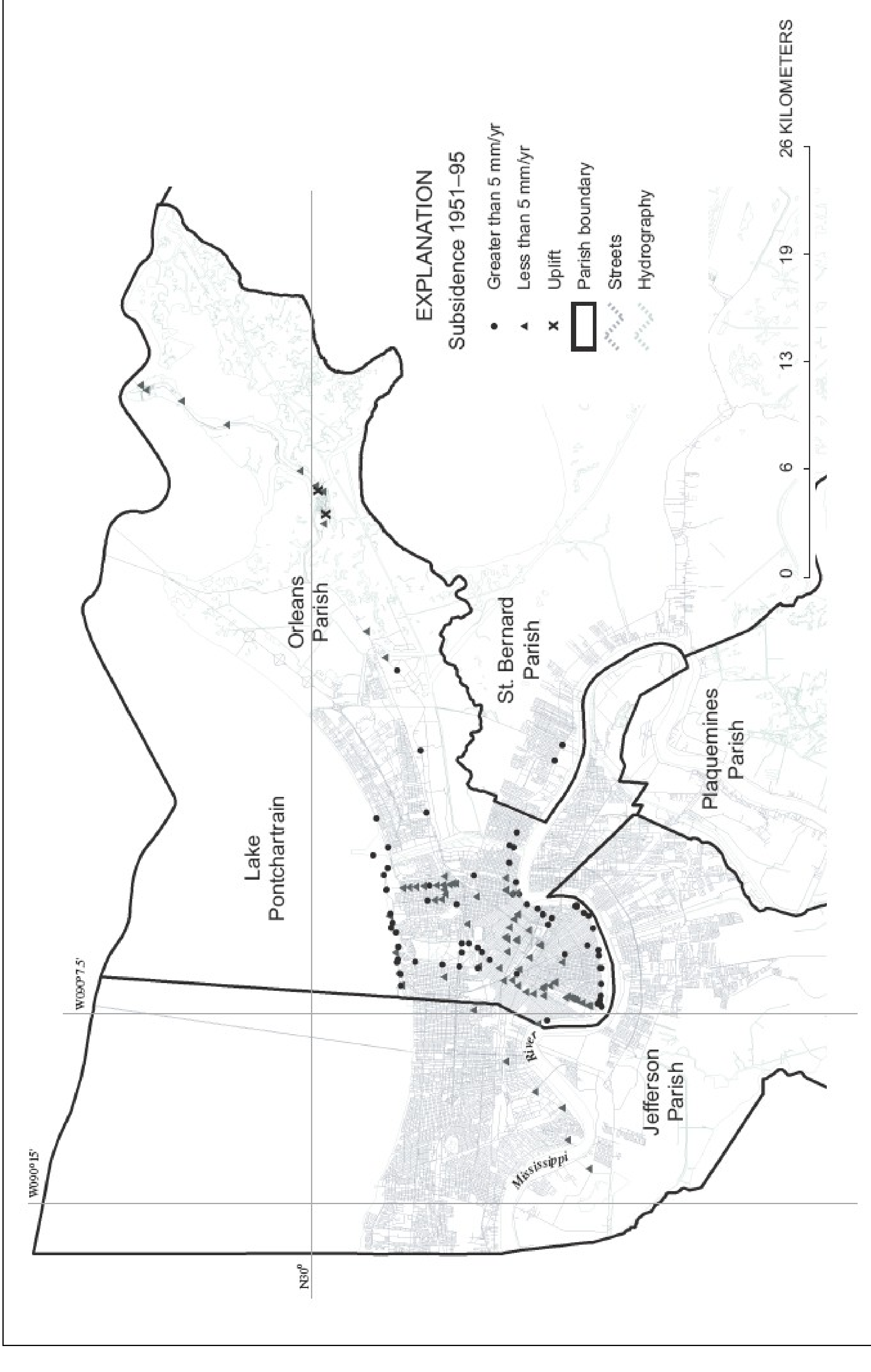


Figure 1. Mean annual local subsidence rates for five soil types and the four major geologic units in the New Orleans region.

Doc 23 - Les facteurs de perte de terre dans le sud-est de la Louisiane (recul des terres au profit de l'eau)

Synthèse de l'USGS

LAFAYETTE, LA-Scientists from the U.S. Geological Survey and other federal and state agencies are reporting that Louisiana lost approximately 1,900 square miles of coastal land, primarily coastal marshes, during the 20th century and could lose another 700 square miles over the next 50 years if no new restoration takes place. That means by 2050 one third of coastal Louisiana will have vanished into the Gulf of Mexico. Nationally, Louisiana currently experiences about 90 percent of the total coastal marsh loss in the continental United States.

Based on USGS data, land loss rates have been reduced from 39 square miles per year between 1956 and 1978 to 24 square miles per year from 1990 to 2000. For the entire period, the loss rate has been 34 square miles per year.
In a peer-reviewed report to be released soon, USGS documents the recent work of the Louisiana Coastal Area (LCA) Land Change Study Group. The group includes federal and state government agencies and university experts in remote sensing, geographic information systems, ecosystem processes, and coastal land loss.

Data generated from the report are being used to plan and assess future coastal restoration. Restoring the state's coast will be one of the largest environmental projects ever undertaken in the United States, estimated to cost $14 billion over the next 40 years. State and federal officials, however, estimate that the cost of inaction will amount to more than $100 billion in infrastructure alone. The group used historical data and the latest technology to predict land changes, especially the conversion of land to open water from 2000 to 2050. The report was done in support of the Louisiana Coastal Area Comprehensive Coastwide Ecosystem Restoration Study.

According to James B. Johnston, spatial analysis branch chief at the USGS National Wetlands Research Center, "If we take wetland loss information from the USGS and the U.S. Army Corps of Engineers, we know that Louisiana lost 1,900 square miles from 1932 to 2000, roughly an area the size of the state of Delaware. Based on the best scientific estimates appearing in the LCA Land Loss Report, the state will lose an additional 700 square miles, about equal to the size of the greater Washington, D.C.-Baltimore, Md. area."

The area undergoing the greatest wetland loss is the Barataria and Terrebonne basins, south of New Orleans. Communities in that vicinity include Thibodaux, Houma, Golden Meadow and Grand Isle. From 1956 to 1978 that area, according to John Barras, USGS geographer, accounted for 43 percent of Louisiana's total coastal wetland loss. From 1978 to 1990, Barataria-Terrebonne experienced 61 percent of the state's loss and from 1990 to 2000, it was 66 percent. The LCA report predicts the area's percentage of loss to be as much as 80 percent from 2000 to 2050 if no new restoration occurs.

The impacts on human populations, the oil and gas infrastructure, fisheries and the seafood industry, and wildlife will be considerable if coastal wetlands continue to disappear. Not only are there significant populations in the Barataria-Terrebonne area, Johnston said, but also the entire region helps buffer larger populations and property in the New Orleans area from hurricanes and other storms. The U.S. Census Bureau estimates that about half of Louisiana's 4.5 million people live in coastal parishes. Without wetlands to buffer storms both people and property are at risk.

Louisiana wetlands are also natural protection for the oil and gas production facilities and pipelines delivering fuel to heat the homes and power the cars of about a quarter of the United States. Without wetlands as a buffer, storms could devastate the U.S. energy security because coastal Louisiana is the home of the U.S. Strategic Petroleum Reserve Sites, a necessity during national emergencies, as well as thousands of miles of pipelines and numerous refineries.
Coastal Louisiana wetlands are termed "America's Wetlands" because of their great environmental and societal value. They make up the seventh largest delta on Earth and are the heart of an intricate ecosystem some scientists say is on the verge of collapse. They contain over 40 percent of the U.S. tidal marshes and support the largest commercial fishery in the lower 48 states. These wetlands provide wintering habitat for millions of waterfowl and migratory birds as well as home for several endangered and threatened species. Coastal Louisiana contains 10 national wildlife refuges and one national park encompassing more than 500 square miles, some of which have wetland loss affecting their capacity to support fish and wildlife.

There are many causes of wetland loss, but chief among them are the dams, levees, navigation projects and channels erected along the mainstream and major tributaries of the Mississippi River. These projects, started in 1928 following the watershed flood of 1927, were completed in 1963, coinciding with the first observations of major coastal land loss in Louisiana. They have resulted in a 67 percent decrease in sediment delivered to the Louisiana coast, a necessary process to keep marshlands replenished.

Données additionnelles (LaCoast – site institutionnel de préservation des zones humides)

Coastal Louisiana has been extensively altered by human activity. Each of the primary causes of land loss has a natural and man-induced component. Subsidence, for example, occurs naturally in the wetlands built by the Mississippi River as a consequence of geologic downwarping and compaction of a sediment column with a high component of water, gas, and organic materials (Kolb and van Lopik 1958, McGinnis et al. 1991). However, subsidence also may be significantly affected by local drainage efforts that reduce the water content of the upper few feet of the soil profile (Harrison and Kollmorgen 1947), by placement of levees and other structures that load the surface (Kolb and van Lopik 1958), or by removal of minerals (e.g., oil, gas, or sulphur) from near-surface deposits.

Similarly, sediment deprivation in a marsh can be a natural consequence of the switching and change in dominance of the various distributaries of the Mississippi River (Coleman and Gagliano 1964), but it also is affected by development of continuous river levee systems that prevent overbank flooding and crevasse development (Kesel 1989) or promote loss of sediment into deep waters overlying the continental slope (Viosca 1928). Finally, hydrologic alterations can occur as a natural consequence of the breakup of barrier island systems at the mouths of estuaries (Penland and Boyd 1981), abandonment of distributary channels, or the development of tidal drainage networks (Tye and Costers 1986). However, the viability of coastal wetlands also is affected by thousands of miles of dredged channels and associated levees that alter hydrology, sedimentation, and salinity regimes (Scaife et al. 1983, Swenson and Turner 1987).

Historical perspective

More than 4 million acres of the coastal wetlands built by the Mississippi River survived into the 20th Century. Nearly one million of these acres have been converted to open water in the last 60 years alone (Dunbar et al. 1992). It is critical to clearly identify the processes that have caused the most damage in the past to determine whether they are still causing destruction and to prioritize restoration efforts to stop or offset the most serious loss-producing processes. Much coastal wetland loss in Louisiana, as in other maritime states, accompanied canal, railroad, and highway building, and development of drainage systems for agricultural, industrial, and residential purposes. In the first two decades of the 20th century over 200,000 acres were leveed and put under pump to create agricultural and suburban lands (Harrison and Kollmorgen 1947). Pumping of the organic soils caused rapid subsidence within the leveed areas and many areas, with the exception of some suburban districts adjacent to New Orleans, underwent conversion to open water once the pumps stopped or storms breached the levees.

Unique to Louisiana is the connection between current land loss and the evolution of a comprehensive levee system along the Mississippi River and the damming of distributaries like the Atchafalaya River, Bayou Plaquemine, Bayou Manchac, Bayou Lafourche, and several others south of New Orleans. The confining of the Mississippi River to a small part of its original flood plain and to a single course was initiated to provide flood control in the last century. Efforts to improve navigation resulted in the extension and stabilization of the mouth as a jettied channel to the edge of the continental shelf (Humphreys and Abbot 1861). Sediment supply to river flanking marshes was decreased, but continued to occur through crevasses or high-water levee breaks (Millis 1894). The disastrous 1927 flood galvanized the Nation and provided impetus for a massive federal effort to raise and reinforce levees for comprehensive flood control (Elliott 1932).

The suspended sediment load from the Mississippi River drainage system that helped build these wetlands apparently declined in the mid-1950's following a long-term drought and the construction mentioned above (Meade and Parker 1985). Measurements of bed materials also show a shift to finer grained sediment in the active delta during the 20th century (Keown et al. 1981). However, land clearing for agriculture and urban expansion has undoubtedly contributed to increased sediment loading in the river over the last 200 years. These changes, coupled with the elimination of direct input to the wetlands through crevasses, levee breaks, and delta lobe construction, have influenced sediment supply rates to the coastal wetlands.

Development of projects within the coastal basins themselves accelerated once river flooding was controlled. Large navigation channels were constructed and enlarged between 1920 and 1970. The Gulf Intracoastal Waterway joined and incorporated several smaller canals running parallel to, but considerably inland of, the coast. In addition, large channels perpendicular to the coast were built to connect inland ports located along the GIWW with the Gulf of Mexico. The dredging of smaller channels for drilling rig access and pipeline installation proliferated in the coastal wetlands of Louisiana during the oil and gas exploration and development boom of the 1950's, 1960's, and 1970's (Lindstedt et al. 1991). Where onshore fields were developed, the marsh was broken up by dense canal networks. Offshore fields also caused destruction as pipeline canals were dredged through the marshes and barrier islands to connect with onshore processing facilities. By 1978, more than six percent of Louisiana's coastal wetlands had been directly converted to open water or spoil through canal dredging alone (Baumann and Turner 1990).

Characterization of regional land loss

The rates at which different parts of the coastal plain are sinking have been related to the thickness of sediment deposited during the last 8,000 years, which varies across the coastal zone. This sediment has the potential to lose volume by dewatering, degassing, and compaction (Penland et al. 1991). During the last glaciation, about 20,000 years ago, when sea level was about 400 feet lower than it is today, the ancestral Mississippi eroded a deep valley into the underlying Pleistocene surface across what is now the coastal zone. When sea level began to rise, the valley was gradually filled with sediment, until about 5,000 years ago when sedimentation spilled out of the valley across the deltaic plain. Consequently, some parts of the deltaic plain are underlain by a massive thickness of Holocene sediment of more than 400 feet. The Holocene layer gradually thickens seaward (Frazier 1967). Slow seaward growth of the chenier plain on the western end of the state has resulted in a much thinner wedge (generally less than 40 feet) of recent deposits over the Pleistocene (Gould and McFarlan 1959).

The rate of sinking and compaction of organic soils and the varied history of sediment deposition across the coastal zone means that RSLR also varies. RSLR estimates include 0.09 inches per year for regional sea level rise in the Gulf of Mexico (Gornitz et al. 1982), and in Louisiana range from a high of 0.51 inches per year in the Atchafalaya and Mississippi deltas to 0.24 inches per year in the chenier plain (Ramsey and Moslow 1987). However, other factors can affect RSLR in local areas. Basin sediment can move downward along fault lines. There are hundreds of "growth faults" in coastal Louisiana, some of which cause displacement at the land surface. The downthrown side of these faults is seaward, and unless sediment deposition counteracts this displacement, land loss rates may increase on this side of the fault, which is thought to be true in the Barataria basin south of Empire.

The gulf shoreline of Louisiana retreats an average of 13.8 feet per year (U.S. Geological Survey 1988). However, some sections prograde as much as 11.2 feet per year on average, while other sections retreat at mean rates that are as high as 50.2 feet per year. Shoreline movement is not a steady process; accelerated erosion occurs during and after the passage of major cold fronts, tropical storms, and hurricanes (Dingler and Reiss 1991). Field measurements have documented 65 to 100 feet of coastal erosion during a single 3- to 4-day storm. These major storms produce a low-relief barrier landscape (Penland et al. 1988, 1990). Erosion along gulf and bay shorelines has resulted in a 55 percent decrease in the total area of Louisiana's barrier islands, and a great deal of lateral and inland migration, between 1880 and 1988. Isles Dernieres, in the Terrebonne basin, has the highest rate of coastal erosion of any Louisiana barrier system. Over the last 100 years the gulf shoreline of these islands has retreated northward a distance of 5,390 feet.

Hurricane Andrew struck the Terrebonne and Barataria barrier islands in 1992, causing extensive erosion and breaching. Beaches were eroded more than 130 feet in two days, and some islands were reduced in area by 30 percent (Stone et al. 1993, van Heerden et al. 1993). The destabilized condition of the barrier islands, combined with the winter storms of 1992-1993, further accelerated the erosion problem (U.S. Geological Survey 1992).
Patterns of land loss between the 1930's and 1983 have been mapped coast wide (Britsch and May 1987), and these maps provide a clear indication that many other "hot spots" of loss exist. For most of these sites the cause of loss is so compounded that it defies any simple explanation (Leibowitz and Hill 1987). While land has been lost along gulf and bay shorelines, far more has disappeared in interior marshes many miles inland of the coast (Turner and Rao 1987), as ponds have formed, expanded, and coalesced into larger water bodies (Fisk et al. 1936, Reed 1991).

Doc 25 – Two Cities, Two Evacuations: Some Thoughts on Moving People Out

Source : Social Science Research Council (http://www.ssrc.org/)
By Joseph Scanlon (http://understandingkatrina.ssrc.org/Scanlon/)

On November 10, 1979, a freight train hauling cars with five different chemicals derailed at a level crossing in the suburban city of Mississauga, Ontario, just west of Toronto. Because they could see and hear propane tanks exploding and could smell chlorine, the Peel Regional Police Force decided to evacuate most of city, or about 217,000 people. Once the evacuation decision was made, the police made it known in every possible way: They told the media—including local radio, television and cable and the national media; They were quite explicit about who had to leave—they released maps of the areas affected so people could see their homes were in the evacuation zone; They sent officers door to door, covering every private home and every apartment; They followed those officers along every street with police cars with loud hailers broadcasting the evacuation decision; and They were specific about what people should do and where they should go.

For example, police told individuals if they had private vehicles they should keep driving until they passed the police perimeter. Those who did not have private vehicles were informed that Mississauga Transit would take care of them. Police instructed people to find their own accommodation if possible. If they had nowhere to go, a shelter had been opened by the Red Cross at Square One, the city's largest shopping centre.
Because of the timing of the incident—it occurred just minutes before midnight on a Saturday night—offices were closed as were most stores. However, in addition to telling people to leave their homes, the police also ordered an evacuation of a number of health facilities, including the Mississauga General Hospital. To do this they called on the Metro Toronto ambulance service which quickly canvassed all area hospitals to determine bed availability, then sent roughly 200 ambulance and other medical transport vehicles to Mississauga. With the help of the police, who established clear routes between Mississauga and other area hospitals, the ambulance service was able to move most patients directly from Mississauga to another hospital which could deal properly with that type of patient—and which knew the patient was coming. The only hiccup occurred when a physician ordered the ambulance service to move some patients from the Mississauga General to his hospital. Those patients had to be moved again when that hospital was also evacuated.

Not everything went perfectly. The evacuation area had to be expanded and those who took shelter at Square One moved to another location. Some people refused to move and police had neither the time nor the inclination to force them to go. (They did however note who had remained behind so they could reach them in case of emergency.)
Mississauga occurred more than a quarter of a century ago and was hailed as an extremely well managed evacuation. It seems reasonable to ask: if it was possible to do things so well then, why was it do difficult to do them equally well in New Orleans?

Of course, there were some differences, including some that made things easier in Mississauga. For one thing, the incident occurred late on a Saturday night on a holiday weekend. Most people were at home with their families and most had their own vehicles. There were also plenty of roads for them to take as they left. Traffic was not much of a problem. For another, the residents of Mississauga were affluent compared to those of New Orleans. Most could afford private accommodation if they did not have family or friends to take them in. And—except right around the derailment—there was no destruction in Mississauga. Yet the Mississauga evacuation occurred after an unexpected derailment. Unlike the situation in New Orleans, there was no warning, no time to prepare, no time to adjust plans.
Social scientists have argued for years that there are many misconceptions about human and organizational behaviour in disaster. They say, for example, that panic is rare and that victims are not dazed and confused but are the real first responders. They say that anti-social behaviour such as looting is rare to non-existent and that in disasters crime rates usually fall. They say that victims often resent those who come to assist especially if that assistance is offered in a bureaucratic way. And they say that in disaster individuals do quite well, but organizations do not. It is interesting to see whether social scientists are right when Mississauga and New Orleans are examined.

Certainly in both locations there was no panic, no sign whatsoever of hysteria. In fact the real problem in both places—and especially in New Orleans—was the lack of panic. Instead of being frightened to the point they felt compelled to flee, many in New Orleans decided to stay and take their chances. This is the opposite of panic. Of course, there was a major difference between the two cities. In Mississauga, everyone was urged to go. No provisions were made for those who wished to remain. In New Orleans, despite the evacuation order, the city offered to provide a public shelter for those who decided to stay—or did not have any way of leaving. This clearly gave a mixed message: you have to go but if you stay we have a place for you to do so. That seems, in retrospect, to have been a terrible mistake, and it was magnified by the fact that those who stayed were told to bring their own supplies of food, water and other necessities.
What about the second misconception—that victims are dazed and confused and in shock. There is no evidence to suggest that happened in either city. Certainly in New Orleans there was anger at what had happened and concern, especially about those who were trapped in their homes or other buildings. But those persons—or so it appeared—did the best they could under very difficult circumstances. Did the survivors assist others? At this point it is difficult to tell. None of the media interviews appear to have asked questions about this. They have treated those who stayed as incapable of helping themselves. Perhaps that was the case. Probably we will never know.

The biggest difference between the two cities—or so it appears—was the looting. In Mississauga, crime rates dropped almost to nil. The only serious incident was a series of break-ins by a group of persons who had done the same previously. They were arrested and that was that. In New Orleans, in contrast—or so it would appear—there was a great deal of criminal activity. At least that is what the news media and officials would have us believe. It is important that this be looked at in context.

First, it is important to realize that behaviour that is normally not appropriate may well be appropriate in a disaster. For example, if someone started using an axe to chop a hole in the roof of a private residence in normal times, there would be immediate calls for a police response and arrests would follow. In the wake of the flood, there were many occasions where those with axes who chopped holes in roofs were welcome as saviours. People trapped under their eaves troughs had no other way to get out. The same behaviour has different meaning in a different context.
That means it is important to examine the context of various acts which seem to have occurred in New Orleans. Persons for example were reported to have broken into stores to "steal" water, food, even diapers. This behaviour is just as appropriate as if someone using an axe to chop through a roof. The stores were closed. No arrangements had been made for food, water and clothing to be provided. People took the only recourse they had for survival. The social norms had changed.

Second, it is essential to look at what usually happens in order to make accurate comparisons. Mississauga is not a high crime city. Murders are rare. So are robberies with violence. New Orleans is very different. Its murder rate is 10 times the national average. Its robberies run at three times the national average. And it's reasonable to assume that crimes involving the use of weapons are far more common than in Mississauga, Ontario, Canada, where there are far, far tighter rules about who can legally own a gun. (In Canada, in most cases, when a criminal uses a weapon, that weapon has come into the country illegally from the United States.) In looking at New Orleans, it is important to ask not whether there was any criminal violence after the disaster but whether the rate of crime increased or fell.

The fourth misconception is that people welcome outside assistance. This was certainly true in the hurricane area when those assisting came to do search and rescue, came to provide fresh water or came to provide belated transportation out of the stricken areas. It is not surprising there was not so welcome a response to those who came to provide what is being called the restoration of law and order. However so far we know little of the reaction to the aid efforts and nothing about whether there are going to be bureaucratic rules about assistance and about how the relief money is allocated. Certainly there is lots of evidence from past incidents that those who know how to work the legal system—in short those who have money—are more likely to get aid.

The final misconception is that emergency agencies and government will perform better than individuals. In Mississauga to some extent it was a draw. The public performed well but so did those in charge. In New Orleans it is hard to avoid drawing the conclusion that the authorities performed rather badly indeed.

Hurricane Katrina was in two ways an expected event. It has been known for decades that sooner or later a major storm would made landfall at New Orleans. And it was known what that would mean to a city protected by dykes or levees. Moreover, the United States weather service did its usual superb job of tracking this storm. It was known well before impact that there was every chance a Category Five hurricane would strike. The weather service even managed to downgrade Katrina to a Category Four just before impact. City officials clearly understood and acted on that information and that is why they declared an evacuation was required.

Making an evacuation announcement was important. Getting it the widest possible attention was also important. And it did lead to many leaving—including local media who relocated outside the city. But that decision was undermined in two ways. First no provision appears to have been made for those without private transport and without resources. The flood of buses that came in to relocate those who took shelter in public arenas should have come in before Katrina not after it. Second, the announcement that public shelters were available made the message to leave seem less convincing. People search for some way to discount a warning. New Orleans provided that.

Is it fair to compare the two cities, Mississauga and New Orleans? Perhaps in some ways it is not. The circumstances were certainly very different. Most residents of Mississauga were away for roughly a week and most knew their homes and possessions would be intact when they returned. New Orleans' residents face a very different return if and when that comes. Yet Mississauga is 40 per cent the size of New Orleans, which is not that large a city. And the problem being discussed is not the recovering, restoration and return but the handling of the evacuation of a major city. On that basis, the comparison is legitimate and disturbing.

It is always easier to look back and see what might have been done than to look ahead and see what should be done. But surely it is reasonable to suggest that New Orleans had the time and the resources—if it had utilized all emergency personnel—to send persons door to door to tell people to go. And surely, given the precise nature of the warning, it would have been possible to round up the buses needed to move people out. And surely arrangements could have been made to release the supplies locked in various stores and warehouses and make them available to those who were told they could stay behind.

The authorities in New Orleans had two options. They could have increased the pressure to evacuate by making arrangements for a massive move out via public transportation and by sending persons door to door to convey the warning and the fact that free transportation was available in the clearest possible way. Or they could have developed a plan for how to deal with the needs of those who stayed once they decided and made clear this was a legitimate option. From what has been reported they seem to have chosen neither of those options.

Despite Gustave LeBon's perception that in times of crisis people revert to what he called the "lower orders,"research has shown that people generally behave quite well in the wake of a disaster. They look around them to see what has to be done and, if possible, do it. The problem in New Orleans of course was that those who survived often did not have the capacity to do what needed to be done. Many were trapped in their homes unable to help themselves let alone help others. Most—including those who sheltered in public facilities—were soon short of water, food, clothing and sanitary facilities. It was urgent that there be a) a massive relief effort and b) a massive search and rescue effort to find those who were trapped and to help them. Given the flooding it would seem logical to suggest this had to be done by water craft, perhaps the sort of flat bottom boat that is used in the Florida Everglades.

Of course, some of those who survived did do what they could to help themselves. Given their desperate need for liquid they found sources for fresh water and, where necessary, did what was needed to get that water. If that involved breaking into a store, that is what they did. They did the same thing when they needed food or diapers or fresh clothing. If the authorities wanted to prevent this they had the two options described above. They would have got the people out of they could have brought supplies in.

Sadly, the authorities chose to view the situation in New Orleans after Katrina not as one involving desperate people urgently in need of assistance but as a situation requiring law and order. So the police—though reluctant at first—began to crack down on what they were being told was "looting". And the military arrived with a show of force.

Forcing people to leave their homes is not easy. No community has the resources to enforce an evacuation order if there is major resistance. Further, the ability to act is a function of the resources available. From the evidence available, it appears that moving almost everyone out of New Orleans would have been far more difficult than moving people out of Mississauga. And even in Mississauga some refused to go. But it is hard to avoid thinking that if the resources that became available after the hurricane— helicopters, buses, shelters, personnel—had been called in before Katrina struck, there would be many fewer problems now.

Doc 24 - The Geography of Social Vulnerability: Race, Class, and Catastrophe

Source : Social Science Research Council (http://www.ssrc.org/)
By Susan L. Cutter (http://understandingkatrina.ssrc.org/Cutter/)

It was bound to happen. The scenario had been researched, rehearsed, and replayed over and over again among emergency managers. It was just a matter of when and where the major hurricane would strike a large American city. Two specific scenarios had been considered—a major hurricane with 20 foot plus storm surge inundation affecting the Gulf Coast region or a hurricane-induced levee failure in New Orleans. Both captured the imagination of emergency planners designing training scenarios. Hurricane Pam, the fictional FEMA-funded emergency exercise for federal, state, and local officials in Louisiana, encapsulated both scenarios. Hurricane Katrina played them out in real time.

The revelations of inadequate response to the hurricane's aftermath are not just about failures in emergency response at the local, state, and federal levels or failures in the overall emergency management system. They are also about failures of the social support systems for America's impoverished—the largely invisible inner city poor. The former can be rectified quickly (months to years) through organizational restructuring or training; the latter requires much more time, resources, and the political will to redress social inequities and inequalities that have been sustained for more than a half century and show little signs of dissipating.

How did we arrive at such a confluence of natural and social vulnerabilities manifested as the Hurricane Katrina disaster? This complex emergency began with geography—the spatial interaction of humans and their environment over time. Officially founded in 1718 by Jean-Baptiste Le Moyne de Bienville, New Orleans was strategically located at the crossroads of three navigable water bodies, Lake Pontchartrain, the Gulf of Mexico, and the Mississippi River. Important primarily as a trading depot for French fur trappers, the city evolved into one of the most important ports in America providing a gateway to the nation's agricultural riches.[1]

The original settlement was on the highest ground in the bayou, Vieux Carré (the French Quarter), which later became the heart and soul of the modern city. How prescient for the early settlers to build on the highest ground available. As the settlement grew in the ensuing decades, New Orleans became a major American port city and a sprawling metropolis sandwiched between and surrounded by water. The siting and growth of New Orleans was inevitable given its access to water-borne transportation routes, but that access also contributed to the extremely precarious and peculiar range of environmental risks. The human transformation of the physical environment enabled the city to grow and prosper.[2]

To reduce the natural risks of flooding, the physical environment surrounding New Orleans was re-engineered, spawning an era of structural river control.[3] Levees were built to control the flow of the mighty Mississippi, but they were also built to contain flooding from Lake Pontchartrain, especially useful during hurricane season. The ideology of conquering and taming nature (an inherited European ideal that man could actually control nature), rather than living in harmony with it, was (and still is) the driving force in the production of the physical vulnerability of the metropolitan area. Instead of seeing the deposition of alluvium that one expects in a deltaic coastline, the levees channeled the river and its sediment, destroying protective wetlands south and east of the city. With many areas of the city below sea level, even heavy rainfall became a problem filling the city with water just like a giant punchbowl. An elaborate pumping system was required to keep the city dry during heavy rains, let alone tropical storms. What would happen during a hurricane, a levee failure, or an intentional levee breach used to divert floodwaters away from the city as was done in 1927? [4]

Concurrent with the physical transformation of the city, a new social geography was being created as well. The South's segregated past was best seen in the spatial and social evolution of southern cities, including New Orleans. Migration from the rural impoverished areas to the city was followed by white flight from urban areas to more suburban communities. Public housing was constructed to cope with Black population influxes during the 1950s and 1960s and in a pattern repeated throughout America, the housing was invariably located in the most undesirable areas—along major transportation corridors, on reclaimed land, or next to industrial facilities. Employment opportunities were limited for inner city residents as jobs moved outward from the central city to suburban locations, or overseas as the process of globalization reduced even further the number of low skilled jobs. The most impoverished lived in squalor-like conditions concentrated in certain neighborhoods within cities, with little or no employment, poor education, and little hope for the future for their children or grandchildren. It is against this backdrop of the social geography of cities and the differential access to resources that we can best understand the Hurricane Katrina disaster.

Socially created vulnerabilities are largely ignored in the hazards and disaster literature because they are so hard to measure and quantify. Social vulnerability is partially a product of social inequalities—those social factors and forces that create the susceptibility of various groups to harm, and in turn affect their ability to respond, and bounce back (resilience) after the disaster.[5] But it is much more than that. Social vulnerability involves the basic provision of health care, the livability of places, overall indicators of quality of life, and accessibility to lifelines (goods, services, emergency response personnel), capital, and political representation.

Race and class are certainly factors that help explain the social vulnerability in the South, while ethnicity plays an additional role in many cities. When the middle classes (both White and Black) abandon a city, the disparities between the very rich and the very poor expand. Add to this an increasing elderly population, the homeless, transients (including tourists), and other special needs populations, and the prospects for evacuating a city during times of emergencies becomes a daunting challenge for most American cities. What is a major challenge for other cities became a virtual impossibility for New Orleans. Those that could muster the personal resources evacuated the city. With no welfare check (the hurricane struck near the end of the month), little food, and no help from the city, state, or federal officials, the poor were forced to ride out the storm in their homes or move to the shelters of last resort. This is the enduring face of Hurricane Katrina—poor, black, single mothers, young, and old—struggling just to survive; options limited by the ineffectiveness of preparedness and the inadequacy of response.

In the actually planning for emergencies, social vulnerability is captured under the heading of "special needs populations." While small communities can identify their special needs populations, it becomes a daunting task in major cities. What is the homeless population and where are they? How many tourists are in town that may need help in evacuating? How full are the large hospitals, outpatient clinics, and mental health care facilities? What about nursing homes? Prisons? The healthy poor are rarely considered as a special needs population, even though they lack the financial resources to respond to emergencies.

As a nation, we have very little experience with evacuating cities from natural hazards let alone technological failures or willful acts. Crisis relocation planning was the norm during the height of the Reagan administration, but many social scientists scoffed at the implausibility of the effort as a precautionary measure against a nuclear attack. Our collective experience with evacuations is based on chemical spills or toxic releases, planning for nuclear power plant accidents, and hurricanes. In most cases, but certainly not all, the evacuations have been in rural or suburban places, not a major U.S. city. Florida's hurricane experience has been a suburban phenomena not an inner city one. The potential differences in response are critical and highlight the difficulties in emergency preparedness for major cities. The number of large urban hospitals, the dependence on public transportation, and the need for mass sheltering all complicate preparedness efforts in these dense multi-ethnic and multi-racial cities. In addition to the sheer number of people at risk, emergency managers have the additional task of identifying those residents who may be the most vulnerable—the poor, the infirmed, the elderly, the homeless, women, and children. The nescient result is an ever-widening disparity in society's ability to cope with more persistent social and economic problems in urban areas, let alone a potential mass impact event of unknown origin. This is the story of Hurricane Katrina and its aftermath.

Scale, of course, is also an important element to consider. While the terrorist attacks of September 11, 2001 affected two major cities (New York and Washington D.C.), the actual damage swath in New York City, for example was quite small (tens of acres, not hundreds of square miles) and involved one local jurisdiction. Hurricane Katrina affected a much larger region, geographically, encompassing more than 600 miles of the Gulf coastline stretching from Grand Isle, LA to Gulf Shores, AL; three states; and hundreds of local jurisdictions. This is not meant to minimize the social, economic, or political importance of 9-11, but rather to place the response and recovery in perspective in terms of its geographical scale.

Just as there is variation in the physical landscape, the landscape of social inequity has increased the division between rich and poor in this country and has led to the increasing social vulnerability of our residents, especially to coastal hazards.[6] Strained race relations and the seeming differential response to the disaster suggests that in planning for future catastrophes, we need to not only look at the natural environment in the development of mitigation programs, but the social environment as well. It is the interaction between nature and society that produces the vulnerability of places. While physical vulnerability is reduced through the construction of disaster-resistant buildings, changes in land use, and restoration of wetlands and floodways, a marked reduction in social vulnerability will require an improvement in the overall quality of life for the inner city poor. We should not have the equivalent of developing world conditions in a nation as wealthy as the United States. This is the tragedy of Hurricane Katrina. Few outside of the region knew of the impoverished conditions for many New Orleanians, which is why one of the city's nicknames, "The City that Care Forgot," seems so poignant.

Disasters will happen. To lessen their impacts in the future, we need to reduce our social vulnerability and increase disaster resilience with improvements in the social conditions and living standards in our cities. We need to build (and rebuild) damaged housing and infrastructure in harmony with nature and design cities to be resilient to environmental threats even if it means smaller, more livable places, and fewer profits for land and urban developers and a smaller tax base for the city. Disasters are income neutral and color-blind. Their impacts, however, are not.

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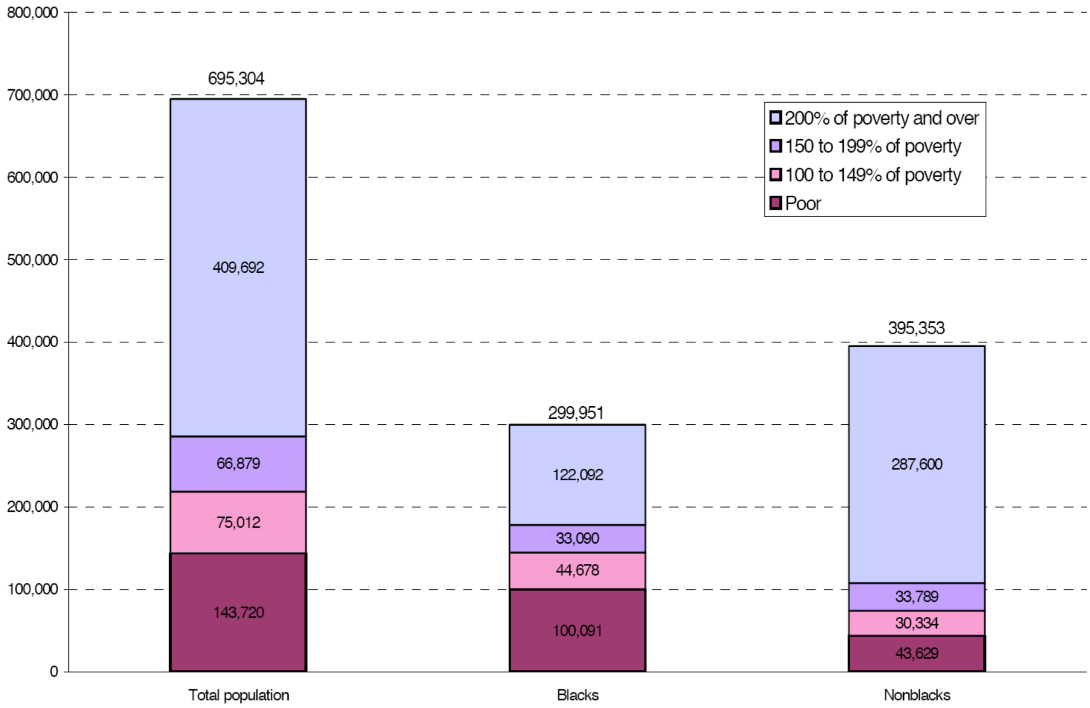
Doc 16bis – Nombre de personnes touchées par l'ouragan Katrina, en fonction de leur caractéristiques « ethnique » et de leur degré de richesse.

Figure 7. Estimated Number of Persons in Hurricane Katrina Floc or Storm-Damaged Areas, by Race and Poverty Status in 1999 (Population for whom Poverty Status is Determined based on 200 Census Data)



Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

Note: Population for whom poverty status is determined. Excludes persons living in institutions and unrelated individuals under age 15.

Doc 19 bis – Comparaison de la dispersion des habitants de deux quartiers « ethniquement » différents de la Nouvelle-Orléans.