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A Longitudinal Study: The Impact of a Comprehensive Emergency Management
System on Disaster Response in The Commonwealth of The Bahamas

by

Erin P. Hughey

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Geography & Environmental Science and Policy
College of Arts and Sciences
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Date of Approval:
August 28, 2008

Keywords: Disaster management, hazards, risk, vulnerability, human geography

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Dedication

This research is dedicated to the staff of The Bahamas National
Emergency Management Agency (NEMA).

Acknowledgements

I would like to express my most sincere gratitude to the many individuals who have assisted during my journey to produce this dissertation. Above all, I would like to thank Dr. Graham A. Tobin, my advisor and friend for his continued support and guidance. You allowed me to explore my research in a way that facilitated its growth and development. Always available to listen to my latest challenges and successes, I would not have been able to accomplish this without you. Thank you does not seem like enough.

I would like to thank my committee member Dr. Thomas Mason, for providing me with the opportunity to engage in research in the Bahamas and for his continued guidance along the way. The avenues for success that you have provided to me will not be wasted.

I would like to thank my committee member Dr. Elizabeth Strom for teaching me to more carefully reflect on the language that I choose. Your contributions have aided in making this research a stronger and more comprehensive product.

I would like to thank my committee member Dr. Kevin Archer for his support when I felt like I would never make it to the finish line. You have taught me to embrace the shades of gray that exist, no longer should it be only black and white.

I would like to thank my committee member Dr. Steven Reader for his insightful feedback, comments, and dedication in working with me to reshape the

way in which I viewed my data and my dissertation. I have a stronger dissertation because of it.

In addition to my committee members I would like to thank the staff of The Bahamas National Emergency Management Agency (NEMA) for their support of this research. Through endless days of archival research, interviews, surveys, and the national response to three major hurricanes, the NEMA staff has strengthened my commitment to the importance of this research. A very special thank you is extended to the following individuals: Mr. Carl F. Smith; Ms. Gayle Outten-Moncur; Mr. Luke Bethel; Ms. Eleanor Davis; Mr. Wendell Rigby; and Ms. Chrystal Ginton.

I would also like to thank my family for their encouragement during this process: Francis William Hughey, Jr.; Martha J. Hughey; Jessica A. Santillo; Sara J. Mercer; MaryRuth Briggs; Amy K. Cronk; Francis William Hughey III; Joseph A. Hughey; Joseph W. Green Sr.; Bonnie Green; and Lara McNeil.

Most of all, I would like to thank my husband, Joseph W. Green Jr., for his endless support and encouragement. You have been patient, understanding, and loving throughout this process. I look forward to providing you with the same love and support as you embark on your journey towards a Ph.D. Thank You!

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Erin P. Hughey

ABSTRACT

Global trends show increasing losses from disasters as the number of people at risk grows by 70 to 80 million per year (United Nations, 2004). Although the frequency of natural disasters may be constant the human interaction with the given hazard has shifted through changes in development practices, environmental protection as well as the distribution of population and wealth. In an effort to combat the negative social, economic, and environmental impacts of hazards, strategies for identifying vulnerable populations and implementing mitigation measures is a high priority in hazards research. However despite our best efforts disasters have and will continue to negatively impact communities resulting in loss of life and property. To that end nations must establish effective emergency response capabilities to meet the needs of all residents potentially at harm.

This study examined the establishment of a comprehensive emergency management (CEM) system in the nation of The Bahamas. Employing a longitudinal study design to examine the six study hurricanes: Andrew 1992, Floyd 1999, Michelle 2001, Frances 2004, Jeanne 2004, and Wilma 2005. The

goal of this research was two fold; first, to test Quarantelli's (1997a) methodology for evaluating the management of disaster response to determine if it could be operationalized and second, to compare response operations under CEM with response operations prior to its implementation.

Mixed methods were used to collect and analyze data. Data for the study were collected over a six-year period from 2001-2007. The following data collection techniques were employed for this study: (1) archival research, (2) structured surveys, (3) semi-structured interviews, and (4) participant observation. Data were analyzed in using three key tools: First, the surveys and closed-ended questions associated with the interviews were analyzed using standard statistical techniques. The data were then applied to 8 of the 10 criteria for measuring the management of national disaster response operations as outlined by Quarantelli (1997a). Finally, data were applied to the Model of Community Response to Disaster (Hughey, 2003).

Results indicated that Quarantelli's (1997a) model for evaluating the management of disaster response could be operationalized. Findings also revealed an association between the implementation of a CEM system and improvements in disaster response within The Bahamas.

Chapter One:

Introduction

Comprehensive Emergency Management (CEM) is the integrated approach of managing all-hazards through all four phases of the emergency management cycle.

1.1 Introduction

Global trends show increasing losses from disasters as the number of people at risk grows by 70 to 80 million per year (United Nations, 2004).

Although the frequency of natural disasters may be constant the human interaction with the given hazard has shifted through changes in development practices, environmental protection as well as the distribution of population and wealth. In an effort to combat the negative social, economic, and environmental impacts of hazards, strategies for identifying vulnerable populations and implementing mitigation measures has and continues to be a high priority in hazards research. However despite our best efforts disasters continue to negatively impact communities resulting in loss of life and property. To that end nations must establish effective emergency response capabilities to meet the needs of all residents potentially at harm.

Disaster response is a challenge for every jurisdiction. Meeting the immediate and long-term needs that result from a disaster is a complex task that requires a multifaceted integrated approach involving a variety of agencies and organizations. The hazards literature has shown that a 'one size fits all' cookie

cutter approach to disaster response is ineffective. For example, White's (1969a) and (1974) research acknowledges that differences within communities require distinctive solutions for each location. CEM builds on that foundation through a program of risk and vulnerability assessments as well as cataloging of resource availability. This process allows for the identification of jurisdiction specific challenges and further facilitates a coordinated environment well suited for effective response to disasters. Emergency management practitioners have reported that a centralized and coordinated emergency management system improves all phases of the emergency management cycle (*mitigation, preparedness, response, and recovery*) by decreasing the duplication of services and improving communication between all agencies (Krep, 1991 a).

This research examines the effectiveness of CEM as a national strategy for managing disaster response. The Commonwealth of The Bahamas was selected as the study site for this research, which takes into consideration the geography, politics, and economic conditions within the nation. Six hurricane events were selected for this research study; three before the 2002 implementation of a CEM system and three after. This research expands beyond a comparison between response operations to address key research questions surrounding the value and effectiveness of emergency management strategies. Furthermore, this research provides a longitudinal examination of the development and implementation of a national comprehensive emergency management system.

The Bahamas was selected as a study site for two key reasons: (1) Geography: The Bahamas faces many challenges to disaster response due in part to its unique geography. The Bahamas is an archipelago of over seven hundred islands and cays that stretches almost 100,000 square miles from Great Inagua in the south to Walker's Cay in the north (Office of the Prime Minister, 2007). (See Map 1.1) With a dispersed population, inhabiting approximately 20 main islands a coordinated emergency response effort is a considerable challenge. Moreover, the location of The Bahamas gives it a high and recurrent risk for hurricanes. (2) In 2002 The Bahamas began the process of developing a CEM system. This process has been documented from the beginning and provides for a longitudinal study of CEM suitability for island nations.

1.2 Research Goal and Objectives

The goal of this research is two fold; first, to document the development of a comprehensive emergency management system within The Bahamas and second, to compare response operations under CEM with response operations prior to its implementation. This longitudinal approach to hazards research is not often used; rather the research norm has been to administer case studies following an event. Although many of the case studies conducted in hazards research have provided us with critical findings, the longitudinal approach facilitates the establishment of baseline indicators to gauge progress over long periods. Long range research, such as this, also facilitates a broader understanding of the complex and ever evolving dynamics surrounding disaster response within a given location.

1.2.1 Research Objectives

1. To identify and report areas of success, as well as potential barriers to effective disaster response under the CEM system, in an effort to add to the geography literature on hazards.
2. Test the validity of Quarantelli's (1997) methodology for evaluating the management of disaster response operations.
3. To determine the geographic, and political challenges to emergency management within the Commonwealth of the Bahamas.
4. To identify techniques being utilized within the Commonwealth of The Bahamas to respond to and recover from the impacts of disasters.

1.3 Background

This research was initially undertaken through a partnership with The Commonwealth of The Bahamas and the University of South Florida's Global Center for Disaster Management and Humanitarian Action (Global-CDMHA). Over a six year period (2001-2007) this researcher worked directly with the government of The Bahamas to build the foundation for a national emergency management structure based on fundamental hazard and emergency management theories.

The Bahamas has a long history of extreme events that has required the mobilization of national resources. Despite extensive experience with disasters, as recently as June of 2002 The Bahamas had no formalized national disaster response policy or plan in place. This research includes an evaluation of national response to six hurricanes as well as the political development of a national

agency to coordinate emergency response. The study design provided unique insight into the development process through interviews with top members of the government, including the Prime Minister. This dissertation research further facilitated the first geography hazard study to document and analyze the impact of the CEM system from conception through implementation. It is through this process that we were able to identify the value of the CEM system. This research also sheds light on the unique concerns of island nations, beyond just the challenge of remoteness. It provides insight and relevance to both researchers and practitioners in a way that allows for the implementation of successful response and recovery initiatives to reduce or eliminate human suffering.

1.4 Study Site: The Geography of The Bahamas

Issues of geography relate directly to the ability of The Bahamas to respond and recover from disasters, with particular consideration given to hurricanes. The Commonwealth of The Bahamas is an archipelagic nation which extends over 100,000 sq mi. of the southwestern edge of the North Atlantic Ocean, with some 700 islands and over 2000 cays totaling a land area of 5,833 sq. mi. (Office of The Prime Minister, 2007). The Bahamas are just 50 miles east of Florida and extend 750 miles south-east to within 50 miles of Cuba and Haiti (Office of The Prime Minister, 2007). (See Map 4.1) According to the Bahamas Environment, Science and Technology (BEST) Commission the largest of The Bahamas Islands is Andros, with an area of 2,300 square miles. Eighty percent of Andros is less than one meter above mean sea level leaving it particularly

vulnerable to storm surge during a hurricane. Harbour Island, with an area of one and a half square miles (1 ½ sq. mi.), and Spanish Wells, with an area of half a square mile (½ sq. mi.) are the two smallest inhabited islands (BEST Commission, 2007).

Traditionally the Islands of The Bahamas are divided into three regions: Northwest, Central and Southeast Islands. The islands included in the Northwest are: *Abaco, Andros, Bimini, Eleuthera, Grand Bahama, New Providence and The Berry Islands*. Central Islands include *Cat Island, Long Island, Exuma and its Cays, Rum Cay and San Salvador*. The Southeast Islands include *Acklins, Crooked Island, Inagua, Mayaguana and Ragged Island*. (See Map 4.1) There are more than twenty inhabited islands with the main population centers being located on the Islands of New Providence and Grand Bahama. The Capital City of Nassau is located on the island of New Providence and Freeport, referred to as the 'second city' is located on the island of Grand Bahama. The term 'Family Islands' is used to describe all surrounding islands.

1.4.1 Climate

Consideration of The Bahamas climate is important to identifying and understanding challenges associated with emergency planning, response and recovery. The Bahamas is a typical tropical maritime wet/dry climate. The wet season occurs during the summer months and is usually in association with tropical activity such as hurricanes (Bahamas Department of Meteorology, 2006).

The islands of The Bahamas are insulated from North America by the Straits of Florida and do not experience extremes in temperature.

Humidity in the Bahamas is extremely high, principally during the summer months. Winds are predominantly easterly throughout the year and averages below 10 knots (11.5 mph). The Bahamas Department of Meteorology (2006), reported average rainfall on the Island of New Providence at 2 inches a month from November through April and 6 inches a month from May through October.

1.4.2 Geology

As shown in Figure 1.2 The Bahamas are low, carbonate islands that rest on two large bank systems; The Little Bahama Bank in the northern Bahamas; and the Great Bahama Bank which extends from central to southwestern Bahamas (Gerace et. al., 2002). The Bahamas Platform, extends more than 840 miles, from the coast of Florida to the island of Hispaniola. The Bahama Platform became exposed as a result of four major glacial advances during the Pleistocene. Weathering later altered the landscape creating karst formations such as caves, sink holes and solution pits (Weech, 2000).

The Islands of the Bahamas have generally low relief. According to data obtained through the BEST Commission (2007), Cat Island is home to the highest point in the Bahamas at 206 ft. The capital city of Nassau on the Island of New Providence has ridges rising to about 100 ft. Consideration for the geology of the region must be taken into consideration when developing plans to address response and recovery activities especially when dealing with the hurricane hazard. For examples, should islands with little relief have evacuation

plans to move populations off the island in the event of a hurricane or should they shelter in place? Additionally, what type of resources would it take to move an entire island population, where would you move them, and for how long?

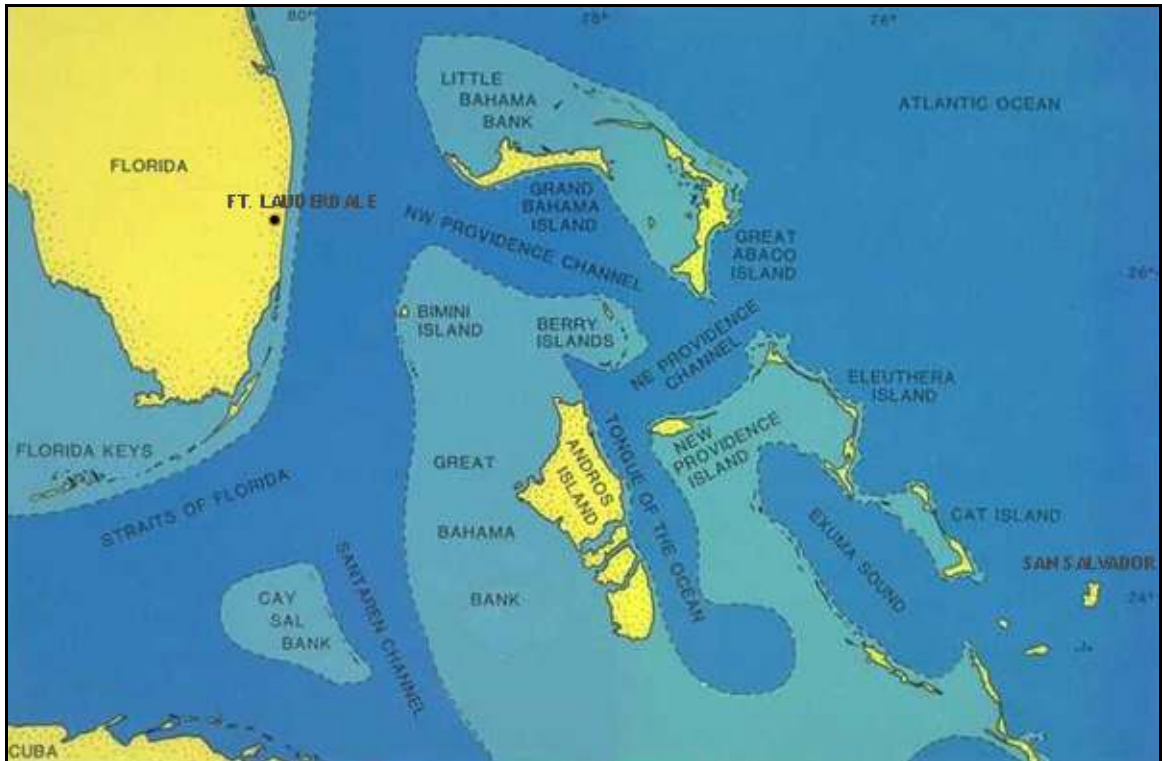


Figure 1.2 – Geology of the Bahamas (Source: Curran, 1985)

1.4.3 Bahamas Hydrologic Setting

Due to the porosity of limestone, water from rainfall and runoff is rapidly delivered underground, resulting in a scarcity of freshwater rivers and streams in the Bahamas (Gerace, 2002). Despite being surrounded by water, it is freshwater that is a scarce commodity on the islands. The Bahamas has no freshwater rivers or lakes and until recently has relied exclusively on groundwater. It is important to note however that not all groundwater in the Bahamas is salt free. “The groundwater resources of The Bahamas are comprised of freshwater,

brackish, saline and hypersaline waters found in the near and deep subsurface” (BEST Commission, 2007:16). Many of the islands have large brackish lakes and others are infiltrated by tidal creeks.

The scarcity of freshwater creates a variety of challenges for a nation on a daily basis. Couple a limited water supply with the impact of a hurricane and the situation quickly becomes critical. Having a limited supply of potable water for residents and tourists must always be a concern for The Bahamas. Cant (1996:331) cited a limited supply of fresh water facilities as, “a major obstacle to economic development in The Bahamas and other small carbonate islands.”

In early 2000, following Hurricane Floyd, The Bahamas began the process of developing the necessary infrastructure to allow for large desalinization facilities on several of the islands. This effort was intended to ease freshwater limitations and ensure adequate amounts of water were available to both residents and tourists (Bahamas Water and Sewerage Corporation, 2006). In addition, construction has begun on desalinization plants at many of the large tourist resorts (*i.e. Atlantis, Club Med, Sandals*). Despite these efforts potable water following a disaster remains a top priority. One of the challenges in response to recent hurricanes is how best to transport water supplies. Usually, transported between islands by barge the loss of ports and docks as a result of strong storm surge and heavy winds makes this option impossible in the immediate aftermath of a storm. Additionally with one gallon of water weighing eight pounds it is not practical to transport large quantities of water by airliners.

1.4.4 Demographics

The Bahamas have a relatively small population base dispersed among its twenty (20) main inhabited islands, with an annual growth rate of 0.86% since 1980. The official 2005 government census reported a population of 303,611. Twenty-six and a half percent of the population is between the ages of 0-14, 66.1% of the population is between the ages of 15-64, and only 6.4% of the population is over the age of 65 (Bahamas Census Office, 2005). Table 1.1 shows the population is centered in the two main urban areas of New Providence and Grand Bahama. Although New Providence, is a small island with only 80 square miles (80 sq. mi.) of area, it is home to 69% of the nations population. Grand Bahama, with approximately 530 square miles (530 sq. mi.) in area, is home to 15% of the population. (BEST Commission, 2007) The remaining population is scattered throughout the Family Islands.

Having a population dispersed throughout a large geographic area adds to the complexity of disaster planning and response. Special considerations must be made for communication and logistic challenges that can exist. It is also critical to note that although The Bahamas has a relatively small population with just over 300,000 there is a sharp increase in overall island population as a result of the tourism industry.

POPULATION IN ISLANDS CENSUS YEARS 1970 - 2000				
Island	1970	1980	1990	2000
New Providence	101,503	135,437	172,196	210,832
Grand Bahama	25,859	33,102	40,898	46,994
Abaco	6,501	7,271	10,003	13,170
Acklins	936	618	405	428
Andros	8,845	8,307	8,177	7,686
Berry Islands	443	509	628	709
Bimini	1,503	1,411	1,639	1,717
Cat Island	2,657	2,215	1,698	1,647
Crooked Island	715	562	412	350
Eleuthera	6,247	8,331	7,993	7,999
Exuma and Cays	3,767	3,670	3,556	3,571
Harbour Island	2,238	1,133	1,219	1,639
Inagua	1,109	924	985	969
Long Island	3,861	3,404	2,949	2,992
Mayaguana	581	464	312	259
Ragged island	208	164	89	72
Rum Cay	80	78	53	80
San Salvador	776	747	465	970
Spanish Wells	983	1,167	1,372	1,527
The Bahamas	168,812	209,514	255,049	303,611

Table 1.1 - Population in islands Census Years 1970-2000 (Source: Bahamas Census Office Department of Statistics, 2005)

According to the Bahamas Ministry of Tourism, more than 5 million tourists visited The Bahamas during the 2005 calendar year. Therefore, all disaster planning and response activities must take into consideration not only the needs of its citizens but also the needs of tourists. Appropriate planning activities must be implemented not only for the purposes of improving disaster response and saving lives but also to ensure the economic stability of the nation by maintaining a strong tourism industry.

Island	Total Population	Males	Females	Number of Households
The Bahamas	303,611	147,778	155,833	87,714
New Providence	210,832	101,610	109,222	59,707
Grand Bahama	46,994	23,035	23,959	13,977
Abaco	13,170	6,711	6,459	3,929
Acklins	428	227	201	134
Andros	7,686	3,780	3,906	2,145
Berry Islands	709	416	293	265
Biminis	1,717	886	831	552
Cat Island	1,647	854	793	559
Crooked Island	350	172	178	132
Eleuthera	7,999	3,933	4,066	2,408
Exuma and Cays	3,571	1,875	1,696	1,133
Harbour Island	1,639	799	840	493
Inagua	969	476	493	302
Long Island	2,992	1,533	1,459	961
Mayaguana	259	129	130	96
Ragged Island	72	44	28	26
Rum Cay	80	45	35	30
San Salvador	970	497	473	279
Spanish Wells	1,527	756	771	586

Table 1.2 – Bahamas Island Population (Source: Bahamas Census Office Department of Statistics, 2005)

Key Labour Force Statistics					
ITEM	1999	1999-2004			2004
		2001	2002	2003	
Total Labour Force					
All Bahamas	157,640	164,675	167,980	173,795	176,330
New Providence					
Grand Bahama	113,240	117,900	119,700	123,380	125,385
	23,900	25,055	25,190	26,350	26,465
Employed Labour Force					
All Bahamas	145,350	153,310	152,690	154,965	158,340
New Providence					
Grand Bahama	104,440	109,770	108,255	108,685	111,725
	21,625	23,345	23,580	24,050	24,000
Unemployed Labour Force					
All Bahamas	12,290	11,365	15,290	18,830	17,990
New Providence					
Grand Bahama	8,800	8,130	11,445	14,695	13,660
	2,275	1,710	1,610	2,300	2,465
Labour Force Participation Rate					
All Bahamas	76.8%	76.2%	76.4%	76.5%	75.7%
New Providence	77.7%	78.1%	77.6%	78.0%	77.5%
Grand Bahama	75.3%	75.2%	74.4%	76.0%	74.7%
Unemployment Rate					
All Bahamas	7.8%	6.9%	9.1%	10.8%	10.2%
New Providence					
Grand Bahama	7.8%	6.9%	9.6%	11.9%	10.9%
	9.5%	6.8%	6.4%	8.7%	

Table 1.3 – Key Labour Force Statistics (Labour Force Data is not available for the Year 2000, which was a Census year. The Census is a major national project; therefore the Department during that year undertook no other household surveys) Source: Bahamas Department of Statistics

Table 1.4 below provides additional demographic information about the Commonwealth of The Bahamas. Although the population is growing in terms of

numbers of births, there is a negative net migration of residents. This is attributed to limited education and job opportunities within the country (Bahamas Census Office Department of Statistics, 2005). Increased numbers of Bahamians are moving to the United States and neighboring Caribbean nations.

THE BAHAMAS DEMOGRAPHIC DATA	
Birth Rate	<i>18.69 births / 1000 population (2002 est.)</i>
Death Rate	<i>7.49 deaths / 1000 population (2002 est.)</i>
Net Migration Rate	<i>-2.63 migrant(s) / 1000 population (2002 est.)</i>
Infant Mortality Rate	<i>17.08 deaths/ 1000 live births (2002 est.)</i>
	<i>Total Population: 69.87 years</i>
Life Expectancy at Birth	<i>Females: 73.49 years (2002 est.)</i>
	<i>Males: 66.32 years (2002 est.)</i>
	<i>85% Black</i>
Ethnic Groups	<i>12 % White</i>
	<i>3% Asian and Hispanic</i>
	<i>32% Baptist</i>
	<i>20% Anglican</i>
	<i>19% Roman Catholic</i>
Religion	<i>6% Methodist</i>
	<i>12% Other Protestant</i>
	<i>3% None or unknown</i>
	<i>2% Other</i>
Languages	<i>English</i>
	<i>Creole (among Haitian immigrants)</i>
	<i>Total Population: 98.2%</i>
Literacy (age 15+)	<i>Male: 98.5%</i>
	<i>Female: 98%</i>

Table 1.4 Demographics (Source: Bahamas Census Office Department of Statistics)

1.4.5 Political Structure

The Commonwealth of The Bahamas gained independence from Great Britain on July 10, 1973. As a Constitutional Parliamentary Democracy the government structure is based on the Westminster model. This three branch governmental structure (*Executive, Legislative, and Judicial*) is led by The Prime Minister and elected by the people. Table 1.5 below provides an overview of the governmental structure of The Bahamas.

THE GOVERNMENTAL STRUCTURE OF THE BAHAMAS	
Executive Branch	<ul style="list-style-type: none"> ✓ Head of Government: Prime Minister ✓ Nominal Chief of State: Queen Elizabeth II (since February 6, 1952), represented by Governor General ✓ Cabinet: Cabinet appointed by the governor general on the prime minister's recommendation
Legislative Branch	<p>Bicameral Parliament</p> <ul style="list-style-type: none"> ✓ The Senate (16-member body appointed by the governor general upon the advice of the prime minister and the opposition leader for five-year terms) ✓ The House of Assembly (40 seats; members elected by direct popular vote to serve five-year terms)
Judicial Branch	<ul style="list-style-type: none"> ✓ Supreme Court ✓ Court of Appeal ✓ Magistrates Courts

Table 1.5 – The Governmental Structure of The Bahamas (Source: Office of The Prime Minister, 2007)

The Commonwealth of The Bahamas has a two party political system; The Free National Movement (FNM) and The Progressive Liberal Party (PLP). Table

1.6 below displays the Prime Ministers and their party affiliation that have served The Bahamas since gaining independence in 1973.

PRIME MINISTERS COMMONWEALTH OF THE BAHAMAS		
Term	Prime Minister	Political Party
July 10, 1973 – Aug. 1992	Lynden O. Pindling	<i>Progressive Liberal Party</i>
Aug. 1992- May 2002	Hubert A. Ingraham	<i>Free National Movement</i>
May 2002 – May 2007	Perry G. Christie	<i>Progressive Liberal Party</i>
May 2007 - Present	<i>Hubert A. Ingraham</i>	<i>Free National Movement</i>

Table 1.6 – Prime Ministers of the Commonwealth of The Bahamas

The political environment within The Bahamas plays a significant role in the functioning of the emergency management structure. The Office of The Prime Minister establishes the tone and direction for national emergency management and ultimately is seen as the responsible agent. For purposes of this research, an interview with Prime Minister Perry G. Christie was conducted on January 25, 2007.

1.4.6 Economy

Bahamians are tied to the land and sea for economic stability and growth. Agriculture has been a key component of the economy and continues to be in the Family Islands where residents are fishermen and/or farmers. It was not until the development of the modern tourism industry that Bahamians began to move away from agriculture and more towards the service industries. According to data from the Central Bank of The Bahamas, tourism currently accounts for over fifty percent (50%) of the GDP and directly or indirectly employs half of the nation's labor force (Central Bank of The Bahamas, 2006). Table 1.7 below provides 2004 and 2005 economic data on the nation.

ECONOMY OF THE BAHAMAS	
GDP (2005)	\$5.8 Billion
Growth Rate (2005)	2.7%
Per capita GDP (2005)	\$18,062
Natural Resources (2005)	Salt, aragonite, timber
Tourism (2005)	50% GDP
Government Spending (2004)	20% of GDP
Financial Services (2005)	15% of GDP
Construction (2004)	10% of GDP (products are largely tourism related)
Manufacturing (2004)	8% of GDP (products – plastics, pharmaceuticals, rum)
Agriculture and Fisheries (2004)	3% of GDP (products – fruits, vegetables, lobster & fish)
	✓ Exports - \$450.8 million – (plastics, fish, salt, rum, chemicals)
Trade (2005)	✓ Imports – 2.57 billion – (foodstuffs and animals, machinery and transport equipment, chemicals, mineral fuels)

Table 1.7– Economy of The Bahamas (Source: Central Bank of The Bahamas)

Imports and Exports are a large component of the economy of The Bahamas. In 2005, \$2.57 billion worth of goods were imported into the commonwealth. Key imports include food related goods, animals, machinery, transport equipment, chemicals, and mineral fuels. Key suppliers to The Bahamas include; United States (84%), Curacao (7.2%), Puerto Rico (1.9%), European Union (1.2%), and Japan (1.2%) (Central Bank of The Bahamas, 2005). Exports in 2005 were \$450.8 million consisting of plastics, fish, salt, chemicals and rum. Main market destinations of Bahamian exports by destination: United States (66.6%), European Union (18.3%), Canada (5.1%), and South Africa (1%) (Central Bank of The Bahamas, 2005).

Distribution of Household by Income Group						
All Bahamas, New Providence and Grand Bahama: 2004						
Income Group B\$	ALL BAHAMAS		NEW PROVIDENCE		GRAND BAHAMA	
	Number.	Amount B\$	Number	Amount B\$	Number	Amount B\$
0-5,000	4,475	11,187,500	2,625	6,562,500	620	1,550,000
5,001-10,000	7,655	57,412,500	4,745	35,587,500	1,450	10,875,000
10,001-15,000	8,490	106,125,000	5,855	73,187,500	940	11,750,000
15,001-20,000	8,235	144,112,500	5,535	96,862,500	1,470	25,725,000
20,001-40,000	29,735	892,050,000	20,435	613,050,000	4,920	147,600,000
40,001-60,000	18,680	934,000,000	13,160	658,000,000	3,125	156,250,000
60,001-80,000	10,185	712,950,000	7,245	507,150,000	1,540	107,800,000
80,001-100,000	5,210	468,900,000	4,020	361,800,000	550	49,500,000
100,001 & OVER	4,905	539,550,000	3,830	421,300,000	440	48,400,000
NOT STATED	2,295	-	1,550	-	275	-
TOTAL	99,865	3,866,287,500	69,000	2,773,500,000	15,330	559,450,000

Table 1.8 – Distribution of Household by Income Group: All Bahamas, New Providence and Grand Bahama 2004 (Source: Bahamas Department of Statistics)

To ensure continued economic growth within The Bahamas it is necessary to ensure tourism, agriculture, and manufacturing are adequately equipped to plan, mitigate, respond and recover from a potential disaster. This requires that all national emergency management policies and procedures integrate public and private industry to ensure economic stability within the nation.

Number of Households and Household Income, All Bahamas, New Providence and Grand Bahama: 2004				
ISLAND	Number of Households	Total Household Income B\$	Mean Household Income B\$	Median Household Income B\$
ALL BAHAMAS	97,570	3,866,287,500	39,626	33,600
NEW PROVIDENCE	67,450	2,773,500,000	41,119	34,066
GRAND BAHAMA	15,055	559,450,000	37,160	30,820

Table 1.9– Number of Households and Household Income: All Bahamas, New Providence and Grand Bahama 2004 (Source: Bahamas Department of Statistics)

1.4.7 Hurricane Risk

The Bahamas have a long history of hurricane activity with records stretching as far back as the 1500's. Tropical weather is a reality of living on the islands and residents take the threat of hurricane activity seriously. Long before The Bahamas Department of Meteorology was around to issue hurricane warnings residents looked to the sea and sky for clues about approaching weather.

“Before the onset of an approaching storm, the sea-level often rose to above normal positions. By watching the rise in the sea-level the locals could tell whether there was an approaching storm. Today this rise in the sea-level just before the onset of the storm and during the storm is referred to as the storm surge. Just before the onset of an approaching hurricane the seas would give these residents a small window of opportunity to prepare for a hurricane or to evacuate to a hurricane shelter” (Neely, 2006:21)

The geographic location of The Bahamas gives it a high and recurrent risk for hurricanes. The Bahamas has recorded the largest number of storm events passing within 60 nautical miles of the major Caribbean Islands. In fact, five of

the top six affected islands of the Caribbean lie within the Bahamas chain; in descending order of frequency are Abaco, Grand Bahama, Bimini, New Providence and San Salvador (Bahamas Department of Meteorology, 2006). This low-lying archipelagic nation has experienced multi-island, multi-year, and multi-hurricane impacts.

The commonwealth of the Bahamas is affected by hurricanes of two different origins, Cape Verde and the Western Caribbean. The island chain lies on the most common route of the more dominant Cape Verde Hurricanes, which form over the Atlantic mainly during the mid hurricane season (*August-October*) (Dean and Rolle, 1999).

1.4.7.1 Bahamas Hurricane History

The Bahamas has a rich hurricane history. A culture tied to the land and sea the country has endured numerous hurricanes with records stretching as far back as 1500. Table 1.10 below highlights the storms for which I was able to find a record. This table does not presume to capture all of the tropical activity to have impacted the islands. However, these data do hope to place in perspective the challenges facing The Bahamas with regards to hurricane preparedness and response.

HURRICANES AFFECTING STUDY AREA					
Year	Mon/Day	Name	Deaths	Damage	Landfall
1554	unknown	1554	unknown	2 ships & crew	<i>Great Inagua</i>
1563	unknown	1563	35 reported	'Urca of Tristan de Salvatierra' ship & crew	<i>Grand Bahama</i>
1595	unknown	1595	unknown	17 spanish treasure bearing ships & crew	<i>Abaco</i>
1599	End of June	1599	unknown	1 ship & crew	<i>Great Inagua</i>
1609	unknown	1609	32 reported	'Sea Adventure' & crew	<i>Central Islands</i>
1622	9/15	1622	550 reported	Spanish Terra Firma Fleet & crew	<i>Central Islands</i>
1623	unknown	1623	150 reported	two ships & crew	<i>Central Islands</i>
1630	unknown	1630	unknown	two ships & crew	<i>Grand Bahama</i>
1641	September	1641	unknown	one ship & crew	<i>Southeastern Bahamas</i>
1692	10/24	1629	unknown	unknown	<i>Central & Northwest Islands</i>
1713	1 st week of September	1713	unknown	one ship & crew	<i>Northwest Islands</i>
1715	7/30	1715	1000 reported	10 ships & crew	<i>Southeastern Bahamas</i>
1720	unknown	1720	unknown	2 ships & crew	<i>Central Bahamas</i>
1729	August	1729	unknown	Significant damage to Nassau	<i>New Providence</i>
1733	7/15	1733	unknown	16 ships & crew	<i>Southeastern Bahamas</i>
1796	10/3	1796	unknown	Damage homes in northern settlements	<i>Northwest Islands</i>
1800	August	1800	unknown	9 ships & crew	<i>Inagua</i>
1804	9/5	1804	unknown	Numerous ships reported missing and damage to settlements throughout the island chain.	<i>Inagua</i>

1806	8/30	1806	unknown	26 ships destroyed in Nassau Harbour. Damage to cotton machines in the Exumas.	<i>South and Central Islands</i>
1806	9/14	1806	unknown	124 homes destroyed (2/3 of the settlement) will the remaining homes suffering some degree of damage.	<i>Eleuthera</i>
1813	7/26	1813	unknown	1/3 of the Nassau settlement was damaged or destroyed	<i>New Providence</i>
1814	10/4	1814	unknown	Damage to crops, ships in Nassau. Roof damage was also reported	<i>South and Central Islands</i>
1815	8/9	1815	unknown	One ship and crew	<i>Southern Islands</i>
1815	8/29	1815	unknown	Damage to homes on Eleuthera & Spanish Wells	<i>Eleuthera</i>
1815	9/20	1815	22 reported	Damage to homes on Cat Island and Salt ponds on Inadua	<i>Southern Islands</i>
1818	10/14	1818	unknown	16 ships destroyed & crew	<i>Central Islands</i>
1819	9/18	1819	unknown	Damage to ships in port	<i>New Providence</i>
1819	9/22	1819	unknown	Major damage to agriculture and ships in port	<i>Abaco, Winward Little Island, Egg Island, Stocking Island</i>
1822	9/26	1822	unknown	Damage to agriculture and housing.	<i>New Providence, Abaco, Exuma</i>
1824	9/13	1824	unknown	Nassau: damage to the church, barracks, jail and 103 homes were destroyed.	<i>Central Islands</i>

1830	8/11	1830	unknown	Major Damage to homes and crops in the northern islands. One ship and crew were lost.	<i>Entire archipelago chain impacted with significant damage to San Salvador, Eleuthera & Grand Bahama</i>
1837	7/30	1837 (1)	unknown	Numerous ships sank in port throughout the Central and Northern Islands	<i>San Salvador, Eleuthera & Grand Bahama</i>
1837	8/4	1837 (2)	25 reported	Over 30 ships destroyed	<i>Entire archipelago chain impacted</i>
1837	8/16	1837 (3)	unknown	Flooding in Grand Bahama & destroyed homes in San Salvador. Homes, crops and livestock were impacted on Long Island. Almost all homes were destroyed on Rum Cay. Nassau reported damage to ships and homes.	<i>Central and Northern Islands</i>
1837	9/12	1837 (4)	unknown		<i>New Providence</i>
1837	10/15	1837 (5)	“A captured slave ship with 500 aboard was wrecked at Governor’s Harbour with many fatalities” (Neely, 2006:30)	19 ships in Nassau Harbour	<i>Central Islands</i>

1844	10/5	1844	unknown	“we experienced a severe hurricane on the banks of the night of Oct. 5 th and the loss of lives and property has been greater than in any previous gale for some years” (Redfield, 1846:343)	<i>Central Bahamas</i>
1848	Late Aug.	1848	unknown	Damage to homes and businesses throughout the islands	<i>Entire archipelago chain impacted</i>
1866	9/24	1866	387 reported	Over 1034 persons were reported homeless as a result of the storm. Wide spread damage throughout the islands.	<i>Entire archipelago chain impacted</i>
1883	9/4	1883	50 reported	“tremendous amount of property damage” (Neely, 2006:31)	<i>Entire archipelago chain impacted</i>
1899	unknown	1899	200 plus	Damage to ships and homes	<i>Major impact reported on Andros and Exuma</i>
1926	8/2	1926 (1) Nassau Hurricane of 1926	106	Cat. 4 storm. Delivered flooding rains and loss of crops. Major damage to structures in Nassau. Several thousand residents were left homeless.	<i>Entire archipelago chain impacted</i>
1926	9/17	1926 (2) The Great Miami Hurricane	unknown	Cat 3 storm. Significant flooding and damage to crops.	<i>South and Central Islands.</i>

1928	9/14	1928 Lake Okeechobee Hurricane	Unknown	Cat 4 storm. Destroyed homes and businesses. Damage to crops and ships reported throughout the islands.	<i>Entire archipelago chain impacted. Major damage reported in central and northern islands.</i>
1929	9/25	1929	Hundreds	Cat 5 storm. Destroyed Andros, capsized ships in Nassau Harbour, and destroyed buildings in downtown Nassau. Wide spread damage was reported throughout the islands	<i>Entire archipelago chain impacted</i>
1933	7/25	1933 (1)	unknown	unknown	<i>Entire archipelago chain impacted</i>
1933	8/27	1933 (2)	unknown	unknown	<i>South and Central Bahamas</i>
1933	9/7	1933 (3)	unknown	unknown	<i>Entire archipelago chain impacted</i>
1933	10/1	1933 (4)	unknown	unknown	<i>Northwestern Islands</i>
1933	10/25	1933 (5)	unknown	Tropical storm	<i>Central and Northwestern Islands</i>
1960	9/7	Donna	114 deaths from the Leeward Islands to The Bahamas	Category 4 Hurricane	<i>Southern Islands of The Bahamas</i>
1965	9/6	Betsy	1 death	Category 4 Hurricane	<i>Northwestern Islands</i>
1979	9/3	David	None	Category 1 Hurricane	<i>Andros & Bimini</i>

1992	8/23	Andrew	4 deaths	Category 4 Hurricane	<i>Central and Northwestern Islands</i>
1996	10/18	Lili	0	Category 2 Hurricane	<i>Northwestern Islands</i>
1999	9/14	Floyd	2	Category 4 Hurricane	<i>Central and Northwestern Islands</i>
2001	11/05	Michelle	0	Category 2 Hurricane	<i>Northwestern Islands</i>
2004	9/2-5	Frances	2	Category 4 Hurricane	<i>Entire archipelago chain impacted</i>
2004	9/25	Jeanne	0	Category 2 Hurricane	<i>Northwestern Islands</i>
2005	10/24	Wilma	1	Category 3 Hurricane	<i>Northwestern Islands</i>
2007	10/31	Noel	0	Tropical Storm	<i>Northwestern Islands</i>

Table 1.10 Hurricanes Impacting Study Area (Source: Nelly (2006), Government of The Bahamas (2005))

1.4.7.2 Hurricane Andrew 1992

Just prior to the impact of Hurricane Andrew in August of 1992 the nation went through a change in government lead by Hubert A. Ingraham. This was the first change in government since The Bahamas gained independence in 1973 and the first national disaster response in the nation's history. The last major hurricane to impact The Bahamas was Hurricane Betsy in 1965, while the nation was still under British rule.

On August 23, 1992, Hurricane Andrew passed over Eleuthera, the Berry Islands and South Bimini causing severe flooding and property damage. Four (4) Bahamian lost their lives as a result of hurricane Andrew. Of critical concern for the nation following landfall were the immediate emergency needs of food and clean water. The logistics of meeting these needs proved challenging with

extreme damage to transportation routes (airports, ports, and roadways). The movement of goods between the Family Islands immediately following the event was nearly impossible. Prime Minister Ingraham placed The Royal Bahamas Defence Force (RBDF) in charge of responding to hurricane generated needs. (See Appendix B for detailed storm development and impact information.)

1.4.7.3 Hurricane Floyd 1999

Hurricane Floyd devastated the central and northern islands of The Bahamas. The key concerns for the nation were meeting immediate emergency needs of food and clean water to all areas impacted. Damage to well fields, and transportation routes (airports, ports, and roadways) prevented the movement of emergency goods between islands as well as on the island. A detailed discussion on the development and impact of Hurricane Floyd can be found in Appendix B of this dissertation.

1.4.7.4 Hurricane Michelle 2001

A national response to Hurricane Michelle was conducted through the Cabinet Office with direct reporting to the Office of The Prime Minister. Although Hurricane Michelle was not as destructive as Hurricanes Andrew or Floyd, the impact to the nation's capital highlighted gaps in emergency response capabilities. Hurricane Michelle response activities were spearheaded by the RBDF with disorganized levels of support from a variety of ministries and organizations.

Long-term recovery operations for Hurricane Floyd were still underway when Hurricane Michelle impacted the nation. As a result many of the critical personnel brought together to coordinate recovery efforts for Floyd also took on the challenge of Hurricane Michelle. Applying the amended version of Quarantelli's (1997a) criteria for evaluating the management of disaster response operations reveals that the national response to Michelle was not successful.

1.4.7.5 Hurricane Frances 2004

Every island in The Bahamas was impacted by Hurricane Frances. The category 4 hurricane remained over the nation for more than 72 hours (Bahamas Department of Meteorology, 2004a). Of major concern following the passage of Frances was clean water with extensive damage reported to the water well fields. Transportation routes (airports, ports, and roadways) sustained considerable damage prevented the movement of emergency goods between islands as well as on the island (NEMA, 2004a, Hughey, 2004b).

Disaster response operations were for the first time coordinated by NEMA through the National EOC. The EOC was located in the Churchill Building on the first floor just below the Cabinet Office and the Office of The Prime Minister (NEMA, 2004a; Office of the Prime Minister, 2004a; Hughey, 2004b). Table 6.14 shows that seven of the eight criteria were not accomplished. The results of the evaluation are discussed in detail below.

“My fellow Bahamians and residents of The Bahamas. Good Morning. You are aware by now that our beloved country and home – The Commonwealth of The Bahamas – is preparing for the almost certain landfall of Hurricane Frances. It is of the utmost importance that you

know and accept that Hurricane Frances as presently constituted is regarded as the strongest and most intense hurricane force that has threatened our country. Hurricane Frances has sustained winds of 140mph which makes it a Category 4 Hurricane and the potential exists for further strengthening. Make no mistake about it, this is a very intense and powerful hurricane that must be taken with the utmost seriousness by all of our citizens and visitors.

As, I speak to you, the island of Great Inagua, Mayaguana, Acklins and Crooked Island and our neighbours the Turks and Caicos Islands are beginning to feel the wrath of Frances. While hurricane warnings remain in effect for these areas, in another hour the Government of The Bahamas will issue hurricanes warnings for the Central Bahamas to include Long Island, San Salvador, Exuma and Cays, Ragged Island, Long Cay, Cat Island, Rum Cay, South Eleuthera and South Andros. This means that hurricane conditions can be felt in the warning areas within 24 hours. A watch will also be issued for the Northwest Bahamas, including New Providence, North Eleuthera, Spanish Wells, Harbour Island, North and Central Andros, Bimini, Berry Islands, Abaco and Grand Bahama. Hurricane Conditions can be felt in the watch areas within 36 hours.

On the present course it will affect New Providence and Eleuthera by Thursday night and Friday morning. The Northern Bahamas including Abaco and Grand Bahama will likely be affected during Friday afternoon and Saturday morning. For the purpose of impressing upon you the compelling need for urgent action, I shall again state that Hurricane Frances is a major and potentially very dangerous hurricane. Hurricane force winds extend some eighty (80) miles from the centre. Tropical storm force winds extend some 185 miles from the centre. This hurricane is therefore a large and powerful system with the potential to severely and negatively affect many of the communities in our country.

As Prime Minister, I therefore urge all Bahamians and residents of The Bahamas to take this threat seriously and to rush to complete all precautions, not in panic, but with a clear-headed resolve and a sober sense of purpose.

A hurricane of this strength generally has a storm sea surge of between 13 and 18 feet above the normal tide. Persons who live in coastal areas, small cays, low lying areas and areas that are prone to flooding should evacuate their homes before the hurricane hits and weather conditions no longer allow safe evacuations. In addition persons who do not consider their dwellings to be sound should contact their local Administrators at the earliest opportunity.

I have asked the Secretary to the cabinet to allow non-essential staff of Public Service to leave work today at 12:00 noon so as to enable them to complete the task of securing their homes and property. I also ask businesses to release their staff early so that they can likewise secure their property and homes.

I need hardly tell you that early preparation is essential for mitigating the damage that can be done by such a large and powerful hurricane. I am also exhorting businesses not to engage in what is commonly known as price gouging or profiteering. This is truly a time of emergency when civil responsibility and conduct befitting good citizenship ought to be paramount in the minds of all our people.

I urge you to continue to listen by radio to hurricane updates so that you may act on an informed basis. All of our emergency operations systems are in place at both the national level in New Providence and throughout the Family Islands. Every effort has been made to strengthen our communications and emergency response capacities and where necessary to put in place additional specially selected personnel.

Additional resources, both skilled manpower, equipment and material resources, have been made available to the Bahamas by the United States Government, Caricom countries and other agencies and we are on standby. On behalf of the Bahamian people I would take this opportunity to thank all of them for the consideration they have exercised in our favour.

My fellow Bahamians although we have made every human effort to prepare ourselves for Hurricane Frances, it is for me, on your behalf, to acknowledge that we are ultimately in the hands of God. We pray for His guidance at this time and for safekeeping during this time of crisis and peril

We have faced many such perils in the course of the centuries and have always pulled through. With God's good grace we shall do so again. Be of good courage then for our faith is in the God of all creation; the God who rides upon the storm." (Remarks by the Rt. Hon. Prime Minister Perry Christies, On Hurricane Frances. 1st September, 2004.)

1.4.7.6 Hurricane Jeanne 2004

As Hurricane Jeanne approached the Islands of The Bahamas, emergency personnel were just beginning the process of trying to recover from

Hurricane Frances. Frances, a category four hurricane, had slowly marched its way up the archipelago less than three weeks earlier. With drained resources, tired response personnel, and already extensive damage to critical facilities Jeanne compounded an already extreme emergency situation.

1.4.7.7 Hurricane Wilma 2005

Hurricane Wilma was the only storm requiring a national response to cause any significant damage to The Bahamas during the 2005 Hurricane Season. One death was reported as a result of Hurricane Wilma and was directly related to storm surge inundation. The concentrations of damages were mainly in the vicinities of the northwestern islands.

1.5 Problem Statement

A large gap exists in the hazards research with regards to emergency management strategies, specifically the value of the Comprehensive Emergency Management (CEM) system. The traditional hazard case studies have not facilitated the necessary understanding of CEM which requires the integration of all four phases of the emergency management cycle.

Research by Pelling and Uitto (2001) identified remoteness, and lack of natural resources as major challenges for island nations making them increasingly vulnerable to disasters, but little is known about approaches utilized effectively to manage these challenges. No island specific emergency management techniques have been established as best practices. Additionally, no analysis has been conducted to see if emergency management techniques utilized in large developed nations such as the United States and Canada are

transferable and adequately meet the needs of island nations. Also lacking in the hazards literature is a longitudinal study that examines the development, application, and evolution of emergency management techniques within island nations.

1.6 Research Questions

The primary intent of this longitudinal study is to examine the validity of CEM as a national strategy for managing disaster response. The following research questions were examined within the context of the study site.

1. Can Quarantelli's (1997) methodology for evaluating the management of disaster response be operationalized?
2. Can CEM, a United States emergency management strategy, be an effective strategy for an archipelagic nation?
3. Did the implementation of a CEM system improve disaster response?

1.7 Research Hypotheses

1. It is hypothesized that Quarantelli's (1997) can be applied successfully to evaluate disaster response operations.
2. It is hypothesized that CEM is an effective and successful emergency management strategy for The Commonwealth of The Bahamas.
3. It is hypothesized that the implementation of CEM will improve all areas of disaster response.

1.8 Research Design

This exploratory research utilized a longitudinal study design that incorporated a mixed methods approach to answering the research questions. A comprehensive literature review was conducted to ensure that findings were placed in the appropriate context. Through exhaustive archival research, six study hurricanes (Andrew 1992, Floyd 1999, Michelle 2001, Frances 2004, Jeanne 2004, and Wilma 2005) were reconstructed from development to landfall. National Government response to all six of the hurricanes was evaluated utilizing an amended version of Quarantelli's (1997a) *Ten Criteria for Evaluating the Management of Community Disasters to test the metric and determine its usefulness. Traditional hazards methodologies such as structured surveys and interviews were also utilized in the research design as a way to further examine the impact of CEM on emergency response in the Commonwealth of The Bahamas.*

1.9 Organization of the Dissertation

Chapter two provides a review of the foundational literature in the field of hazards with specific attention provided to our understanding of hazard concepts and theoretical models. Also provided in chapter two is discussion on the key components of comprehensive emergency management.

Chapter three details the study design and methodology, to include data collection, data application and analysis, as well as advantages and limitations of the methodology.

Chapter Four begins the results section of the research and provides discusses the research findings associated with the application of Quarantelli's (1997a) eight criteria for evaluating disaster response.

Chapter five discusses the results associated with data collection from the structured surveys and the semi-structured interviews.

Chapter Six examines the application of The Model of Community Response to Disasters. This theoretical model was applied in two distinct phases: (1) pre-CEM phase and (2) post-CEM phase.

Chapter Seven provides a summary and discussion of results associated with each of the research questions and places the findings within the current literature on hazards. A set of general conclusions and suggestions for future research are also provided.

Chapter Two: Literature Review

“The increasingly complex nature of hazards means that geography matters now more than ever.” (Cutter, 1994: xiv)

2.1 Introduction

Hazards research requires an understanding of the complex interactions between the natural and social systems. This chapter provides a review of key research studies that have influenced the way we think about hazards. Historically, hazards research has come from the three intellectual disciplines of geography, sociology, and engineering. However, with the occurrence of large multi-jurisdictional disasters such as the 2004 Indian Ocean Tsunami and Hurricane Katrina 2005, hazards research has considerably intensified and expanded. A variety of disciplines including public health, public administration, economics, and psychology have all produced important hazards research. This expansion is both timely and necessary as we in the academic community work to develop better strategies for saving lives and protecting property. Found throughout this chapter are the foundational components needed to contextualize this dissertation research.

2.2 History of Hazards Research in Geography

In the field of geography, hazards research traditionally focused on the relationship between humans and the environment. In the mid 1940's researchers at the University of Chicago began a multidisciplinary research agenda with sociologists and geographers to explore the environment, hazards, and the social interaction. It is here that the origins of hazards research took root. Gilbert F. White, a student in geography in the early 1940's wrote a pioneering dissertation that first asked the questions that still direct hazards research today:

- Why are certain adjustments to hazards preferred over others?
- Why, despite investments in those adjustments, are social losses from hazards increasing? (White, 1945)

White, internationally renowned today as the father of natural hazards research (Mileti, 1999) was influenced by late 1920's philosopher John Dewey. Dewey (1929) explored the human ecology school of thought noting that humanity exists in a natural world that is innately hazardous resulting in human insecurity. He further explored how environmental perils such as floods and earthquakes do not exist independently of society because these events are defined, reshaped and redirected by human activities.

In White's 1973 research titled *Natural Hazards Research*, he spoke to the importance of geography in hazards research. In particular he noted that many geographers had neglected "the theory of man-environment relationships" and its applications to public policy (White, 1973:193). "The geographer loses an

opportunity to apply his knowledge, skills, and insights to fundamental questions of the survival and quality of human life. He [The Geographer] also fails to sharpen and advance theoretical thinking by testing it in a challenging arena of action” (White, 1973:193). When addressing the questions associated with hazards research and geography, White also points out that hazards research is well situated within the discipline. “The research seeks application of new techniques to one of the old and recurring traditions of geographical enterprise – the ecology of human choice” (White, 1973:194).

White’s work further influenced the hazards field by first utilizing a research approach related to the study of policy activities. This approach was intended to expand our understanding of the decision-making process as it relates to extreme events. His work continued to develop the field by utilizing a research paradigm and model of decision-making focused on how man copes with risk and uncertainty in the midst of environmental events (White, 1936, 1962, 1964, 1974a, 1974b). This research not only expanded the interdisciplinary field of hazards research he also illustrated how hazards research is a traditional theme in geography and places geographers in the critical role of bridging the gap between the physical and social sciences.

2.3 Hazards Terminology

To place this dissertation research into context, it is critical to review the theoretical debate over the definition of hazards terminology. Researchers have worked to define and conceptualize ‘natural hazards.’ As in all fields, attempting to classify events is critical. Research must be placed within the appropriate

theoretical framework in order to obtain meaningful findings/results and move the discipline forward.

As mentioned previously, hazards research is a multi-disciplinary study. The lack of clear and widely agreed upon vocabulary has plagued studies and led to some confusion. Tobin and Montz (1997) point out that much of the terminology used in natural hazards has been used interchangeably, including references to hazard, disaster, risk, and vulnerability. Additionally, Chakraborty, et al., (2005) note how problematic the estimation of risk and vulnerability can be, partly due to a lack of accurate data and partly due to the way in which available data are utilized. It is because of these challenges that before moving forward in an effort to expand the literature we must first fully understand the current state of the discipline.

It is through the examination of our current frameworks within natural hazards research that we are better able to reshape and expand our views. The following section provides discussion on the discourse surrounding hazards terminology and the theoretical frameworks currently being applied. This provides the opportunity to perhaps rethink and re-conceptualize our understanding of hazards, facilitating a new way of examining our research questions. Furthermore, it is by doing this that we will ultimately influence the shape of the potential solutions, as well as the shape and character of the means we use to attain those solutions and make them operational.

2.3.1 Defining the Field of Natural Hazards

Many of the early dominant views in the field of natural hazards research identified disasters as a result of geophysical processes. A geophysical event was seen as a trigger for loss of life and damage to property. This approach identified the root cause of large-scale death and destruction as directly attributed to the extremes of nature rather than encompassing the social structures. White (1945) identified natural hazards as the result of interacting natural and social forces. Table 2.1 below provides a temporal examination of how the field of natural hazards has been defined. Although White's work identified an interaction between the physical and social components other researchers were slow to move away from viewing natural hazards as only a geo-physical process.

By the early-1980's steps towards a more human explanation of natural hazards was taking hold. Hewitt (1983) research strongly spoke out against the overwhelming attention devoted to geophysical process and neglect of social forces. Throughout the mid-1980's and 1990's natural hazards research embraced the physical and human components influencing hazards. Our current understanding of 'natural hazards' as a field of study is one that embraces the human and physical geography.

Author	Year	Natural Hazard Definition
White, Gilbert F.	1945	Natural Hazards are the result of interacting natural and social forces.
Burton and Kates	1964	Those elements of the physical environment harmful to man and caused by forces extraneous to him.
American Geological Institute	1984	A naturally occurring or man-made geologic condition or phenomenon that presents a risk or is a potential danger to life or property.
Smith, Keith	1996	The potential for extreme geophysical events, such as floods, to create an unexpected threat to human life and property.
Tobin and Montz	1997	The potential interaction between humans and extreme natural events.
United Nations	2004	A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Table 2.1 Selected Definitions of Natural Hazards

2.3.1.1 Defining Disaster

The definition of ‘disaster’ has followed a similar path as the development of the field of natural hazards. Historically disasters were seen as ‘Acts of God’ and generally outside human control. Dynes & Drabek (1992) suggest that disaster events were made worse by the idea that residents could do nothing to reduce the impact.

“When such events occurred in communities, they created great fear and personal trauma. This created social chaos, making local communities incapable of effective action requiring outside authorities, especially the military, were needed to re-establish command and control” (Dynes & Drabek, 1992:12).

Author	Year	Disaster Definition
Sheehan & Hewitt	1969	Those events leading to 100 deaths, 1000 injuries, or \$1 million in damages.
Brown & Goldin	1973	Disasters are inherently political phenomena and should be so conceptualized.
Dynes	1974	The physical agent, the physical consequences of the agent, the way in which the impact of the physical agent is evaluated, and the social disruption and social changes brought about by the physical agent and its impact.
Quarantelli & Dynes	1977	Disaster is primarily a social phenomenon and is thus identifiable in social terms.
Kreps	1984	Disasters are events observable in time and space, in which societies or their larger sub-units incur physical damages and losses and or disruption of their routine functions. Both the causes and consequences of these events are related to the social structures and processes of society or their sub-units.
Dynes	1988	Disasters are events, occurrences, situations which are socially disruptive.
Taylor	1989	Catastrophic events that (a) interfere severely with everyday life, disrupt communities, and often cause extensive loss of life and property, (b) overtax local resources, and (c) create problems that continue far longer than those that arise from the normal vicissitudes of life.
Glickman et. al.	1992	The death of 25 persons.
Tobin & Montz	1997	Disaster is defined as an event that has a large impact on society.
<i>Weichselgartner</i>	<i>2001</i>	Disasters are more accurately seen as social phenomena whereas the overall damage due to natural hazards is the result both of natural events that act as 'triggers' and a series of societal factors.

Table 2.2a – Selected Definitions of Disaster

Author	Year	Disaster Definition (Continued)
<i>McEntire</i>	2004	Disasters are the disruptive and/or deadly and destructive outcome or result of physical or human-induced triggering agents when they interact with and are exacerbated by vulnerabilities of diverse but overlapping environments.
United Nations	2004	A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

Table 2.2b – Selected Definitions of Disaster

Table 2.2 highlights a variety of selected disaster definitions that have been used within the hazards literature. The common theme among all of the definitions is the impact to society. Without an adverse reaction to the society a disaster does not exist. Brown and Goldin (1973) push the idea of ‘disaster’ further by identifying disasters as the result of political phenomena or ‘society’, removing completely a geophysical trigger.

Dynes (1974, 1988) and McEntire (2004) utilize a qualitative measure to define ‘disaster’ identifying ‘*disruption to society*’ as a disaster. Quantitative measures have also been utilized, for example, Sheehan and Hewitt (1969) utilized death, injuries and economic thresholds. Currently there is no national or international threshold which categorically defines or identifies a disaster. Within the response community a disaster is many times identified by the types of resources that must be mobilized in response to an event. A full activation of all

agencies active in disasters, illustrates an event that is taxing on resources and requires a large coordinated effort, thus being identified as a disaster.

2.3.1.2 Defining Risk

Author	Year	Risk Definition
Hammer	1972	The sum of possible alternative numbers of fatalities weighted by their probabilities.
Zenter	1979	Risk as the total number of deaths
Ritter	1981	Risk as the Probability of occurrence for an undesirable outcome
UNDRO	1982	Risk is equal to loss divided by unit time
Crouch and Wilson	1982	The probability of an event multiplied by the severity of that event.
Crozier	1988	Risk is the expected number of lives lost, persons injured, damage to property and disruption of economic activity due to a particular natural phenomenon, and consequently the product of specific risk and elements at risk.
Petak and Atkisson	1982	Risk is broken into two functions: first, the probability that an event, or a series of events of various magnitudes, will occur, and second, the consequences of those events
Crozier	1988	Risk is the expected number of lives lost, persons injured, damage to property and disruption of economic activity due to a particular natural phenomenon, and consequently the product of specific risk and elements at risk.
Beck	1992	Risk is a systematic way of dealing with hazards and insecurities induced and introduced by modernization.
Cutter	1996	Risk is the likelihood of probability that an event will occur.
Tobin and Montz	1997	Risk as probability of occurrence multiplied by vulnerability

Table 2.3a – Selected Definitions of Risk

Author	Year	Risk Definition (Continued)
United Nations	2004	The probability of harmful consequences, or expected losses (death, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural and human-induced hazards and vulnerable conditions.
Hyndman & Hyndman	2006	Risk is essentially a hazard considered in the light of its recurrence interval and expected costs. The greater the hazard and the shorter its recurrence interval, the greater the risk.

Table 2.3b – Selected Definitions of Risk

Table 2.3 shows some of the varying definitions of risk employed by hazards researchers. Examining the table from a temporal perspective highlights an interesting pattern. During the 1970s, risk was often based primarily on the number of fatalities, whereas in the 1980s there was at least an effort among academics to broaden the term to incorporate the probability of a particular geophysical event recurring. By the 1990's, researchers turned away from numbers of dead as a measurement of risk, and focused more on geophysical mechanisms and probabilities of occurrence.

This changing emphasis reflects the evolving role of emergency management and hazards research within the United States and, to some extent, globally. The 1970s witnessed a variety of disasters both natural and technological that impacted the terminology and definitions used by hazard researchers. For example, the super outbreak of tornadoes in 1974 and the Three Mile Island nuclear power plant incident focused attention on the terminology used in hazard studies.

The 1980's brought awareness of catastrophic man-made disasters such as 1984 Bhopal, India explosion at the Union Carbide Chemical Plant which killed thousands and sickened tens of thousands more. The 1985 volcanic eruption of Nevado del Ruiz killed thousands, buried whole towns in ash, and mud. Additionally, the 1986 Chernobyl nuclear disaster in Ukraine (former Soviet Union) brought worldwide attention to hazards and an increased desire to further understand the concepts associated with risk.

'Risk' and 'risk assessment' have raised several research questions. For example, Cutter (1993) noted, that there is no such thing as a risk-free or hazard-free environment despite American preoccupation with a zero-risk society. Clearly the idea that any area is completely safe from a natural or man-made disaster is incorrect. Graham's (1995) research, which focuses on technological and environmental disasters, highlighted the need for continued research by academics on these concepts. "The analytical tools of risk assessment, as applied to chemicals and radiation, have assumed a critical role in decision making in the United States" (Graham, 1985:29). The United Nations identifies risk assessments as:

"a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend" (UN 2004:18).

It is through our application of risk assessments that hazard practitioners have been able to make more informed decision about how best to utilize limited resources to protect lives and minimize damage. The concept of risk and risk

assessment has been a hazard concept that practitioners have effectively made operational during the emergency management mitigation phase.

2.3.1.3 Defining Vulnerability

During the 1990s researchers began to examine not only the geographic areas with potential risk for geophysical or technological events but also the populations that are most vulnerable. Table 2.4 below displays selected variations of the vulnerability definitions that are being utilized in hazards research. Like risk, no clear agreed upon definition has been developed and accepted by either academics or practitioners.

Author	Year	Definition
Timmerman	1981	Vulnerability is the degree to which a system acts adversely to the occurrence of a hazardous event.
UNDRO	1982	Vulnerability is the degree of the loss to a given element or set of elements at risk resulting from the occurrence of a natural phenomenon of a given magnitude.
Susman, O'Keefe, Wisner	1983	The degree to which different classes in society are differentially at risk, both in terms of the probability of occurrence of an extreme physical event and the degree to which the community absorbs the effects of extreme physical events and helps different classes to recover.
Kates	1985	Vulnerability is the capacity to suffer harm and react adversely.
Crozier	1988	Vulnerability is the degree of loss to a given element at risk or a set of such elements resulting from the occurrence of a natural phenomenon of a given magnitude and expressed on a scale of 0 (no damage) to 1 (total loss).

Bogard	1989	Vulnerability is operationally defined as the inability to take effective measures to insure against losses.
Mitchell	1989	Vulnerability is the potential for loss.
Panizza	1991	The degree to which a system, including population, buildings, infrastructures, economic activity, social organization and any expansion and development programs in an area may react adversely to the occurrence of a hazardous event.
Watts & Bohle	1993	Vulnerability is defined in terms of exposure, capacity and potentiality. Accordingly, the prescriptive and normative response to vulnerability is to reduce exposure, enhance coping capacity, strengthen recovery potential and bolster damage control via private and public means.
Blaikie et. al.	1994	Vulnerability refers to social and material conditions derived from characteristics of individuals and groups that make them susceptible to harm and loss from environmental hazards and that constrains their ability to cope with the adversity of disasters.
Smith	1996	Vulnerability implies a measure of risk combined with the level of social and economic ability to cope with the resulting event.
Alexander	1997	Vulnerability is defined as a measure of loss and as a measure of exposure to a loss
Hewitt	1997	The attributes of persons, or activities and aspects of community that can serve to increase damage from given dangers
Tobin and Montz	1997	Vulnerability is a systems approach, a combination of the physical characteristics of natural hazards, political/economic factors, and social characteristics.
Comfort et. al.	1999	Vulnerability are those circumstance that place people at risk while reducing their means of response or denying them available protection.

Wisner et. al.	2004	The characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard.
United Nations	2004	The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.
Chakraborty, Tobin, and Montz	2005	A human-induced situation that results from public policy and resource availability/distribution, and it is the root cause of many disaster impacts.

Table 2.4– Selected Definitions of Vulnerability

As is evident in the above literature review, hazards research is multi-disciplinary leading to a variety of interpretations of vulnerability. Susman et al's. (1983), definition of vulnerability encompasses elements of risk as well as class attributes such as poverty and support systems. Panizza (1991) characterizes vulnerability as the adverse reaction that the 'system' (including population, infrastructure, economy, etc.) may have as a result of a hazardous event. Like risk it is important for researchers to explore the different variations of vulnerability in an effort to better prepare practitioners so that they may make better planning, mitigation, and response decisions.

2.3.2 Phases of Emergency Management

There is general agreement among hazards researchers and practitioners that there are four distinct phases of a disaster event: *mitigation, preparedness, response, and recovery* (NGA 1979; Clary 1985; FEMA 2003a; Kates and Burton 1986a, 1986b). These phases have slight variations but as explored by Clary's

1985 work, all the phases are interrelated with the creation of boundaries as a simplification which aids discussion, modeling, and application.

Figure 2.1 illustrates the interrelated and cyclical nature of the emergency management phases. FEMA (2003b:9) refers to this as the “occurrence cycle”. It is through this process that emergency plans are constantly reviewed and updated to accurately represent a jurisdiction’s management capability. As shown in the figure 2.1, management strategies involving mitigation and preparedness efforts are designed to improve response and recovery.

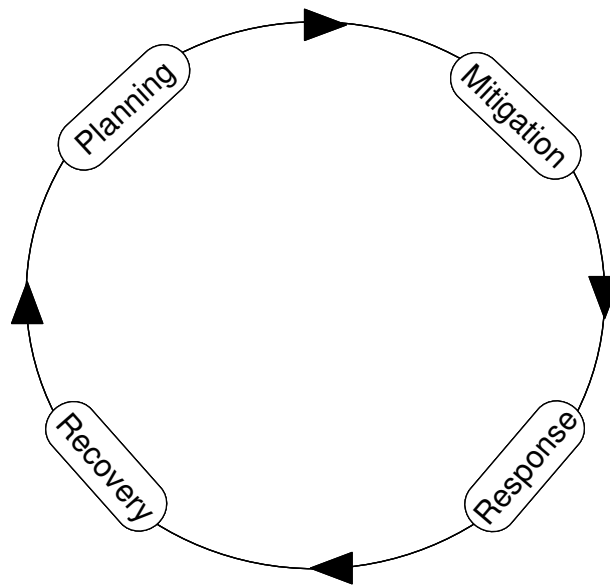


Figure 2.1 Four Phases of Emergency Management

2.3.2.1 Mitigation Phase

Hazard Mitigation refers to “sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects” (FEMA, 2006). Mitigation actions involve lasting, often permanent, reduction of exposure

to, probability of, or potential loss from a hazard. The National Governors Association in 1979 defined mitigation activities to include “arms build-up to deter enemy attack or legislation that takes the unstable double-bottom tanker off the highways” (NGA, 1979:12). Although many researchers have removed the idea of an arms-build up as a potential mitigation measure it is important to understand the roots of mitigation lie within the military response to hazards.

In the early to mid-1980’s hazard mitigation took a very strong structural path in an attempt to control the hazard through engineered concepts. Examples of this engineered mitigation strategy included the implementation of zoning and building codes, firewalls, floodwalls, levees and dams. Since the early-1990’s with hazards researchers focusing on the identification of social factors that may lead to vulnerability, the emergency management practitioners have slowly moved in a more balanced direction utilizing both structural and non-structural mitigation initiatives. Additionally community and state supported events such as ‘*Flood Awareness Week*’ in combination with federal flood buyout programs are providing a more comprehensive understanding of the mitigation phase (FEMA, 2003b; American Red Cross, 2002; Hughey, 2003).

In communities such as San Francisco, California, emergency managers have made a concerted effort to educate businesses and the public on simple measures they can take to reduce loss or injury as a result of an earthquake, such as fastening bookshelves, water heaters, and file cabinets to walls can prevent them from falling. These structural measures in combination with an aggressive program designed to help business identify ‘places of refuge’ during

an earthquake is a simple and cost effective way, to save lives and protect property (San Francisco Office of Emergency Services and Homeland Security, 2005).

Việt Nam provides another notable case study on mitigation. Since 1993 the nation has pursued a methodical strategy of reducing risk through national development objectives. The National Disaster Management Unit embarked on a program focused on assisting the residents of the Mekong River Delta in an effort to help them learn to *'Live With the Floods'*. Mitigation measures under this new program have ranged from relocating extremely vulnerable communities, to altering the cropping calendar. Additionally, experience gained from the 2000 and 2001 flood events resulted in an effective mitigation measures designed to prevent drowning deaths of children. According to data provided by the UN, 2001 flooding in the Mekong River Delta killed 106 people, 99 of whom were children. As a result a unique mitigation concept known as “emergency kindergartens” were developed. The emergency kindergartens allow parents to drop off their children during the rainy season. This allows parents to leave their children supervised at the time of emergency, when they are otherwise preoccupied with securing personal possessions and other resources crucial for their livelihood (UN, 2004:82). This program in combination with a nationwide information system that provides real-time information for flood and storm control has dramatically decreased children’s deaths associated with the flood hazard. During the 2002 floods 918 emergency kindergartens were organized housing over 20,000 children.

2.3.2.2 Preparedness

Preparedness is often referred to as planning and many times the two terms are used interchangeably within the hazards literature. Preparedness is defined as “planning how to respond when an emergency or disaster occurs and working to marshal the resources to respond effectively” (FEMA, 2003b:12). The purpose of disaster planning activities is to help save lives and minimize damage by preparing individuals and communities to respond appropriately when a disaster strikes. Emergency planning is not a one-time event. Rather, it is a continual cycle of planning, training, exercising, and revision that takes place throughout the four phases of the emergency management cycle. According to Quarantelli (1988, 2001) disaster planning when based in scientific research makes an important difference in reducing unknowns. All planning activities must take into consideration the geophysical components of a hazard which places a community at risk and the social constructs which create vulnerable populations.

The emergency preparedness phase is where most hazards research can be applied effectively. Risk studies help to identify geographic areas that may have an increased probability of experiencing a given disaster. Vulnerability studies have been effective at identifying those populations which may not be able to respond and recover from disasters. Results from risk and vulnerability studies can most effectively be operationalized during the preparedness phase.

The goal of all preparedness activities is to anticipate problems and present possible solutions. Without regular training and exercising of a disaster

plan the activation of the plan during a disaster can result in a dysfunctional response. FEMA (2003b) identifies components of a good disaster plan as:

- ✓ Based on facts and scientific evidence
- ✓ Based on community resources inventory
- ✓ Provides organizational Structure
- ✓ Uses Simple Language
- ✓ Elements are coordinated
- ✓ 'Living Document' which is tested and updated regularly
- ✓ A comprehensive document which provides guidelines for response to any disaster

It is through preparedness and mitigation activities that response to a disaster can ultimately be improved.

2.3.2.3 Response

Response is defined as “the period during and immediately following a disaster” (FEMA, 2003b). Response activities are designed to provide emergency assistance to victims of a disaster and reduce the likelihood of secondary damage. The response phase has five stages: (FEMA, 2003b; Quarentelli, 1997)

1. Alert and Notification
2. Warning
3. Protection of Citizens and Property
4. Providing of Public Welfare
5. Restoration

The length of each of these five stages are dependent on the hazard, for example alert and notification of a hurricane or flood may be several days while there may only be minutes or even seconds during the notification stage for a tornadoes.

The goal of the response phase is to meet the immediate emergency needs of the affected population (e.g. search and rescue; immediate medical care; public safety; evacuation). The emergency services communities are the first responders and primary component to the response phase. For this reason it is critical that planning and mitigation activities are done in cooperation with all individuals and agencies responsible for respond during a disaster.

2.3.2.4 Recovery

Recovery is defined as “activities necessary to restore the jurisdiction to normal” (FEMA, 2003b). Although researchers agree that recovery is a distinct phase in the emergency management process (*Clary 1985; FEMA 2003a; Kates and Burton 1986a, 1986b*) the activities (*e.g. restoration of power, clearing of roads*) and the goal of recovery is an active debate in the hazards literature (Berke et al., 1993; Mileti, 1999; Mitchel, 1996; Shrubsole, 1999). Like risk and vulnerability definitions of recovery vary greatly. In contrast to FEMA’s definition Quarantelli (1999:3) defines recovery as “attempting to and/or bringing the post disaster situation to some level of acceptability. This may or may not be the same as the pre-impact level.” The vague conceptualizations of recovery can make this phase difficult to implement.

2.4 Comprehensive Emergency Management (CEM)

To understand the application of each of the four phase of emergency management the concept of Comprehensive Emergency Management (CEM) must be discussed. In the late 1970’s, United States Governors were becoming

increasingly concerned by the lack of national policy for managing natural and man-made disasters. It was during this time that a variety of federal agencies had responsibilities related to disaster response but a clear national strategy for managing disasters was lacking.

In 1977 amid growing concern that the federal government was ill equipped to aid state governments in response to a major or catastrophic disaster the National Governors Association (NGA) formed a subcommittee on disaster assistance to urge the President to establish a new centralized federal emergency management agency. The NGA further requested that the federal government fund a year long analysis of the problems and challenges associated with managing all types of emergencies.

In 1979 the research findings of the analyses were released by the NGA. The document presented for the first time a comprehensive emergency management approach aimed at aiding state leaders in coping with emergencies. Included in this document was the first set of emergency management tools based on case studies from a variety of states. The research identified a fragmentation within and between federal and state agencies as a challenge to effective emergency management.

The NGA report and the establishment of FEMA was the beginning of a large consolidation of over thirty plus federal agencies responsible in some way for disaster management. For the first time, all preparedness, mitigation, response and recovery programs were being stressed in a coordinated manner at the federal level. In the eyes of the NGA the goal of FEMA was to provide a

foundation for a comprehensive national emergency management system wherein federal, state, and local emergency management organizations become equal partners.

The 1979 NGA study not only identified fragmentation at the federal and state level as causes for ineffective emergency management programs but also identified a keystone in our modern understanding of emergency response by identifying the intertwined relationship between preparedness, mitigation, response, and recovery. For the first time in the hazards literature the NGA study clarifies that each mechanism is equally important to the success of the others and cannot be divorced from one another.

In 1979 the term Comprehensive Emergency Management (CEM) was a new term referring to a “states responsibility and capability for managing all types of emergencies and disasters by coordinating the actions of numerous agencies” (NGA, 1979:11). CEM was very different from the then popular term *Comprehensive Emergency Preparedness*. *Comprehensive Emergency Preparedness* placed the emphasis “in practice if not legislative intent, on the preparedness phase of emergency management” (NGA, 1979:11). The preparedness phase of emergency management was focused on the exclusion of response, mitigation, and recovery for three key reasons: “1) A lack of federal funds to states to mount mitigation and long-term recovery planning; 2) a lack of state funds, staff, and time to coordinate these phases, and 3) a lack of understanding of the relationships between the four phases” (NGA, 1979:11).

The NGA hoped to present CEM to the federal government in an effort to have state and federal officials view emergency management in a more holistic and inter-connected context. The intent of CEM was to develop a program which was capable of identifying the right agencies and individuals in a common sense way. Those identified would have useful resources to bring to bear on all phases of the emergency management cycle and provide the motivation for them to apply their resources in the most productive manner and in a coordinated fashion.

McEntire (2004) argues that CEM has for years organized emergency management into useful but perhaps, overly simplified, disaster phases. CEM has been the traditional theory of emergency management. Britton (1999), Oliver-Smith and Hoffman (1999) have all noted that this single perspective can limit understanding and expansion. Britton further argues that CEM has trouble capturing the wider political, economic and cultural explanations of disasters.

CEM, although developed in the United States, has been adopted worldwide. The Caribbean Disaster Emergency Response Agency (CDERA) utilizes this same concept under the term Comprehensive Disaster Management (CDM). CDM has been defined as “including integrated management of all natural and human-induced hazards and involving management through all phases of the Disaster Management Cycle” (CDERA, 2001:3). CEM and CDM are used interchangeably. Despite the title both CEM and CDM are multi-hazard, and multi-sectoral in their application as well as both being concerned primarily

with integrating vulnerability assessment and risk reduction into planning and management. Figure 2.2 illustrates the framework of an effective CEM plan.

The major components of the CEM Plan as shown in Figure 2.2 are risk identification and social vulnerability as applied to the four phases of emergency management. The effectiveness of the model is based on a solid understanding of the geophysical risks that a community faces as well the social structure within that community that creates vulnerable populations. Applying these two theoretical concepts to CEM allows emergency managers to integrate community specific elements to the all-hazards planning¹ and response approach.

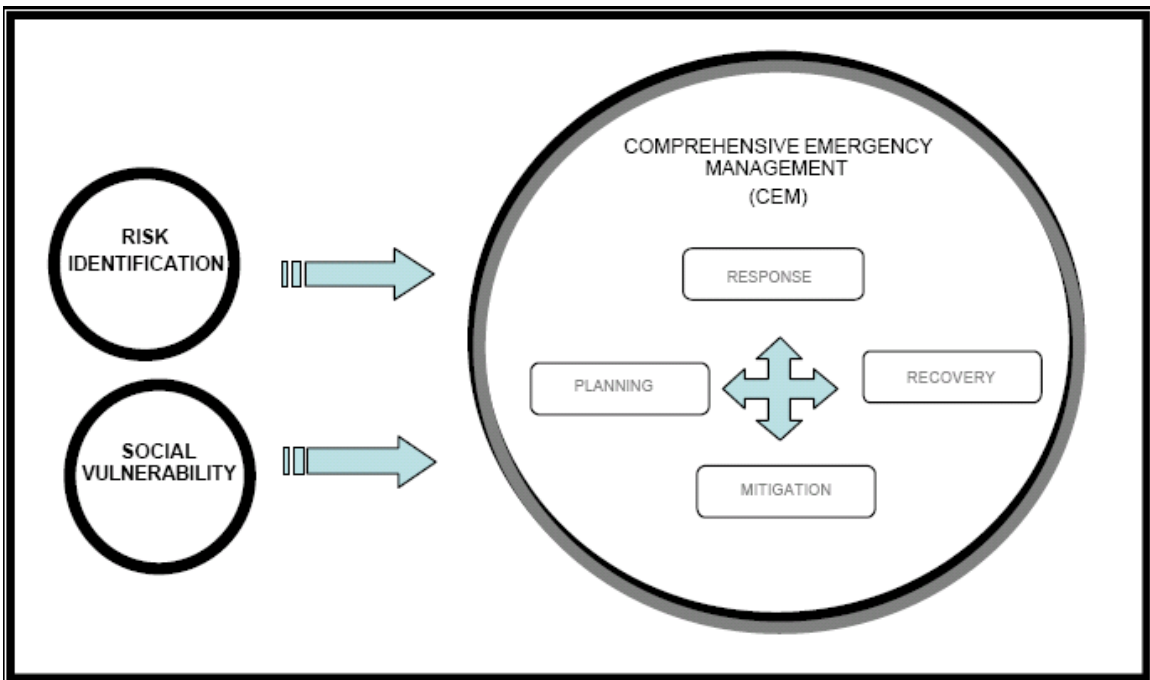


Figure 2.2 – Framework of a Comprehensive Emergency Management Plan (Source: Hughey, 2003)

An advantage of the CEM system is the all-hazards approach. The commonalities among all types of technological and natural disasters indicate

¹ All-Hazards approach is a term used in the response community to describe, a generic, basic response planning component for all types of hazards.

that many of the same disaster management strategies can be applied to all hazards. These common management approaches are a primary element of CEM and CDM (Hughey, 2003; Tobin et al., 2004). The objective of CEM has been to build capacity to prepare and respond, as well as to implement institutional mechanisms to reduce the impact of these extreme events. The integrated and holistic approach that is needed to minimize loss and dislocation can be advanced through the CEM process.

2.5 Theoretical Frameworks In Hazards Research

By the mid-1980's through the 1990's geographers and hazards research began to examine more closely the social frameworks that influenced how hazards affected individuals and groups, taking into consideration the interaction between geophysical aspects and the social environment. Researchers in the discipline have attempted to develop theoretical frameworks in an attempt to model the complex social and physical components which cause disasters. This section will highlight two selected theoretical models (The Hazards-of-Place Model and The Pressure and Release (PAR) Model) that have been instrumental in moving the hazards literature forward. Contributions and gaps of each model will be identified and discussed.

2.5.1 Hazards-of-Place Model

Cutter's 1996 Hazards-of-Place model shown below in Figure 2.3 develops a framework for looking at the social factors that influence or shape the susceptibility of various groups to harm as well as those characteristics of

communities and the built environment which create place inequalities. Cutter defines risk as an objective measure of the likelihood of a hazard event and defines mitigation as measures to lessen risks or reduce their impact. These two components risk and mitigation combine to create what Cutter identifies as the hazard potential. The Geographic Context or proximity to the hazard potential and the Social Fabric or experience with the hazard can create biophysical vulnerability, social vulnerability or both biophysical and social vulnerability. The combination of the two types of vulnerability intern creates Place Vulnerability.

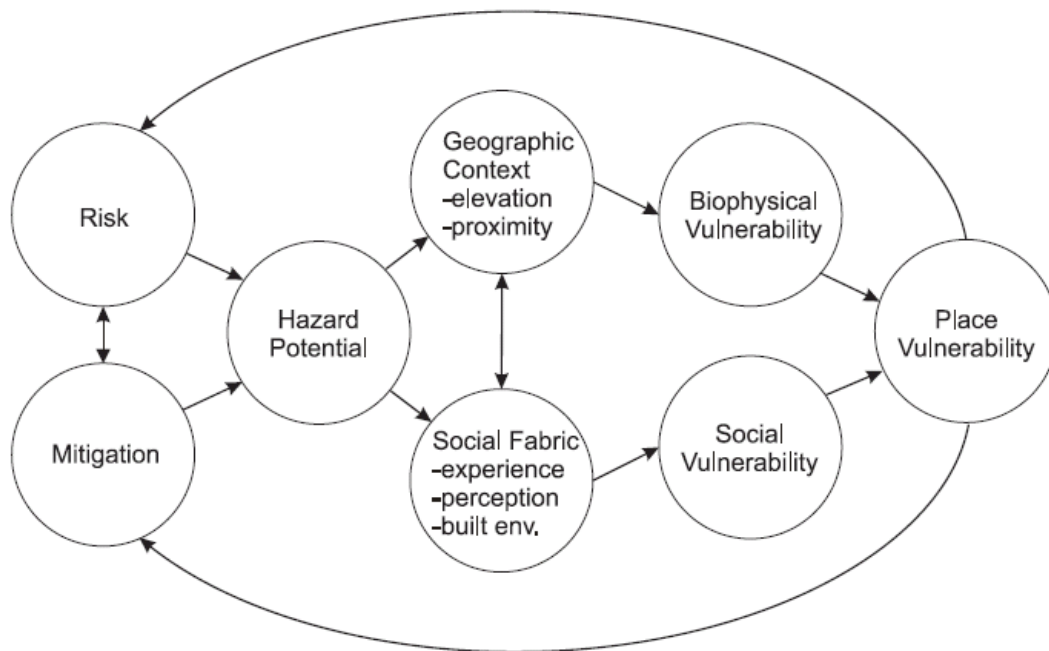


Figure 2.3 - The Hazards-of-Place Vulnerability Model (Source: Cutter et al. (2003) Modified from Cutter (1996))

Although this model provides a path for discussing vulnerability of place, a gap exists in the understanding of the social aspects of vulnerability in both the geographic literature and dialogue. Mileti (1999), highlights components of

biophysical vulnerability and the vulnerability of the built environment; largely ignoring the socially created vulnerabilities. There is good reason for this; socially constructed vulnerabilities are difficult to measure. Current hazards research has utilized individual characteristics of persons (age, race, health, income, type of dwelling unit, employment) to estimate social vulnerability at a jurisdictional level (Cutter, 1996, Cutter et al., 2003). I would argue that utilizing data obtained exclusively through the United States Census as the factors for determining social vulnerability eliminates the elements that are intrinsic to a community that may increase or reduce social vulnerability. The model also fails to take into consideration the political and community structures which exist within an area.

Cutter et al. (2003:257) describe social vulnerability in the context of the Hazard-of-Place model as a “multidimensional concept that helps to identify those characteristics and experiences of communities that enable them to respond to and recover from environmental hazards”. I would argue however that Cutter et al (2003) selected variables for use in the study that were based on case studies that lack a larger theoretical or conceptual understanding of comparative indicators of social vulnerability. The Hazard-of-Place model provides a strong foundation but does not have the ability to adapt to each unique community. The model further has limitations that prevent it from becoming operational.

2.5.2 Pressure and Release Model

Figure 2.4 the Pressure and Release (PAR) Model developed by Wisner (1994) has been utilized as a tool for illustrating how disasters occur when natural hazards affect vulnerable people. “The image resembles a nutcracker, with increasing pressure on people arising from either side – from their vulnerability and from impact (and severity) of the hazard for those people (Wisner, 2004:50).” It is only when the physical hazard and the social components of vulnerability come together that a disaster occurs. The PAR model identifies the disaster as the intersection between the physical and social forces.

The PAR model requires communities to trace the connections that link the impact of a hazard on people with a series of social factors and processes that generate vulnerability. This model places significant responsibility on the structures of society believing that natural hazards and hazard vulnerability can best be determined by understanding the social processes that impact choice.

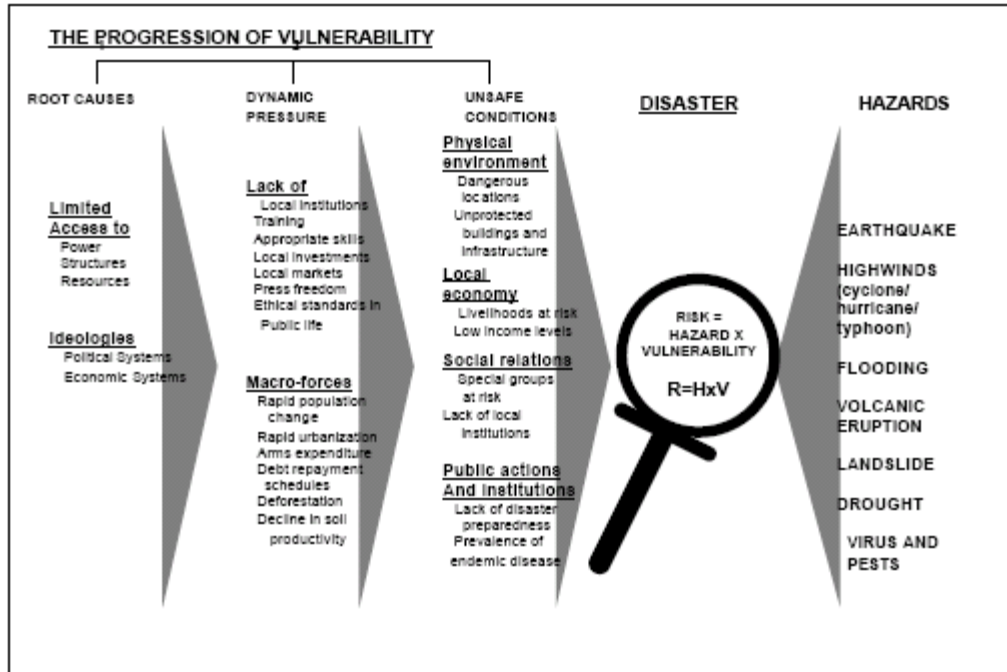


Figure 2.4 – Pressure and Release Model (Source: Wisner, 2004)

Wisner (2004) identifies the root causes of vulnerability as economic, demographic and political processes which impact the allocation and distribution of resources among different groups. Such root causes are directly connected to the function/dysfunction of the state. Dynamic pressures are identified as the activities and processes that translate the effects of root causes both temporally and spatially into unsafe conditions. Unsafe conditions are the specific forms in which the vulnerability of a population is expressed in time and space in conjunction with a hazard.

Placing the recent Hurricane Katrina disaster within the PAR model for examination illuminates a myriad of root causes such as poor economic conditions of residents as well as an inadequate local emergency management structure. Add to the root causes a combination of dynamic pressures like lack of

resources, training, and planning to create unsafe conditions within the City of New Orleans. When these vulnerabilities collided with an unprecedented geophysical force (category four hurricane) the disaster was considerable.

The PAR model provides a valuable tool to researchers and emergency managers by identifying the components that contribute to social vulnerability. The identification of these components allow for changes through application at all levels of government. To prevent another disaster like Hurricane Katrina the root causes and the dynamic pressures within New Orleans will have to be addressed. The PAR model provides the identification of key components that emergency managers and community leaders can make operational.

The PAR model has a wide application in both small and large communities and at the different levels of governments. Wisner (2004) model takes into consideration the larger economic and political system that impact individuals and communities abilities to effectively respond and recover from a disaster. It additionally identifies the potential mitigation areas to improve future disaster response.

2.6 Local Response to Disasters

Disasters affect jurisdictional areas in unique ways with differences attributed to the type of disaster, extent of damage, and available resources. As jurisdictions plan and mitigate for hazards they need to make sure that the plan does not fall into the common cookie cutter, one size fits all disaster plan, which may leave them more vulnerable. White's (1969, 1974) writings acknowledge that differences in communities require solutions to be distinctive for every area.

The acknowledgement of risk to a disaster and the communities understanding of vulnerability is required to ensure that the planning phase of a disaster is adequate. Although communities are constantly faced with the risk of hazards, they are not all equally vulnerable. White (1945) emphasizes the importance of understanding how individuals and groups make decisions about alternative programs for managing hazards.

Well trained professionals are an essential component to successful emergency management (Kates and Burton, 1986a) although, Wolensky and Wolensky (1990), argue that four other elements are also required: 1) A foundation of supportive values for local government action, 2) The legal authority to act, 3) An advocacy supporting action, and 4) Necessary institutional resources. Applying these five core components to the four stages of a disaster, the following model (Figure 2.5) is developed. The model which was initially intended to examine the effectiveness of small communities to respond to disasters could be applied to any community regardless of size. The model allows for the identification of elements that may be missing resulting in poor hazard management strategies.

The Model of Community Response to Disaster (Figure 2.5) takes into consideration the large contextual setting in which disasters take place. This model also addresses the concerns of Britton (1999), and Oliver-Smith and Hoffman (1999) that the traditional theory of emergency management i.e. CEM, overly simplifies the disaster phases and has trouble capturing the wider political, economic and cultural explanations of disasters. Figure 2.5 below ensures that

the policy process and intergovernmental system are not divorced from one another by applying to the phases of mitigation, planning, response, and recovery the key components identified by Wolensky and Wolensky (1990) and Kates and Burton (1986a):

- Well trained professionals
- *A foundation of supportive values for local government action*
- *The legal authority to act,*
- *An advocacy supporting action, and*
- *Necessary institutional resources*

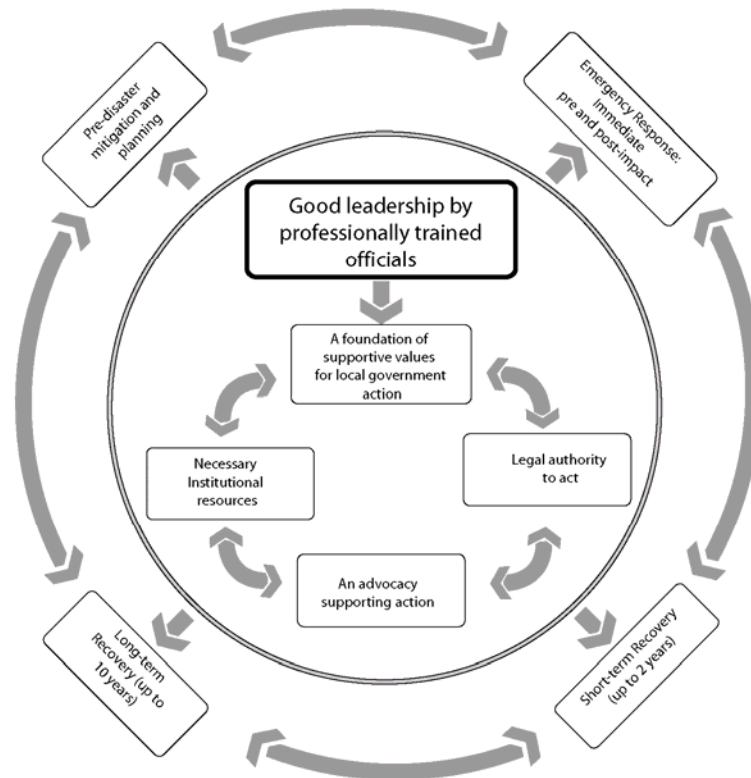


Figure 2.5 - Model of Community Response to Disaster (Source: Hughey, 2003)

2.6.1 Exploring the Model of Community Response to Disaster

The hazard literature illustrates agreement among researchers with regards to good leadership (Kates and Burton, 1986a). The key to an effective hazard management plan is good leadership and professionally trained officials. This element is the keystone to the above model while still illustrating that good hazard management is more complex than just this one feature.

A foundation of supportive values for government action enables concepts to be developed into policies and provides government leaders the backing to spend money in an effort to build resources. This is critical when dealing with jurisdictions that have a limited economic base. Hazard mitigation and planning is only one of the many issues facing government and many times gets placed on the back burner. If both the government and residents place importance on hazard management the community will be better prepared. Often officials are also more willing to engage in hazard policy if constituents are encouraging of such action.

Working within the constraints of any governmental systems and hazard mitigation boundaries, a jurisdiction can find itself with little or no legal authority to act. Changing political situations can seriously impair mitigation projects initiated at the local level. With new political leadership come new political agendas which can stop or alter mitigation measures before completion. Case studies such as Tobin and Peacock (1982) evaluations of Soldiers Grove, Wisconsin, has shed light on the U.S. federal governments' attitude towards alternative mitigation measures. Cases in point, when dealing with the flood

hazard, some communities have chosen to select non-structural adjustments to regulate the floodplain. However, without the authority to act and the support of government officials such measures can be halted, continuing to leave citizens vulnerable.

It is important to realize that strong support from government leaders is not always enough to ensure that policies and mitigation measures come to fruition. Clearly following a disaster, citizen support for action is high, but consensus on which alleviation strategy should be implemented is not always easy to achieve. As the immediate response phase comes to an end, many citizens try to get life 'back to normal' and are faced with other urgent problems, such as lost wages or lost industrial production. If a strong support for action does not exist within the community, policies for hazard reduction can fall through the cracks.

Every jurisdiction must have an accurate assessment of available resources. Being familiar with what resources and personnel are available during a disaster is crucial. Although many jurisdictions have a limited economic base and fewer immediate resources available, through mutual-aid agreements with neighboring jurisdictions, resources can be easily mobilized to respond. Being able to quickly assess the community needs and having the knowledge of resource availability, aid can be requested in a timely manner to ensure all immediate emergency needs are met. The application of the Model of Community Response to Disaster a jurisdiction can evaluate and determine gaps

that exist. Identification of gaps allows for the improvement and development of a more effective comprehensive emergency management system.

2.7 Discussion

As a geographer in the field of hazards research I believe it is our responsibility to bridge not only the gap between physical and social sciences but also to bridge the gap between theoretical and applied research. We have a responsibility to ensure that our research findings are presented in an effective and meaningful way not only to the rest of the hazards research community but also to emergency managers in the field. In an effort to reduce vulnerability and disaster losses our research must get into the hands of decision makers and we must enable them to apply the findings. Examples of research which have not only made significant contributions to the academic community but also to the emergency management community includes White (1945, 1958), Cutter (1996), Quarantelli (1997, 2000), Wisner et al. (2004), and Tobin et al. (2005).

This research attempts to build upon the foundation that has been developed in the hazards literature and previously discussed in this chapter to further expand our understanding of comprehensive emergency management and its impact on disaster response. The selected study design and methods are discussed in following chapter. Outlined are the data collection tools and procedures as well as a description of data interpretation and analysis.

Chapter Three: Study Design & Methods

3.1 Introduction

This research study used a longitudinal approach to improve our understanding of the Comprehensive Emergency Management (CEM) system on disaster response. The purpose of this study was to identify and report areas of success, as well as potential barriers to effective disaster response under the CEM system, in an effort to add to the geography literature on hazards. The study design and methods utilized in this research tested the validity of Quarantelli's (1997) methodology for evaluating the management of disaster response operations. This longitudinal study design was intended to determine the geographic, and political challenges to emergency management within the Commonwealth of The Bahamas as well as identify and document techniques being utilized to respond to and recover from disasters. Furthermore, the study design is intended to produce benchmarks for further evaluation from which we can continue to gauge the impact of CEM on future disasters within The Bahamas. The following chapter discusses the qualitative and quantitative methodology that was used and includes discussion of the study design, data

collection tools, and procedures. Additionally, provided in this chapter is a description of the process through which data were interpreted and analyzed.

3.2 Background

The goal of this research was two fold; first, to document the development of a comprehensive emergency management system within The Bahamas and second, to compare response operations under CEM with response operations prior to its implementation. This research study used qualitative and quantitative methods to analyze response operations to six disasters within The Bahamas. Figure 3.1 below displays the six study hurricanes and their temporal relationship to the implementation of CEM.

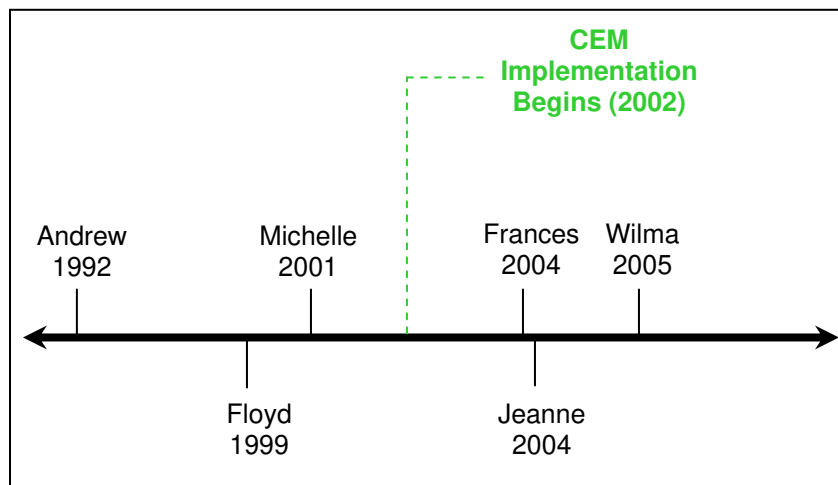


Figure 3.1 – Timeline of selected study hurricanes

The purpose of examining the above six hurricanes was to determine the impact of CEM on disaster response. By examining three response operations prior to the implementation of CEM we are better able to evaluate through comparison

the extent to which the national response operations were improved or worsened.

Keeping with the goal of the study, it was imperative that the research strategy employed answer the three objectives posed by the study:

3.2.1 Research Objectives

1. To identify and report areas of success, as well as potential barriers to effective disaster response under the CEM system, in an effort to add to the geography literature on hazards.
2. Test the validity of Quarantelli's (1997) methodology for evaluating the management of disaster response operations.
3. To determine the geographic, and political challenges to emergency management within the Commonwealth of the Bahamas.
4. To identify techniques being utilized within the Commonwealth of The Bahamas to respond to and recover from the impacts of disasters.

The research strategy additionally required that the selected methods of data collection and analysis address fully the research questions.

3.2.2 Research Questions

1. Can Quarantelli's (1997a) methodology for evaluating the management of disaster response be operationalized?
2. Can CEM, a United States emergency management strategy, be an effective strategy for an archipelagic nation?
3. Did the implementation of a CEM system improve disaster response?

Based on the literature (NGA, 1979; McLoughlin , 1985; Petak, 1985; Quarantelli, 1997; Britton, 2001; FEMA, 2003a; McEntire 2004; Tobin et al., 2004;) it is hypothesized that the implementation of CEM will have improved all areas of disaster response. It is further believed that the CEM system is an appropriate and effective strategy for disaster response within the Commonwealth of The Bahamas. The following section characterizes the research strategy utilized for this study by detailing the study design to include the utilized methods for data collection and analysis.

3.2.3 Selection of the Six Study Hurricanes

The selection of the six study hurricanes as displayed in Figure 3.1 above were based on the following criteria.

- (1) Any disaster impacting The Commonwealth of The Bahamas that required a response by the national government following the implementation of CEM.
- (2) A matching number of disasters impacting The Commonwealth of The Bahamas that required a response by the national government prior to the implementation of CEM.

To date Hurricanes Frances (2004), Jeanne (2004), and Wilma (2005) are the only disasters to impact the nation that have required a national response post CEM. Although there were smaller disaster such as brush fires, localized flooding events, and a ferry accident that have occurred since the implementation of CEM none of the events required a national response; for that reason these events were not selected as part of this study.

As a comparison group, three disasters that required a national response but occurred prior to the implementation of CEM were also included in this study. Hurricanes Andrew (1992), Floyd (1999), and Michelle (2001) were selected for the following reasons: (1) they were the most recent national response operations to take place prior to the CEM implementation, and (2) large amounts of data were available that documented in detail the national response initiatives. Excluded from this group were Hurricane Lili (1996) and The Bay Street Fire of 2001. Hurricane Lili was excluded due to the limited documentation dedicated to the national response. During preliminary archival research only one report from the Ministry of Public Works could be located which addressed the national response initiative. The Bay Street Fire was excluded because, although it created a large negative economic impact to the nation, the response to the disaster event required the mobilization of only three national agencies. The partial mobilization of national assets as well as limited data on the national response removed the fire from inclusion in this study.

3.3 Methods

This longitudinal study used a mixed methods research approach. The longitudinal design allowed for repeated observations of the impact of CEM on national disaster response. Creswell and Plano-Clark (2007) define mixed methods research as the collection and analysis of qualitative and quantitative data. Qualitative data can consist of “open-ended information that the researcher gathers through interviews with participants” (Creswell and Plano-Clark, 2007:6). Qualitative data can also be collected through observation and review of records

and reports. For this research qualitative data were collected through the collection of documents, semi-structured interviews, and participant observations. “Quantitative data includes closed-ended information such as that found on attitude, behavior, or performance instruments” (Creswell and Plano-Clark, 2007:6). This research collected quantitative data through surveys and census documents. The mixed methods utilized for data collection and analysis are discussed in detail below.

3.3.2 Data Collection Tools

This mixed-methods research utilized a triangulation design, the purpose of which was to obtain different but complementary data on the national response to disaster operations in The Bahamas. Data for this study were collected over a six year period from 2001-2007. This study employed the following data collection techniques:

- Archival research,
- Structured surveys,
- Semi-structured interviews, and
- Participant observations.

3.3.2.1 Archival Research

Archival research is often utilized by researchers to provide background information or to provide details to events that one was unable to witness (Stake, 1995). For this research study archival data were a critical component in providing clarity with regards to national disaster operations pre- and post- CEM implementation. Throughout the study period available relevant records and

reports regarding response to the six study hurricanes were collected. This archival research was used to reconstruct each disaster with special consideration given to the response phase. Archival data were additionally used to 'fill in the blanks' with regards to the social and political environment surrounding each event.

The collection of records and reports were important in this study to provide a more thorough understanding of national disaster response initiatives as well as provide insight into the dynamics surrounding emergency management within The Bahamas. Archival data were collected through the following agencies, organizations, and ministries.

- Department of Meteorology
 - Hurricane Andrew (1992)
 - Hurricane Floyd (1999)
 - Hurricane Michelle (2001)
 - Hurricane Frances (2004)
 - Hurricane Jeanne (2004)
 - Hurricane Wilma (2005)
- Office of The Prime Minister
 - Report on Hurricane Andrew
 - Report on Hurricane Floyd
 - The Bahamas National Geographic Information Centre
- The Airport Authority
 - Situation Report to NEMA on Hurricane Frances and Jeanne
 - Situation Report to NEMA on Hurricane Wilma
- The Bahamas National Emergency Management Agency (NEMA)
 - National Emergency Response Plan
 - NEMA Hurricane Frances Situation Reports
 - NEMA Hurricane Jeanne Situation Reports
 - NEMA Hurricanes Frances and Jeanne Briefing Notes
 - NEMA Hurricane Wilma Situation Reports
- The Bahamas Red Cross
 - Hurricane Andrew Situation Report to the International Federation of Red Cross Red Crescent Societies
 - Situation Report to NEMA on Hurricanes Frances and Jeanne
- The Bahamas Telecommunication Company

- Hurricane Floyd Report
- Report on Hurricane Michelle
- Report on Hurricane Frances & Jeanne
- The Royal Bahamas Defence Force
 - Hurricane Michelle After-Action Report
 - Hurricane Frances Situation Report to NEMA
 - Hurricane Jeanne Situation Report to NEMA
 - Hurricane Wilma Situation Report to NEMA
- The Royal Bahamas Police Force
 - Hurricane Frances Situation Report to NEMA
- The Ministry of Finance
 - Hurricane Wilma
- The Ministry of Health and Social Development
 - Report on Hurricane Michelle
 - Situation Report to NEMA on Hurricane Frances
 - Situation Report to NEMA on Hurricane Jeanne
 - Situation Report to NEMA on Hurricane Wilma
- The Ministry of Public Works and Transportation
 - Situation Report to NEMA on Hurricane Frances
 - Situation Report to NEMA on Hurricane Jeanne
 - Situation Report to NEMA on Hurricane Wilma
- The Ministry of Tourism
 - The Impact of the 2004 Hurricane Season on Tourism
- Water and Sewerage Corporation
 - Report on the 2004 Hurricane Season: Hurricanes Frances & Jeanne
 - Hurricane Wilma Situation Report to NEMA

Further data were obtained through regional and international organizations active in disaster response to include:

- The Caribbean Disaster Emergency Response Agency (CDERA)
 - Comprehensive Approach for Disaster Management in the Caribbean
- The United Nations (UN)
 - Living with Risk: A Global Review of Disaster Reduction

To aid in the analysis of the archival data, each document was summarized and placed in chronological order. This established order allowed for the easy identification of emerging themes and application to the six study hurricanes.

Strengths and Limitations of Archival Research

The collection of archival data were important for this study to provide a historic understanding of disaster response initiatives prior to the implementation of CEM. It is critical when using archival materials in research to understand the context in which they were written or developed. Researchers must identify the background of the document to determine the basis on which it was written, including whether it was written firsthand, through secondary resources, solicited, signed or edited (Lincoln & Guba, 1985). For this study archival data were validated through semi-structured interviews and observation data.

3.3.2.2 Structured Survey Data

Over the six-year study period that data were collected I developed a strong working relationship with the NEMA staff and emergency management support agencies. With strong support from the director of NEMA Mr. Carl Smith, surveys were conducted by NEMA and the originals were provided to me for analysis and inclusion in this study. The Structured surveys were designed by NEMA for the Family Island Administrators². The surveys were self administered and voluntary. A copy of the structured survey can be found in Appendix A of this document. There are a total of twenty Family Island Administrators responsible for serving as the NEMA representative for each of their respective jurisdictions. There was a 100% return rate for the surveys.

² Family Island Administrators are elected officials who represent their respective islands. Many administrators have a multi-island jurisdiction since many of the family islands are small both in population and geography. Family Island Administrators also serve as the NEMA representatives within their jurisdictions.

The structured surveys provided data on the Family Island Administrators perspectives on national disaster response to the six study hurricanes as well as information on disaster planning and training. The SPSS statistical program was used to run descriptive statistics on the population. The survey data collected were used in combination with archival research, semi-structured interview, and participatory observation data to gauge the impact of the CEM system on national response to the six disaster operations selected for this study.

Strengths and Limitations of Survey Data

There are several benefits to using a self-administered structured survey. According to Bernard (2000) self-administered surveys allow respondents the opportunity to answer sensitive questions without the presence and pressure of a researcher. This makes the respondent feel more comfortable and perhaps more likely to answer honestly. Regardless of how the survey is administered the data obtained can have limitations relating to retrospective questions concerning attitudes, perception, and sequence of events. Another challenge with administering surveys is participant recall. Accurately reconstructing activities surrounding an event and the timing of response initiatives is difficult. During disaster operations a variety of response initiatives are required to take place simultaneously. This requires that researchers are familiar with the functional activities that must be executed during a disaster. Limitations associated with recall as well as question design bias must be considered when analyzing the data. To validate the data and address potential limitations, survey

data were used in combination with archival research, semi-structured interviews, and participant observation data.

A major strength of survey data is the opportunity to collect data that can provide a more comprehensive understanding of the impacts of response operations. The survey utilized in this research allowed Family Island Administrators to rate response initiatives based on their experiences and perspectives. The surveys utilized both open and closed-ended questions allowing respondents an opportunity to use their own words to convey their perspective on the national response.

3.3.2.3 Semi-Structured Interviews

Semi-structured interviews were conducted with NEMA staff members to obtain information on the national response to the six study hurricanes as well as validate archival and survey data. Interviewing is a prominent means of data collection in the social science, and this study utilized semi-structured face-to-face interviews. Semi-structured interviews were selected for this research for two key reasons. First, the semi-structured format ensured that essential topics and information were gathered while also providing an opportunity to utilize probing techniques to draw out additional information. The interviews were an important component of this research, allowing participants the opportunity to convey their thoughts on the impact of CEM.

Table 3.1 identifies the interviewees, their official title, and the date each interview was conducted. Prime Minister Perry G. Christie was selected for an interview to obtain data on the current and future direction of emergency

management within The Bahamas. This interview provided insight into the political and economic importance of a comprehensive emergency management structure. All six NEMA staff members were interviewed to obtain data on the management of response operations both pre- and post-CEM. Interviews were also used to validate archival and survey data. The interviews additionally provided a broad understanding of the philosophy directing current emergency management practices within the nation.

<i>Semi-Structured Interviews</i>		
Name	Official Title	Interview Date(s)
Perry G. Christie	Prime Minister of The Bahamas	- January 25, 2007
Carl F. Smith	Under Secretary, Cabinet Office & Interim Director NEMA	- December 20, 2006 - January 25, 2007 - June 14, 2007
Chrystal Ginton	First Assistant Secretary	- December 18, 2006 - June 13, 2007
Gayle Outten-Moncur	Senior Assistant Secretary	- December 19, 2006 - December 20, 2006 - January 24, 2007 - June 14, 2007
Luke Bethel	Chief Petty Officer	- December 18, 2006 - June 13, 2007
Eleanor Davis	Administrative Cadet	- December 19, 2006 - June 13, 2007
Wendell Rigby	Supplies Officer	- December 19, 2006 - June 13, 2007

Table 3.1 - Semi-Structured Interviews Conducted

Strengths and Limitations of Semi-Structured Interviews

There are a number of benefits to conducting semi-structured interviews including the opportunity it provides to respondents to have control over the flow of the interview. Instead of forced responses, the semi-structured interview encourages a two way discussion between the researcher and the participant. According to Denzin and Lincoln (1998), semi-structured interviews allow respondents not only the opportunity to provide an answer but also the reasons behind their answers.

Semi-structured interviews however can prove to be difficult if the interviewer is not skilled at the technique. The interviewer must identify the appropriate areas and times to probe as well as know when and how to move the discussion along. The data obtained through the semi-structured interviews can be compromised if the interviewer asks leading, vague, or insensitive questions. Other pitfalls associated with semi-structured interviews include the interviewer's failure to keep the discussion on topic, probe properly, and/or a failure to judge answers correctly. One of the biggest challenges associated with semi-structured interviews comes during the analysis phase. The data obtained is rich with information however; a vast amount of irrelevant information can also be obtained.

The semi-structured interviews provided clarity to questions that emerged during archival research and provided support to the survey data that were collected. To address and overcome the challenges associated with semi-structured interviews I developed a strong working relationship with the NEMA

staff and the Prime Minister before conducting the interviews. This allowed me the opportunity to develop a rapport with the interviewees and establish an open dialogue. Furthermore, during the analysis phase the data were used in support of the archival, survey, and participant observation data.

3.3.2.4 Participant Observation

The intent of the observations was to gain insight into the governmental and organizational dynamics surrounding disaster response within The Bahamas. Hammersley and Atkinson (1983) argue that all social research is a form of participant observation, since we cannot study the social world without being part of it. Gold (1958) outlined four methods of collecting observational data: (1) the complete participant, (2) the participant-as-observer, (3) the observer-as-participant, and (4) the complete observer. In the context of this study, participant observation represents the established participant role that this researcher took during the implementation of the comprehensive emergency management system as well as the active role established during response to Hurricanes Frances and Jeanne. According to Gold (1958) this identifies a more 'participant as observer' role.

For the purposes of this study it was not possible to be a non-participant naturalistic observer due to the pre-existing relationships nor do I believe that a naturalistic observation technique would allow for the untangling of intertwined relationships that govern emergency response within the nation. Furthermore, it was not possible to go unnoticed and limit the affect of my presence on the behavior. I believe my interaction with all individuals and agencies active in

disaster helped reduce bias and prevented participants from changing their behavior on my behalf. This has led to a more natural emergency response environment. According to Becker (1958) sociologists utilize this method when they are especially interested in understanding a particular organization or substantive problem. Due to the complex nature of disasters, participation in all four phases of the emergency management cycle provided a stronger understanding of the complex social dynamics impacting national response operations.

Historically field research has been associated most strongly with participant observation (Becker, 1958). Fieldwork in The Bahamas was undertaken over a six year period (2001 – 2007). Actively participating in the development of an emergency management structure within The Bahamas I joined monthly disaster committee meetings, annual disaster preparedness conferences, planning and training activities, as well as activations of the National Emergency Operations Center (EOC) to include Hurricanes Frances and Jeanne 2004. This component of participant observation in combination with the previously stated data collection methods creates a holistic research perspective that has produced a very rich data set.

Strengths and Limitations of Participant Observations

There are two key limitations associated with observation data collection methods. The first limitation is with data validity. Observation data are susceptible to researcher bias and subjective interpretation. To overcome issues

associated with validity the data were used in combination with archival research, survey, and semi-structured interview data.

The second limitation to observation data is ethics. Several features of observation research make it vulnerable to questions of ethical malpractice. Invasion of privacy by venturing into private areas or by misrepresenting oneself as a member can be an issue. During this study NEMA and all of its members were made aware of my role within the context of disaster response as well as data collection.

“One great strength of the observational method lies in the ease through which researchers can gain entrée to settings” (Denzin and Lincoln, 1994: 382). Participant observation provides an opportunity for researchers to better understand the complex relationships that exist within an organization. I had the opportunity with the full support of NEMA to participate in planning, training, and response operations. The insight gained through participation in these activities allowed for the development of strong relationships with individuals and agencies active in disasters. Thus, a better understanding of the complex relationships that exist at the national level relating to disaster response initiatives within The Bahamas was achieved.

3.4 Data Application and Analysis

Data collected through archival research, structured surveys, and semi-structured interview were analyzed in several ways. First, the surveys and closed-ended question associated with the interviews were analyzed using standard statistical techniques. The data were then applied to 8 of the 10 criteria

for measuring the management of national disaster response operations as outlined by Quarantelli (1997). Finally, data were then applied to the Model of Community Response to Disaster (Hughey, 2003). Each of these analyses techniques are discussed in detail below.

3.4.1 Standard Statistical Analysis of Survey and Interview Data

Population data were gathered for both the surveys and interviews. Descriptive statistics were run utilizing the SPSS software and results are reported and discussed in chapter 5 of this document.

3.4.2 Measuring The Bahamas National Response to Hurricanes: Andrew (1992), Floyd (1999), Michelle (2001), Frances (2004), Jeanne (2004) and Wilma (2005)

Emergency Management is the process of coordinating available resources to deal with emergencies effectively, thereby saving lives, avoiding injury, and minimizing economic loss (FEMA, 2003b). The first step towards understanding the impact of the CEM system on the ability of The Bahamas to respond during a disaster required an evaluation of response operations. Hurricanes Andrew, Floyd, and Michelle were selected as three disasters which required a national response prior to the implementation of a CEM system. Hurricanes Frances, Jeanne, and Wilma were selected as three disasters which required a national response following the implementation of a CEM system.

Evaluating the management of each of the six disasters utilizing the same criteria provides a baseline for comparative analysis. An amended version of Quarantelli's (1997a) *Ten Criteria for Evaluating the Management of Community*

Disasters was selected. This methodological approach is being used to both compare and differentiate between each hurricane response in an effort to gauge how *effectively*³ each disaster was managed. Employing this comparative research methodology assisted in expanding our understanding of The Bahamas disaster response capabilities. It further facilitated the verification and/or falsification of assumptions surrounding CEM in The Bahamas.

Quarantelli's (1997a) evaluation criteria were selected for application in this research because it is rooted in the empirical research previously undertaken by social and behavioral scientist. The criteria were developed from over 500 different studies on disasters and mass emergencies conducted with the support of the Disaster Research Center (DRC). (For general summaries of the literature from which the evaluation criteria were developed see: Kreps 1984, 1989; Drabek 1986; Dynes, Demarchi and Pelanda 1987; Auf der Heide 1989; Quarantelli and Pelanda 1989; Lagadec 1990; Drabek and Hoetmer 1991; Clarke and Short 1993; Quarantelli and Popov 1993; Cutter 1994; Dynes and Tierney 1994; Porfiriev and Quarantelli 1996)

A prominent researcher in the field of hazards Dr. Quarantelli has worked closely with local and federal emergency managers to bridge the gap between researchers and practitioners. Quarantelli's (1997a) research was chosen for application in this study to test his criteria to see first, if they can be operationalized and second, if they are suitable for comparing and contrasting

³ *Effective* is defined as a desired and intended result has been produced; this definition differs from that of efficiency which requires that the results be obtained in the best possible way. (Quarantelli, 1997:43)

the management of several response operations. Dr. Quarantelli's research cuts across natural and technological disasters and identifies that there is no significant behavioral differences in the two types of crises. This is important to note since CEM is based on the principal that all disasters, regardless of the trigger require the same response mechanisms.

The foundation of Quarantelli's research is, "what is crucial is not management per se, but good management" (Quarantelli, 1997a:39). The key question then becomes what constitutes '*good management*' and how can that be measured. Quarantelli's model, developed for evaluating the management of disaster response operations at the local level provided ten criteria to evaluate if the response was effective. This study is examining the national response of The Bahamas to six hurricanes. There are significant differences to local and national response requirements and even greater difference between response operations within the United States and an archipelagic nation such as The Bahamas. Some of the major differences include: *availability of resources, legal authority to act, as well as strong control over governmental agency response*. Because of these differences as well as challenges associated in measuring some of the criteria developed by Quarantelli, this research utilized only eight of the ten components. Table 3.2 lists the criteria that were selected for this research to gauge effective emergency management.

The two criteria suggested by Quarantelli (1997a) that were omitted from this study are: *Generating an appropriate delegation of tasks and division of labor and blending emergent and established organizational behaviors*. There were

two major challenges in including these criteria in the evaluation of effective emergency management within The Bahamas that lead to their exclusion. First, there are no clear benchmarks within the hazards literature to measure if tasks were delegated appropriately nor is there agreement as to who should be doing the delegating. Secondly, although research has shown that groups of private citizens carrying out important disaster tasks can be an essential part of the disaster management process (Stallings and Quarantelli, 1985) the literature is centered within the United States and does not take into consideration more remote and dispersed locations such as The Bahamas Family Islands. In areas that are not easily accessible by outside groups with a small population base it is likely that disaster related activities are addressed within pre-established organizational structures such as a churches and/or local government. Furthermore, archival research and observation data did not identify any emergent organizations within the national response. For these reasons they were removed from examination within this study.

Eight Criteria for Evaluating The Management of Disaster Operations Within The Bahamas	
1. Adequately carrying out generic functions;	Yes/No
2. Effectively mobilizing personnel and resources;	Yes/No
3. Adequately processing information;	Yes/No
4. Properly exercising decision-making;	Yes/No
5. Developing overall coordination;	Yes/No
6. Correctly recognizing differences between response and agent-generated demands;	Yes/No
7. Providing appropriate and accurate reports for the news media;	Yes/No
8. Having a well-functioning emergency operations center;	Yes/No

Table 3.2 - Eight Criteria for Evaluating The Management of Disaster Operations Within The Bahamas. Source: Amended from Quarantelli (1997a)

3.4.2.1 Eight Criteria for Evaluating the Management of Disaster Response Operations within The Bahamas

Provided in this section is a detailed discussion of each of the eight criteria selected for use in this study. A summary of Quarantelli's (1997a) research as well as how each criterion was implemented to evaluate the six study hurricanes is presented.

The first criterion is; *carry out generic functions in an adequate way*. Regardless of the disaster agent certain functions must be carried out. For evaluation of this criteria ten generic functions were identified by Quarantelli (1997a) and Kreps (1991b). The ten functions include: 1) *Warnings*; 2) *Evacuations*; 3) *Sheltering*; 4) *Emergency Medical Care*; 5) *Search and Rescue*; 6) *Protection of Property*; 7) *Mobilization of Emergency Personnel and Resources*; 8) *Assessing the Damage*; 9) *Coordinating emergency management*

activities; 10) *Restoring essential public services*. As proposed by Quarantelli (1997a), the following two questions were applied to each of the ten generic functions.

1. *Was the need for the function recognized early?*
2. *Was the function carried out without too many problems?*

SAMPLE: FUNCTION EVALUATION CHART		
FUNCTIONS	Was the Need for the function recognized early? (Y/N)	Was the function carried out without too many problems? (Y/N)
1. Warning		
2. Evacuations		
3. Sheltering		
4. Emergency Medical Care		
5. Search and Rescue		
6. Protection of Property		
7. Mobilization of Emergency Personnel and Resources		
8. Assessing the Damage		
9. Coordinating emergency management activities		
10. <i>Restoring essential public services</i>		

Table 3.3 - Sample Function Evaluation Chart. (Data Source: Quarantelli, 1997a)

According to Quarantelli (1997a) if yes can be answered to all of the above questions then “it is very likely that there was adequate management of generic functions” (Quarantelli, 1997a:43). To answer these questions as they apply to the six hurricanes included in this research study (*Hurricanes Andrew 1992, Floyd 1999, Michelle 2001, Frances 2004, Jeanne 2004, Wilma 2005*) data

were gathered from a variety of sources including Official Reports from the Office of The Prime Minister, Hurricane After-action Reports, Observation, Survey Data and Personal Interviews with individuals active in the emergency response. Due to the vague and subjective nature of the two questions, application to the six hurricanes was problematic and is discussed in detail in chapter 6 of this dissertation.

The second criterion is: *Mobilize personnel and resources effectively*. Quarantelli (1997a) argues that in the majority of disasters, there is no lack of necessary personnel or resources. Research by Bolin (1990) illustrates that sooner or later, with no planning, needed personnel and resources become available. With the exception of catastrophes such as the 2004 Tsunami, this has generally been true for response. It is important to keep in mind the challenges associated with the mobilization and movement of resources/equipment between islands. Quarantelli (1997a) further argues that the goal is not just mobilization or personnel and resources, but rather *effective* mobilization. "Effective means that a desired and intended result has been produced; this definition differs from that of efficiency which requires that the results be obtained in the best possible way" (Quarantelli, 1997a:43). The example of evacuation operations was given to illustrate the distinct difference between *effective and efficient*. "An evacuation may have got the population out of an endangered area and been effective, but it may not have been very efficient in terms of the use of unnecessary resources, the time consumed by the problems generated" (Quarantelli, 1997a:43).

To answer the question of effective mobilization of personnel and resources for the six hurricanes in this study the following three questions will be examined.

1. *Were the needed personnel and resources identified well in the crisis?*
2. *Were they located quickly and brought to bear correctly?*
3. *Were they appropriate to the problems generated by the disaster?*

Quarantelli suggests that if the following questions can be answered positively then it would suggest that the “needed personnel and resources had not simply been mobilized but mobilized effectively” (Quarantelli, 1997a:44). To answer this question, data were gathered from emergency operation center logbooks, hurricane after-action reports, official reports from the Office of The Prime Minister, observation, and personal interviews with individuals active in the emergency response. As with criterion one, the questions proposed by Quarantelli (1997a) to evaluate the effective mobilization of personnel and resources are subjective and, as you will see in chapter 6, problematic.

The third criterion is: *allow the adequate processing of information*. This criterion focuses less on the technology utilized to ensure communication but rather places the emphasis on the content of *what, when* and *to whom* the information was made available. Although communication between the islands can be difficult during times of disasters, that, in itself, does not constitute poor management of a disaster. The amount and type of information being made available for decision making can significantly impact the response phase. As

Quarantelli (1997a) points out there are multiple streams of information flow during the response phase of a disaster:

- ✓ *Within every responding organization;*
- ✓ *Between organizations;*
- ✓ *From citizens to organizations; and*
- ✓ *From organizations to citizens.*

As a result of a disaster, staffing requirements will increase and may alter the regular flow of information. The addition of new individuals to the daily flow of information can create real challenges. If individuals are not properly equipped to provide, receive, and process information the system can become overloaded and inadequate for managing the disaster response operation. An example of this is the requirement of around the clock staffing. Extra demands are being placed on an organizations internal system which may bring about a loss and/or delay of information.

Quarantelli (1997a) contends that it is possible to evaluate the adequacy of information flow in a disaster. "If organizations and/or citizens did not get the information they needed, clearly the disaster management was not as it should have been" (Quarantelli, 1997a:46). Furthermore "information, the ability to process it, the relationships in a multi-person communication network and the authority to structure, control and regulate information across an emergency command affects the total effectiveness of the response system" (Wybo & Kowalski, 1998:131-2).

For the purposes of this research communication flow for each of the six hurricanes were evaluated. Data were gathered from a variety of sources

including official reports from the Office of The Prime Minister, hurricane after-action reports, observation, survey data, personal interviews with individuals active in the emergency response, and local newspaper reports.

The fourth criterion is: *permit the proper exercise of decision-making.*

Research has illustrated that it is uncommon for the usual chain-of-command and/or lines-of-authority to break down during response to a disaster. The problems associated with decision-making are usually associated with four key areas:

1. *Loss of higher-echelon personnel because of overwork.*
2. *Conflict over responsibility for new disaster tasks.*
3. *Clashes over organizational domains between established and emergent groups.*
4. *Surfacing of organizational jurisdictional differences.*

Specific tasks such as firefighting and law enforcement have very clear authorities responsible for performing functions. Rarely in a disaster operation does confusion over who is responsible for repairs to phone or sewer lines occur. The problems associated with decision making arise from the introduction of new challenges. For example number one above occurs from a tendency of key officials to work too long during the crisis period. "Personnel remaining on the job round-the-clock will eventually collapse from exhaustion or make bad decisions" (Quarantelli, 1997a:46). This problem is further compounded by the fact that when replacements come they will lack the necessary information for correct decision-making partly because crucial data will not have been formally recorded or processed.

Proper decision-making requires all relevant knowledge. If criterion four was not performed sufficiently or if any of the above four difficulties discussed occur it is appropriate to say that the proper exercise of decision-making was not permitted. To evaluate criteria four, each of the four questions identified by Quarantelli (1997a) were answered based on the data gathered through surveys of Island Administrators, interviews with individuals active in the emergency response, hurricane after-action reports, and observations.

The fifth criterion for good disaster management is: *focus on the development of overall coordination*. Coordination during a disaster operation comes into play when more than one emergency organization is involved. Coordination is critical and required to make sure that the response operation goes smoothly through the facilitation of information and the synchronization of critical functions that may require a variety of organizations.

It is vital to remember that control is not coordination. Having 'someone in charge' does not mean that the required coordination of organizations is occurring. Indeed, the idea that one person is controlling response operations can prevent the necessary coordination required to meet the emergency needs. Research by (Dynes, 1994) illustrates the differences and difficulties in utilizing a '*command and control*' model such as the Incident Command System (ICS) as opposed to a '*coordination*' model such as the Comprehensive Emergency Management (CEM) System in response to a disaster operation.

Coordination between organizations is plagued with difficulties for several reasons beginning with misunderstandings about what '*coordination*' really

means. According to Quarantelli (1997a) coordination is neither self-explanatory nor a matter of consensus. Some groups view coordination as merely informing others of what they will be doing. Others see it as the centralization of decision-making within a particular agency or among a few key officials. Quarantelli (1997a:48) defines coordination as “mutually agreed upon cooperation about how to carry out particular tasks.”

Good disaster management was evaluated on the kinds of efforts made at coordination and the relative absence of problems. According to Quarantelli (1997a) a lack of coordination will be apparent if there are problems associated with the delivery of services due to disagreements between organizations regarding tasks. Data relating to the delivery of services were gathered for each of the six study hurricanes through archival research, surveys, personal interviews and observation.

The sixth criterion identified was, *correctly recognizing difference between response and agent-generated demands*. It is important to note that regardless of the disaster type, hurricane, flood, or radiological event; many of the same functions or activities must take place. It is critical that these core functions, such as communication and logistics, are carried out in addition to the unique demands that are generated from a specific ‘agent’ or disaster type. Part of Quarantelli’s discussion of ‘good disaster management’ requires that there is correct reorganization of agent- and response-generated needs and demands. Agent-generated needs are defined as “demands derived from the particular disaster agent” (Quarantelli, 1997a:42). An example of an agent-generated need

would be the necessity of sandbags in response to a flood event. Agent-generated needs will vary considerably depending upon the disaster impact and specific nature of the agent. Response-generated needs however are defined as “demands common to all disasters because they are produced by the very efforts responding organizations make to manage community disasters” (Quarantelli, 1997a:42). The response-generated demands are predictable and independent of any particular disaster agency. For example, effective mobilization of personnel and resources, adequate information flow, good decision making, and coordination between organizations are all required regardless of the incident to which you are responding. Disaster planners have termed the planning process to meet the needs of response-generated demands as ‘all-hazards’ planning. Quarantelli (1997a) asserts that the correct recognition between agent- and response-generated demands can be determined if criteria two through five as listed below were answered in a positive way.

2. Effectively mobilizing personnel and resources
3. Adequately processing information
4. Properly exercising decision-making
5. Developing overall coordination

Evaluation of criteria six is dependent upon the assessment of these four components which were done through the application of data obtained during archival research, surveys, interviews and observations.

The seventh criterion of good disaster management is: *provide the mass communication system with appropriate and accurate information*. With today’s technology, the media are instantly on the scene of any disaster. The information being provided through the media can significantly influence the

perceptions and responses of disaster victims, potential volunteers, and even response agencies (Fry, 2003; Tobin and Montz, 1997; Quarantelli, 1996). It is critical that appropriate and accurate information is being provided in a structured and standardized approach.

According to Quarantelli (1997a:50) “good disaster management should encourage the development of patterns of relationships that are acceptable and beneficial to the responding organizations, the mass media and the citizens in general.” Indicators of good relationship include:

- ✓ *Cooperative interaction between organizational and community officials and media representatives;*
- ✓ *Regularly scheduled briefings by response organizations to the media;*
- ✓ *Citizens believe their local media are giving them a relatively accurate picture of what is happening.*

Quarantelli (1997a:51) argues that “when these relationships are good, members of the press are satisfied with the amount and quality of information that is given to them by officials, who in turn want them to disseminate information about the disasters.” He further states that if relevant information regarding the response is not provided to the local media they will disseminate, even if unintentionally, news that is inaccurate. A measure of good disaster management is if the media was provided with appropriate and accurate information. Evaluation of this criterion was done using data obtained from archival research, to include newspapers, radio, and television archives, as well as data from interviews, and observations.

The eighth and final criterion for good disaster management is: *have a well-functioning Emergency Operations Center (EOC)*. An EOC serves as the

nucleus for disaster response activities and facilitates the successful completion of the previous seven criteria. Given the number of agencies and groups required to respond to any given disaster the likelihood of response complications resulting from poor management is high. During a disaster response operation, a variety of activities are occurring simultaneously all with equal importance. An EOC is intended to facilitate the effective implementation of all required response activities and should be seen not just as a place and structure but also a function (Perry 1991:204, FEMA 1995:27).

It is important to remember that more than just a common location is needed to be considered a well-functioning EOC. Although a coordinated and organized response can be improved if all responding organizations are represented at a common location, it does not ensure success. Response operations many times last for days and even weeks, this requires that the EOC meet minimum physical requirements. For Example the EOC should:

- ✓ *Be located in a safe area in close proximity to key transportation routes;*
- ✓ *Have sufficient work space;*
- ✓ *Have bathroom and sleeping facilities;*
- ✓ *Have adequate communication provisions;*
- ✓ *Have computers and necessary supplies;*
- ✓ *Have maps and equipment inventory.*

However, the physical requirements are still not enough for an EOC to be considered 'well functioning'. An EOC is of little value if agencies and organizations active in response do not send liaison personnel to the EOC. In addition to physical requirements for an EOC, there are social requirements that are equally essential. For example the EOC should require that:

- ✓ *Liaison personnel be knowledgeable and possess certain decision-making responsibilities in their own organizations.*

An effective response is unlikely if organizational representatives at the EOC are low level employees. These individuals may not only have inadequate knowledge of the organizations capabilities and resources, but they are also not involved in the decision making process. If there is proper staffing of the EOC, information can be collected and disseminated appropriately to ensure that tasks are executed accordingly. Additionally, proper staffing of the EOC provides for an ideal problem solving environment. Complications with response operations can be addressed between organizations in a timely fashion to ensure effective response.

It is dangerous, however, to assume that just because the physical and social requirements listed above are in place that the EOC will be 'well functioning'. The EOC environment is both dynamic and stressful. Personal dynamics can prevent an operation from running smoothly. "The social climate of an EOC is a very stressful one: there is pressure to take action, limited and uncertain information, shifting priorities and overlapping lines of authority and responsibility" (Perry 1991:210).

Criterion eight for determining good disaster management, *have a well-functioning Emergency Operations Center (EOC)*, was measured by first determining if the previous seven criteria were answered in a positive way. Additionally data were gathered through the EOC log books, hurricane after-action reports, interviews with individuals active in disaster response, and

observation. Data were applied to each of the six study hurricanes to determine if there was a well-functioning EOC.

3.4.3 The Model of Community Response to Disasters

Evaluating the management of the six study hurricanes utilizing Quarantelli's (1997a) 'Criteria for Good Management' provided a foundation for examining the impact of a CEM system. However, to fully understand the findings as they apply to the dynamic political, social, and economic environment of The Bahamas, The Model of Community Response to Disasters was also applied. (See Figure 3.2) This theoretical framework is amended from Hughey (2003).

Combining the elements put forth by Kates and Burton (1986a) and Wolensky and Wolensky (1990) as applied to the four phase of emergency management, allowed for the identification of gap that resulted in poor hazard management. This theoretical model further illustrates the importance of the policy process and intergovernmental system that impacts disaster response.

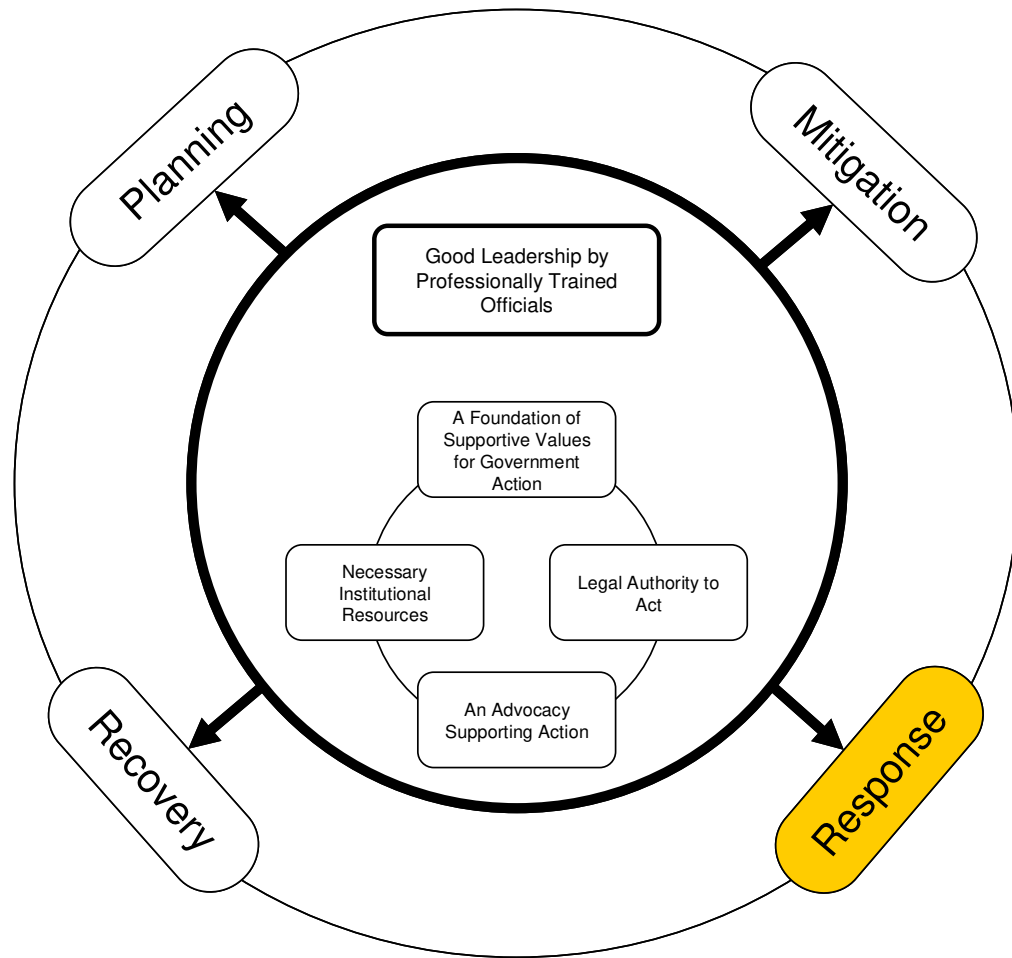


Figure 3.2- Model of Community Response to Disasters

The model begins with the identification of good leadership by professionally trained officials as argued by Kates and Burton (1986). Undoubtedly, well trained and experienced professionals are essential components to the successful management of a disaster. However the hazards literature (Quarantelli, 1997a; 1997b; Mileti 1999, Mitchell 1996) has further illustrated that there is much more required to meet successfully the challenges of disaster response. Wolensky and Wolensky (1990), argue that four other elements are also required: (1) a foundation of supportive values for local government action, (2) the legal authority to act, (3) an advocacy supporting

action, and (4) necessary institutional resources. These four elements in combination with good leadership are then applied to the four phases of emergency management: (1) Preparedness, (2) Response, (3) Recovery, and (4) Mitigation as displayed above in Figure 3.2.

As discussed in Chapter Two the four phases of emergency management are widely accepted within the hazard research field with slight variations (Clary 1985; FEMA 2003; Kates and Burton 1986). The phases of disaster management as pointed out by Bruce (1985) are interrelated, so simplification and boundaries must be developed in order to discuss them individually, understanding that many times these phases are occurring simultaneously or with some overlap. The delineation between the four phases of a disaster has allowed researchers and responders to find order in a disordered and chaotic environment.

The application of the model was done in two distinct phases, the pre-CEM phase, which provides the contextual framework necessary to understand Hurricanes Andrew, Floyd, and Michelle, and the post-CEM phase, that examined Hurricanes Frances, Jeanne, and Wilma. By exploring emergency response in these two phases ensures that the wider political, economic, and cultural explanations surrounding response to the six study hurricanes is addressed. This type of examination further allows for a more complete understanding of the mechanisms that impacted response initiatives.

3.5 Strengths and Limitations of the Study Design

Longitudinal data permit the measurement of differences or change in a variable from one period to another, in this case the management of disaster operations following the implementation of a comprehensive emergency management system. This allows for the description of patterns of change over time, and can be used to locate the causes of social phenomena and sleeper effects, that is, connections between events that are widely separated in time. The major limitations to a longitudinal study which utilized the retrospective design are:

1. *Recall Bias*: Retrospective questions concerning motivational, attitudinal, cognitive or affective state are particularly problematic because respondents find it hard to accurately recall the timing of changes in these states.
2. *Retrospective studies must be based on survivors*: For this study it means that I was limited to those individuals who were still working for NEMA or The Bahamas Government. Any individuals who have moved, changed jobs, or passed away were omitted and biases may arise.

3.6 Summary

This chapter described the mixed methods approach employed for this study including the strengths and limitations associated with the four data collection techniques: (1) archival research, (2) structured surveys, (3) semi-structured interviews, and (4) participant observations. Detailed descriptions of the two theoretical frameworks used as well as how Quarantelli's (1997a) criteria for evaluating the management of disaster response operations and the model of community response to disasters (Figure 3.2) were applied. Application and testing of these two frameworks allowed for the development of a baseline for

comparison between the six study hurricanes as well as a more comprehensive understanding of the mechanisms impacting response. Figure 3.3 provides a flow diagram for the stages of this research.

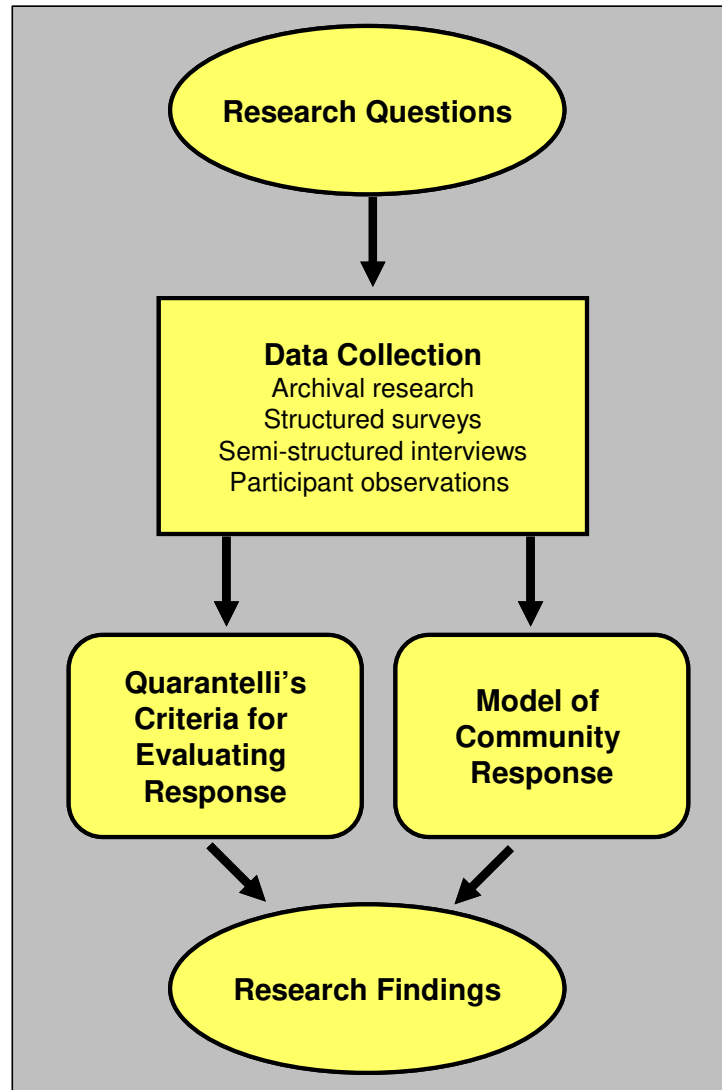


Figure 3.3 – Methodology Flow Diagram

Chapter Four

Results: Application Of Quarantelli's Criteria For Evaluating Response

4.1 Introduction

Chapter four discusses the research findings associated with the testing of Quarantelli's (1997a) eight criteria for evaluating disaster response. The results are presented in a combination of tabular and written form. The data in this chapter are formatted to answer the following research questions.

- Can Quarantelli's (1997a) methodology for evaluating the management of disaster response be operationalized?
- Based on Quarantelli's methodology did the implementation of a CEM system improve disaster response?

The criteria are applied to each of the six study hurricanes to determine if improvements in disaster response were identified after the implementation of CEM.

Data obtained through surveys, semi-structured interviews, archival research, and observations were applied to assess each of the eight evaluation criteria as outlined in Chapter 3. The eight criteria were equally applied to the six study hurricanes in an effort to determine if Quarantelli's methodology could be operationalized as well as to identify the success of pre- and post-CEM response operations.

Eight Criteria for Evaluating The Management of Disaster Response Operations to the Six Study Hurricanes						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
1. Adequately carrying out generic functions;	No	No	No	No	No	No
2. Effectively mobilizing personnel and resources;	No	No	No	No	Yes	Yes
3. Adequately processing information;	No	No	No	Yes	Yes	Yes
4. Properly exercising decision-making;	No	No	No	No	No	Yes
5. Developing overall coordination;	No	No	No	Yes	Yes	Yes
6. Correctly recognizing differences between response and agent-generated demands;	No	No	No	No	No	Yes
7. Providing appropriate and accurate reports for the news media;	No	No	No	Yes	Yes	Yes
8. Having a well-functioning emergency operations center;	No	No	No	No	No	No

Table 4.1 - Eight Criteria for Evaluating The Management of Disaster Response Operations to the Six Study Hurricanes

Table 4.1 displays the results of the evaluation for all six study hurricanes using Quarantelli's (1997a) eight criteria. Each criterion is examined in detail below to evaluate the usefulness of Quarantelli's (1997a) methodology for evaluating the management of disaster response operations. The methodology, if it can be operationalized, will be able to examine the shifts in disaster response as a result of CEM. Hurricanes Andrew, Floyd, and Michelle were managed under the pre-CEM system. Disaster response during this time was seen as the responsibility of the Royal Bahamas Defence Force (RBDF) and a 'command and control' model for disaster response was utilized. Hurricanes Frances, Jeanne, and Wilma were managed under the post-CEM system. Disaster response after the implementation of CEM in 2002 was the responsibility of the National Emergency Management Agency (NEMA) and 'comprehensive coordination' model for response was implemented.

4.2 Examination and Application of Quarantelli's Eight Criteria

4.2.1 Criterion One: Adequately Carrying Out Generic Functions

The first component of Quarantelli's methodology was to determine if generic emergency response functions were carried out adequately. Regardless of the disaster agent certain functions must be carried out. The ten generic functions were evaluated for this research were identified by Quarantelli (1997a) and Kreps (1991b) and include 1) *Warnings*; 2) *Evacuations*; 3) *Sheltering*; 4) *Emergency Medical Care*; 5) *Search and Rescue*; 6) *Protection of Property*; 7) *Mobilization of Emergency Personnel and Resources*; 8) *Assessing the Damage*; 9) *Coordinating emergency management activities*; 10) *Restoring essential public*

services. According to Quarantelli’s (1997a) the following two questions must be applied to each of the ten generic functions.

1. *Was the need for the function recognized early?*
2. *Was the function carried out without too many problems?*

As discussed in Chapter Three, if ‘yes’ can be answered to both questions then the function can be considered to be “adequately carried-out”. Table 4.2 shows that generic functions were not “adequately carried-out” during any of the six disaster response operations. A detailed description and supporting data for the responses in Table 4.2 are provided in Table 4.3 and sections 4.2.1.1 – 4.2.1.6.

Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion One						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Adequately carrying out generic functions;	No	No	No	No	No	No

Table 4.2 – Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion On

GENERIC FUNCTION EVALUATION CHART												
	Pre-CEM						Post-CEM					
Hurricane	Andrew 1992		Floyd 1999		Michelle 2001		Frances 2004		Jeanne 2004		Wilma 2005	
FUNCTIONS	Q1. Was the Function recognized early?*(Y/N)	Q2. Was the function carried out without too many problems?*(Y/N)	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2
1. Warning	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Evacuations	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
3. Sheltering	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Emergency Medical Care	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Search and Rescue	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Protection of Property	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7. Mobilization of Emergency Personnel and Resources	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes
8. Assessing the Damage	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
9. Coordinating emergency management activities	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
10. Restoring essential public services	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

Table 4.3 Generic Function Evaluation Chart Applied to the Six Study Hurricanes

4.2.1.1 Hurricane Andrew 1992 Criterion One: Adequately Carrying Out Generic Functions

Table 4.4 provides a summary of the ten generic functions that were evaluated for this research and their application to Hurricane Andrew 1992.

Hurricane Andrew 1992 GENERIC FUNCTION EVALUATION CHART		
FUNCTIONS	Was the Need for the function recognized early? (Y/N)	Was the function carried out without too many problems? (Y/N)
1. Warning	Yes	Yes
2. Evacuations	Yes	No
3. Sheltering	No	No
4. Emergency Medical Care	Yes	Yes
5. Search and Rescue	No	No
6. Protection of Property	Yes	Yes
7. Mobilization of Emergency Personnel and Resources	No	No
8. Assessing the Damage	No	No
9. Coordinating emergency management activities	No	No
10. Restoring essential public services	No	No

Table 4.4 – Evaluation of Generic Functions in Response to Hurricane Andrew 1992

Hurricane Andrew Generic Function 1 (Warning)

Based on data gathered from The Bahamas Department of Meteorology (1992) and interviews with NEMA staff, warnings for Hurricane Andrew were

effectively executed. On Saturday August 22nd hurricane warnings were issued for the islands of the Northwest Bahamas and were maintained until 7am on Monday the 24th (Bahamas Department of Meteorology, 1992). Hurricane warnings are issued by the Department of Meteorology when hurricane force winds (sustained winds of 74mph or higher) are expected in an area within the next 24 hours or less. The warnings issued by the Department of Meteorology were provide to The Broadcasting Corporation of The Bahamas, ZNS, who then communicated the warnings throughout the Islands via television and radio.

“I was still with the Defence Force in 1992. Everyone was aware Hurricane Andrew was going to hit, we were warned to secure our homes and prepare for a category 5 storm” (Bethel, 2006).

“The Met Department does a great job of tracking the storm and providing the most up to date information to the public. From Andrew to Wilma Bahamians knew the storms were coming” (Outten-Moncur, 2007a).

Based on the data from the Department of Meteorology and the interviews with NEMA staff, the need for warnings was recognized early and the function was carried out with no notable problems.

Hurricane Andrew Generic Function 2 (Evacuations)

In 1992 there was no legal authority to act or avenue for issuing ‘official’ evacuation orders within the Commonwealth of The Bahamas. Through archival research, interviews with NEMA staff, and informal discussions with Island Administrators there was no evidence that evacuations were issued. The Department of Meteorology (1992) did encourage residents in unsafe structures to relocate and seek shelter in more secure locations. However, ‘official’ requests for evacuation were not issued and national resources were not made

available to aid residents. The data shows that the need for evacuations was recognized by the Department of Meteorology however the function was not carried-out effectively.

Hurricane Andrew Generic Function 3 (Sheltering)

The Bahamas Red Cross Society (1992) with support from the RBDF and the Ministry of Social Services (Office of the Prime Minister, 1992) opened emergency shelters throughout The Bahamas. Data on the number of shelters opened, individuals housed, and services provided were not available.

“After Hurricane Andrew passed shelters were opened. The shelters were run mostly by Social Services” (Luke Bethel, December 18, 2006).

Based on informal discussions with Red Cross representatives, Island Administrators, as well as NEMA staff it appears that many of the shelters were opened after Andrew made landfall to deal with the dislocation of population due to housing damage. This post impact sheltering of a population is known as recovery shelters. In contrast response shelters the focus of this research, are opened prior to landfall to provide residents with a safe location to ride out the storm. As a result the available data suggests that emergency response shelters were not recognized early or carried-out effectively.

Hurricane Andrew Generic Function 4 (Emergency Medical Care)

National emergency medical care was adequate in meeting the needs of residents in response to Hurricane Andrew. Four deaths were reported (Office of the Prime Minister, 1992) and based on informal discussions with the Minister of Health, and Hospital Authority representative Paul Newbold, the national

emergency medical system was able to coordinate response to injuries. At no time was the system overwhelmed or incapable of meeting the medical needs of the nation. Based on the available data, it appears that the function was recognized early and carried out effectively.

Hurricane Andrew Generic Function 5 (Search and Rescue)

Search and Rescue was not a formal function in 1992 during response to Hurricane Andrew. According to informal discussions that I had at the 2005 national NEMA conference in Nassau, with the Island Administrators from San Salvador and Bimini, search and rescue was an informal function conducted at the local level by a variety of organizations in a disjointed and uncoordinated manner. Local residents, the police and fire department, as well as the RBDF provided assistance with search and rescue services. Data obtained through archival research makes no reference to Hurricane Andrew search and rescue operations. As a result both question posed by Quarantelli to evaluate this functions were assessed negatively indicating the function was not identified early or executed effectively.

Hurricane Andrew Generic Function 6 (Protection of Property)

Protection of Government property was carried out by the Ministry of Works and Transportation (Office of the Prime Minister, 1992). With responsibility for Government Buildings the Ministry of Works secured all government facilities by installing hurricane shutters and/or plywood to protect windows. The protection of government property was recognized early and

carried out with no notable problems. Many residents also took precautions with their property by securing windows and clearing debris.

Hurricane Andrew Generic Function 7 (Mobilization of Emergency Personnel and Resources)

The RBDF controlled disaster operations in response to Hurricane Andrew (Office of the Prime Minister, 1992; Bethel, 2006; Rigby, 2006). No formal emergency operations center (EOC) was established to allow for a multi-organizational response, rather the operations was controlled by the RBDF. This caused several problems, including limited and/or delayed preliminary damage assessment reports. The lack of a detailed assessment triggered a delay in the activation of resources and personnel. General comprehensive coordination was lacking and was evident through the singular response by the RBDF. Communication was poor and potential support agencies were not activated or provided with updated information. (Bethel, 2006; Rigby, 2006) As a result there were significant delays in the activation and movement of emergency materials and personnel producing a disjointed response. Applying the data to Quarantelli's methodology shows that the need for the mobilization of emergency personnel and resources was not recognized early nor was it carried out effectively.

Hurricane Andrew Generic Function 8 (Assessing the Damage)

According to the Office of the Prime Ministers' (1992) report on the impact of Andrew, it appears that some informal damage assessments were conducted by ministries to determine what type of recovery would be required (Office of the

Prime Minister, 1992). This information however was related to long term fiscal needs to rebuild and not immediate response needs. There is no evidence that a comprehensive coordinated assessment was conducted at the national level.

“During Hurricane Andrew damage assessment was not done. We now have a detailed system in place that ensures uniformed criteria for assessments” (Bethel, 2006).

Because preliminary damage assessments (PDA) were not conducted it was difficult to determine in the immediate aftermath of Andrew the full magnitude and impact of the storm. Informal discussions with Island Administrators during the 2005 and 2006 NEMA conferences revealed that they were not aware of any assessments that were conducted immediately following Hurricane Andrew to determine the level of damage. Anecdotal information indicated problems with duplication and uncoordinated reporting, that resulted in confusion. Although the assessments by some ministries were conducted they focused on recovery, not response. The lack of a national PDA following Hurricane Andrew indicates that the need was not recognized early or carried out effectively.

Hurricane Andrew Generic Function 9 (Coordinating Emergency Management Activities)

During response to Hurricane Andrew there was very little coordination of emergency management activities, and primary responsibility was assigned to the RBDF. Utilizing a military ‘command and control’ model of operation there was limited coordination between multiple agencies.

“Remember I was with the RBDF at that time [1992 Hurricane Andrew], and there was no structure like there is today to allow for coordination” (Bethel, 2006).

“During Hurricane Andrew nothing was coordinated, agencies worked independently there was no structure in place to ensure the Family Islands were prepared or able to respond” (Outton-Moncur, 2006b)

Government ministries lead specific emergency activities related to their mission (Office of The Prime Minister, 1992) however, this was conducted in an uncoordinated and disjointed manner. According to informal discussions with Island Administrators and NEMA staff, there was no centralized sharing of information which lead to duplications of efforts and wasting of resources. Based on this information and applying Quarantelli’s methodology this function was not recognized early or implemented effectively.

Hurricane Andrew Generic Function 10 (Restoring Essential Public Services)

The restoration of essential services such as water, electricity and phone were significantly delayed following Hurricane Andrew. Eleuthera, the Berry Islands and South Bimini all reported interruption to services. The Bahamas Telecommunication Company (BTC), The Bahamas Electric Corporation (BEC), and the Water and Sewerage Corporation (W&SC) all worked to restore services (Office of the Prime Minister, 1992). Data regarding the length of outages could not be obtained. Informal discussions with the Island Administrator from San Salvador at the 2005 NEMA Conference indicated that there were portions of the Family Islands that were without power for several months. There are no data to suggest that the need for the function was recognized early or implemented effectively.

4.2.1.2 Hurricane Floyd 1999 Criterion One: Adequately Carrying Out Generic Functions

Table 4.5 provides a summary of the ten generic functions identified by Quarantelli (1997a) and evaluated for this research as they relate to Hurricane Floyd.

Hurricane Floyd 1999 GENERIC FUNCTION EVALUATION CHART		
FUNCTIONS	Was the Need for the function recognized early? (Y/N)	Was the function carried out without too many problems? (Y/N)
1. Warning	Yes	Yes
2. Evacuations	Yes	No
3. Sheltering	No	No
4. Emergency Medical Care	Yes	Yes
5. Search and Rescue	No	No
6. Protection of Property	Yes	Yes
7. Mobilization of Emergency Personnel and Resources	No	No
8. Assessing the Damage	Yes	No
9. Coordinating emergency management activities	No	No
10. Restoring essential public services	No	No

Table 4.5 – Evaluation of Generic Functions in Response to Hurricane Floyd 1999

Hurricane Floyd Generic Function 1 (Warning)

The data gathered from The Bahamas Department of Meteorology (1999) and interviews with NEMA staff indicate that warnings for Hurricane Floyd were

effectively executed. At 5pm on September 13th, 1999 tropical storm warnings⁴ were issued for the Southeast Bahamas and the Turks and Caicos Islands. A hurricane watch⁵ was also posted for the Central Islands of The Bahamas (Bahamas Department of Meteorology, 1999). The Broadcasting Corporation of The Bahamas, communicated the warnings throughout the Islands of The Bahamas via television and radio.

“The Bahamian public responded well to the hurricane alert messages, and took advice given to them seriously. This was subsequently reflected in the fact that there was one casualty [later reclassified as two] and property damage was minimized in most islands. The department of Meteorology was commended by the media and the general public, for the issuing of timely and accurate warnings. The response to our warning system was just tremendous” (Lightbourne and Dean, 1999:12).

In response to Hurricane Floyd data indicates that need for warnings were recognized early and the function was carried out effectively.

Hurricane Floyd Generic Function 2 (Evacuations)

‘Official’ evacuation orders in response to Hurricane Floyd were not issued for the Islands of The Bahamas. Although the news media and Department of Meteorology did encourage residents of low lying areas and families with homes close to the sea to relocate to a more secure location, no ‘official’ request for evacuations were made (Office of The Prime Minister, 1999). The data indicates that the general function of evacuations was recognized by the Department of

⁴ Tropical Storm warnings are issued by The Department of Meteorology when tropical storm conditions are expected in the specified area within 24 hours.

⁵ Hurricane watches are issued by the Department of Meteorology to indicate that hurricane conditions are possible in the specified area, usually within 36 hours. When the Department of Meteorology issues a hurricane watch they notify residents to prepare to take immediate action to protect your family and property in case a hurricane warning is issued.

Meteorology but not carried-out effectively. No resources or coordination took place to facilitate the movement of residents in response to Hurricane Floyd.

Hurricane Floyd Generic Function 3 (Sheltering)

The Bahamas Red Cross Society with support from the RBDF and the Ministry of Social Services and Community Development opened emergency shelters (Ingraham, 1999). Data on the number of shelters opened, individuals housed, and services provided were not available for Hurricane Floyd. There are no data to suggest that the need for shelters was recognized early. Based on the Prime Minister's Communication to Parliament regarding shelter operations, it appears that The Bahamas Red Cross Society in coordination with Social Services were successful in providing shelter services (Ingraham, 1999). However, as with Hurricane Andrew the shelters were recovery not emergency response shelters.

“Social Services worked closely with the Island Administrators to ensure shelters were open for those that lost their homes [as a result of Hurricane Floyd]” (Glinton, 2006)

The need for response shelters was not recognized early nor was the function carried-out effectively.

Hurricane Floyd Generic Function 4 (Emergency Medical Care)

“At no time following the passage of Hurricane Floyd did we [The Bahamas] experience a medical or public health emergency related to the hurricane” (Ingraham, 1999:4). National emergency medical care was adequate in meeting the needs of residents in response to Hurricane Floyd with only two deaths reported in association with the storm (Office of The Prime Minister,

1999). The Ministry of Health in coordination with the Pan American Health Organization additionally provided support in the rapid assessment of water supplies, waste water and excreta disposal and solid waste management throughout the islands (Ingraham, 1999). Through informal discussions with Paul Newbold of The Bahamas Hospital Authority, following Hurricane Andrew standard operating procedures (SOPs) were put in place in preparation for a medical emergency. Those SOP's were followed as identified by Prime Minister Ingraham (1999) and successfully executed in response to Hurricane Floyd. As a result, the need for emergency medical care was assessed to have been recognized early and carried-out with no notable problems.

Hurricane Floyd Generic Function 5 (Search and Rescue)

Search and Rescue was not a formal function in 1999 and operations were conducted by a variety of local and national organizations in an uncoordinated manner. Based on informal discussions that I had with members of The Bahamas Police and Defence Force indicated that search and rescue was never a major focus of training or concern. Buildings that were destroyed by Hurricane Floyd were searched by local residents, police or fire. This indicates that the function was not recognized early or executed effectively.

Hurricane Floyd Generic Function 6 (Protection of Property)

Protection of Government property was carried out by the Ministry of Works and Transportation (Office of The Prime Minister, 1999). The Ministry of Works was responsible for securing government buildings by installing hurricane shutters and/or utilizing plywood to protect windows. The Department of

Meteorology reported that residents responded effectively to their recommendations regarding the protection of homes in preparation for Hurricane Floyd (Lightbourne and Dean, 1999). Quarantelli's criteria were applied to this function and indicate that the protection of private and government property was recognized early and carried out with no notable problems.

Hurricane Floyd Generic Function 7 (Mobilization of Emergency Personnel and Resources)

Although an emergency operations center was established by the RBDF it was not a multi-agency command center. This created several problems to include, limited and/or delayed preliminary damage assessment information intern generated a delay in the activation of resources and personnel. A lack of comprehensive coordination and shared communication lead to a disjointed multi-organizational response. As a result there were delays in the activation and movement of emergency materials and personnel.

“Hurricane Floyd is unique in that long-term recovery was well organized. A Disaster Recovery Committee was put in place by the Prime Minister to coordinate with Social Services and develop protocol for providing aid. However, this happened weeks after Floyd impacted the nation and in the interim response efforts were lacking” (Outten-Moncur, 2006a).

Reports from the Office of the Prime Minister (1999) indicate that the RBDF did provide emergency relief shipments of water, canned and dry food stuffs, emergency first aid kits, insect repellants and other emergency supplies such as batteries, flashlights and children's disposable diapers that had been donated by the private sector in New Providence. Reports further indicate that churches, private radio stations and numerous corporate citizens also made

donations. However, the movement and distribution of emergency relief was difficult and many times delayed for extended periods of time. Applying the data to Quarantelli's methodology indicates that the need for the mobilization of emergency personnel and resources was not recognized early nor was it carried out effectively. This is an example of what Quarantelli classifies as eventual relief.

Hurricane Floyd Generic Function 8 (Assessing the Damage)

A PDA is used to determine the magnitude and impact of a disaster as well as identify needs that require immediate attention. Following the impact of Floyd, damage assessments were conducted by a variety of organizations to include the RBDF, Ministry of Works, OFDA, and PAHO (Office of the Prime Minister, 1999). However, all of the assessments utilized different evaluation criteria for damage classification. There was no uniformity to the process which created incomplete assessments and duplication of information. According to Gayle Outten-Moncur (2006) the uncoordinated reporting during response to Hurricane Floyd created confusion during the response operation. Furthermore, it created disorder in the collection of data for this research. Applying the data to Quarantelli's criteria indicates the need for damage assessment was recognized but the function was not effectively carried out.

Hurricane Floyd Generic Function 9 (Coordinating Emergency Management Activities)

During response to Hurricane Floyd there was very little 'coordination' of emergency management activities. The RBDF took the lead by establishing an

EOC while The Bahamas Red Cross Society and Ministry of Social Services established shelters. Additional ministries lead specific emergency activities related to their mission however in an uncoordinated and disjointed manner.

“Everything was going so fast, things could have been more organized or more structured. At that time [1999 Hurricane Floyd], I was still with the Defence Force, I was confused with trying to find a central point because there seemed to be so many different central points of operation” (Bethel, 2006)

Informal discussions with Island Administrators during the 2005 and 2006 NEMA conference, indicated that a contributing factor to the slow response of the national governments to Floyd was due in part to no centralized sharing of information. The Island Administrator from Eleuthera also indicated there were duplications of effort and wasting of resources due to a lack of coordination. Based on Quarantelli’s criteria this general function of coordinating emergency management was neither recognized early nor implemented effectively.

Hurricane Floyd Generic Function 10 (Restoring Essential Public Services)

The restoration of essential services such as water, electricity and phone services were significantly delayed following Hurricane Floyd. Reports issued on October 13th 1999 indicated that a month following the event some islands were still struggling with water quality and water supply issues (Ingraham, 1999). Reports from the Water and Sewerage Corporation indicated that “coliform indicator bacteria have been reported, and were detected during the mission, in bottled water” (W&SC, 1999). These reports were issued weeks after the passage of Hurricane Floyd indicating that the essential public service of clean drinking water had not been restored.

“The storm [Hurricane Floyd] wreaked havoc on the communications system of The Bahamas, downing hundreds of telephone and electrical poles and causing major damage to telecommunications towers. Because of this, for a time, virtually all communications between our islands and to the outside world were severed. The absence of stand-by generators on a number of islands, such as Cat Island, meant that for some twenty four hours after the eye of the storm had crossed that island emergency satellite telephones remained inoperable and we were without confirmed accurate reports” (Ingraham, 1999:81).

The statement by Prime Minister Ingraham, confirms previously provided data that assessments were not conducted in a timely manner as well as illustrates that the need for restoration of essential public services were recognized early.

4.2.1.3 Hurricane Michelle 2001 Criterion One: Adequately Carrying Out Generic Functions

Table 4.6 provides a summary of the ten generic functions as they were applied to Hurricane Michelle.

Hurricane Michelle Generic Function 1 (Warning)

According to The Bahamas Department of Meteorology (2001) and NEMA staff members, warnings for Hurricane Michelle were effectively executed.

According to reports issued by the Department of Meteorology (2001) at 6am of Saturday, November 3rd, residents of the Northwest and Central Bahamas were urged to monitor the progress of Hurricane Michelle as a Tropical Cyclone Alert⁶ was issued. A Hurricane Watch was posted by 11pm that evening for the following islands: Bimini, Grand Bahama, Abaco, The Berry Islands, Andros, New Providence, Eleuthera, Exuma, Cat Island, Ragged Island, Long Island,

⁶ When a tropical cyclone can possibly bring storm or hurricane conditions to some part of The Bahamas within 60 hours an alert is issued by the Meteorological Department.

Rum Cay and San Salvador. The warnings issued by the Department of Meteorology were broadcast on ZNS radio and television channels.

“Everyone took Michelle very seriously. Forecasted to directly impact the Island of New Providence, residents were uneasy. It is rare for a Hurricane to impact the capital. Warnings were issued and most residents took action” (Outten-Moncur, 2006b).

The data indicates that as with Hurricanes Andrew and Floyd, the need for warnings in response to Michelle was recognized early and the function was carried out with no notable problems.

Hurricane Michelle 2001 GENERIC FUNCTION EVALUATION CHART		
FUNCTIONS	Was the Need for the function recognized early? (Y/N)	Was the function carried out without too many problems? (Y/N)
1. Warning	Yes	Yes
2. Evacuations	Yes	No
3. Sheltering	Yes	Yes
4. Emergency Medical Care	Yes	Yes
5. Search and Rescue	Yes	Yes
6. Protection of Property	Yes	Yes
7. Mobilization of Emergency Personnel and Resources	No	No
8. Assessing the Damage	Yes	No
9. Coordinating emergency management activities	No	No
10. Restoring essential public services	Yes	No

Table 4.6 – Evaluation of Generic Functions in Response to Hurricane Michelle 2001

Hurricane Michelle Generic Function 2 (Evacuations)

In 2001 there continued to be no legal authority to act or avenue for issuing 'official' evacuation orders. As Hurricane Michelle approached, The Department of Meteorology, at 11pm on Saturday, November 3rd informed residents "to begin securing their properties, and to evacuate the following islands and cays: Cat Cay, Red Bays, Ocean Cay, Berry Islands, the Upper-Exuma Cays and similar Cays in the Watch area" (Bahamas Department of Meteorology, 2001:10-11). Evacuation orders within The Bahamas are voluntary and once warnings were issued it was the responsibility of residents to obtain the means to evacuate.

"Michelle did not cause me to evacuate my home. I live on high ground and am not prone to flooding, plus my home is a very strong structure. Two or three members of my wife's family stayed with us during the storm" (Rigby, 2006)

"Department of Social Services and the Red Cross opened shelters in church facilities and schools on the island of New Providence" (Glinton, 2006).

Although no 'official' evacuation orders were issued by The Government of The Bahamas or the RBDF, the Department of Meteorology did encourage residents in unsafe structures to relocate. Although the need for evacuations was recognized by the Department of Meteorology the function was not carried out in a formal, uniformed way to aid residents.

Hurricane Michelle Generic Function 3 (Sheltering)

The Bahamas Red Cross Society with support from the RBDF and the Ministry of Social Services and Community Development opened emergency shelters in response to Hurricane Michelle (Office of the Prime Minister, 2001).

Data on the number of shelters opened, individuals housed, and services provided were not available for Hurricane Michelle. Informal discussions with NEMA staff members however, indicated that the need for shelters was recognized early and the function was carried out without too many problems (Glinton, 2006; Outten-Moncur, 2006b). Unlike Andrew and Floyd, Hurricane Michelle impacted the capital city of Nassau where resources and personnel were available to effectively carry out the function of sheltering.

Hurricane Michelle Generic Function 4 (Emergency Medical Care)

The Island of New Providence, home to over 69% of the nation's population, was significantly impacted by Hurricane Michelle. The Bahamas Ministry of Health (2001) reported no major emergencies or deaths in association with Hurricane Michelle. According to Paul Newbold, representative with The Bahamas Hospital Authority, all area hospitals and clinics were functioning normally. National emergency medical capabilities were adequate to meet all health related needs generated as a result of Hurricane Michelle. Based on available data it appears that the need for emergency medical care was recognized early and the function was carried out with no notable problems.

Hurricane Michelle Generic Function 5 (Search and Rescue)

Flooding was the major concern with Hurricane Michelle. Although damage to buildings was reported, unlike Hurricanes Andrew and Floyd, the islands did not experience extensive damage. The requirement for urban search and rescue was minimal and was successfully addressed by the RBDF and the Fire Department (Office of the Prime Minister, 2001). Also important was the

need for maritime search and rescue in response to a sailboat with Haitian migrants on the Shores of Long Island (Bahamas Department of Meteorology, 2001). This was also successfully addressed by the RBDF. Based on available data it appears that search and rescue requirements in response to Hurricane Michelle were recognized early and carried out effectively.

Hurricane Michelle Generic Function 6 (Protection of Property)

Protection of Government property was carried out by the Ministry of Works and Transportation. With responsibility for Government Buildings the Ministry of Works secured government facilities by installing hurricane shutters and utilizing plywood to protect windows. Business owners in downtown Nassau also utilized sandbags to protect against flooding. According to informal discussions with NEMA staff members many residents of New Providence did not take any mitigative action to protect their properties in preparation for Hurricane Michelle believing that the hurricane would not hit them. Based on the official after action report issued by the Bahamas Department of Meteorology (2001), warnings were issued to residents to secure property illustrating that the need for the function was identified early. Yet many residents did not heeding warnings. To ensure consistent and uniformed evaluation of this generic function the focus stayed on the protection of government property as it had in response to Hurricanes Andrew and Floyd. The data shows that the need for the function was both recognized early and carried out effectively by the Ministry of Works and Transportation.

Hurricane Michelle Generic Function 7 (Mobilization of Emergency Personnel and Resources)

Hurricane Michelle was the first hurricane to make landfall on the island of New Providence since Hurricane Janice in 1958. Mobilization of personnel was very difficult since many residents were responding to needs at their own home and were not available to participate in official response operations. Additionally, as with Hurricanes Andrew and Floyd the RBDF established an EOC, however it was not multi-agency. This created several problems, including limited PDA information intern a delaying the activation of resources and personnel (Office of The Prime Minister, 2001).

“We [the nation of The Bahamas] were not prepared to deal with a direct hit to Nassau. Many residents did not secure food and water prior to landfall. The heavy rain and sea surge washed out many of the roads making it difficult for emergency personnel and residents to move around the island” (Davis, 2006).

“Hurricane Michelle brought awareness about emergency management and the need to have a well coordinated response” (Outten-Moncur, 2006b).

As with previous response operations a lack of comprehensive coordination and shared communication created a disjointed multi-organizational response. The need for the mobilization of emergency personnel and resources was not recognized early nor was it carried out effectively.

Hurricane Michelle Generic Function 8 (Assessing the Damage)

According to the Office of the Prime Minister (2001) damage assessment in response to Hurricane Michelle was completed by multiple ministries and organizations. The uncoordinated function produced inconsistent reporting, for instance, the RBDF (2001) indicated extensive damage to ports on the north side

of New Providence, while the Ministry of Works reported no damage (Office of the Prime Minister, 2001).

“Had uniformed assessment protocol been in place response could have been better organized” (Bethel, 2006).

Duplicated information and uncoordinated reporting caused a slowdown in response efforts. The need for damage assessment was recognized, however the function was not effectively carried out.

Hurricane Michelle Generic Function 9 (Coordinating Emergency Management Activities)

During response to Hurricane Michelle there was very little coordination of emergency management activities. Ministries responded independently of one another to needs as they arose.

“Following Michelle it was difficult to communicate as a result of downed phone lines. Offices were closed and government employees were dealing with issues at their home so it was hard to get things done” (Rigby, 2006).

As during Hurricanes Andrew and Floyd the RBDF established an EOC at the Cabinet Office, providing support and briefings to the Office of the Prime Minister (Office of the Prime Minister, 2001). Overall response activities were uncoordinated, with no centralized sharing of information resulting in duplication of efforts (Bethel, 2006). The coordination function was not recognized early nor was it implemented effectively.

Hurricane Michelle Generic Function 10 (Restoring Essential Public Services)

Interruption to essential public services such as water, electrical power, and telecommunication operations were significant for the northwestern and central islands of The Bahamas (Bahamas Department of Meteorology, 2001;

Office of the Prime Minister, 2001). An estimated 200,000 residents were affected by power outages (BEC, 2001). Extensive flooding compromised the delicate fresh water system of the nation as well as damaged key communications hubs on the island of New Providence. Data suggests that the need to restore essential public services were recognized early however, a lack of planning, resources, and information produced extensive delays in executing the function (Office of the Prime Minister, 2001).

4.2.1.4 Hurricane Frances 2004 Criterion One: Adequately Carrying Out Generic Functions

Table 4.7 provides a summary of the ten generic functions as they apply to Hurricane Frances. Data obtained through interviews, surveys, and archival research indicate that most of the generic functions were both recognized early and carried out without too many problems. However, according to Quarantelli (1997a) for us to answer yes to the first criteria we must answer yes to all ten functions. Since generic function seven (7), mobilization of emergency personnel and resources, was not carried out without too many problems criterion one must be answered no. A detailed review of the ten generic functions is provided below.

Hurricane Frances 2004 GENERIC FUNCTION EVALUATION CHART		
FUNCTIONS	Was the Need for the function recognized early? (Y/N)	Was the function carried out without too many problems? (Y/N)
1. Warning	Yes	Yes
2. Evacuations	Yes	No
3. Sheltering	Yes	Yes
4. Emergency Medical Care	Yes	Yes
5. Search and Rescue	Yes	Yes
6. Protection of Property	Yes	Yes
7. Mobilization of Emergency Personnel and Resources	Yes	No
8. Assessing the Damage	Yes	Yes
9. Coordinating emergency management activities	Yes	Yes
10. Restoring essential public services	Yes	Yes

Table 4.7 – Evaluation of Generic Functions in Response to Hurricane Frances 2004

Hurricane Frances Generic Function 1 (Warning)

The Bahamas Department of Meteorology (2004a) issued its first alert on Hurricane Frances at 6pm on August 30th when the projected tracks indicated that the hurricane would impact the Turks and Caicos Islands, and the Islands of the Southeast Bahamas. Within twelve hours of the first alert Frances was upgraded to a Hurricane Watch. Hurricane Warnings were issued at noon on August 31st for The Turks and Caicos Islands and the Southeast Islands of the

Bahamas. A Hurricane Watch was still in effect for the Central Islands of The Bahamas and a Hurricane Alert was issued for the Northwestern Islands (Bahamas Department of Meteorology, 2004a).

At noon on September 1st, Hurricane warnings for the Central Bahamas were issued as the warnings for the Southeast Islands remained in effect. The Northwest Bahamas remained under a Hurricane Watch. By 9am that evening while Frances was some 80 miles east-southeast of the Island of Mayaguana, Hurricane Warnings were issued for the entire archipelago. The Broadcasting Corporation of The Bahamas, communicated the alerts, watches, and warnings throughout the Islands of The Bahamas via television and radio (Bahamas Department of Meteorology, 2004a; NEMA, 2004a).

Warnings were also issued through ZNS by the Director of the National Emergency Management Agency, Mr. Carl Smith and Prime Minister Perry Christie (NEMA, 2004a; Hughey, 2004b). The need for warnings were recognized early and based on available data the function was carried out with no problems. The Bahamian public responded well to the hurricane alert messages securing their homes and property. All available data indicates that the general function one, warning, was both recognized early and effectively carried-out.

Hurricane Frances Generic Function 2 (Evacuations)

As with the previous three hurricanes examined in this study no legal authority to act or avenue for issuing 'official' evacuation orders was in place during response to Frances. Utilizing the media, NEMA in coordination with the

Department of Meteorology, encouraged residents of low lying areas and families with homes close to the water to relocate to more secure areas (Bahamas Department of Meteorology, 2004a; NEMA, 2004a). These were voluntary actions Bahamians were encouraged to heed. Also important to note, although the government in the form of NEMA encouraged the population to move the responsibility to take action remained with residents. Data gathered indicates in response to Hurricane Frances the need for the function was recognized early but the facilitation and execution of the function was not carried-out effectively (Hughey 2004b).

Hurricane Frances Generic Function 3 (Sheltering)

The RBDF with strong support from The Bahamas Red Cross Society, Ministry of Social Services, and the Ministry of Health, opened emergency shelters in response to Hurricane Frances throughout the islands (NEMA, 2004a; Hughey, 2004b). Island Administrators, serving as the NEMA representative on the Family Island, reported back to the national EOC on a regular basis with the status of shelter operations. Around 2am on September 2nd, Prime Minister Perry Christie participated in calls to the Island Administrators from the national EOC (See Picture 4.1). On the morning of September 2nd, the following islands confirmed that shelters had been opened or would be opening within the next few hours: Inagua, Mayaguana, Acklins/Crooked Island/Long Cay, Long Island, Exuma, San Salvador & Rum Cay, Cat Island, North, Central and South Andros, Nassau, Chub Cay, Great Harbor Cay, Abaco, Grand Bahama, Bimini, Cat Cay, Ocean Cay, and Walker's Cay (See Picture 4.2). NEMA was able to quickly

identify the need for shelters and coordinate the carrying-out of the shelter function with few problems.



Picture 4.1 – National Emergency Operations Center in Response to Hurricane Frances, September 2, 2004. Prime Minister Perry Christie, RBDF Personnel, and Erin Hughey work to evaluate the status of shelters on the Family Islands. (Source: Global Center for Disaster Management and Humanitarian Action)



Picture 4.2 – Hurricane Frances Shelter, Island of New Providence. (Source: Erin Hughey)

Hurricane Frances Generic Function 4 (Emergency Medical Care)

All emergency medical care needs were coordinated by Emergency Support Function (ESF) 8, Health and Medical Services (National Response Plan, NEMA 2002). The Ministry of Health was the lead agency responsible for coordinating emergency medical care, with strong support from the Hospital Authority, Public Health Department, Department of Agriculture, and Mental Health Services. Additional support came from the Pan American Health Organization (PAHO), which arrived in country in anticipation of Frances. Picture 4.3 below displays members of ESF 8 working to coordinate the national response effort to Hurricane Frances.



Picture 4.3 – ESF 8 Health and Medical Service in support of Hurricane Frances response efforts. (Source: NEMA)

There were two (2) deaths associated with Hurricane Frances (Bahamas Ministry of Health, 2004). Minor medical issues were also reported, according to the Ministry of Health, response to all health related issues were coordinated

effectively by ESF 8 personnel. Rapid assessments of water supplies, waste water, and solid waste management throughout the islands were carried out soon after the passing of the storm (Bahamas Ministry of Health, 2004). The need for emergency medical care was recognized early and based on available data the function was carried out with no notable problems.



Picture 4.4 – ESF 8 Health and Medical Service in support of Hurricane Frances response efforts. (Source: NEMA)

Hurricane Frances Generic Function 5 (Search and Rescue)

Search and Rescue operations were coordinated under ESF 10a Urban Search and Rescue. The RBDF was the lead agency responsible for coordinating search and rescue operations, with strong support from the Royal Bahamas Police and Fire Departments, Ministry of Works and Utilities, Public Hospital Authority, and the Department of Land and Survey (NEMA, 2004a; Hughey, 2004b). Unofficial search and rescue operations were also conducted by residents throughout the islands. ‘Search and Rescue’ operations were, for

the first time in the history of emergency response within The Bahamas, an official function (NEMA, 2002). The need for search and rescue was recognized early through pre-planning and was carried out without too many problems. As a result of the independent or unofficial search and rescue initiatives that did take place after Hurricane Frances, NEMA has attempted to bring training to the family island to establish community response units. This ensures citizens who are participating in the function of 'search and rescue' have the necessary skills to be successful and prevent injury (Bethel, 2006; Outten-Moncur, 2006b).

Hurricane Frances Generic Function 6 (Protection of Property)

Protection of Government property was carried out by The Bahamas Ministry of Works and Transportation (2004a) as outlined in the National Response Plan (NEMA, 2002). With responsibility for Government Buildings the Ministry of Works secured government facilities by installing hurricane shutters and utilizing plywood to protect windows. The Department of Meteorology (2004a) reported that residents responded effectively to their recommendations regarding the protection of homes in preparation for Hurricane Frances. Through personal observation (Hughey, 2004b) residents and business owners of Nassau secured windows, sandbagged doors and cleared debris from surrounding areas. (See Pictures 4.5 and 4.6) The protection of private and government property was recognized early and carried out with no notable problems.



Picture 4.5 – The protection of property in preparation for Hurricane Frances (2004) (Source: Erin Hughey)



Picture 4.6 – The protection of government property in preparation for Hurricane Frances (2004). (Source: Erin Hughey)

Hurricane Frances Generic Function 7 (Mobilization of Emergency Personnel and Resources)

Relief supplies and distribution were coordinated under ESF 7 (NEMA, 2002). NEMA was the lead agency responsible for coordinating the mobilization of emergency personnel and resources, with strong support from the RBDF, Ministry of Finance, Public Hospitals Authority, Ministry of Transportation and Aviation, Ministry of Works and Utilities, and the Department of Social Services (NEMA, 2004a). On September 1, 2004, NEMA activated the National EOC in response to Hurricane Frances. All agencies and organizations active in disaster response were notified via fax, e-mail and/or phone that the EOC had been activated and their designated EOC representatives were to report to the Churchill Building in downtown Nassau. Many, although not all, support agencies sent representatives to the EOC, an initial briefing by NEMA staff on the situation took place the afternoon of September 1st (Hughey, 2004b; NEMA, 2004a).

EOC staff established lines of communication with their respective agency as well as with their Family Island contacts (Hughey 2004b). This coordination was intended to allow for the sharing of information throughout the EOC, facilitating the matching of needs with available resources. Required personnel and resources were identified well at the start of the crisis and the function was soundly carried out for the first 12 hours (NEMA, 2004a). However, following landfall, communication became difficult due to downed phone lines and power outages hindering the coordination of resources (NEMA, 2004a). Difficulties with communication resulted in delays, slowing the activation and movement of

emergency materials. The need for the mobilization of emergency personnel and resources was recognized early but not fully effectively carried out.



Picture 4.7 – National EOC, RBDF confirms the status of Frances with a Meteorologist from The Bahamas Department of Meteorology. (Source: Erin Hughey)



Picture 4.8 – Hurricane Frances National EOC (Source: Erin Hughey)

Hurricane Frances Generic Function 8 (Assessing the Damage)

Public Works and Engineering, ESF 3 was responsible for damage assessment activities (NEMA, 2002). The Ministry of Works and Utilities was the lead agency responsible for coordinating damage assessment with strong support from The Bahamas Electricity Corporation, The Bahamas Telecommunication Company, Water and Sewerage Corporation, BEST Commission, and the Department of Environmental Health. For the first time in the history of emergency response within the Bahamas, this team worked together to assess damage on each of the islands. The teams then provided a formal damage assessment report back to NEMA, from which response decision could be based (NEMA, 2004a).

Additional international organizations such as USAID and the International Red Cross also accompanied many of the damage assessment teams (Hughey, 2004b; NEMA 2004a). (See Pictures 4.9 and 4.10) This team effort provided a comprehensive understanding of the damage to each of the islands and the needed response. All damage assessments were completed within 72 hours of the storm passing over Grand Bahama (Bahamas Ministry of Public Works & Engineering, 2004). This coordinated effort allowed for a timely and appropriate response. The need for damage assessment was recognized early, and the function was executed with few problems.



Picture 4.9 – Hurricane Frances Damage Assessment Team (Source: NEMA)



Picture 4.10 – Hurricane Frances, OFDA Damage Assessment Team (Source: NEMA)

Hurricane Frances Generic Function 9 (Coordinating Emergency Management Activities)

Hurricane Frances was the first response effort by the newly formed National Emergency Management Agency (NEMA). Although problems with information flow did arise, the activation of a national EOC allowed for collaborative response efforts (Hughey, 2004b; NEMA, 2004a). Through

regularly scheduled briefings and situation reports, agencies were able to coordinate activities (NEMA, 2004). This centralized sharing of information led to effective service delivery. The need for coordination was recognized early and implemented with few problems.

Hurricane Frances Generic Function 10 (Restoring Essential Public Services)

ESF 1: Transportation, ESF 2: Communication, and ESF 3: Public Works and Engineering, were responsible for coordinating the restoration of essential public services (NEMA, 2002). The Ministry of Transport and Aviation, The Royal Bahamas Police Force, and The Ministry of Works and Utilities were the lead agencies responsible for coordinating the restoration of essential public services (NEMA, 2002). The restoration of water, electricity and phone services were quick to be restored in the south and central Islands of The Bahamas; approximately 48 to 72 hours following the storm (BEC, 2004; BTC 2004). More significant delays were reported on the Island of Grand Bahama due to flooding that was later exacerbated by the impact of Hurricane Jeanne (NEMA, 2004a).

Immediately following the preliminary damage assessment reports the three emergency support functions worked together to prioritize the restoration of services. Of greatest concern was (1) damage to the fresh water wells in the Northwestern Islands of The Bahamas, (2) restoration of transportation routes (airports and ports), and (3) electrical and telecommunication services (NEMA, 2004). The restoration of essential public services was both recognized early and carried-out with few problems.

4.2.1.5 Hurricane Jeanne 2004 Criterion One: Adequately Carrying Out Generic Functions

Table 4.8 provides a summary of the ten generic functions as they apply to Hurricane Jeanne.

Hurricane Jeanne 2004 GENERIC FUNCTION EVALUATION CHART		
FUNCTIONS	Was the Need for the function recognized early? (Y/N)	Was the function carried out without too many problems? (Y/N)
1. Warning	Yes	Yes
2. Evacuations	Yes	No
3. Sheltering	Yes	Yes
4. Emergency Medical Care	Yes	Yes
5. Search and Rescue	Yes	Yes
6. Protection of Property	Yes	Yes
7. Mobilization of Emergency Personnel and Resources	Yes	Yes
8. Assessing the Damage	Yes	Yes
9. Coordinating emergency management activities	Yes	Yes
10. Restoring essential public services	Yes	Yes

Table 4.8 – Evaluation of Generic Functions in Response to Hurricane Jeanne 2004

As noted with Hurricane Frances, due to extensive planning the identification of key functions were recognized early. The results shown in Table 4.8 and the discussion below illustrate that all of the generic functions were recognized early. Evacuations were the only function that was not carried out

effectively. Despite the improvements in recognition and implementation of all ten generic functions as compared to the previous four hurricanes since yes can not be answered to all questions in all categories Criterion One is classified as not being effectively carried-out in response to Hurricane Jeanne.

Hurricane Jeanne Generic Function 1 (Warning)

Hurricane Jeanne was a meandering storm that began to approach The Bahamas approximately ten days after the nation had been hit by Frances (Bahamas Department of Meteorology, 2004b). Jeanne's development and path were a challenge for forecasters and their models. The storm moved east and away from The Bahamas before looping back and making landfall on the northwestern islands. According to The Bahamas Department of Meteorology (2004b) fifty-eight (58) alerts were issued during the threat and passage of Jeanne. The first news item was issued at 6:00pm on Monday, September 13 when a new tropical depression formed east of the Leeward Islands. Eighteen hours later, while moving toward the west-northwest at 12 mph, the depression was upgraded to tropical storm status and was named Jeanne (Bahamas Department of Meteorology, 2004b).

At 6:00pm, Tuesday, September 14, tropical storm warnings were issued for the Southeast Bahamas and a tropical storm watch was issued for the islands of the Central Bahamas. All warnings were lifted at 6:00 am on Sunday, September 19 when tropical storm Jeanne began to move away from the Southeast Bahamas. The warnings, issued by the Department of Meteorology

were communicated to the public through the Broadcasting Corporation of The Bahamas (Bahamas Department of Meteorology, 2004b; Hughey, 2004b).

The Department of Meteorology resumed alerts four days later at 6:00am on Thursday, September 23 as Jeanne regained hurricane status and turned back towards The Bahamas (Bahamas Department of Meteorology, 2004b). At this time the National EOC was still activated in response to Hurricane Frances and in coordination with the Department of Meteorology, NEMA issued warnings to residents during already scheduled media briefings (NEMA 2004a; NEMA 2004c). The need for warnings were recognized early and coordinated through NEMA to ensure the public was prepared.

“Everyone was keeping their eye on Jeanne as we worked to recover from Frances. Trevor [Trevor Basden, Meteorologist assigned to NEMA during response to Hurricanes Frances and Jeanne from The Bahamas Department of Meteorology] continued to remind us that another storm was out there. When it began to move East we thought we were out of the woods” (Bethel, 2006)

Based on information gathered through NEMA documents, The Bahamas Department of Meteorology, NEMA staff members and personal observation, the need for warnings was clearly recognized early and carried out with no notable problems.

Hurricane Jeanne Generic Function 2 (Evacuations)

As discussed previously during discussion of Hurricane Frances, in 2004 there was no legal authority to act or avenue for issuing ‘official’ evacuation orders in response to Hurricane Jeanne. NEMA in coordination with the Department of Meteorology notified the public that:

“If you live in a coastal zone, or in a structure which might not be strong, have an evacuation plan.

- *If you must evacuate, remember to shut of electricity and gas.*
- *Take your survival kit, shelters do not provide food, water, bedding or other essential items.*
- *Provide for your pet, if necessary. Pets are not allowed in shelters” (NEMA, 2004c).*

Utilizing the regularly scheduled briefings that had been established during Hurricane Frances, NEMA strongly encouraged residents to take appropriate action. The need for evacuation in response to Hurricane Jeanne was recognized and encouraged early. Many residents heeded the warnings and took action early (Hughey, 2004b; NEMA, 2004b). However, since resources were not made available to aid residents in an evacuation or facilitate an evacuation location the function was not carried-out effectively.

Hurricane Jeanne Generic Function 3 (Sheltering)

Shelter Services, ESF 6 was responsible for all activities surrounding shelter operations (NEMA, 2002). The RBDF was the lead agency responsible for coordinating shelter openings with support from The Department of Social Services, Ministry of Health, and The Bahamas Red Cross. Hurricane Frances response and recovery operations were still underway as Jeanne threatened the central and northwestern islands of The Bahamas (Hughey, 2004b). Many of the same shelters that were serving as recovery shelters for Frances remained open (RBDF, 2004a; NEMA, 2004b). Data confirms that the need for shelters was recognized early and the function was well coordinated and carried out effectively.

Hurricane Jeanne Generic Function 4 (Emergency Medical Care)

With a strong emergency medical teams already assembled in response to Hurricane Frances, assets were already in place to address Hurricane Jeanne (NEMA, 2004b). Medical care continued to be coordinated by ESF 8, Health and Medical Services (NEMA, 2002). The Ministry of Health was the lead agency coordinating the operation, with aid provided by the Hospital Authority, Public Health Department, Department of Agriculture, and Mental Health Services. PAHO, already in country assisting with response and recovery to Frances provided additional support to the ESF 8 team (NEMA, 2004b). There were no deaths or serious injuries associated with Hurricane Jeanne. However, mental health services were provided on the Islands of Abaco and Grand Bahama which were seriously impacted by both storms (Bahamas Ministry of Health, 2004b). Applying Quarantelli's criteria for evaluation indicates that the need for emergency medical assistance was recognized early and carried out effectively in response to Hurricane Jeanne.

Hurricane Jeanne Generic Function 5 (Search and Rescue)

As with Hurricane Frances search and rescue operations in response to Jeanne were coordinated under ESF 10a Urban Search and Rescue (NEMA, 2002). The RBDF was the lead agency responsible for coordinating search and rescue operations, with support from the Royal Bahamas Police and Fire Departments, Ministry of Works and Utilities, Public Hospital Authority, and the Department of Land and Survey. Unofficial search and rescue operations were also conducted by residents throughout the islands (RBDF, 2004). Many of the

response teams were already in place as a result of Hurricane Frances and were able to quickly jump back into action in response to Jeanne (RBDF, 2004). Data indicates that the need for search and rescue was recognized early and carried out with no notable problems.

Hurricane Jeanne Generic Function 6 (Protection of Property)

Protection of government property was carried out by the Ministry of Works and Transportation in response to Hurricane Frances (NEMA 2002; NEMA, 2004a). Many of the government buildings were still secured with hurricane shutters or plywood when warnings were issued for Hurricane Jeanne. NEMA in coordination with the Department of Meteorology urged residents in the northwestern Bahamas to again secure their homes and take appropriate precautions (NEMA, 2004c). Apply Quarantelli's evaluation criteria indicates that the protection of private and government property was recognized early and carried out with no notable problems.

“Once residents installed shutters or plywood for Frances it didn't come down until after hurricane season” (Rigby, 2006).

Hurricane Jeanne Generic Function 7 (Mobilization of Emergency Personnel and Resources)

Relief supplies and distribution were coordinated under ESF 7. NEMA was the lead agency responsible for the mobilization of emergency personnel and resources, with support from the RBDF, Ministry of Finance, Public Hospitals Authority, Ministry of Transportation and Aviation, Ministry of Works and Utilities, and the Department of Social Services (NEMA 2002). The national EOC had been fully operational since September 1st as a result of Hurricane Frances and

remained functioning in response to Hurricane Jeanne (Hughey, 2004b; NEMA, 2004b). Already existing agency liaisons remained at the EOC to coordinate response operations. EOC staff maintained lines of communication with their respective agency as well as with their family island contacts. The coordination with Family Island Administrators and the National EOC was critical to ensuring that available resources appropriately matched emergency needs. With depleting assets as a result of two hurricanes in three weeks information sharing and strong coordination was critical (Hughey, 2004b).

Required personnel and resources were identified well and activated to respond to Hurricane Jeanne. Communication issues that had plagued response to Hurricane Frances were addressed through onsite training prior to landfall of Hurricane Jeanne (Hughey, 2004b; NEMA, 2004b). Applying Quarantelli's evaluation criteria indicates that the need for the mobilization of emergency personnel and resources was recognized early and carried out effectively.

Hurricane Jeanne Generic Function 8 (Assessing the Damage)

Public Works and Engineering, ESF 3 was responsible for damage assessment activities (NEMA, 2002). As with response to Frances, The Ministry of Works and Utilities, took the lead in coordinating the effort with strong support from The Bahamas Electricity Corporation, The Bahamas Telecommunication Company, Water and Sewerage Corporation, BEST Commission, and the Department of Environmental Health (Bahamas Ministry of Works, 2004b; NEMA, 2004b). The same damage assessment teams established during Frances were again used to assess the damage to the Family Islands (Bahamas

Ministry of Works, 2004b; NEMA, 2004b). The teams worked well at coordinating information and providing a picture of the situation on the ground. This allowed for a quick response and effective matching of assets and needs (NEMA, 2004c).

International organizations such as USAID and the International Red Cross that had been in country to assist with response to Frances also accompanied many of the Hurricane Jeanne damage assessment teams (Hughey, 2004b; NEMA 2004c). All damage assessments were completed within 48 hours of the storm passing over Grand Bahama. This coordinated effort allowed for a timely and appropriate response. The need for damage assessment was recognized early, and the function was executed with few problems.

Hurricane Jeanne Generic Function 9 (Coordinating Emergency Management Activities)

Emergency coordination activities related to Hurricane Jeanne benefited from the impact of Hurricane Frances three weeks earlier. With the EOC in place and activated, many of the 'kinks' related to information flow in response to Frances had been worked out (Hughey, 2004b). The EOC was successfully facilitating collaborative response efforts between numerous agencies and organizations (NEMA, 2004c). Already established briefings and situation reports continued in response to Jeanne and allowed for the centralized sharing of information. Application of Quarantelli's evaluation criteria indicates that the function was recognized early and implemented with few problems.

“Jeanne was easier and harder. Because the EOC was activated for Frances, we had all the right people together to quickly make decision about Jeanne. However, we were all tired” (Outten-Moncur, 2006b).

Hurricane Jeanne Generic Function 10 (Restoring Essential Public Services)

As with Hurricane Frances ESF 1: Transportation, ESF 2: Communication, and ESF 3: Public Works and Engineering, were responsible for coordinating the restoration of essential public services (NEMA, 2002). The Ministry of Transport and Aviation, The Royal Bahamas Police Force, and The Ministry of Works and Utilities were the lead agencies responsible for coordinating the restoration of essential public services (NEMA, 2002; NEMA, 2004b). The main challenge to restoration of services was flooding. Many of the essential services such as water and electricity were delayed in the northwest Bahamas following Frances do to extensive flooding (BEC, 2004b). Many of the hardest hit areas were also impacted by Jeanne resulting in extended delays. Minor outages or interruptions to services in the Central Bahamas were brought back on line within 48 hours of the passage of Jeanne (BEC, 2004b).

Immediately following the completion of damage assessment reports the three ESF's worked together to prioritize the restoration of services. Of greatest concern was (1) damage to the fresh water wells in the Northwestern Islands of The Bahamas, and (2) the restoration of transportation routs (airports and ports) (Bahamas Port Authority, 2004; Bahamas Water and Sewerage Corporation, 2004). The data suggests that the restoration of essential public services was both recognized early and implemented without any major problems.

4.2.1.6 Hurricane Wilma 2005 Criterion One: Adequately Carrying Out Generic Functions

Hurricane Wilma (2005) was the final storm that was examined in the post-CEM phase. Table 4.9 provides a summary of the evaluation of the ten generic functions. As with Hurricane Jeanne all ten functions were recognized early however, general function two, evacuations were not carried-out effectively. A discussion on each function is provided below.

Hurricane Wilma 2005 GENERIC FUNCTION EVALUATION CHART		
FUNCTIONS	Was the Need for the function recognized early? (Y/N)	Was the function carried out without too many problems? (Y/N)
1. Warning	Yes	Yes
2. Evacuations	Yes	No
3. Sheltering	Yes	Yes
4. Emergency Medical Care	Yes	Yes
5. Search and Rescue	Yes	Yes
6. Protection of Property	Yes	Yes
7. Mobilization of Emergency Personnel and Resources	Yes	Yes
8. Assessing the Damage	Yes	Yes
9. Coordinating emergency management activities	Yes	Yes
10. Restoring essential public services	Yes	Yes

Table 4.9 – Evaluation of Generic Functions in Response to Hurricane Wilma 2005

Hurricane Wilma Generic Function 1 (Warning)

On Sunday, October 23, 2005 hurricane warnings were in effect for the islands of the Northwest Bahamas including Grand Bahama, Abaco, Bimini, Berry islands, Andros, Eleuthera, and New Providence (Bahamas Department of Meteorology, 2005; NEMA, 2005). The Bahamas Department of Meteorology tracked Wilma as it moved over the Yucatan Peninsula, Cuba, and Florida always keeping NEMA up to date on the storms status. NEMA in coordination with the Department of Meteorology, issued warnings to residents of the northwest Bahamas and encouraged residents in costal areas to relocate to shelters or more secure facilities (NEMA, 2005). The need for warnings were recognized early and based on available data the function was carried out with no problems. The northwestern islands had been significantly impacted by Hurricanes Frances and Jeanne the year before and residents took quick action in response to the warnings.

Hurricane Wilma Generic Function 2 (Evacuations)

As with the previous five storms examined there was still no legal avenue for issuing mandatory evacuations in response to Wilma. NEMA (2005) in coordination with the Department of Meteorology (2005) issued the now standard public notification:

“If you live in a coastal zone, or in a structure which might not be strong, have an evacuation plan.

- *If you must evacuate, remember to shut of electricity and gas.*
- *Take your survival kit, shelters do not provide food, water, bedding or other essential items.*
- *Provide for your pet, if necessary. Pets are not allowed in shelters” (NEMA, 2005).*

NEMA strongly encouraged residents to take appropriate action in response to Wilma and to continue monitoring the storm (NEMA, 2005). Application of Quarantelli's evaluation criteria suggests that the need for evacuation in response to Hurricane Wilma was recognized and encouraged early. What was lacking was the effective execution of the function through aid to residents or the establishment of evacuation centers or location points.

Hurricane Wilma Generic Function 3 (Sheltering)

ESF 6 Shelter Services, coordinated all shelter operations in response to Hurricane Wilma the same as had been done in response to Hurricanes Frances and Jeanne (NEMA, 2002; NEMA 2005). The RBDF was the lead agency responsible for shelter operations with strong support from The Ministry of Social Services, The Ministry of Health, and The Bahamas Red Cross Society (RBDF, 2005). Emergency shelters were opened throughout the northwestern islands of the Bahamas. NEMA provided coordination between ESF 6, Island Administrators, and the public to inform them of the location and services provided at the shelters (NEMA, 2005). The need for shelters was recognized early and the function was well coordinated and carried out without any notable problems.

Hurricane Wilma Generic Function 4 (Emergency Medical Care)

Emergency medical care in response to Hurricane Wilma was coordinated by ESF 8 Health and Medical Services (NEMA, 2002). The Ministry of Health was the lead agency responsible for coordinating emergency medical care, with support from the Hospital Authority, Public Health Department, Department of

Agriculture, and Mental Health Services (NEMA 2002, NEMA 2005). There was only one (1) death associated with Hurricane Wilma and was attributed to storm surge inundation (Bahamas Ministry of Health, 2005; NEMA, 2005). Rapid assessments of water supplies, waste water, and solid waste management were conducted by the ESF 8 team following the passage of Wilma (Bahamas Ministry of Health, 2005). Application of Quarantelli's evaluation criteria indicates that the need for emergency medical care was recognized early and the function was carried out with no problems.

Hurricane Wilma Generic Function 5 (Search and Rescue)

Since 2002 and the implementation of a CEM system search and rescue operations were addressed by ESF 10a Urban Search and Rescue (NEMA 2002; NEMA 2005). The RBDF was the lead agency responsible for search and rescue operations, with strong support from the Royal Bahamas Police and Fire Departments, Ministry of Works and Utilities, Public Hospital Authority, and the Department of Land and Survey (RBDF, 2005). The most extensive need for search and rescue was reported on the Island of Grand Bahama (NEMA 2005). As with many of the previous disaster operations unofficial search and rescue operations were also conducted by residents. The Data indicates that the need for search and rescue was recognized early and carried out without too many problems.

Hurricane Wilma Generic Function 6 (Protection of Property)

The Ministry of Works and Transportation was responsible for the protection of government property in preparation for Hurricane Wilma (NEMA,

2002; Bahamas Ministry of Public Works, 2005). With responsibility for Government Buildings the Ministry of Works secured government facilities throughout the northwestern islands by installing hurricane shutters and plywood (Bahamas Ministry of Public Works, 2005; NEMA, 2005). NEMA reported that residents responded effectively to recommendations regarding the protection of homes (NEMA, 2005). The data suggests the protection of private and government property was recognized early and carried out with no notable problems in response to Hurricane Wilma.

Hurricane Wilma Generic Function 7 (Mobilization of Emergency Personnel and Resources)

ESF 7 Relief Supplies and Distribution coordinated the mobilization of emergency personnel and resources (NEMA, 2002). NEMA, with support from the RBDF, Ministry of Finance, Public Hospitals Authority, Ministry of Transportation and Aviation, Ministry of Works and Utilities, and the Department of Social Services activated the National EOC to coordinate assets in an effort to successfully respond to immediate emergency needs generated by Wilma (NEMA, 2005). A partial activation of the national EOC occurred on the morning of October 22nd and was fully staffed and operational in response to Wilma twenty-four hours later (NEMA, 2005). All agencies and organizations were put on alert the early morning of October 22nd and notified of the potential full activation of the EOC. A few key players, such as the Department of Meteorology and the RBDF were activated on the 22nd and staffed the EOC in coordination with NEMA (Bahamas Department of Meteorology, 2005; NEMA, 2005; RBDF, 2005).

Once the EOC was fully activated agency liaisons reported to the Churchill Building in Nassau and quickly established lines of communication with their respective agency as well as with their Family Island contacts. This coordination allowed for the sharing of information throughout the EOC, facilitating the matching of needs with available resources (NEMA, 2005). NEMA effectively mobilized emergency personnel and resources quickly assessing the need and implementing procedures with no notable problems.

Hurricane Wilma Generic Function 8 (Assessing the Damage)

ESF 3, Public Works and Engineering coordinated all damage assessment activities in response to Wilma (NEMA, 2005). The Ministry of Works and Utilities was the lead agency responsible with strong support from The Bahamas Electricity Corporation, The Bahamas Telecommunication Company, Water and Sewerage Corporation, BEST Commission, and the Department of Environmental Health (Bahamas Ministry of Public Works, 2005). The same damage assessment teams that had been established during Hurricanes Frances and Jeanne were again utilized. The use of these teams allowed for consistency in reporting and streamlined information flow (Bahamas Ministry of Public Works, 2005; NEMA, 2005). The coordination of damage assessment was very successful in providing a comprehensive representation of the situation on the ground. It further allowed for a quick response and effective matching of assets and needs.

International assistance was also provided by USAID and the International Red Cross. All preliminary damage assessments were completed within 48

hours of Wilma passing over Grand Bahama (NEMA, 2005). The coordinated effort allowed for a timely and appropriate response. Thus, the need for damage assessment was recognized early, and the function was executed with few problems.

Hurricane Wilma Generic Function 9 (Coordinating Emergency Management Activities)

Hurricane Wilma was the third national disaster response operation coordinated by NEMA. Having fully implemented the CEM system and the national response plan NEMA was well equipped and trained to coordinate emergency management activities. The national EOC was successfully activated with well established communication lines between NEMA and The Family Islands (NEMA, 2005). Information flow was insured through regularly published situation reports and media briefings (Bahamas Department of Meteorology; NEMA, 2005). All of these activities facilitated centralized sharing of information and coordinated service deliver. Thus the coordination of emergency management activities in response to Hurricane Wilma was recognized early and implemented with few problems.

Hurricane Wilma Generic Function 10 (Restoring Essential Public Services)

According to the National Response Plan, ESF 1: Transportation, ESF 2: Communication, and ESF 3: Public Works and Engineering, were responsible for coordinating the restoration of essential public services following Hurricane Wilma (NEMA, 2005). The Ministry of Transport and Aviation, The Royal Bahamas Police Force, and The Ministry of Works and Utilities were the lead

agencies coordinating this functional response (NEMA, 2005). The main challenge to the restoration of services was flooding in Grand Bahama (Bahamas Department of Meteorology, 2005). Essential services were delayed in areas that experienced extreme flooding or suffered damage requiring the rebuilding of infrastructure (BEC, 2005; BTC 2005).

Immediately following the completion of Hurricane Wilma preliminary damage assessment reports ESF 1, 2, and 3 worked together to prioritize the restoration of services (NEMA, 2005). Minor outages or interruptions to services in the Central and Northwest Bahamas were brought back on line within 72 hours of the passage of Wilma. The restoration of essential public services was both recognized early and implemented without any major problems.

4.2.1.7 Criterion One Summary

Referring back to Table 4.3, a complete examination of each of the ten generic functions as they apply to the six study hurricanes reveals an interesting pattern. What emerges is a clear improvement in the early recognition of each of the ten functions. Based on the data, this improvement can be associated with the implementation of a CEM system in 2002. The development of a national response plan that outlined responsibility and standard operating procedures (SOPs) for each of the functions prior an event enabled The Bahamas to more quickly identify critical functions and needs. The plan however, did not always result in each function being carried-out effectively although there was a noted improvement in post-cem response operations.

Testing of Quarantelli’s methodology reveals a lack of detailed evaluation criteria for the ten generic functions can allow for subjective interpretation. This can also lead to difficulty when attempting to compare response operations. The metric needs to be better refined to ensure consistent application to reduce interpretation errors.

4.2.2 Criterion Two: Effectively Mobilizing Personnel and Resources

Similar to generic function seven, criterion two of Quarantelli’s methodology is effectively⁷ mobilizing personnel and resources. Table 4.10 displays the results of criterion two as it was applied to the six study hurricanes. A detailed description and supporting data for the responses in Table 4.10 are provided in Table 4.11 and sections 4.2.2.1 – 4.2.2.6.

Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Two						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Effectively Mobilizing Personnel and Resources	No	No	No	No	Yes	Yes

Table 4.10 - Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Two

4.2.2.1 Hurricane Andrew 1992 Criterion Two: Effectively Mobilizing Personnel and Resources

In response to Hurricane Andrew effective mobilization of personnel and resources did not occur. As highlighted previously during the review of the

⁷ “Effective means that a desired and intended result has been produced; this definition differs from that of efficiency which requires that the results be obtained in the best possible way” (Quarantelli, 1997a:43).

generic functions, the response operation, commanded by the RBDF, did not coordinate national assets to manage the disaster. A decentralized response to disaster-generated needs lead to multiple agencies conducting simultaneous operation in a disjointed manner. As a result needed personnel and resources were not identified quickly or brought to bear accordingly (Office of the Prime Minister, 1992, Bethel 2006).

Criterion Two: Effectively Mobilizing Personnel and Resources						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Q1. Were the Needed personnel and resources identified well in the crisis?	No	No	No	Yes	Yes	Yes
Q2. Were they located quickly and brought to bear correctly?	No	No	No	No	Yes	Yes
Q3. Were they appropriate to the problems generated by the disaster	No	No	No	Yes	Yes	Yes

Table 4.11 – Criterion Two: Effectively Mobilizing Personnel and Resources

4.2.2.2 Hurricane Floyd Criterion Two: Effectively Mobilizing Personnel and Resources

In response to Hurricane Floyd effective mobilization of personnel and resources did not occur. Through discussions with NEMA staff members Gayle Outten-Moncur (2007b) and Luke Bethel (2006) needed personnel and resources were not identified quickly during the response period. Due to the decentralized nature of the response, agencies and organizations responded without a clear understanding of critical needs or available assets. Multiple damage

assessments were conducted (Outten-Moncur 2006a) but without a mechanism to share the information necessary resources and personnel could not be brought to bear correctly.

To compound the issue, international donations were arriving at an accelerated pace (Ingraham, 1999). Personnel and resources many times were not well matched to the needs of the nation or logistically could not be delivered to residents in need (Bethel, 2006). It took several weeks to establish a formal flow of information that would allow residents to seek assistance and for The Bahamas government to adequately move resources into the appropriate impact areas (Glinton, 2006).

4.2.2.3 Hurricane Michelle Criterion Two: Mobilize Personnel and Resources Effectively

As with Andrew and Floyd, effective mobilization of personnel and resources in response to Hurricane Michelle did not occur. Michelle made landfall on the Island of New Providence and the impact on the functioning of government caused difficulty in mobilizing personnel and resources (Office of the Prime Minister, 2001). Mobilization of personnel in response to Hurricane Michelle was very difficult since many residents were responding to needs at their own home (Davis, 2006). Also compounding problems with resources was the decentralized emergency response by a variety of agencies and organizations. A clear understanding of critical needs was not achieved. Without this, resources were not able to be moved into the most critical areas.

4.2.2.4 Hurricane Frances Criterion Two: Mobilize Personnel and Resources Effectively

In response to Hurricane Frances, effective mobilization of personnel and resources did not fully occur (NEMA, 2004a). Needed personnel and resources were identified well during the first part of the crisis period. However, Hurricane Frances impacted the entire archipelago leaving the nation under direct impact from a category 4 hurricane for over 72 hours. NEMA served as the lead agency responsible for coordinating the mobilization of emergency personnel and resources under ESF 7 (NEMA, 2002).

The mobilization of personnel and the delivery of essential resources were hindered significantly when communication between the islands failed (Hughey, 2004b; BTC 2004). RBDF personnel had been stationed throughout the family islands with satellite telephones prior to Frances impact. Satellite phones had also been provided to the Family Island Administrators to ensure communication with NEMA. However, due to operator error and a lack of training, many of the satellite phones were useless (Hughey, 2004b; NEMA, 2004). This resulted in misappropriation of resources. A combinations of errors and issues prevented resources from being brought to bear correctly and quickly (NEMA, 2004).

4.2.2.5 Hurricane Jeanne Criterion Two: Mobilize Personnel and Resources Effectively

In response to Hurricane Jeanne, effective mobilization of personnel and resources did occur, due in part to Hurricane Frances (Hughey, 2004b; Outten-Moncur, 2006b). The National EOC had been fully operational since September 1st and remained functioning in response to Hurricane Jeanne. Already existing

agency liaisons remained at the EOC improving the movement of critical personnel (NEMA, 2004b; NEMA, 2004c). Established lines of communication between the National EOC, agency representative, and Family Island Administrators were well established and functioning effectively (Hughey, 2004b; NEMA, 2004b).

Resources had been inventoried during response to Frances and allowed for the quick mobilization of assets. Communication issues that had plagued response to Hurricane Frances were addressed through onsite training prior to Jeanne's landfall (NEMA, 2004b).

"I traveled to many of the Family Islands and trained them on the use of Satellite Phones (Rigby, 2006)."

Additionally assets such as food and water were staged in Grand Bahama in anticipation of Jeanne (NEMA, 2004b; NEMA, 2004c). Application of the evaluation criteria insinuates that the need for the mobilization of emergency personnel and resources was recognized early and carried out effectively in response to Hurricane Jeanne.

4.2.2.6 Hurricane Wilma Criterion Two: Mobilize Personnel and Resources Effectively

Effective mobilization of personnel and resources did occur in response to Hurricane Wilma. Needed personnel and resources were identified well during the first part of the crisis period when an alert was issued to all agencies and organizations active in disaster response (NEMA, 2005). NEMA served as the lead agency responsible for coordinating the mobilization of emergency personnel and resources under ESF 7 (NEMA, 2002; NEMA, 2005).

Through the activation of the National EOC the mobilization of personnel and resources was achieved (NEMA 2005). Communication issues that had created problems in response to previous hurricanes were addressed through coordination with the RBDF, The Bahamas Telecommunication Company, and NEMA. The coordination between agencies allowed for the successful mobilization of personnel and resources in response to Hurricane Wilma.

“By the time Wilma impacted us, everyone know what to do and the response ran smoothly” (Outten-Moncur, 2006b).

4.2.2.7 Criterion Two Summary

As previously displayed in Tables 4.10 and 4.11 an improvement in the effective mobilization of personnel and resources occurred following the implementation of a CEM system. As with criterion one, an association with the improvement in the function and the development of a national emergency response plan is noted. The development of a response plan outlined activities and procedures that facilitated the government’s ability to locate and bring to bear the correct personnel and resources in an appropriate way. It is also important to note that the association between CEM and improvements in criterion two do not rule out the potential impact or importance that experience may have played in noted improvements to response operations.

4.2.3 Criterion Three: Allow The Adequate Processing of Information

This criterion focuses less on the technology utilized to ensure communication but rather places the emphasis on the content of *what*, *when* and *to whom* the information was made available. Tables 4.12 displays the research findings for criterion three as they apply to the six study hurricanes. An

improvement in information processing is noted after the implementation of CEM. A detailed description and supporting data for the responses in Table 4.12 are provided in Table 4.13 and sections 4.2.3.1 – 4.2.3.6.

Eight Criteria for Evaluating The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Three						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Adequately processing information	No	No	No	Yes	Yes	Yes

Table 4.12 - Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Three

Criterion Three: Allow the Adequate Processing of Information						
Allowed for the adequate processing of information...	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Q1. within every responding organization	—	—	—	Yes	Yes	Yes
Q2. between organization	No	No	No	Yes	Yes	Yes
Q3. From citizens to organizations	—	—	No	Yes	Yes	Yes
Q4. from organizations to citizens	Yes	Yes	Yes	Yes	Yes	Yes

Table 4.13 – Application of Criterion Three: Allow the Adequate Processing of Information

4.2.3.1 Hurricane Andrew 1992 Criterion Three: Allow the Adequate Processing of Information

Table 4.14 displays the research findings for criterion three as they apply to Hurricane Andrew. Not enough data existed to determine if adequate processing of information was occurring within every responding organization.

According to interviews with NEMA staff and informal discussions with members of the RBDF, there was very little information sharing between organizations during the response phase.

“During Andrew we [Ministry of Social Services] were not aware of what other ministries’ were doing” (Glinton, 2006)

The status of information processing from citizens and organizations was not able to be determined. During the response phase of Hurricane Andrew a formal line of communication between citizens and response organizations was not identified. Emergency police and fire phone numbers did exist, however, telephone lines in the central and northwestern islands were down. Additionally, no direct communication lines were established to address exclusively hurricane generated needs.

The Department of Meteorology had a strong line of communication established with citizens through The Broadcasting Corporation of The Bahamas. ZNS provided regular information to the public regarding hurricane warnings. Archival research showed that newspaper articles notified residents of shelter locations, however the articles appeared after Andrew made landfall. Therefore, applying the evaluation process developed by Quarantelli (1997a) it becomes apparent that processing of information in response to Hurricane Andrew was not adequate.

Evaluation of Hurricane Andrew Information Processing	
Allow the adequate processing of information...	Yes/No
Within every responding organization	---
Between organizations	No
From citizens to organizations	---
From organizations to citizens	Yes

Table 4.14 – Evaluation of Hurricane Andrew Information Processing

4.2.3.2 Hurricane Floyd 1999 Criterion Three: Allow the Adequate Processing of Information

According to interviews with NEMA staff, informal discussion with members of the RBDF as well as information obtained through after-action documents, adequate information sharing between organizations did not occur (Water and Sewerage Corporation 1999; Lightbourne and Dean, 1999; Bethel, 2006; Outten-Moncur, 2006b).

“Ensuring quick access to information through improved communication is a priority for the government and something that is being address” (Ingraham, 1999:92).

“In response to Hurricane Floyd, as with Andrew, we [Ministry of Social Services] were not made aware of how other ministries’ were responding” (Glinton, 2006)

Data were not available to determine if there was adequate processing of information within every organization responding to Hurricane Floyd. Limited data relating to the status of information processing from citizens to organizations. During the response phase of Hurricane Floyd a formal line of communication between citizens and response organizations was not identified.

Emergency police and fire phone numbers as with Andrew existed but with damage to phone lines down in the immediate aftermath of the hurricane communication was limited. Additionally, no direct communication lines were established to address exclusively hurricane generated needs (Rigby, 2006).

A strong line of communication between the response organizations and the citizens of The Bahamas existed through The Broadcasting Corporation of The Bahamas. ZNS provided regular information to the public regarding hurricane warnings and shelter locations. As with Hurricane Andrew, Meteorologist Basil Dean provided regular updates on the status of the storm broadcast on ZNS radio and television (Dean and Rolle, 1999).

Applying the available data to Quarantelli’s methodology (Table 4.15) indicates that the adequate processing of information did not take place during response to Hurricane Floyd in 1999.

Evaluation of Hurricane Floyd Information Processing	
Allow the adequate processing of information..	Yes/No
Within every responding organization	---
Between organizations	No
From citizens to organizations	---
From organizations to citizens	Yes

Table 4.15 – Evaluation of Hurricane Floyd Information Processing

4.2.3.3 Hurricane Michelle 2001 Criterion Three: Allow the Adequate Processing of Information

This researcher was unable to determine based available data the status of information flow within every responding organizations. Interview data suggest

that processing of information between agencies did not take place. The Hurricane Michelle report issued by the office of the Prime Minister (2001) also supports challenges associated with information flow between agencies. Service deliver was delayed as a result of inadequate communication between organizations.

As with the previous two storms formal lines of communication between citizens and response organizations were not identified. Emergency police and fire phone numbers were available however, telephone lines were down in the immediate aftermath rendering communication non-existent. Additionally, no direct communication lines were established to address exclusively hurricane generated needs.

Evaluation of Hurricane Michelle Information Processing	
Allow the adequate processing of information..	Yes/No
Within every responding organization	---
Between organizations	No
From citizens to organizations	No
From organizations to citizens	Yes

Table 4.16 – Evaluation of Hurricane Michelle Information Processing

A strong line of communication between the response organizations and the citizens of The Bahamas was made available through ZNS. ZNS provided regular information to the public regarding hurricane warnings, shelter information and public safety concerns.

Based on the results displayed in Table 4.16, and applying the evaluation process developed by Quarantelli (1997a) as discussed in the methodology

(chapter 3) of this document it is clear that adequate processing of information did not take place during response to Hurricane Michelle.

4.2.3.4 Hurricane Frances 2004 Criterion Three: Allow the Adequate Processing of Information

Hurricane Frances was the first hurricane to impact The Bahamas following the implementation of CEM. Data obtained from Official NEMA situation reports, interviews with NEMA staff members, and personal observations indicate that organizations were adequately processing information internally. A strong communication line had been established between the EOC to each of the agencies and organizations active in disaster response (Hughey, 2004b). The respective agencies had EOC liaisons which provided a link allowing for the sharing of information (NEMA, 2004a). Based on the response activities generated, it appears that the organizations were able to adequately process information in an effort to meet immediate emergency needs.

The activation of the national EOC and the presence of EOC agency/organization representatives allowed for the sharing of information between groups. A centralized location, regularly scheduled briefings, and detailed situation reports allowed for the coordination of resources between organizations to meet the needs of residents (NEMA, 2004a).

A line of communication between citizens to the national EOC was also established through an EOC phone number (Hughey, 2004b; NEMA, 2004a). The lines were manned and requests for assistance were coordinated from the national office to the local island administrator. Strong lines of communication also existed between NEMA and the citizens through the media with regularly

scheduled briefings. NEMA established a media briefing room and provided updates to the public four times a daily. The media briefings were very successful in educating the public on the impact of Hurricane Frances and how most effectively to seek assistance if needed (NEMA, 2004a). (See Pictures 4.11 and 4.12)

Based on the results displayed in Table 4.17, adequate processing of information did take place during response to Hurricane Frances in 2004.

Evaluation of Hurricane Frances Information Processing	
Allow the adequate processing of information..	Yes/No
Within every responding organization	Yes
Between organizations	Yes
From citizens to organizations	Yes
From organizations to citizens	Yes

Table 4.17 – Evaluation of Hurricane Frances Information Processing



Picture 4.11 – Hurricane Frances Regularly Scheduled Media Briefings, Mr. Carl Smith, Director of The Bahamas National Emergency Management Agency. (Source: Erin Hughey)



Picture 4.12 – Hurricane Frances Regularly Scheduled Media Briefings, Department of Meteorology and the Port Authority. (Source: Erin Hughey)

4.2.3.5 Hurricane Jeanne 2004 Criterion Three: Allow the Adequate Processing of Information

Data from official NEMA situation reports, interviews with NEMA staff members, and personal observations indicate that organizations were adequately

processing information internally. Communication between ministries and organizations responding to Jeanne and the National EOC were well functioning. Agency liaisons were present in the EOC and provided an avenue to share information (Hughey, 2004b; NEMA, 2004b). During shift changes and internal EOC briefings each organization provided reports on key shared information as it related to organizational operations. Based on the response activities generated it appears that the organizations were able to adequately process information in an effort to meet immediate emergency needs (Hughey, 2004b).

A line of communication between citizens to the national EOC was also established through an EOC hotline (Hughey, 2004b; NEMA 2004c). The lines were manned and requests for assistance were coordinated from the national office to the local Island Administrator. Strong lines of communication also existed between NEMA and the citizens through the media with regularly scheduled briefings (NEMA, 2004b; NEMA 2004c). Based on the results in Table 4.18 which display the results of the evaluation process as discussed in Chapter 3 of this document, it suggests that adequate processing of information did take place during response to Hurricane Jeanne 2004.

Evaluation of Hurricane Jeanne Information Processing	
Allow the adequate processing of information..	Yes/No
Within every responding organization	Yes
Between organizations	Yes
From citizens to organizations	Yes
From organizations to citizens	Yes

Table 4.18 – Evaluation of Hurricane Jeanne Information Processing

4.2.3.6 Hurricane Wilma 2005 Criterion Three: Allow the Adequate Processing of Information

Data from Hurricane Wilma situation reports issued by NEMA (2005) as well as data obtained through interviews with NEMA staff, showed that organizations adequately processed information internally. A strong communication line was established between NEMA and support agencies through the national EOC (NEMA, 2005). These lines were first established with the implementation of CEm and later tested during response to Hurricanes Frances and Jeanne. NEMA also held regularly schedule briefings before and after shift changes as well as provided up-dated situation reports to facilitate information flow (NEMA, 2005). Response agencies had EOC liaisons available to allow for information sharing. Based on the response activities generated, organizations were able to adequately process information in an effort to meet immediate emergency needs.

Evaluation of Hurricane Wilma Information Processing	
Allow the adequate processing of information..	Yes/No
Within every responding organization	Yes
Between organizations	Yes
From citizens to organizations	Yes
From organizations to citizens	Yes

Table 4.19 – Evaluation of Hurricane Wilma Information Processing

A communication hotline for citizens was established at the national EOC (NEMA, 2005). The phone line was manned by NEMA support staff and volunteers and allowed citizens the opportunity to both report and obtain critical

emergency information. Strong lines of communication also existed between NEMA and the citizens through the media with regularly scheduled briefings. As with response to Frances and Jeanne, NEMA established a media briefing room to provide information and updates to the public four times a day. The media briefings were very successful in educating the public on the impact of Hurricane Wilma as well as provide critical information regarding how best to seek assistance if needed. Based on the results displayed in Table 4.19, adequate processing of information took place in response to Hurricane Wilma 2005.

4.2.3.7 Criterion Three Summary

Referring back to Table 4.13, a consistent pattern of improvement in the processing of information following the implementation of CEM is noted. Planning to develop clear lines of communication between citizens, the government, and response agencies allowed for faster and more accurate processing of information and improved response operations. Experience and improved recording keeping may also be associated with the improvement in information flow and should not be discarded as a contributing factor to the improvement in the processing of information in all four categories.

4.2.4 Criterion Four: Permit the Proper Exercise of Decision-Making

As outlined in chapter three, the problems associated with decision-making are usually associated with four key areas:

5. *Loss of higher-echelon personnel because of overwork.*
6. *Conflict over responsibility for new disaster tasks.*
7. *Clashes over organizational domains between established and emergent groups.*
8. *Surfacing of organizational jurisdictional differences.*

Table 4.20 displays the research findings for criterion four as they apply to the six study hurricanes. An improvement in exercising decision-making is noted in response to Hurricane Wilma. A detailed description and supporting data for the responses in Table 4.20 can be found in sections 4.2.4.1 - 4.2.4.6.

Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Four						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Permit the Properly Exercising Decision-Making;	No	No	No	No	No	Yes

Table 4.20 - Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Four

4.2.4.1 Hurricane Andrew 1992 Criterion Four: Permit the Proper Exercise of Decision-Making

During Hurricane Andrew the usual chain-of-command and lines-of-authority were in place and functioning. Direct lines of communication to the Office of the Prime Minister existed between The RBDF and Government Ministers. The problem with exercising proper decision-making resided not with the line of communication, but the format and timing of information with which high-echelon personnel could make decisions. During the examination of criterion one generic functions, it was noted that Ministry specific damage assessment reports were conducted independently and utilized a variety of different criteria for classification. This created confusion about the extent of damage and slowed the critical response and recovery decision-making process. Furthermore, regularly scheduled reporting was not required at the time of

Andrew preventing timely decision-making and delayed service delivery. The Data do not suggest any conflicts over responsibility for new disaster tasks or clashes over organizational domains existed in response to Hurricane Andrew. The decentralized response did result in delays associated with information flow, slowing the decision-making process.

4.2.4.2 Hurricane Floyd 1999 Criterion Four: Permit the Proper Exercise of Decision-Making

As with Andrew, during Floyd the usual chain-of-command and lines-of-authority were in place and functioning. The RBDF and the Government Ministers had direct lines of communication to the Office of the Prime Minister (Office of the Prime Minister, 1999). The problem with exercising proper decision-making resided not with the line of communication but the format and timing of information on which high-echelon personnel could make decisions. Conflicting damage assessment reports that utilized different criteria prevented decision-makers from having a clear understanding of the situation on the ground (Bethel, 2006). According to informal discussions with members of the police and Defence Force regularly scheduled reporting was not required and prevented timely decision making and delayed the delivery of response services.

“We [RBDF] were in the field distributing supplies where needed. At no time am I aware of reporting out to anyone other than our officer in charge. As I mentioned earlier, there were many different central points of control, I was always trying to determine the line of authority” (Bethel, 2006).

No formal records of conflict over response phase responsibilities were found during this research. However, based on informal discussions with island administrators and officials from a variety of government agencies it appears that

uncertainty regarding fiscal responsibility was of major concern. In an effort to preserve agency budgets many organizational leaders were hesitant to spend their scarce funds. Uncertainty regarding potential reimbursement or fear of misusing government funds also caused delays. Application of Quarantelli's criteria indicates that at the very least proper decision-making was delayed by inadequate processing of information.

4.2.4.3 Hurricane Michelle 2001 Criterion Four: Permit the Proper Exercise of Decision-Making

During Hurricane Michelle as in the previous two hurricanes examined the usual chain-of-command and lines-of-authority were in place and functioning. The RBDF and the Government Ministers had direct lines of communication to the Office of the Prime Minister (Office of the Prime Minister, 2001). The problem with exercising proper decision-making resided not with the line of communication but the format and timing of information on which high-echelon personnel could make decisions (Smith, 2006).

The same challenges associated with Hurricanes Andrew and Floyd were identified in the response to Hurricane Michelle. Conflicting damage assessment reports and changing criteria for evaluation prevented decision-makers from having a clear understanding of the situation on the ground (Office of the Prime Minister, 2001). Additionally, regularly scheduled reporting did not take place preventing timely decision-making. Also important to note is the impact Michelle had on the Island of New Providence and government offices. Most businesses and government offices were closed for several days adding to delays and

difficulties in processing information. Based on the data it appears that proper decision-making was prevented by inadequate processing of information.

4.2.4.4 Hurricane Frances 2004 Criterion Four: Permit the Proper Exercise of Decision-Making

During Hurricane Frances the usual chain-of-command and lines-of-authority were in place and functioning as outlined in the national response plan. With the introduction of a national emergency management agency and a national disaster response plan, the direct lines of communication were clearly spelled out (NEMA 2002). However, as pointed out by Quarantelli (1997a) the problems associated with decision-making are usually not because of a breakdown in communication but rather problems associated with the following four key areas: (1) loss of high-echelon personnel because of overwork; (2) conflict over responsibility for new disaster tasks; (3) clashes over organizational domains between established and emergent groups; (4) surfacing of organizational jurisdictional differences.

The response to Hurricane Frances experienced a significant level of high-echelon personnel who were overworked and unable to make decisions (Hughey, 2004b). Because Frances impacted the Bahamas for over 72 hours, EOC staff members worked around the clock with little or no breaks. Due to limited staffing, shifts could not be established which lead to persons being over worked, leading to irritability, arguments, and poor decision making (NEMA, 2004a).

Compounded by lack of sleep and a very stressful working environment, internal conflict over responsibilities did take place among EOC staff members

(Hughey, 2004b). All conflicts were eventually resolved but did impact decision making for a period of time. In response to Hurricane Frances clashes over organizational domains between established and emergent groups did not occur. Due to the small population within the Bahamas and the remoteness of many of the islands, new emergent groups did not develop. The surfacing of organizational jurisdictional differences also did not occur in response to Hurricane Frances (NEMA, 2004a). The data suggests that proper decision-making was impacted most significantly by the loss of high-echelon personnel because of overwork.

4.2.4.5 Hurricane Jeanne 2004 Criterion Four: Permit the Proper Exercise of Decision-Making

During Hurricane Jeanne, as with the previous four hurricanes that have been evaluated, the usual chain-of-command and lines-of-authority were in place and functioning. However, with two hurricanes impacting the nation within three weeks the response to Hurricane Jeanne experienced a significant level of high-echelon personnel who were overworked and unable to make decisions (Hughey, 2004b). Due to exhaustion and stress, both poor decision making occurred as well as conflicts over responsibilities took place.

“You are exhausted and it makes it difficult to be effective, you need to go home and take break, that is what happened in 2004 with Frances and Jeanne” (Otten-Moncur, 2006b).

There were no reported clashes over organizational domains between established and emergent groups in response to Jeanne. The surfacing of organizational jurisdictional differences also did not occur in response to Hurricane Jeanne (Hughey, 2004b). Proper decision-making was impacted most

significantly by the loss of high-echelon personnel because of stress and exhaustion (Hughey, 2004b). Quarantelli's evaluation criteria suggest that proper decision making did not occur in response to Hurricane Jeanne. The same or similar problems experienced during response to Hurricane Frances were also experienced during Jeanne.

4.2.4.6 Hurricane Wilma 2005 Criterion Four: Permit the Proper Exercise of Decision-Making

During Hurricane Wilma the usual chain-of-command and lines-of-authority were in place and functioning. To avoid the same problems that had been experience during response to Hurricanes Frances and Jeanne, NEMA required 12-hour shifts to help reduce exhaustion and down or overworked personnel (NEMA, 2005).

The very stressful working environment, did create some internal conflicts but they were quickly resolved and according to NEMA staff did not impact their ability to make decision effectively (Glinton, 2006; Outten-Moncur, 2007a). There were no clashes over organizational domains nor were there any jurisdiction disputes (Outten-Moncur, 2007a). Thus, during response to Hurricane Wilma, the National EOC was able to effectively exercise proper decision-making.

4.2.4.7 Criterion Four Summary

Referring back to Table 4.20, no pattern of improvement is noted following the implementation of CEM. Response operations to Hurricanes Frances and Jeanne experienced the same problems that pre-CEM response experienced. Improvements in the proper exercising of decision-making noted in response to

Hurricane Wilma appear to be associated with experience rather than a change in the fundamental management strategy of disaster response.

4.2.5 Criterion Five: Focus on the Development of Overall Coordination

Criterion five focuses on the critical function of coordination. Table 4.21 displays the research findings for criterion five as they apply to the six study hurricanes. A marked improvement in overall response coordination is seen after the implementation of CEM. A detailed description and supporting data for the responses in Table 4.21 can be found in sections 4.2.5.1 – 4.2.5.6.

Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Five						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Focus on the Development of Overall Coordination	No	No	No	Yes	Yes	Yes

Table 4.21 – Evaluation of The Management of Disaster Response Operations to the Six Study Hurricanes: Quarantelli (1997a) Criterion Five

4.2.5.1 Hurricane Andrew 1992 Criterion Five: Focus on the Development of Overall Coordination

A military response was generated to address Hurricane Andrew needs.

With no official agency responsible for emergency management the RBDF established ‘command’ and provided assistance. This structure produced a disjointed operation that did not allow for a coordinated civil / military response.

An operation center was established by the Defence Force to coordinate the logistics of their response. The operation center did not facilitate the coming together of all agencies and organizations active in disaster response. As a

result the facilitation of information and the synchronization of critical functions did not occur.

“2003 [in preparation for Hurricane Isabel] was the first time a national EOC was activated. Prior to that the Police and Defence Force would coordinate their own activities independent of one another” (Outten-Moncur, 2006a).

4.2.5.2 Hurricane Floyd 1999 Criterion Five: Focus on the Development of Overall Coordination

Official Hurricane Floyd disaster response operations were managed by the RBDF. As with Andrew a ‘command and control’ style response was implemented which did not facilitate a cooperative or comprehensive arrangement for all agencies needed to respond to a major disaster such as Floyd. A national emergency operations center was established at the Office of The Prime Minister led by Commander Steven Russell, however it lacked the contributions of other national and international organizations responding (Ingraham, 1999). To compound this issue, no family island EOC’s were opened to facilitate the movement of emergency response information (Bethel, 2006).

The disjointed response operation prevented the synchronization of critical functions that required a variety of organizations. For example, the movement of water required the RBDF ships to transport goods, but the port department and ministry of works also were needed to coordinate delivery to areas that could receive the ships due to damage to infrastructure. Once the goods arrive the movement from the port to a distribution center again required coordination with the Bahamas Red Cross and the Ministry of Social Services in an effort to provide the goods to residents that were in need. Without a clear avenue to

communicate with all of these agencies severe delays in the delivery of services occurred (Outten-Moncur, 2006b).

“...the Police and Defence Force would coordination their own activities independent of one another” (Outten-Moncur, 2006a).

The data as it was applied to Quaranteilli's (1997a) methodology indicates that overall response coordination and the synchronization of critical functions did not occur

4.2.5.3 Hurricane Michelle 2001 Criterion Five: Focus on the Development of Overall Coordination

As with Andrew and Floyd, Hurricane Michelle disaster response operations were 'commanded' by the RBDF. Again the command and control structure did not facilitate a cooperative or comprehensive arrangement for all agencies responding. An EOC was established at the Cabinet Office but was staffed by only Defence Force personnel (Office of the Prime Minister, 2001).

The lack of interaction between all agencies required to respond prevented successful coordination and synchronization of critical functions that required a variety of organizations (Bethel, 2006, Outten-Moncur, 2006b). Further preventing the development of overall coordination was a missing avenue of communication to share information or request assistance (Smith, 2007a).

4.2.5.4 Hurricane Frances 2004 Criterion Five: Focus on the Development of Overall Coordination

Hurricane Frances disaster response operations were managed by NEMA (NEMA, 2004a). The national EOC was established in Nassau with Family Island EOC established in corresponding jurisdictions (NEMA, 2002). This

cooperative and comprehensive arrangement allowed agencies and organizations to come together in a structured and coordinated way to provide necessary emergency response services.

As a result of the new coordination as outlined in the emergency response plan (2002), critical services such as the movement of food and water to impacted areas occurred effectively. For example, the national EOC facilitated the coordination between ESF 11: Food and ESF 1: Transportation (NEMA, 2004a). This type of coordination did not occur in response to the other three hurricanes. NEMA was able to locate national resources and coordinate with the necessary ministries ensuring the movement of assets to the affected Family Islands (NEMA, 2004). Once assets arrived on the family islands, local EOC personnel were prepared to coordinate the delivery of goods to those in need. NEMA was able to successfully ensure that immediate emergency needs were met through effective coordination of services (Hughey, 2004b; NEMA 2004a).

4.2.5.5 Hurricane Jeanne 2004 Criterion Five: Focus on the Development of Overall Coordination

Hurricane Jeanne response operations were also coordinated out of the National EOC, managed by NEMA and situated in Nassau (Hughey, 2004b; NEMA, 2004b; NEMA, 2004c). Response operations to Jeanne benefited from Hurricane Frances with regards to coordination. Despite depleted resources and tired staff, overall coordination was in place and functioning when the nation was impacted by Jeanne (Hughey, 2004b).

Coordination and response followed the guidelines as established in the national comprehensive emergency management plan (CEMP) (NEMA, 2002).

The established coordination system allowed for the coming together of response agencies to manage the deliver of services to residents. As a result, critical service and immediate emergency needs were met. Application of Quarantelli's evaluation criteria indicate that overall coordination in response to Hurricane Jeanne was effective.

4.2.5.6 Hurricane Wilma 2005 Criterion Five: Focus on the Development of Overall Coordination

Hurricane Wilma response operations were managed by NEMA through the national EOC (NEMA, 2005). All agencies active in disaster were represented at the national EOC. Family Island Administrators in the Northwestern Bahamas established corresponding jurisdictional EOC's to coordinate response efforts.

"The establishment of sub-NEMA's on the Family Islands made it very easy to direct and coordinate the response" (Bethel, 2006).

This cooperative and comprehensive arrangement between the national and island EOC's facilitated the sharing of information and allowed for effective synchronization of response efforts (NEMA, 2005). NEMA was able to successfully ensure that immediate emergency needs were met through planning and coordination of services.

4.2.5.7 Criterion Five Summary

Referring back to Table 4.21, a marked improvement in overall response coordination is seen after the implementation of CEM. The key reason for this improvement is the development of a national response plan that required multi-agency coordination over a two-year period prior to the impact of Frances. This

coordination helped to facilitate a strong working relationship between ministries and established a successful environment for coordination when a disaster struck.

4.2.6 Criterion Six: Correctly Recognizing Differences Between Response and Agent-Generated Demands

Criterion six focuses on the importance of correctly recognizing the differences between response and agent-generated demands.

Evaluation of Criterion Six: Correctly Recognizing Differences Between Response and Agent-Generated Demands						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
2. Effectively mobilizing personnel and resources;	No	No	No	No	Yes	Yes
3. Adequately processing information;	No	No	No	Yes	Yes	Yes
4. Properly exercising decision-making;	No	No	No	No	No	Yes
5. Developing overall coordination;	No	No	No	Yes	Yes	Yes
6. Correctly recognizing differences between response and agent-generated demands;	No	No	No	No	No	Yes

Table 4.22 - Evaluation of Criterion Six: Correctly Recognizing Differences Between Response and Agent-Generated Demands

Quarantelli (1997a) asserts, as outlined in chapter three that the correct recognition between agent- and response-generated demands can be determined if criteria two through five we answered in a positive way. Examination of Table 4.22, which summarizes criteria 2-5 indicates that only during response to Hurricane Wilma did emergency management officials correctly recognize the difference between response- and agent-generated demands.

4.2.7 Criterion Seven: Provide the Mass Communication System with Appropriate and Accurate Information

Criterion seven focuses on providing the mass communication system with appropriate and accurate information. Table 4.23 shows the research findings as they apply to the six study hurricanes. A clear pattern of improvement is shown during post-CEM response operations. A detailed description and supporting data for the responses in Table 4.23 can be found in sections 4.2.7.1 – 4.2.7.6.

Evaluation of Criterion Seven: Provide the Mass Communication System with Appropriate and Accurate Information						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Provide Appropriate and Accurate Reports for the News Media	No	No	No	Yes	Yes	Yes

Table 4.23 - Evaluation of Criterion Seven: Provide the Mass Communication System with Appropriate and Accurate Information

4.2.7.1 Hurricane Andrew 1992 Criterion Seven: Provide Appropriate and Accurate Reports for the News Media

A cooperative interaction between the Department of Meteorology and the media existed during response to Hurricane Andrew. The Broadcasting Corporation of The Bahamas and the Department of Meteorology worked in close coordination to provide regular updates and warnings. Meteorologist Basil Dean, remained on the air throughout the storm broadcasting over ZNS radio and television stations providing The Bahamas with hurricane updates (Dean and Rolle, 1992). What was lacking was the interaction between all agencies active in disaster response and the media. In 1992 there was no mechanism in place to facilitate regularly scheduled disaster briefings. As a result limited information was being released to the public regarding response efforts.

The citizen's belief and trust in the local media was not able to be determined by the available data. The lack of information provided to the media for dissemination indicated that mass communication systems were not provided with appropriate and accurate information.

4.2.7.2 Hurricane Floyd 1999 Criterion Seven: Provide Appropriate and Accurate Reports for the News Media

A cooperative interaction between organizational and community officials and media, seems to have existed during response to Hurricane Floyd. The Broadcasting Corporation of The Bahamas, in close coordination with The Department of Meteorology, provided regular updates and warnings regarding

Hurricane Floyd (Department of Meteorology, 1999). As with Andrew, what were missing were regularly scheduled briefings by response organizations to the media. There is no record of briefings being provided to the media through the emergency operation center or by the RBDF.

After reviewing newspaper archives there appears to be information from political representatives to the media regarding their support for recovery but little if any indication that response organizations were feeding the media critical response information. The citizens' belief and trust in the local media was not able to be determined with available data. However, the lack of information being provided to the media for dissemination to the public indicates that mass communication system were not provided with the appropriate and accurate information related to the Hurricane Floyd response efforts.

4.2.7.3 Hurricane Michelle 2001 Criterion Seven: Provide Appropriate and Accurate Reports for the News Media

A cooperative interaction between organizational and community officials and media, seems to have existed during response to Hurricane Michelle. The Broadcasting Corporation of The Bahamas in close coordination with The Department of Meteorology (2001) provided regular updates and warnings regarding the status of Michelle. As with the two previous response operations, there were no regularly scheduled briefings by response organizations to the media. There is no record of briefings being provided to the media through the EOC or by the RBDF.

After reviewing newspaper archives there appears to be information directly related to the physical components of the storm as provided by the

Department of Meteorology (2001) but information on response information was lacking. The citizen's belief and trust in the local media was not able to be determined with available data. However, the lack of information being provided to the media for dissemination to the public indicates that mass communication system were not provided with the appropriate and accurate information related to the Hurricane Michelle response efforts.

4.2.7.4 Hurricane Frances 2004 Criterion Seven: Provide Appropriate and Accurate Reports for the News Media

NEMA provided appropriate and accurate information to the news media using a structured and standardized approach(Hughey, 2004b). ESF 5 Planning and Information, instituted regularly scheduled briefings as well as established the official position of public information officer (PIO) (NEMA, 2002; NEMA 2004a). The PIO was a skilled member of the Bahamas Information System trained to provide information to the media on the daily activities of government (Hughey; 2004b). Working closely with the NEMA director, Mr. Carl Smith and top EOC management the PIO established briefings at 8:00am, 11:30am, 5:00pm and 9:00pm (Hughey, 2004b; NEMA 2004a). The briefings were held daily while the EOC was fully operational. The times selected were just prior to the local news broadcasts allowing news agencies the opportunity to have the most updated information for residents. The news media was notified by phone and fax of the scheduled briefings and were encouraged to attend. The PIO additionally coordinated representatives from a variety of agencies to ensure accurate information was provided directly from the agencies to the news media (Hughey, 2004b). This facilitated information flow from NEMA to the residents of

the Bahamas. The PIO also addressed and provided information to international news outlets such as the BBC, NBC, CBS, and CNN upon request (Hughey, 2004b; NEMA, 2004a).

The established briefings cemented NEMA as the national agency responsible for emergency management. It was through cooperative interaction with media representatives that NEMA was able to ensure accurate information was being publicized. Residents consistently received information on response and recovery efforts directly from NEMA (Hughey, 2004b). As a result of this structured approach the mass communication systems were provided with the appropriate and accurate information related to the Hurricane Frances response efforts.

4.2.7.5 Hurricane Jeanne 2004 Criterion Seven: Provide Appropriate and Accurate Reports for the News Media

Response to Jeanne utilized the same approach employed during response to Frances. Through the use of a PIO, ESF 5 Planning and Information, instituted regularly scheduled briefings. Through close coordination with the NEMA director and support agency liaisons the PIO held open briefings for the media at 8:00am, 11:30am, 5:00pm and 9:00pm (Hughey, 2004b; NEMA, 2002; NEMA, 2004b; NEMA, 2004c). These daily briefings, which had been established during response to Hurricane Frances, provided the media with an opportunity to ask questions and provide the most updated information to residents. As a result mass communication systems were provided with the appropriate and accurate information related to the Hurricane Jeanne response efforts (Hughey, 2004b; NEMA, 2004c). Quarentelli's evaluation criteria suggest

that the mass communication system was effectively provided with appropriate and accurate information with regards to Hurricane Jeanne. Data was not available to determine the citizens trust in the local media.

4.2.7.6 Hurricane Wilma 2005 Criterion Seven: Provide Appropriate and Accurate Reports for the News Media

Through the use of a PIO, ESF 5 Planning and Information, instituted regularly scheduled briefings (NEMA, 2002; NEMA, 2005). NEMA provided appropriate and accurate information to the media using a structured and standardized approach in response to Hurricane Wilma. This same approach was used in response to Hurricanes Frances and Jeanne. Through close coordination with the NEMA director and support agency liaisons the PIO held open briefings for the media at 8:00am, 11:30am, 5:00pm and 9:00pm. These daily briefings, which had been established a year earlier during response to Hurricane Frances, provided the media with an opportunity to ask questions and provide the most updated information to residents (NEMA, 2005).

4.2.7.7 Criterion Seven Summary

Referring back to Table 4.23, a clear pattern of improvement is shown during post-CEM response operations. The improvement can be associated with the implementation of the national response plan (2002), which outlined responsibilities and operating procedures to ensure accurate and timely information regarding disasters is delivered to the public.

4.2.8 Criterion Eight: Have a Well-Functioning Emergency Operations Center (EOC)

Criterion eight examines the functioning of the EOC during each of the six study hurricanes. Table 4.24 displays the results of Quarnatelli’s (1997a) methodology for evaluating the functioning of an EOC. Evident is the fact that none of the six study hurricanes had a ‘well-functioning emergency operation center’. A detailed description and supporting data for the responses in Table 4.24 can be found in sections 4.2.8.1 – 4.2.8.6

Evaluation of Criterion Eight: Having a well-functioning emergency operations center (EOC)						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
Have a Well-Functioning Emergency Operations Center (EOC)	No	No	No	No	No	No

Table 4.24 - Evaluation of Criterion Eight: Having a well-functioning emergency operations center (EOC)

4.2.8.1 Hurricane Andrew 1992 Criterion Eight: Have a Well-Functioning Emergency Operations Center (EOC)

An operation center was activated by the RBDF in response to Hurricane Andrew. However no multi-agency national EOC was established. The RBDF EOC was indented only to coordinate internal activities associated with response. The EOC did not facilitate the effective implementation of all required response activities for two key reasons. First, the EOC did not house all agencies responding (only the RBDF were present in the EOC) limiting information flow

and preventing the coordination of assets. Secondly, the EOC was housed in a conference room at the cabinet office, and did not meet the necessary physical requirements as outlined by Quarantelli (1997a).

Table 4.25 displays the physical requirements for the EOC as outlined by in the methodology chapter of this document. It is clear to see that the physical requirements were not met. The EOC was located close to the water without easy access to key transportation routes or key facilities. The small conference room did not provide adequate work space for all agencies responding to Hurricane Andrew nor were there adequate sleeping and bathing facilities. The EOC had telephone landlines but the northwestern islands, most significantly impacted by the storm lost telecommunication capabilities and communication between the islands did not exist (Office of The Prime Minister, 1992). The lack of communication was further confirmed by Tellis Symonette, Vice President of The Bahamas Telecommunication Company during an informal conversation on January 26, 2007. Computers were not available in the EOC and all reporting was done by hand resulting in information dissemination delays. Additionally, detailed maps and comprehensive lists of available resources were not on hand. This was validated through personal observation of the EOC facility utilized in response to Andrew as well as informal discussion with RBDF personnel. Applying the data to Quarantelli's criteria it appears that a well-functioning EOC did not exist in The Bahamas in response to Hurricane Andrew.

Evaluation of Hurricane Andrew EOC Physical Requirements	
The National EOC was/had...	Yes/No
1. Located in a safe area in close proximity to key transportation routes;	No
2. Sufficient work space;	No
3. Bathroom and sleeping facilities;	No
4. Adequate communication provisions;	No
5. Computers and necessary supplies;	No
6. Maps and equipment inventories	No

Table 4.25 – Evaluation of Hurricane Andrew EOC Physical Requirements

4.2.8.2 Hurricane Floyd 1999 Criterion Eight: Have a Well-Functioning Emergency Operations Center (EOC)

An EOC was activated at the Office of The Prime Minister by the RBDF. However, to be identified as ‘well-functioning,’ an EOC must be more than just a common location. An EOC is intended to facilitate the effective implementation of all required response activities and should be seen as a function not just a structure. The EOC activated in response to Hurricane Floyd did not house all responding organizations nor did it facilitate the coordination between public, private, local, regional, and international agencies. Manned exclusively by the Defence Force, the EOC lacked knowledgeable liaison personnel.

Furthermore, as displayed in Table 4.26, the physical requirements for the EOC were not met. The EOC was located within 100 yards of the water and only 2.3 feet above sea level. Additionally, the location does not have easy access to transportation routes or key facilities such as the airport or disaster warehouse.

There would have been adequate work space for organizations and agencies responding to Floyd but only the Defence Force was present in the EOC. There were no sleeping facilities located in the EOC and although there were bathrooms, they were not equipped with showers; hence they did not adequately accommodate for long term response operations with any shower facilities.

Evaluation of Hurricane Floyd EOC Physical Requirements	
The National EOC was/had...	Yes/No
1. Located in a safe area in close proximity to key transportation routes;	No
2. Sufficient work space;	Yes
3. Bathroom and sleeping facilities;	No
4. Adequate communication provisions;	No
5. Computers and necessary supplies;	No
6. Maps and equipment inventories	No

Table 4.26 – Evaluation of Hurricane Floyd EOC Physical Requirements

The EOC, located in the cabinet office, had telephone landlines as well as satellite phones that were provided by the RBDF (Bethel, 2006). However, following Floyd telecommunication lines were down throughout the islands (Bahamas Telecommunication Company, 1999). The satellite phones were reliable but operator error resulted in a limited success in reaching representatives on the family islands (Rigby, 2006). Computers and necessary supplies were not available. Records and reports were written by hand resulting in delays in the dissemination of information. Additionally, detailed maps of the

Family Islands were not available which limited response planning initiatives. Additionally comprehensive lists of available resources did not exist. Based on all of this information it is clear that during the response operations to Hurricane Floyd the eighth criterion for good disaster management, A well-functioning Emergency Operations Center (EOC) was not achieved.

4.2.8.3 Hurricane Michelle 2001 Criterion Eight: Have a Well-Functioning Emergency Operations Center (EOC)

As with Hurricanes Andrew and Floyd an EOC was activated by the RBDF (Office of The Prime Minister, 2001; RBDF, 2001). However, to be identified as 'well-functioning,' an EOC must be more than just a common location. The EOC activated in response to Hurricane Michelle did not house all responding organization nor did it facilitate the coordination between public, private, local, regional, and international agencies (Office of the Prime Minister, 2001). Manned exclusively by the Defence Force, the EOC lacked knowledgeable liaison personnel.

The same location for the EOC was selected for Hurricane Michelle as was used for Hurricanes Andrew and Floyd. Located within 100 yards of the water and only 2.3 feet above sea level the location was not adequate (Hughey, 2004a). Table 4.27 further examines the physical requirement of the EOC.

Evaluation of Hurricane Michelle EOC Physical Requirements	
The National EOC was/had...	Yes/No
1. Located in a safe area in close proximity to key transportation routes;	No
2. Sufficient work space;	Yes
3. Bathroom and sleeping facilities;	No
4. Adequate communication provisions;	No
5. Computers and necessary supplies;	No
6. Maps and equipment inventories	No

Table 4.27– Evaluation of Hurricane Michelle EOC Physical Requirements

The location of the EOC was away from key transportation routes and facilities such as the airport or disaster warehouse. The location did provide for large work spaces for all response agencies but there were no sleeping facilities located in the EOC and although there were bathrooms they did not have shower facilities, making them inadequate for long-term response operations. The EOC had telephone landlines and the Defence Force was equipped with satellite phones (Office of the Prime Minister, 2001). Damage to the telecommunication system (BTC, 2001) prevented the use of landlines. Additionally, the satellite phones did not successfully meet the communication needs because only the RBDF personnel had access to them. Computers and necessary supplies were not available and all records and reports were written by hand. This resulted in delays in information dissemination. Furthermore, detailed maps of the Family Islands were not available which limited response planning initiatives. Also

notable, comprehensive lists of available resources did not exist. Applying the data to Quarantelli's evaluation criteria indicates that a well-functioning EOC was not achieved.

4.2.8.4 Hurricane Frances 2004 Criterion Eight: Have a Well-Functioning Emergency Operations Center (EOC)

As with Hurricanes Andrew, Floyd and Michelle, an EOC was activated. In response to Hurricane Frances NEMA activated the national EOC in the Churchill Building at NEMA's national headquarters. This building is the same physical location that was used to respond to the three previous hurricanes. As identified in prior response efforts, to be identified as 'well-functioning,' an EOC must be more than just a common location.

The EOC activated in response to Hurricane Frances housed a variety of response organization and effectively coordinated efforts between public, private, local, regional, and international agencies (NEMA 2004a). The same physical location of the EOC as with Hurricanes Andrew, Floyd, and Michelle was 100 yards from the water and only 2.3 feet above sea level (Hughey, 2004a; Hughey, 2004b). Part of the Churchill Building had also been condemned due to structural damage. Table 4.28 further examines the physical requirements of the EOC.

The location was away from key transportation routes and facilities such as the airport or disaster warehouse (Hughey, 2004a; NEMA, 2004a). The location did provide for large workspaces for all response agencies. Hurricane Frances directly impacted the nation for over 72 hours, the lack of sleeping or

bathing facilities did not adequately accommodate the long term response operation that was required.

Evaluation of Hurricane Frances EOC Physical Requirements	
The National EOC was/had...	Yes/No
1. Located in a safe area in close proximity to key transportation routes;	No
2. Sufficient work space;	Yes
3. Bathroom and sleeping facilities;	No
4. Adequate communication provisions;	No
5. Computers and necessary supplies;	No
6. Maps and equipment inventories	No

Table 4.28 – Evaluation of Hurricane Frances EOC Physical Requirements

The EOC was equipped with telephone landlines and satellite phone provided by the RBDF. The Defence Force also provided satellite phones to Family Island Administrators. Following Hurricane Frances many of the family islands experienced telecommunication problems (BTC, 2004a; Hughey, 2004b) NEMA, 2004a). The pre-placed satellite phones were ineffective due to lack of training and operator error (Hughey 2004B). Ham radios operated by many of the police forces were used to relay information back to NEMA and the national EOC (RBPF, 2004). Computers and necessary supplies were not available during the response to Frances (Hughey, 2004b). Initially, Records and reports were written by hand resulting in delays in the dissemination of information. Two laptop computers were ultimately located and used to track response activities (Hughey, 2004b). Additionally, detailed maps of the family islands were not

available which limited response planning initiatives. Based on all of this information it is clear that during the response operations to Hurricane Frances the eighth criterion for good disaster management, a well-functioning Emergency Operations Center (EOC), was not achieved. (See Picture 4.13)



Picture 4.13 – Hurricane Frances 2004 National EOC, Nassau Bahamas. RBDF Personnel. (Source: Erin Hughey)

4.2.8.5 Hurricane Jeanne 2004 Criterion Eight: Have a Well-Functioning Emergency Operations Center (EOC)

The National EOC that had been activated in response to Hurricane Frances remained open to coordination activities related to Jeanne (Hughey, 2004b; NEMA, 2004b). The EOC continued to be located at the Churchill Building in downtown Nassau. As identified in prior response efforts, to be identified as ‘well-functioning,’ an EOC must be more than just a common location.

The EOC activated in response to Hurricane Jeanne housed a variety of response organizations and effectively coordinated efforts between public, private, local, regional, and international agencies. However, it was the physical location and requirements that made the EOC ineffective. The same EOC location that was used for the four previous hurricanes was also used in response to Hurricane Jeanne.

The EOC is located away from key transportation routes and facilities such as the airport and disaster warehouse. Although the EOC provided for large work spaces for all response organizations, the lack of sleeping and bathing facilities made the location inadequate to handle long-term response operations. The EOC was equipped with telephone landlines and satellite phone provided by the RBDF. The Defence Force also provided satellite phones to Family Island Administrators. During Hurricane Frances response operations, it became evident that many island administrators did not know how to utilize the satellite phones so in addition to providing the equipment instructions were provided. Computers and necessary supplies were not available during the response to Jeanne, and initial record and reporting was written by hand resulting in delays. Detailed maps of the family islands were not available at the EOC and hindered response planning initiatives. (See Table 4.29) Thus, a well-functioning Emergency Operations Center (EOC) was not achieved during Hurricane Jeanne.

Evaluation of Hurricane Jeanne EOC Physical Requirements	
The National EOC was/had...	Yes/No
1. Located in a safe area in close proximity to key transportation routes;	No
2. Sufficient work space;	Yes
3. Bathroom and sleeping facilities;	No
4. Adequate communication provisions;	No
5. Computers and necessary supplies;	No
6. Maps and equipment inventories	No

Table 4.29 – Evaluation of Hurricane Jeanne EOC Physical Requirements

4.2.8.6 Hurricane Wilma 2005 Criterion Eight: Have a Well-Functioning Emergency Operations Center (EOC)

The National EOC, located at the Churchill Building in downtown Nassau is not a well-functioning facility. As displayed in Table 4.30 below, the minimum physical requirements as established by Quarantelli (1997a) were not met. The EOC activated in response to Hurricane Wilma housed a variety of response organization and effectively coordinated efforts between the different levels of government. However, it was the physical location and requirements that made the EOC ineffective.

Located 100 yards from the water and 2.3 feet above sea level the EOC was not well positioned. Additionally, the EOC was located away from key transportation routes and facilities such as the airport and disaster warehouse. Although the EOC provided for large workspaces for all response organizations,

the lack of sleeping and bathing facilities made the location inadequate to handle long-term response operations.

Evaluation of Hurricane Wilma EOC Physical Requirements	
The National EOC was/had...	Yes/No
1. Located in a safe area in close proximity to key transportation routes;	No
2. Sufficient work space;	Yes
3. Bathroom and sleeping facilities;	No
4. Adequate communication provisions;	Yes
5. Computers and necessary supplies;	No
6. Maps and equipment inventories	No

Table 4.30 – Evaluation of Hurricane Wilma EOC Physical Requirements

The EOC was well equipped with telephone landlines and satellite phone provided by Bahamas Telecommunication Company and the RBDF (BTC, 2005; RBDF, 2005; NEMA, 2005). The Defence Force also provided satellite phones to Family Island Administrators (RBDF, 2005). Computers and necessary supplies were not available during the response to Wilma, and initial record and reporting were again written by hand resulting in delays. Detailed maps of the Family Islands were also not available and hindered response planning initiatives. Thus, a well-functioning EOC was not operational during response to Hurricane Wilma.

4.2.8.7 Criterion Eight Summary

Referring back to Table 4.24, shows that none of the six response operations had a 'well-functioning emergency operations center'. Table 4.31

further identifies the key physical requirements that need to be addressed to ensure a well-functioning EOC is operational to respond to the next disaster to impact The Bahamas.

Evaluation of EOC Physical Requirements						
	Pre-CEM			Post-CEM		
The National EOC was/had... (Yes/No)	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
1. Located in a safe area in close proximity to key transportation routes;	No	No	No	No	No	No
2. Sufficient work space;	No	Yes	Yes	Yes	Yes	Yes
3. Bathroom and sleeping facilities;	No	No	No	No	No	No
4. Adequate communication provisions;	No	No	No	No	No	Yes
5. Computers and necessary supplies;	No	No	No	No	No	No
6. Maps and equipment inventories	No	No	No	No	No	No

Table 4.31 – Evaluation of the EOC Physical Requirements for the Six Study Hurricanes

4.3 Chapter Summary and Discussion

Chapter four examined Quarantelli's (1997a) eight criteria for evaluating disaster response as they apply to the six study hurricanes to determine if:

- Quarantelli's (1997a) methodology for evaluating the management of disaster response could be operationalized.
- Quarantelli's (1997a) methodology was able to determine if the implementation of a CEM system improved disaster response operations in The Bahamas.

Table 4.32 displays the eight evaluation criteria as they apply to the six study Hurricanes. Criterion One, adequately carrying out generic functions, appears not to have been affected by the implementation of CEM. However, upon closer examination what emerged was a clear improvement in the early recognition of each of the ten generic functions, which are encompassed within the first criterion. The data displayed improvements that can be associated with the implementation of a CEM system in 2002 (see table 4.3) and the development of a national response plan that outlined responsibility and SOP's for each of the functions. This pre-planning allowed The Bahamas to more quickly identify critical functions and needs.

- Criterion One of Quarantelli's (1997a) methodology was able to be operationalized and applied to the six study hurricanes.
- Quarantelli's (1997a) methodology identified improvements in response associated with the implementation of a CEM system.

Eight Criteria for Evaluating The Management of Disaster Response Operations to the Six Study Hurricanes						
	Pre-CEM			Post-CEM		
	Andrew 1992	Floyd 1999	Michelle 2001	Frances 2004	Jeanne 2004	Wilma 2005
1. Adequately carrying out generic functions;	No	No	No	No	No	No
2. Effectively mobilizing personnel and resources;	No	No	No	No	Yes	Yes
3. Adequately processing information;	No	No	No	Yes	Yes	Yes
4. Properly exercising decision-making;	No	No	No	No	No	Yes
5. Developing overall coordination;	No	No	No	Yes	Yes	Yes
6. Correctly recognizing differences between response and agent-generated demands;	No	No	No	No	No	Yes
7. Providing appropriate and accurate reports for the news media;	No	No	No	Yes	Yes	Yes
8. Having a well-functioning emergency operations center;	No	No	No	No	No	No

Table 4.32 - Eight Criteria for Evaluating The Management of Disaster Response Operations to the Six Study Hurricanes

Criterion Two, effectively mobilizing personnel and resources, showed improvements following the implementation of the CEM system. An association with the improvement in the function and the development of a national emergency response plan was noted. It is critical to identify however that the improvements associated to the CEM system does not rule out and take away from the impact that experience may have played in improvements to response operations. It is hypothesized that the implementation of the CEM and continued response experience both contributed to the improvement.

- Criterion Two of Quarantelli's (1997a) methodology was able to be operationalized and applied to the six study hurricanes.
- Quarantelli's (1997a) methodology identified improvements in response associated with the implementation of a CEM system.
- Experience was also noted as a contributing factor to the improvement of response.

Criterion Three, adequately processing information, displayed a pattern of improvement following the implementation of the CEM system. The implementation of a national response plan helped to develop clear lines of communication between citizens, the government, and response agencies that allowed for more accurate processing of information and improved response operations. Also associated with the improvement are experience and improved recording keeping.

- Criterion Three of Quarantelli's (1997a) methodology was able to be operationalized and applied to the six study hurricanes.
- Quarantelli's (1997a) methodology identified improvements in response associated with the implementation of a CEM system.
- Experience and improved record keeping was identified as a potential contributing factor to the improvement in response post-CEM.

Criterion Four, the properly exercising decision-making, showed no pattern or association of improvement following the implementation of CEM. Response operations to Hurricanes Frances and Jeanne experienced the same problems with decision-making as the pre-CEM response operations. Improvements were noted in response to Hurricane Wilma but the data indicate that the improvement is associated with experience rather than a change in the fundamental management strategy of disaster response.

- Criterion Four of Quarantelli's (1997a) methodology can be operationalized and was applied to the six study hurricanes.
- Quarantelli's (1997a) methodology did not note any improvements to the exercising of decision-making as a result of the implementation of a CEM system.
- Data indicated improvements in the proper exercising of decision-making was associated with experience.

Criterion Five, developing overall coordination, showed a marked improvement after the implementation of the CEM system. Data indicates improvements are associated with the development of a nation response plan that required multi-agency coordination over a two-year period prior to the impact of Hurricane Frances. The process of developing coordination helped to facilitate a strong working relationship between ministries and agencies active in response allowing for a successful environment for coordination.

- Criterion Five of Quarantelli's (1997a) methodology can be operationalized and was applied to the six study hurricanes.
- Quarantelli's (1997a) methodology identified improvements in response associated with the implementation of a CEM system and the development of a national response plan that required multi-agency coordination.

Criterion Six, Correctly recognizing differences between response and agent-generated demands, was dependent of the success of criteria 2 through 5. The data did not identify an association between criterion six and the implementation of a CEM system.

- Criterion Six of Quarantelli's (1997a) methodology was dependent on the success of criteria 2-5. As a result, criterion six was operationalized and was applied to the six study hurricanes.
- Quarantelli's (1997a) methodology did not identified an association between the identification of response- and agent-generated demands following the implementation of a CEM system.

Criterion Seven, providing appropriate and accurate reports for the news media, showed a clear pattern of improvement during the post-CEM response operations. The data showed the improvement was associated with the implementation of the national response plan (2002).

- Criterion Seven of Quarantelli's (1997a) methodology was operationalized and applied to the six study hurricanes.
- Quarantelli's (1997a) methodology identified an association between improved reporting to the news media and the implementation of a CEM system.

Criterion eight, a well-functioning emergency operations center, showed no improvement associated to the implementation of a CEM system. Challenges to the physical requirements outlined by Quarantelli's (1997a) methodology indicated the EOC facilities utilized in response to each of the six study hurricanes were insufficient.

- Criterion Eight of Quarantelli's (1997a) methodology was operationalized and applied to the six study hurricanes.
- Quarantelli's (1997a) methodology identified no association between the functioning of the EOC and the implementation of a CEM system.

Quarantelli's (1997a) methodology for evaluating the management of disaster response operations was able to be operationalized and applied to all six of the study hurricanes. It is recommended however that the methodology be

refined for ease of application and to ensure consistency in use. A more detailed and structured application guideline is also recommended to prevent subjective employment of the tool. The use of benchmarks would also provide emergency managers with the necessary apparatus to establish response goals and provide a metric to rate the overall improvement to response within a jurisdiction.

Chapter Five

Results: Surveys & Interviews

“Emergency Management is the process of coordinating available resources to deal with emergencies effectively, thereby saving lives, avoiding injury, and minimizing economic loss” (FEMA, 2003b:).

5.1 Introduction

The following chapter provides the research findings associated with data collected from the structured surveys and the semi-structured interviews. The results are presented in tabular form using numerical and percentage totals when appropriate. The data in this chapter are formatted to answer the following research question.

- Did the implementation of a CEM system improve disaster response?

5.2 Survey Findings

As discussed in chapter three of this dissertation, the structured surveys were self administered and intended to gauge the Family Island Administrators perception of disaster response pre- and post-CEM. (See Appendix A) There were a total of twenty (20) Family Island Administrators responsible for serving as the NEMA representative for each of their respective jurisdictions. With a 100% return rate on the surveys, the entire identified population data was obtained.

Questions 1-3 on the survey gauged the respondents' emergency management training background, as well as provided an opportunity for training recommendations. It is important to understand the respondents training and experience because both will inform the respondents perception of response operations. Questions 4 and 5 focused on planning and information. These two question help to provide additional context to the respondents' perceptions of the national response to the six study hurricanes. If an Island Administrator had an emergency plan in place, and had open lines of communication with the national government they may have different response expectations then those who did not have a plan or were not in communication. Questions 6-9 were focused on the response operation to the six study hurricanes. It is important to note that although there were six study hurricanes respondents were asked to rate four response operations. Family Island Administrators were not asked to rate response to Hurricane Michelle 2001, because the family islands were not significantly impacted by the storm. Also noteworthy, is the fact that Hurricanes Frances and Jeanne 2004 were rated as one response operation. Because the two storms occurred within three weeks of one another it was difficult to differentiate between response operations. The remaining six questions on the survey provided additional contextual information on experience and challenges to effective emergency response.

5.2.1 Emergency Management Training

Table 5.1 below displays the results of question one; has your island received disaster training from the NEMA office? As the results show only 40%

of the Island Administrators report having received disaster training for their jurisdiction.

Q1: Has your island received disaster training from the NEMA office?								
	Yes		No		No Response		Total	
	#	%	#	%	#	%	#	%
Has your island received disaster training from the NEMA office?	8	40%	12	60%	0	0%	20	100%

Table 5.1 – Survey Question One, Has your island received disaster training from the NEMA office.

Of the 8 Family Island Administrators who reported that their island had received disaster training the following training courses were identified as being conducted.

- Communications Training
- SUMA Training – (Humanitarian Supply Management Training Course offered by the Pan American Health Organization (PAHO) in coordination with NEMA. SUMA is a tool for the management of humanitarian relief supplies, from the time pledges are made by donors, to their entry into the disaster area and their storage and distribution)
- Damage Assessment Training
- Shelter Management Training was reported by three island administrators
- Community Response
- General Disaster Management Training was reported by two island administrators

- Hurricane Management
- Community Emergency Response Training (CERT) was reported by two island administrators.
- Disaster Assessment
- Annual Conference

Island Administrators were asked what type of emergency management training they would like to see offered by NEMA their responses are provided below. The data illustrates the need for a comprehensive training curriculum.

Q2 – What type of training would you like to see offered by NEMA?

- “Shelter management & disaster communications”
- “I.T. and disaster management”
- “More shelter management, supplies management & distribution system implementation.”
- “CERT” [community emergency response team]
- “More First Aid and Emergency response training. Also more information about shelter management”
- “Mass-Casualty Incident Management”
- “Additional training in shelter, community response and general disaster management as well as search and rescue and environmental and demographics. “
- “Shelter Management & Disaster Communications”
- “Before, during and after a disaster”
- “Proper damage assessment, first responders courses for persons to deal with medical emergencies, proper distribution after a disaster.”
- “Disaster preparedness, operational procedures for command centre, search and rescue, training in first aid.”
- “Working secessions with the disaster preparedness committee”
- “Hurricane preparedness and disaster management”
- “Shelter Management and Damage Assessment”

Six of the twenty Island Administrators chose not to provide training recommendations while the remaining fourteen respondents showed the need for a wide range of training.

Question three asked respondents if they or a representative from their agency attend any of the NEMA Conferences held in 2004, 2005, or 2006. Table 5.2, shows that 75% of the respondents attended or had a representative attended one or more of the NEMA Conferences. What is alarming however, is that 25% of the administrators indicated that they had not participated.

Q3: Did you or a representative from your agency attend any of the NEMA Conferences held in 2004, 2005, and 2006?								
	Yes		No		No Response		Total	
	#	%	#	%	#	%	#	%
Did you or a representative from your agency attend any of the NEMA Conferences held in 2004, 2005, and 2006?	15	75%	5	25%	0	0%	20	100%

Table 5.2 – Survey Question Three, Did you or a representative from your agency attend any of the NEMA Conferences held in 2004, 2005, and 2006?

As a sub section to question three, respondents who responded yes to the question were asked if they found the conference to be useful; explain why or why not?

- "The Conference was very useful because it teaches how to prevent the possible loss of life but it does not follow up with the needs in order to survive afterwards."
- "It opened my eyes to a number of issues that have to do with disaster management"
- "Very Useful"
- "Yes – informative but very detailed therefore training should be held in Family Island."
- "Very Useful, good information"
- "Provided Good Information"
- "Very useful. Final report from Conference would be helpful as reference material."
- "Yes, because as a result were able to make plans more practical and meaningful."
- "Interaction with other Island Representatives and Sharing of Information and Strategies for Preparation was useful"
- "Yes, we learned about what does and does not belong in a shelter. This was August 2005"
- "It helped in Organizing N-G-O and other volunteers for disaster."
- "It was very helpful – should be extended to FI [Family Island] communities or invite more FI [Family Island] first responders."
- "Very useful"
- "Useful. Good Information, Good Networking."
- "Conferences were very useful"

5.2.2 Planning and Information

Question four, displayed in Table 5.3, intended to determine if Island Administrators had a disaster preparedness and response plan for their respective jurisdiction. Eighty-five percent (85%) of respondents reported that they did have a disaster plan in place.

Q4: Does your island have a disaster preparedness and response plan?								
	Yes		No		No Response		Total	
	#	%	#	%	#	%	#	%
Does your island have a disaster preparedness and response plan?	17	85%	3	15%	0	0%	20	100%

Table 5.3 – Survey Question Four, Does your island have a disaster preparedness and response plan?

Of the 17 respondents who reported having an emergency response plan, over 64% stated that their plan had been updated within the last two years. (See Table 5.4) Seventeen percent (17%) reported that their plan was updated in the last three years, while another seventeen percent (17%) did not respond. This reveals that 11 of the 20 Island Administrators (or 55%) have a disaster plan in

place that has been reviewed within the last two years. More importantly 45% of the Island Administrators do not have updated emergency response plan.

Q4a: When was the last time the disaster plan was reviewed and updated?								
	2006		2005		No Response		Total	
	#	%	#	%	#	%	#	%
If yes, when was the last time it was reviewed and updated?	11	64.7%	3	17.6%	3	17.6%	17	100%

Table 5.4 – Survey Question Four(a), When was the last time the disaster plan was reviewed and updated?

Survey question five asked Family Island Administrators to rate on a scale of 1 to 5 (1 being not at all and 5 being completely) NEMA’s efforts to inform the public of its role in disaster planning and response? Table 5.6 shows that the mean ranking was 3.45 with a standard deviation of 0.759. This indicates that the majority of respondents felt that NEMA was doing a good job at informing the public of their role in disaster planning and response. Fifty percent (50%) of the administrators rated the efforts by NEMA to inform the public of its role in disaster planning and response at a 4 or 5.

Q5 – How would you rate NEMA’s efforts to inform the public of its Role in Disaster Planning and Response?					
	N	Minimum	Maximum	Mean	Std. Deviation
How would you rate NEMA’s efforts to inform the public of their role in Disaster planning and Response?	20	.00	5.00	3.4500	0.75915
Valid N	20				

Table 5.5 – Survey Question Five, How would you rate NEMA’s efforts to inform the public of their role in disaster planning and response?

5.2.3 Response Operation

Questions 6-9 on the survey focused on the national response to the six study hurricanes. As stated previously, Island Administrators were asked to rate the national response to four operations: Andrew 1992, Floyd 1999, Frances and Jeanne 2004, and Wilma 2005. Omitted from the survey was response to Hurricane Michelle 2001, because the Family Islands were not significantly impacted by the storm. As discussed in detail in Appendix B of this dissertation, Michelle made landfall on the Island of New Providence impacting the capital city of Nassau. Also important to note is the grouping of Hurricanes Frances and Jeanne. Because the two storms occurred within three weeks of one another and due to overlap in response initiatives Island Administrators were asked to evaluate the response as one event.

A scale of 1-5 was utilized for this research, 1 being not successful and 5 being fully successful.

- 1 represented not successful,
- 2 represented weak success,
- 3 represented good success,
- 4 represented very good success
- 5 represented fully successful.

Because the study population is so small (20 Island Administrators) it is important for this research to examine the number of respondents in each category as well

as the mean rating. By utilizing the mean, a rating for each response was established allowing for comparative evaluation.

Question six, aimed to gauge the Island Administrators perception of the national response to Hurricane Andrew. Respondents were asked, to rate the response on a scale of 1 to 5 (1 being not successful and 5 being fully successful). As shown in Table 5.6 the mean ranking was 2.25 with a standard deviation of 1.48. Based on the mean, the national response to Hurricane Andrew was weak.

Table 5.7 provides the number of responses per ranking. The table however represents only 85% of the total responses. Not displayed in the table are the 3 responses (or 15%) that rated the national response to Hurricane Andrew at zero, displaying great dissatisfaction. The mean as well as the raw numbers show that the Island Administrators did not perceive the national response to Hurricane Andrew to be fully successful.

Q6- How would you rate the success of the national response to Hurricane Andrew (1992)?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Andrew 1992	20	.00	5.00	2.2500	3.0000	3.00	1.48235
Valid N	20						

Table 5.6 – Survey Question Six, How would you rate the National Governments Response to Hurricane Andrew? (Descriptive Statistics)

Q6- On a scale of 1 to 5 how successful was the national response to Hurricane Andrew (1992)?					
	Not Successful (1)	Weak Success (2)	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Number of Respondents	5	0	9	2	1
Percentage	25%	0%	45%	10%	5%

Table 5.7 – Survey Question Six, How would you rate the National Governments Response to Hurricane Andrew? (Response Breakdown)

Survey question seven, was intended to gauge the Island Administrators perception of the national response to Hurricane Floyd. Table 5.8, displays the mean rating of 2.55 with a standard deviation of 0.933. The mean ranking indicates the Island Administrators perceived the national response to Floyd to have weak to good success. The mean score for Floyd was only slightly higher than that of Hurricane Andrew however the decrease in the standard deviation indicates greater agreement among the administrators.

Q7 - How would you rate the success of the National Governments Response to Hurricane Floyd?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Floyd 1999	20	1.00	4.00	2.55	3.0000	3.00	0.93330
Valid N	20						

Table 5.8 – Survey Question Seven, How would you rate the success of the National Governments Response to Hurricane Floyd? (Descriptive Statistics)

Table 5.9 provides the number of responses per ranking. The table represents 100% of the total responses and indicates that the majority of Island Administrators perceived the national response to Hurricane Floyd to have weak to good success. Forty-five percent (45%) perceived the response to be good, this was also the case for Hurricane Andrew.

Q7- How would you rate the National Governments Response to Hurricane Floyd?					
	Not Successful (1)	Week Success (2)	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Number of Respondents	4	4	9	3	0
Percentage	20%	20%	45%	15%	0%

Table 5.9 – Survey Question Seven, How would you rate the success of the National Governments Response to Hurricane Floyd? (Response Breakdown)

Survey question eight, evaluated the national response to Hurricanes Frances and Jeanne. Because the two hurricanes occurred within three weeks of one another and many of the response and recovery initiatives overlapped they were grouped together. Respondents were again asked, to rate the success of the national response on a scale of 1 to 5. As displayed in Table 5.10, the mean score was 3.95 with a standard deviation of 0.686. This score is a marked increase from that of Hurricanes Andrew and Floyd and show strong agreement among the Island Administrators.

Q8 - How would you rate the success of the National Governments Response to Hurricanes Frances & Jeanne?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricanes Frances & Jeanne 2004	20	.00	5.00	3.9500	4.0000	4.00	0.68633
Valid N	20						

Table 5.10 – Survey Question Eight, How would you rate the success of the National Governments Response to Hurricanes Frances and Jeanne? (Descriptive Statistics)

Q8- How would you rate the success of the National Governments Response to Hurricane Frances & Jeanne?					
	Not Successful (1)	Week Success (2)	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Number of Respondents	0	0	5	11	4
Percentage	0%	0%	25%	55%	20%

Table 5.11 – Survey Question Eight, How would you rate the success of the National Governments Response to Hurricanes Frances and Jeanne? (Response Breakdown)

Table 5.11 provides the number of responses per ranking for question eight of the survey. The table represents 100% of the total responses and indicates that the majority of Island Administrators perceived the national response to Hurricanes Frances and Jeanne to have a very good success rate. Seventy-five percent (75%) of the respondents identified the national response to Hurricanes Frances and Jeanne to be very to fully successful.

As displayed in Table 5.12, the means score provided by the Family Island Administrators was 4.05 with a standard deviation of .604. The success of the national response was perceived to be very successful. The standard deviation again shows strong agreement among the island administrators.

Q9 - How would you rate the success of the National Governments Response to Hurricane Wilma?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Wilma 2005	20	3.00	5.00	4.0500	4.0000	4.00	0.60481
Valid N	20						

Table 5.12 – Survey Question Nine, How would you rate the National Governments Response to Hurricane Wilma? (Descriptive Statistics)

Table 5.13 provides the number of responses per ranking for question nine of the survey. The table represents 100% of the total responses and indicates that the majority of Island Administrators perceived the national response to Hurricanes Wilma to have a very good success rate. Eighty-five percent (85%) of the respondents identified the national response to Hurricane Wilma to be very to fully successful. Displayed is a perceived improvement in the national governments response to Hurricane Wilma when compared to Andrew and Floyd. What is not clearly revealed with this data is if the perceived improvements in the national response are due to the implementation of CEM or experience.

Q9- How would you rate the success of the National Governments Response to Hurricane Wilma?					
	Not Successful (1)	Week Success (2)	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Number of Respondents	0	0	3	13	4
Percentage	0%	0%	15%	65%	20%

Table 5.13 – Survey Question Nine, How would you rate the success of the National Governments Response to Hurricane Wilma? (Response Breakdown)

5.2.4 Experience and Challenges Associated with Effective Emergency Response

Table 5.14 displays the results of survey question ten, which asked the Island Administrators' if they were aware that The Bahamas has been working since 2002 to develop a CEM structure in an effort to coordinate disaster planning and response activities. An awareness of CEM and the national efforts exists among island administrators with 60% reporting yes.

Q10 – Were you aware that The Bahamas has been working since 2002 to develop a CEM structure in an effort to coordinate disaster planning and response activities?								
	Yes		No		No Response		Total	
	#	%	#	%	#	%	#	%
Were you aware that The Bahamas has been working since 2002 to develop a CEM structure?	12	60%	8	40%	0	0%	20	100%

Table 5.14 – Survey Question Ten, Were you aware that The Bahamas has been working since 2002 to develop a CEM structure in an effort to coordinate disaster planning and response activities?

Survey question eleven asked Family Island Administrators to identify what they saw as the biggest challenge to disaster preparedness and response on their respective islands. As outlined below, there were a variety of different challenges identified by each administrator.

Q11: What do you see as the biggest challenge to disaster preparedness and response on your island?

- “Hurricane Shelters”
- “Finances and Informing the Public; Emergency Communications; Management of Personnel and Equipment.”
- “Geographical layout. Communication in and between local government, districts and their cays.”
- “Evacuation efforts. People taking the hurricane seriously and also them listening to the warnings and orders from officials and responding to them appropriately.”
- “Geography”
- “Lack of interest. Where interest exists, it is personal & Selfish.”
- “The harmonizing of the various administrative districts. Response plans in the absence of a line of authority among the

administrators, and an approved NEMA representative on the island.”

- “Shelters”
- “(1) Establishing good communication (inter-island & international). (2) Shelter management & support personnel. (3) Identifying adequate shelters. (4) Maintaining inventory of emergency supplies. (5) Establishing a budget for NEMA’s operations on the islands.
- “The potential for a major hurricane to hit New Providence.”
- “Better cooperation by The Public”
- “Suitable Shelters and Supplies.”
- “To have in place up to date worth while hurricane shelters with good communication and other supplies in place.”
- “Lack of training”
- “Insufficient hurricane shelters and the need for more training in disaster preparedness management.”
- “Lack of funding to prepared for and in the aftermath of disaster mobilization of human and technical resources.”
- “Geography of The Bahamas”

Family Island Administrators were asked in survey question twelve to identify what they saw as the biggest challenge to disaster preparedness and response for The Commonwealth of The Bahamas.

Q 12 – What do you see as the biggest challenge to disaster preparedness and response for The Bahamas

- “Geographical layout”
- “To much red tape and not enough action. People not realizing the dangers of a hurricane and not knowing how serious this matter is.”
- “The scattered nature of the geography of The Bahamas makes it difficult to mobilize resources and the urgency in Eleuthera the lack of one central hurricane stretches limited and [illegible] resources.”
- “The absence of an appointed NEMA representative on multi-administrative districts causes coordination problems because each administrator is responsible.”

- “Distribution of Resources, Planning & co-ordinating community preparedness efforts, communications.”
- “Developing and maintaining a satisfactory communication network for all Islands and inhabited cays.”
- “Hurricane Shelters and Communication.”
- “Geographical make-up of the country and scarce resources”
- “Finances & manpower, emergency communication, and medical personnel and equipment.”
- “The biggest challenge as it relates to disaster preparedness and response would be inadequate hurricane shelters, and persons who are reluctant to evacuate when asked to do so. Proper vehicles to be used in severe cases of flooding and voluntary manpower.”
- “Training & educating the general public. Institutionalizing a national awareness campaign.”
- “Providing suitable shelters and equipment.”
- “Better cooperation by the public.”
- “If New Providence is hit by a hurricane”

Survey question thirteen asked Family Island Administrators to identify ways national disaster preparedness and response can be improved. Continued coordination between the islands and NEMA is a main theme throughout. Also identified was the strengthening of institutional resources to ensure emergency needs are effectively met. This question identifies support for government action as well as pinpoints areas for enhancement that the Island Administrators feel will improve response within the nation.

Q13: How do you think national disaster preparedness and response can be improved?

- “By visiting each island and having neighboring islands equipped rather than waiting on New Providence (e.g. Southern Islands).”
- “Cutting through the red tape and responding to the peoples needs as soon as possible.”

- “See #12” [“Training & Education General Public. Instituting a national awareness campaign.”]
- “By supplying No 12” [“Providing suitable shelters and equipment”]
- “By better equipping family islands.”
- “National disaster preparedness response can be improved by frequently upgrading the level of training in New Providence and specifically the family islands.”
- “Government should provide more funds and employ more persons to be trained and work full time with that particular area.”
- “More input and pooling of resources from private sector.”
- “Put proper shelters in place, upgrade the telecommunication system, train personnel that are serious about disaster.”
- “It can be improved by utilizing the Defence Force rather than volunteer personnel for disaster preparedness in most areas volunteers exist only on paper in event of crises attendance of volunteers is not guaranteed.”
- “The National Disaster Team needs to visit each district for on-the-ground evaluation and training.”

Table 5.15 below displays the results for survey question fourteen. Island Administrators were asked if they thought that the passage of the National Disaster Preparedness and Response Act would improve disaster response within The Bahamas. (Why or why not) As the results show 100% of the Island Administrators believe that the legislation will improve disaster response. This is an overwhelming response that indicates there is awareness among the respondents that the government needs the legal authority to act in response to a national disaster.

Q14 – Do you think the passage of the National Disaster Preparedness and Response Act will improve disaster response within The Bahamas?								
	Yes		No		No Response		Total	
	#	%	#	%	#	%	#	%
Do you think the passage of the National Disaster Preparedness and Response Act will improve disaster response within The Bahamas?	20	100%	0	0%	0	0%	20	100%

Table 5.15 – Survey Question Fourteen, Do you think the passage of the National Disaster Preparedness and Response Act will improve disaster response within The Bahamas?

Respondents were also asked to provide additional information on why they felt the legislation would improve disaster response within The Bahamas. The majority of island administrators identified the legislation as providing the legal authority for the government to act.

Q.14a: Do you think the passage of the National Disaster Preparedness and Response Act will improve disaster response within The Bahamas? Why or Why not.

- “Because it establishes the scope of authority for the government and its representatives.”
- “Yes, however an act in and of itself will not improve or mitigate disasters - implementation does which includes resources.”
- “Because more persons would be educated to act in case of emergency or disaster, because of the training received.”
- “Equipment will be available.”
- “Efforts will be more co-ordinated within a legal framework.”
- “Bring about greater awareness of rules and responsibilities to all stakeholders and the general community.”

- “It will allow authorities to make mandatory evacuations thus saving the lives of some people who did not want to leave their houses.”
- “Provides a legal framework”
- “To a certain extent. There is not sufficient teeth in the act.”
- “Provided it is presented and discussed in an island to island campaign.”
- “Yes, because people tend to obey the laws.”
- “It would be officially law and we would have to place more focus and attention towards this situation.”
- “Once the policies and procedures are implemented there should be an improvement.”
- “Because all the right agencies will be involved.”
- “Everyone would know their roles. Funding and equipment will be made available.”

Survey question fifteen asked Family Island Administrators what they thought other island nations in the Caribbean could learn from The Bahamas with regards to disaster preparedness and response. A theme of coordination and self-reliance comes through in the comments provided.

Q15 - What do you think other island nations in the Caribbean can learn from The Bahamas with regards to disaster preparedness and response.

- “That we have a dynamic plan that is consultive based with local residents and districts.”
- “Multi-island strategies.”
- “Making all houses strong enough to withstand hurricane force winds.”
- “Excellent weather and communication reporting via ZNS network. ZNS and the met department are models for the region.”
- “How to effectively coordinate mitigation measures, from many areas.”
- “Multi-island planning strategies, communications & transportation strategies.”

- “Not to depend on churches and lodges for hurricane shelters.”
- “Do not procrastinate or react, be proactive.”
- “That in order for it to be a success, we must all join together and help our neighbors.”
- “By educating the public to act quickly in case of disaster.”
- “A coordinated effort to meet and share ideas.”
- “That good management can result in minimum property damage and loss of lives.”
- “Good planning can reduce losses.”
- “The Bahamas ability to garner international support and to guide and direct its people during the disaster and respond quickly to their needs after the disaster.”

Respondents were also provided with the opportunity to offer any general comments related to emergency management within the Bahamas. The responses provided as well as the answers to questions 10-15 illustrate understanding among the Family Island Administrators of the importance of disaster planning and coordination as a means for improving disaster response and reducing losses.

Family Island Administrators General Comments

- “The concept of Hurricane Preparedness must be taken seriously and the after actions must be declassified out of Nassau thus bringing the administrators more authority and flexibility to act speedily when required.”
- “More attention should be given before a disaster strikes. Teams should be sent to each island to verify if the island was prepared for the pending disaster.”
- “Arrangements for travel to affected Islands need to be coordinated - i.e. - separate flights for politicians and assessment teams.”
- “Funding ought to be provided in an effort to be properly prepared.”

- “NEMA is doing an excellent job in helping to educate Bahamians and the persons living in this country about the importance of disaster preparedness and how to deal with National disasters.”
- “More resources needed to put theory into practice.”
- “Disaster preparedness should be an on going process.”
- “NEMA is to be congratulated for its proactive approach to mitigate disasters, however, visits to every family island is encouraged. The technical and human resources of Mr. Luke Bethel is user friendly.”
- “Disaster Preparedness requires resource to plan properly. A designated head & item amount should be budgeted to assist with Disaster Preparations. At the end of the Season, if funds are not utilized they could be diverted to other national events, e.g. Independence, etc. Proper coastal mapping for potential flooding areas are essential. Islands in the Southern & Central Bahamas needs to be given more attention for Disaster Training. A co-ordinated effort is needed to construct at least one multi-purpose building in each District that can be used as a Shelter and as a Youth Development Center.”
- “Generally pleased with efforts of NEMA. Keep up the good work.”
- “The appointment of a NEMA representative and the establishment of a clear line of authority island wide among the administrators.”

Eleven (11) of the 20 Island Administrators chose to provide general comments. A clear desire for better communication, planning and coordination to ensure that they [Island Administrators] are an active part of emergency management was expressed. Increases in available funding and improvements in asset coordination were also articulated. NEMA was given praise for its proactive approach to emergency management within the nation. It is through the implementation of a CEM system that NEMA was established and the Island Administrators took an active role in the emergency management process. As stated in the

literature (Quarantelli, 1997a, FEMA 2003a) coordination and planning prior to a disaster helps to facilitate more effective emergency response.

The structured survey concluded by obtaining data on experience by asking respondents the number of years they had served as an Island Administrator. Table 5.16 shows the average years served was 9.45 years with a standard deviation of 8.1. This identifies variability in experience levels of the island administrators. It is this difference in experience and years in office that may account for differences in responses. Despite the fact that some Island Administrators may not have been in office at the time of each response operations, they were all impacted by the study hurricanes.

Q - How many years have you served as an Island Administrator?					
	N	Minimum	Maximum	Mean	Std. Deviation
Years Served	20	1	33	9.45	8.121
Valid N (listwise)	20				

Table 5.16 – Number of years served as an Island Administrator.

To examine more closely the relationship between years of experience and hurricane response rankings Figures 5.1 – 5.4 illustrate the value response of Island Administrators by number of years served. Figure 5.1 shows that Island Administrators who have served 5-8 years rated response to Hurricane Andrew ('92) lower than Administrators who served less than 5 years or more than 8 years. A very similar result is also noted in Figure 5.2 in response to Hurricane Floyd ('99).

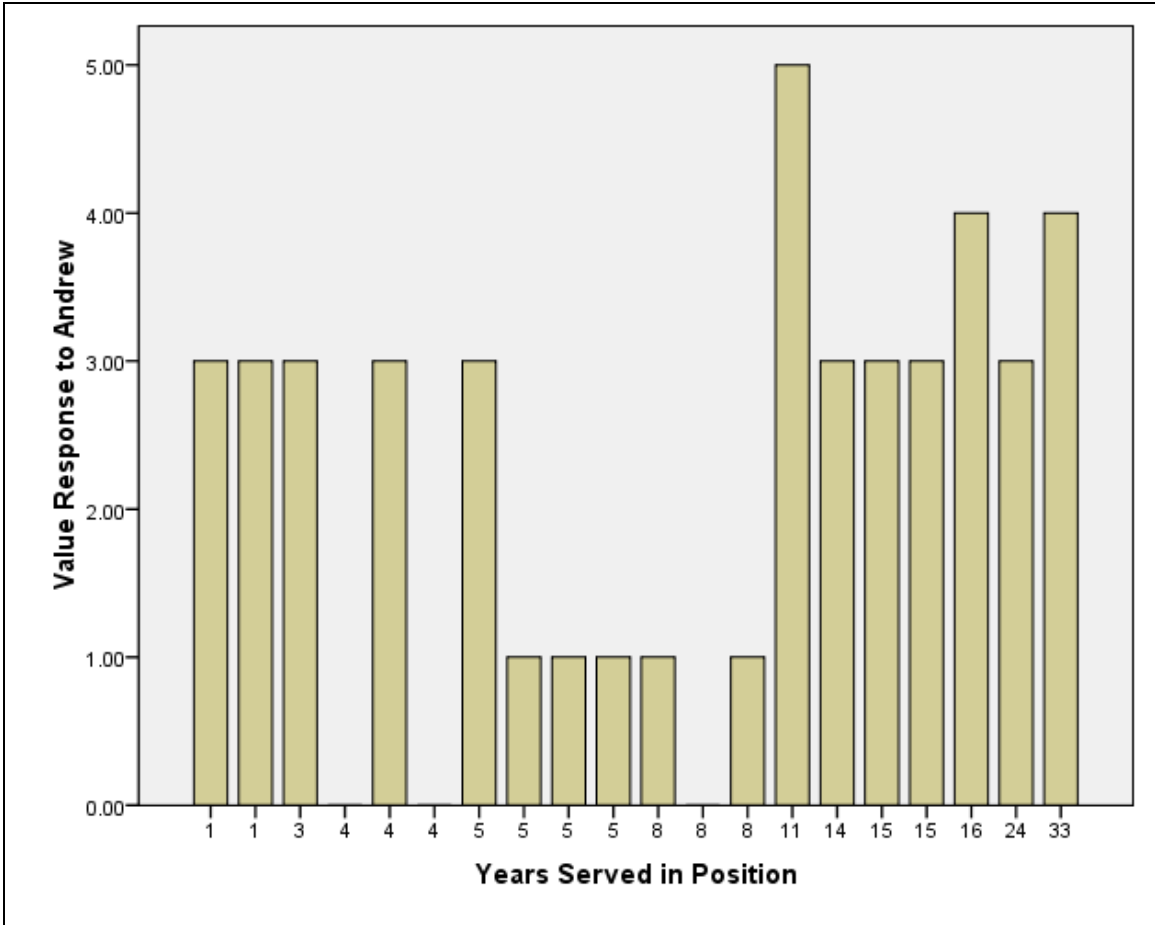


Figure 5.1 – Hurricane Andrew Value Response of Island Administrators by Number of Years Served.

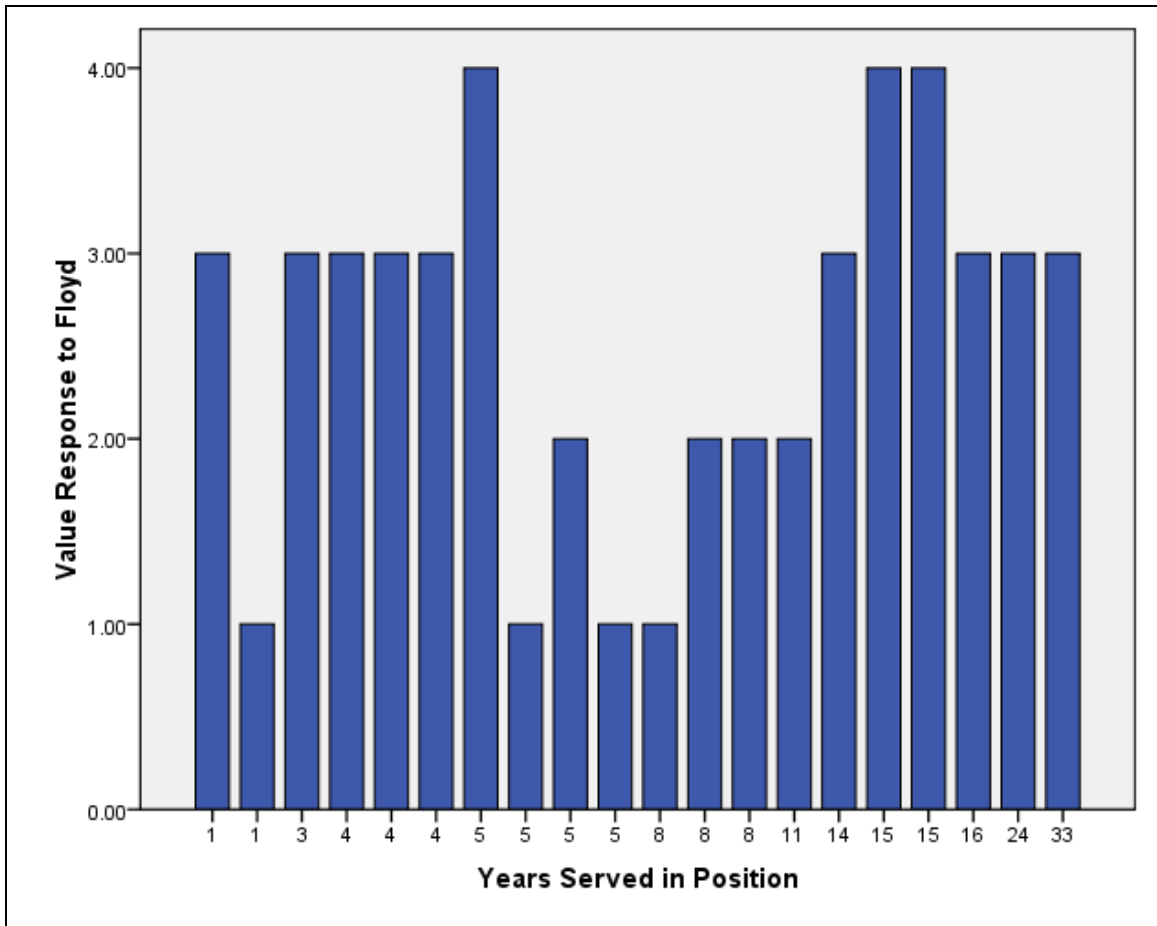


Figure 5.2 – Hurricane Floyd Value Response of Island Administrators by Number of Years Served.

Figures 5.3 and 5.4 show little difference in response rating to Hurricanes Frances, Jeanne and Wilma with regards to numbers of years served. An overall improvement in the administrators perception of response is noted.

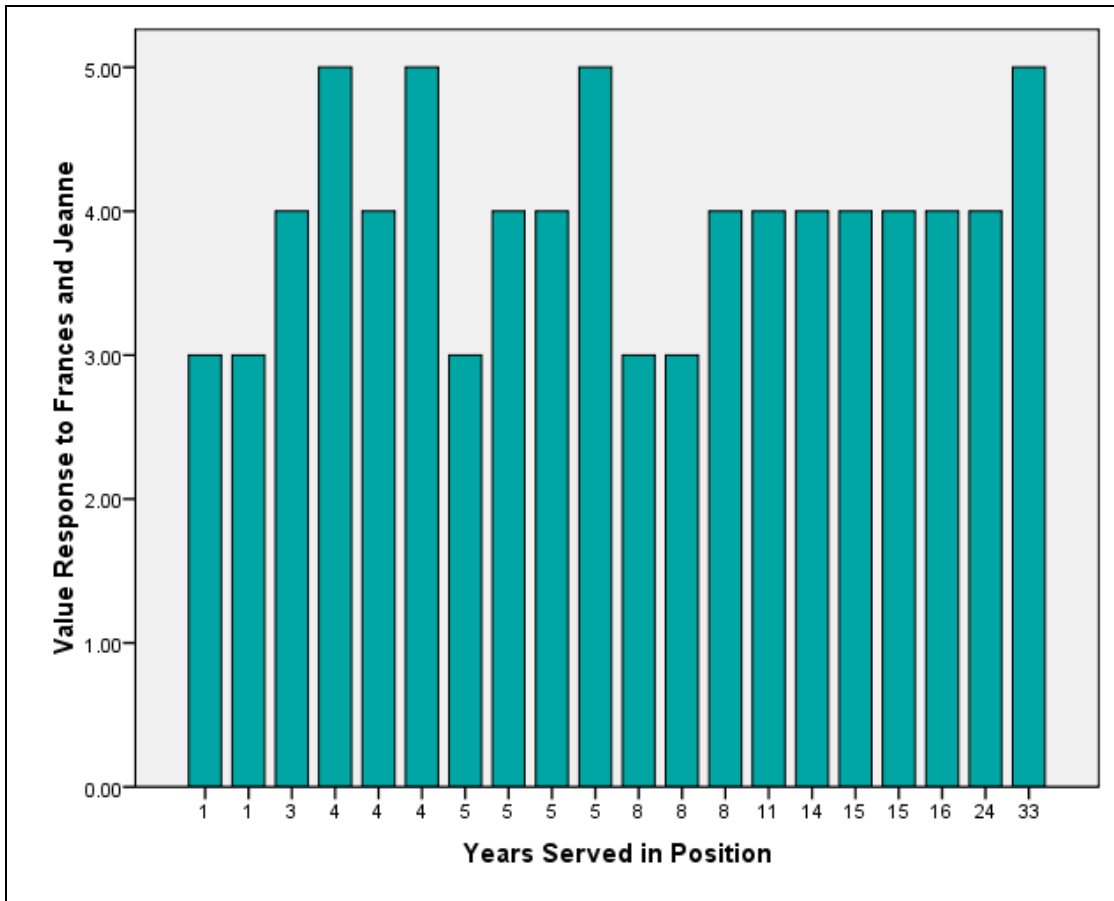


Figure 5.4 – Hurricane Frances and Jeanne Value Response of Island Administrators by Number of Years Served.

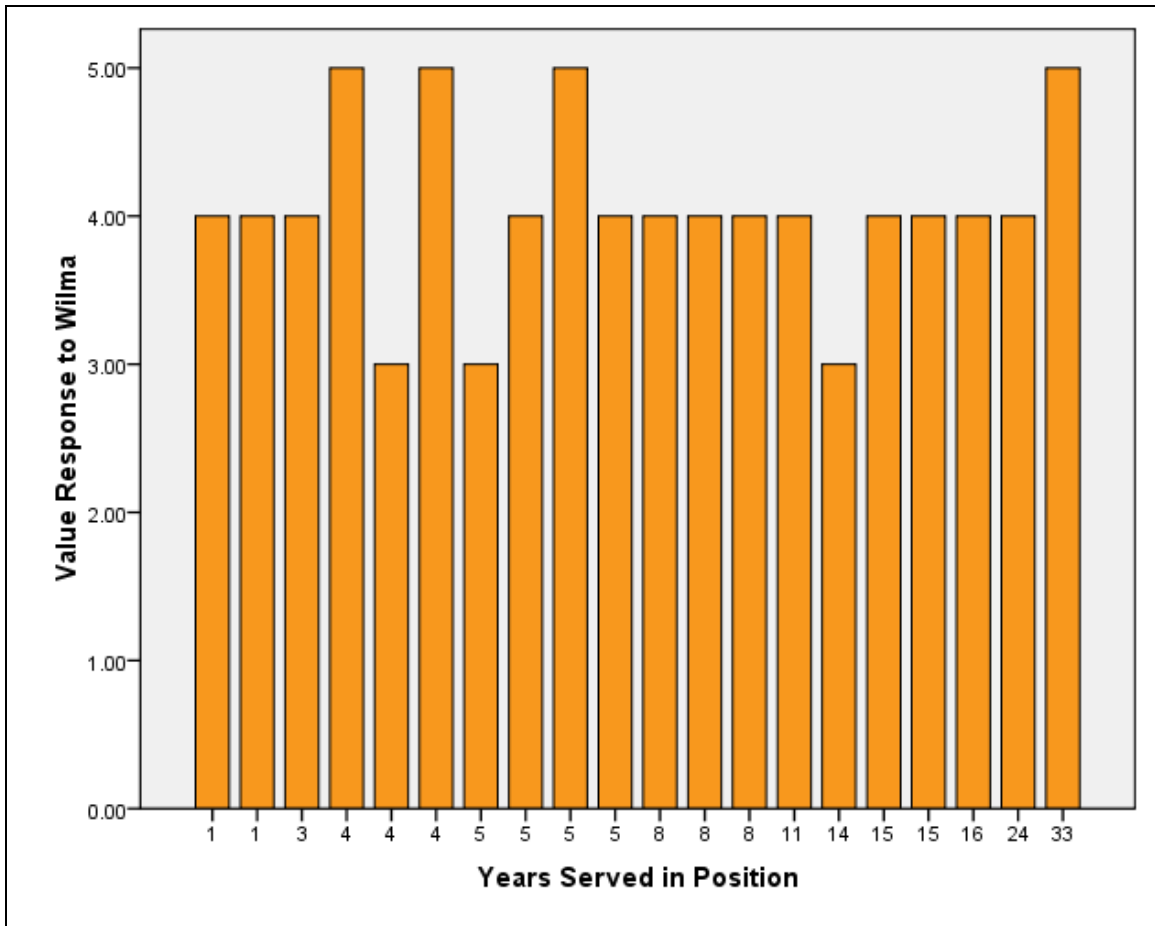


Figure 5.4 – Hurricane Wilma Value Response of Island Administrators by Number of Years Served.

5.2.5 Summary: Survey Results

The structured surveys were distributed to the Family Island Administrators to gauge their perception of emergency management at the national level. The survey was divided into three sections: Planning and Information, Response Operations, and Experience and Challenges. The data revealed the following key findings:

- Sixty percent (60%) of the Island Administrators reported that their respective jurisdiction had not received disaster management training from NEMA.

- Seventy-five percent (75%) of Island Administrators reported that they or a representative had attended a NEMA conference.
- Just over half (55% or 11 respondents) reported that their island had a disaster plan in place that had been reviewed within the last two years.

This data reveal that although NEMA has been working to provide training throughout the nation a more targeted approach needs to take place. Having 40% of your island administrators without proper training and 45% without an updated emergency response plan is cause for concern. If these issues are not addressed effective emergency response will be difficult to achieve.

The structured surveys were also intended to provide data to determine if the CEM system improved disaster response. Based on the data displayed in Tables 5.17 and 5.18 it is apparent that improved ratings exist for response operations to post-CEM events. The data indicate a noticeable jump in the mean between Hurricane Floyd (1999) and Hurricanes Frances and Jeanne (2004). Keeping in mind that the CEM system was first implemented in 2002, can the improved rating be attributed to CEM? The answer is no. Although the Island Administrators rated the post-CEM response operations higher than the pre-CEM response, experience can not be ruled out as the trigger for the improved score. It is hypothesized, based on the literature (Quarantelli, 1997a; FEMA 2003a; and Hughey 2003) that the improvement in the mean score is a combination of the implementation of CEM and experience. This question is further examined in section 5.3 as well as Chapter 6 of this dissertation.

	Hurricane	Island Administrators Mean Ranking
Pre-CEM	Andrew	2.25
	Floyd	2.55
	Michelle	---
Post-CEM	Frances & Jeanne	3.95
	Wilma	4.05

Table 5.17 – Summary Table, the success of the National Governments Response to the study hurricanes as determined by the Island Administrators rankings.

Summary Table: Survey Questions 6-9,					
	Not Successful (1)	Week Success (2)	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Andrew 1992	25%	0%	45%	10%	5%
Floyd 1999	20%	20%	45%	15%	0%
Frances & Jeanne 2004	0%	0%	25%	55%	20%
Wilma 2005	0%	0%	15%	65%	20%

Table 5.18 – Summary Table: Survey Questions 6-9. The table represents the percent of Island Administrators that rated each storm by category. (Response Breakdown)

5.3 Semi-Structured Interviews

Semi-structured interviews were conducted with all staff members of The Bahamas National Emergency Management Agency (NEMA). This semi-structured approach to interviewing allowed flexibility in questioning and facilitated the gathering of information that may not have come through in a more

controlled survey or interview. Interview results are provided below in section 5.3.1, as well as applied to section 5.4 of this document, 'Evaluating the Management of Disaster Response to the Six Study Hurricanes'.

All NEMA staff members were active participants in the national response to Hurricanes Frances (2004), Jeanne (2004), and Wilma (2005). Since the development of NEMA is a direct result of the implementation of a CEM system not all staff members actively participated in a formal capacity to the national response to Hurricanes Andrew (1992), Floyd (1999), and Michelle (2001). All interviewees however were directly or indirectly impacted by all six hurricanes and were well versed on strategies and techniques utilized by the national government prior to 2002.

5.3.1 Semi-Structure Interview Results

During my interviews NEMA staff was asked to evaluate the response efforts of each of the six study hurricanes. Hurricanes Frances and Jeanne were grouped together because the two storms occurred within three weeks of one another. Difficulty separating the two response operations required that they be evaluated as one event. A scale of 1-5 was utilized for this research, 1 being not successful and 5 being fully successful. A half ($\frac{1}{2}$) point scale was not provided as an option to interviewees yet some of the respondents independently chose to select a rating that utilized the scale. This was an independent decision of the part of the participants and is noted in the evaluation tables below.

- 1 represented not successful,
- 2 represented weak success,

- 3 represented good success,
- 4 represented very good success
- 5 represented fully successful.

Because the study population is so small (6 NEMA Staff Members) it is important for this research to examine the number of respondents in each category as well as the mean rating. By utilizing the mean, a rating for each response was established allowing for comparative evaluation.

As shown in Table 5.19, staff members were asked to rate the success of the national governments response to Hurricane Andrew. The mean score for response to Hurricane Andrew was 2.58 with a standard deviation of 0.376. This shows strong agreement among NEMA staff members that the national response effort to Hurricane Andrew had weak to good success. Additionally, Table 5.20 displays the number and percentage of responses in each category. Fifty percent (50% or 3 respondents) rated the success of Hurricane Andrew at 2.5.

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Andrew?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Andrew 1992	6	2.0	3.0	2.5833	2.500	2.5	0.37639
Valid N	6						

Table 5.19 – NEMA Representatives, How would you rate the National Governments Response to Hurricane Andrew? (Descriptive Statistics)

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Andrew?						
	Not Successful (1)	Week Success (2)	2.5	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Number of Respondents	0	1	3	2	0	0
Percentage	0%	16.6%	50%	33.3%	0%	0%

Table 5.20 – NEMA Interviews, How would you rate the National Governments Response to Hurricane Andrew? (Response Breakdown)

NEMA staff was asked to score the success of the national response efforts to Hurricane Floyd. Table 5.21 shows a slight improvement over the response to Andrew with a mean score of 2.83 and a standard deviation of 0.258. The extremely low standard deviation indicates strong agreement among NEMA staff that the national response effort to Hurricane Floyd had weak to good success. Table 5.22 shows 66.6% (or 4 respondents) believe the national governments response to Hurricane Floyd had good success.

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Floyd?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Floyd 1999	6	2.5	3.0	2.8333	3.0000	3.0	0.25820
Valid N	6						

Table 5.21 – NEMA Interviews, How would you rate the success of the national governments response to Hurricane Floyd? (Descriptive Statistics)

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Floyd?						
	Not Successful (1)	Week Success (2)	2.5	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Number of Respondents	0	0	2	4	0	0
Percentage	0%	0%	33.3%	66.6%	0%	0%

Table 5.22 – NEMA Interviews, How would you rate the success of the national governments response to Hurricane Floyd? (Response Breakdown)

Hurricane Michelle was the last storm to impact the nation in the pre-CEM phase. Respondents' were asked to rate the success of the national governments response to Hurricane Michelle. It is important to note that Michelle was the only study hurricane to make landfall on the Island of New Providence and the capital city of Nassau. Table 5.23 shows the mean rating at 2.66 with a standard deviation of 0.408. The mean is lower than that of Hurricane Floyd and also showed slightly less agreement among respondents with an increase in the standard deviation. The lower mean score could be attributed to the impact Michelle had on the national government. As discussed in Appendix B Hurricane Michelle prevented the daily functioning of government business. Banks and national government offices remained closed days after landfall bringing the nation to a halt. The impact of Michelle on the national government caused delays in emergency services and may have contributed to respondents' lower rating. Table 5.24 indicates that 50% of respondents' rated the national response to be good. However due to the small number of respondents' this can be misleading and should be cautiously applied.

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Michelle?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Michelle 2001	6	2.0	3.0	2.66	2.7500	3.0	0.40825
Valid N	6						

Table 5.23 – NEMA Interviews, How would you rate the success of the national governments response to Hurricane Michelle? (Descriptive Statistics)

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Michelle?						
	Not Successful (1)	Week Success (2)	2.5	Good Success (3)	Very Good Success (4)	Fully Successful (5)
Number of Respondents	0	1	2	3	0	0
Percentage	0%	16.6%	33.6%	50%	0%	0%

Table 5.24 – NEMA Interviews, How would you rate the success of the national governments response to Hurricane Michelle? (Response Breakdown)

The year 2002 marked the birth of CEM in The Bahamas and the early establishment of NEMA. Hurricanes Frances and Jeanne were the first response operations coordinated under the CEM system and occurred within three weeks of one another in the fall of 2004. Respondents were asked to score the success of the national response on the 1 to 5 scale. Table 5.25 displays a marked improvement over previous response operations with a mean score of 3.5 and a standard deviation of 0.447. NEMA staff rated the national response to have had good to very good success. Table 5.26 shows that responses were evenly distributed between the following ratings: (3) good success, (3.5) good to very

good success, and (4) very good success. The improvement in the mean score suggests that the national response to Hurricanes Frances and Jeanne were managed better than those that were previously evaluated. However, what is not clear is if the perceived improvement is due to CEM, personal involvement, or perhaps experience.

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Frances & Jeanne?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Frances & Jeanne 2004	6	3.0	4.0	3.500	3.500	3.5	0.44721
Valid N	6						

Table 5.25 – NEMA Representatives, How would you rate the success of the national governments response to Hurricanes Frances and Jeanne? (Descriptive Statistics)

NEMA Interviews: How would you rate the success of the national governments response to Hurricanes Frances & Jeanne?						
	Not Successful (1)	Week Success (2)	Good Success (3)	3.5	Very Good Success (4)	Fully Successful (5)
Number of Respondents	0	0	2	2	2	0
Percentage	0%	0%	33.3%	33.3%	33.3%	0%

Table 5.26 – NEMA Interviews, How would you rate the success of the national governments response to Hurricanes Frances and Jeanne? (Response Breakdown)

Hurricane Wilma, the final study hurricane, occurred in the fall of 2005, a year following Frances and Jeanne. As shown in Table 5.27, respondents again scored the national response high with a mean score of 3.66 and a standard deviation of 0.408. Responses were again tightly grouped with 3 of the six

respondents indicating that the national response to Hurricane Wilma was very successful. (Table 5.28) Although there continues to be an improved mean rating of the national response, it can not be determined with current data if the improvement in is due to the implementation of CEM, personal involvement, or perhaps experience.

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Wilma?							
	N	Min	Max	Mean	Median	Mode	Std. Deviation
Response to Hurricane Wilma 2005	6	3.0	4.0	3.66	3.7500	4.0	0.40825
Valid N	6						

Table 5.27 – NEMA Representatives, How would you rate the success of the national governments response to Hurricane Wilma? (Descriptive Statistics)

NEMA Interviews: How would you rate the success of the national governments response to Hurricane Wilma?						
	Not Successful (1)	Week Success (2)	Good Success (3)	3.5	Very Good Success (4)	Fully Successful (5)
Number of Respondents	0	0	1	2	3	0
Percentage	0%	0%	16.6%	33.3%	50%	0%

Table 5.28 – NEMA Interviews, How would you rate the success of the national governments response to Hurricane Wilma? (Response Breakdown)

How would you rate the national governments response to the following study hurricanes?					
	Andrew	Floyd	Michelle	Frances & Jeanne	Wilma
Mean score	2.58	2.83	2.66	3.5	3.66
Valid N	6	6	6	6	6

Table 5.29 – NEMA Representatives, How would you rate the National Governments Response to Hurricane Wilma? (Mean)

In addition to interviewing NEMA respondents about the effectiveness of response operations to the six study hurricanes, they were also asked to identify the biggest challenges to response within The Bahamas and their opinions on what needed to be done to ensure successful response and recovery in the future. Outlined below are the biggest challenges to emergency response, as identified by respondents.

NEMA Interviews: What do you see as the biggest challenges to successful emergency response?

- “Logistics! As well as accountability through documentation, there needs to be accurate relaying of information to confirm the movement of assets.”
- “Coordination between NEMA and the island sub-NEMAs.”
- “Coordination between all the ministries. Holding of information can not occur, successful emergency management requires information is coordinated through NEMA to ensure proper decision making.”
- “Training and communication at all levels.”
- “Lack of funding for critical assets.”
- “Training! Not everyone on the Family Islands has received emergency management training.”

Training and coordination are two issues that were recognized as challenges to effective emergency response by the NEMA staff; these two key items were also identified by the Family Island Administrators.

NEMA staff members were asked to identify what needed to be accomplished to ensure successful response and recovery in the future. The responses are outlined below; training and coordination were identified as key issues.

NEMA Interviews: What needs to be done to ensure successful response and recovery to future disasters?

- “Coordination from NEMA with the island sub-NEMAs is required. Inter-Island coordination is needed and we are going to be establishing sub-NEMA’s throughout the Family Islands. Since 2003 we have had the Family Island Administrators working as the NEMA representatives. We hope to be able to have a full-time NEMA representative that works as the disaster coordinator on the islands.”
- “National EOC. With the construction of the new EOC we will be better equipped to manage response operations.”
- “All information needs to come through the central NEMA office.”
- “Training! Training! Training! All ministries should be well trained in emergency management procedures. Through our annual Emergency Management conference we are providing training to Family Island Representatives. We have also been able to provide CERT and shelter training on many of the family islands.”
- “NEMA needs to be able to better coordinate the ESFs and more people need to become involved in the emergency management process.”
- “Funding for emergency management within the Bahamas needs to be addressed. Limited assets and resources make it difficult to meet needs.”

5.3.2 Summary: Semi-Structured Interview Results

The semi-structured interviews were conducted with NEMA staff to gauge their perception of emergency management and response at the national level. The interviews as detailed in Chapter 3 of this dissertation, took place on several occasions. The data discussed in this section focused on the response to the six study hurricanes and intended to provide data to determine if the CEM system improved disaster response.

Table 5.29 provides a summary of mean scores for the study hurricanes and Table 5.30 provides a summary of the percentage of NEMA staff that rated each storm by category. An increase in mean score is evident between the pre-CEM and post-CEM response. However, there are not enough data to support CEM being the impetus for the improvement in response. Although the data indicates a noticeable jump in the mean rating between Hurricane Michelle (2001) and Hurricanes Frances and Jeanne (2004) suggesting that post-CEM response operations were handled more successfully than those that occurred pre-CEM experience can not be ruled out as a contributing factor.

	Hurricane	NEMA Staff Mean Ranking
Pre-CEM	Andrew	2.58
	Floyd	2.83
	Michelle	2.66
Post-CEM	Frances & Jeanne	3.5
	Wilma	3.66

Table 5.30 – Summary Table, the success of the national governments response to the study hurricanes as determined by the NEMA staff rankings.

Summary Table: The Percent of NEMA staff that rated each storm by category.							
	Not Successful (1)	Week Success (2)	2.5	Good Success (3)	3.5	Very Good Success (4)	Fully Successful (5)
Andrew 1992	0%	16.6%	50%	33.3%	0%	0%	0%
Floyd 1999	0%	0%	33.3%	66.6%	0%	0%	0%
Michelle 2001	0%	16.6%	33.6%	50%	0%	0%	0%
Frances & Jeanne 2004	0%	0%	0%	33.3%	33.3%	33.3%	0%
Wilma 2005	0%	0%	0%	16.6%	33.3%	50%	0%

Table 5.31 – Summary Table: The percent of NEMA staff that rated each storm by category.

5.4 Summary: Survey & Interview Results

The data in this chapter were formulated to determine if the respondents perceived an improvement in response as a result of the implementation of a CEM system. The structured surveys identified that although the Island Administrators rated the post-CEM response operations higher than the pre-CEM response, experience cannot be ruled out as the trigger for the improved score. The semi-structured interviews with NEMA staff members also examined response to the six study hurricanes. As with the survey results, NEMA staff rated the post-CEM response operations higher. Table 5.31 provides a comparison between the success ratings provided by the Island Administrators and NEMA Staff. An increase in the mean is evident throughout with the exception of Michelle. However, a larger increase in the mean is noted after the implementation of CEM. Despite this, there are still not enough data to support CEM as the impetus for the improvement in response. Experience could not be ruled out as a variable responsible for the improvement in national response. It

is hypothesized, based on the literature (Quarantelli, 1997a; FEMA 2003a; and Hughey 2003) that the improvement in the mean score is a combination of the implementation of CEM and experience.

	Hurricane	Island Administrators	NEMA
Pre-CEM	Andrew	2.27	2.58
	Floyd	2.44	2.83
	Michelle	---	2.66
Post-CEM	Frances & Jeanne	3.66	3.5
	Wilma	4.05	3.66

Table 5.32 – Summary Table: The success of the national governments response to six study hurricanes as determined by the structured surveys and semi-structured interviews. (Mean Rating)

Additionally provided in this chapter is an understanding of the status of the CEM program as it relates to disaster training and planning. According to the structured surveys with the Island Administrators, since the implementation of the CEM system, 60% reported that their respective jurisdiction had not received disaster management training from NEMA. Furthermore, 45% of the Island Administrators reported that their island did not have a disaster plan in place that had been reviewed within the last two years. An outdated or non-existent response plan, combined with a lack of training indicates that there are gaps within the emergency management structure that need to be addressed.

The interview with Prime Minister Perry G. Christie demonstrated awareness by the national government to the importance of a well structured emergency management system. A strong commitment to improving emergency response within the nation and protect and maintain the economic, political and social structure was evident. Through financial and legislative measures the national government has established a strong position in support of a well coordinated national emergency management structure.

The scoring of each of the six national response operations provides us with an understanding of NEMA's perception as compared those of the Family Island Administrators. Data discussed in this chapter helped to identify areas where new initiatives should be developed in an effort to better prepare for and respond to disasters. Additionally, the data provide the necessary foundation and direction for further analysis as this longitudinal research moves forward. Although the improvement in response could not be directly tied to CEM the data provides a baseline for continued examination.

Chapter Six:

Results: Application of the Theoretical Model

6.1 Introduction

This chapter addresses the application of the theoretical model discussed in chapter three of this dissertation and depicted below in Figure 6.1. The model was applied in two phases, (1) the pre-CEM phase, which provides the contextual framework necessary to understand Hurricanes Andrew, Floyd, and Michelle, and (2) the post-CEM phase, that frames Hurricanes Frances, Jeanne, and Wilma. By exploring emergency response in these two periods, it allows for the exploration of the wider political, economic and cultural forces affecting response to the six study hurricanes. Application of this model places each response operations into the larger comprehensive setting and provided a more complete understanding of the mechanisms that improved or hindered response.

6.2 Pre-CEM Model Application

The Model of Community Response to Disasters was applied to the pre-CEM period of this research. A review of each of the key components as outlined below is discussed in detail.

- Good leadership by professionally trained officials
- A foundation of supportive values for government action
- Legal authority to act
- An advocacy supporting action
- Necessary institutional resources

6.2.1 Good Leadership by Professionally Trained Officials

The keystone to the theoretical model as illustrated in Figure 6.1 is 'good leadership by professionally trained officials'. During the Pre-CEM phase, leadership and direction came from the Royal Bahamas Defence Force (RBDF) (Office of The Prime Minister, 1992; Ingraham, 1999). The command and control response style provided by the RBDF was efficient at executing military type tasks but lacked the ability to manage emergency response that required civil-military coordination. Additionally problematic was the lack of training received by RBDF Personnel. No formal emergency management training program existed or was made available (Bethel, 2006).

A Foundation of Supportive Values for Government Action

A foundation of supportive values for local government action enables concepts to be developed into policies and provides government leaders the backing to spend monies in an effort to build resources (Wolensky and Wolensky, 1990). During the Pre-CEM period there was no foundation of support within The Bahamas to encourage or require the development of emergency response policy. The Bahamas, a small nation with a limited economic base, faced a variety of complex issues during this time. Despite the impacts of Hurricanes Andrew and Floyd, both category four storms, it took Hurricane Michelle impacting the nation's capital and interrupting government activity to spark support.

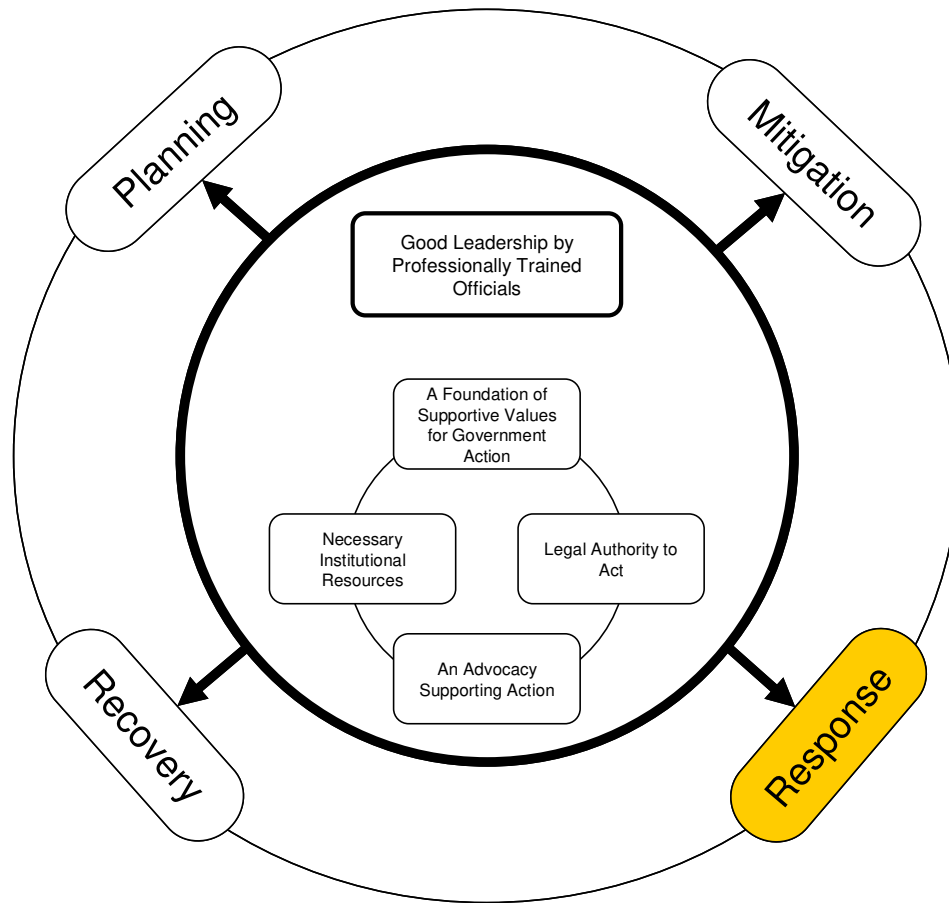


Figure 6.1 – Model of Community Response to Disasters (Source: Amended Hughey, 2003)

6.2.3 Legal Authority to Act

The legal framework within which disaster operations occur can have a significant impact on all four phases of disaster management. During the Pre-CEM phase there was no local or national emergency management policy in place. As a direct result of Hurricane Floyd, the Emergency Relief Guarantee Fund Act, 1999 (Act No. 44 of 1999) was enacted to address financial support for recovery.

Following Hurricane Floyd there was no formal way for the Government of The Bahamas to release funds to assist communities in the rebuilding process or to manage and distribute monetary relief aid received. Act No. 44 of 1999 established an Emergency Relief Guarantee Fund that allowed the Government to “guarantee loans for the relief of persons who have suffered hardship and loss as a result of a disaster and for purposes connected thereto” (Government of The Bahamas Act No. 44, 1999: Chapter 35).

Under this act, persons over the age of eighteen (18) were able to borrow funding to repair or replace occupied residential property, furnishings and appliances damaged or destroyed by the Hurricane or to replace or repair businesses damaged by it. This included rental accommodations, fishing boats, engines, farm buildings, farm equipment, citrus or fruit trees, vegetable crop, livestock, restaurant, processing plants and other commercial enterprises. All money provided to individuals through this act required that the money borrowed be repaid.

The Emergency Relief Guarantee Fund formally established a role for the Government of The Bahamas in disaster management. It also identified the Prime Minister as having the formal role of appointing The Minister responsible for disaster preparedness. Although the act placed the Government of The Bahamas in a reactive role and one of financial backer, the act triggered the development of a loosely coordinated group of representatives from various government ministries that slowly began the process of planning for hurricanes. This informal group was known as ‘The Bahamas National Disaster

Preparedness Committee'. Four years following the impact of Floyd, this group became a formalized committee under the coordination of the National Emergency Management Agency (NEMA) at the direction of Prime Minister Perry Christie.

6.2.4 An Advocacy Supporting Action

The backing of political leaders is not always enough to ensure that hazard polices come to fruition; strong community support is also required. Hazards research has shown (Quarantelli and Dynes, 1976) that following an event, community support for action is high. This was the case in The Bahamas following response to The Bay Street Fire (2001) and Hurricane Michelle (2001).

Despite clear problems with disaster response in 1970's, 1980's and 1990's an advocacy supporting action did not exist until a fire broke out in the port area of Nassau destroying two city blocks and adversely affected the tourism industry. The 'Bay Street Straw Market Fire' was not included in the research study because it only required the response of two national agencies and was confined to a very small area. However, the impact of the fire in combination with the shock of Hurricane Michelle triggered a national policy change and created the necessary advocacy seeking action.

The impact of these two events on the island of New Providence highlighted the critical need for a coordinated and centralized response. Strong citizen support was energized by the local media, which documented both disaster events, making sure to identify the negative impacts to the nation. It was

the support generated as a result that helped to push forward the implementation of a comprehensive emergency management structure within the nation. A strong advocacy seeking action did not exist following Andrew or Floyd. It was this lack of support that allowed previous attempts at hazard policies to fail.

Necessary Institutional Resources

When evaluating the institutional resources component of the Model of Community Response to Disaster (Figure 8.1) it is important to view this in two parts. First, does an accurate assessment of available resources exist within the Bahamas and second, are the necessary institutional resources accessible. During the pre-CEM phase response resources such as necessary communication equipment and supplies of fresh water existed within The Bahamas. However, the assets were distributed between a variety of different agencies and organizations. The lack of coordination during this time prevented the mobilization of available assets. It was this lack of coordination that led to decentralized responses during the pre-CEM phase resulting in unmet disaster needs.

Discussion of the Pre-CEM Application of the Model

The application of the model to the Pre-CEM phase of this research identifies gaps in emergency management capabilities. Lacking were good professionally trained officials, as RBDF were not trained emergency managers (Office of The Prime Minister, 1992). Not having the leadership and skills to effectively coordinate the necessary activities associated with a national disaster,

in combination with no legal authority to act, or advocacy seeking action may have contributed to the decentralized and ineffective emergency management structure identified with the application of Quarantelli's (1997a).

Post-CEM Model Application

For research and discussion purposes activities within The Bahamas have been delineated as pre- and post-CEM. However, in practice the line in the sand is not as clear. As discussed previously, it was the impact of the Bay Street Fire and Hurricane Michelle on the City of Nassau and the Island of New Providence that triggered hazard awareness and action among policy makers and residents. This change in attitude and development of support for action began in 2001 and is still working today in hopes of fully achieving a nationally coordinated emergency management structure.

6.3.1 Good Leadership by Professionally Trained Officials

Emergency management training for NEMA staff members and Government Ministries began in March 2002 with the introduction of three training courses: Emergency Management 101, Emergency Operations Center (EOC) Training, and Emergency Manager: An Orientation to The Position. These three courses, provided by the Global Center for Disaster Management and Humanitarian Action at the University of South Florida, provided the basics in CEM (Hughey, 2004a).

In combination with training NEMA staff, under the leadership of Carl F. Smith, began the process of developing a comprehensive emergency

management plan (CEMP) (Hughey, 2004a). As identified by Quarantelli (1998) the '*process*' of developing a national disaster plan is more important than the actual written document. The '*process*' is considered by many emergency management professionals as more important than the finished document because the process requires the coordination of information between many different ministries and organizations. It is through this process that personal and agency relationships are developed. It is believed that the interaction between ministries in a low stress environment allows for better coordination when a disaster does occur.

The CEMP utilized an Emergency Support Function (ESF) format. The ESF format details the missions, policies, structures, and responsibilities of each government ministry for coordinating resources and programmatic support to NEMA and Family Island Administrators during incidents of national significance. Furthermore, the ESF structure identified primary and support agencies clearly for each core function, preventing confusion over responsibilities during response and recovery. The Bahamas National CEMP has thirteen (13) ESF listed below in Table 6.1 (Hughey, 2004a).

ESF 1	Transportation
ESF 2	Communication
ESF 3	Public Works & Engineering
ESF 4	International Assistance
ESF 5	Planning and Information
ESF 6	Shelter Services
ESF 7	Relief Supplies & Distribution
ESF 8	Health & Medical Services
ESF 9a	Urban Search & Rescue
ESF 9b	Marine Search & Rescue
ESF 10a	Hazardous Material Land
ESF 10b	Hazardous Material Marine
ESF 11	Food
ESF 12	Tourism
ESF 13	Volunteers

Table 6.1 - Commonwealth of The Bahamas National Emergency Support Functions (Data Source: NEMA)

The implementation of national disaster management training and the writing of the CEMP provided a solid foundation on which to build a CEM system. These activities illustrate the leadership and training provided within the Bahamas during the post-CEM phase.

6.3.2 A Foundation of Supportive Values for Government Action

A foundation of supportive values for local government action enables concepts to be developed into policies and provides government leaders the backing to spend money in an effort to build resources. During this Post-CEM phase of the research a strong foundation of support exists within The Bahamas. For example despite a limited economic base, with strong support from residents, The Bahamas Government has matched a \$650,000 donation from the United

States Southern Command to build a new national EOC. To date the EOC has not been constructed but the money has been earmarked, architectural drawings have been developed and the land on which it is to be built has been acquired. The support from residents is high and the local media is hopeful that the EOC will be functioning before the next hurricane season.

Another example of the strong support that exists within the Bahamas are the numerous volunteer organizations, many of which are associated with local churches, that have become certified as ESF 13 support agencies. This active participation by residents in the emergency management process provides for a united and well coordinated environment.

6.3.3 Legal Authority to Act

The legal framework within which disaster operations occur can have a significant impact on all four phases of disaster management. During the Post-CEM phase and in response to the three study hurricanes examined no strong legal or regulatory framework existed. As discussed previously The Emergency Relief Guarantee Fund Act, 1999 (Act No. 44 of 1999) addressed issues associated with the availability of financial support for recovery activities. However, no policies were in place to address the management responsibilities associated with national disasters examined in this study.

Following the impact of Hurricane Wilma in 2005 legislation addressing emergency management within the nation was passed. The 'Act To Provide For a More Effective Organization of The Mitigation of, Preparedness For, Response

To and Recovery From Emergencies and Disasters' also known as the 'Disaster Preparedness and Response Act of February, 2006' stipulated the elements of a National Disaster Organization which includes NEMA as the driver for disaster risk management in The Bahamas. Arranged into eight sections this new legal authority to act provides the necessary foundation for the full implementation of CEM within the nation. Outlined below are the eight section of the legislation.

Part I deals with definitions while Part II speaks to the establishment of a National Emergency management Agency (NEMA) as a Department of Government charged with responsibility for relief management, as well as coordination and implementation of government policies for disaster risk management. NEMA is to be headed by a Director, and the Act addresses the role and function of the Director, appointment of public officers to relevant posts, and to the establishment of NEMA representation on the Family Islands. A Disaster Consultative Committee is to be appointed by each Family Island, and the Committee will be responsible for assisting the Director to discharge the functions of NEMA as appropriate.

Part III deals with the National Emergency Management Advisory Committee, (NEMAC) review of the Disaster Preparedness and Response Policy, and the National Disaster Response Plan. Part IV addresses the requirements and functioning of emergency operation centers and physical and social requirements for shelter operations. Address in Part V of the Act are the obligations of other Public Officers, including liaison functions, environmental Impact Assessments and annual reports to and consultations with the NEMA

Director. Part VI outlines procedures with respect to especially vulnerable areas and precautionary and/or mitigation plans.

Disaster Alerts and Emergencies are addressed in Part VII of the Act. Part VIII, entitled *Miscellaneous*, addresses disaster management items not dealt with in the preceding sections of the Act.

Subsidiary legislation is currently being considered to support the Disaster Preparedness and Response Act. The Attorney General's Office is examining the following priority components not addressed by previous legislation:

- Forecasting and the Meteorological Services
- Evacuations
- Emergency Communications
- Agency/Ministry Disaster Plans
- Disaster Management and Planning for 'Specially Vulnerable Areas'

6.3.4 An Advocacy Supporting Action

The backing of political leaders is not always enough to ensure that hazard polices come to fruition, strong community support is also required. Surveys of Family Island Administrators, informal discussion with residents, and interviews with NEMA staff revealed a strong support from residents for Government action. Of particular interest was the legalization of mandatory evacuation orders that would require residents to leave their homes. This issue is currently being debated and requires careful consideration of the balance between individual and government rights.

Mandatory evacuation orders are but one example of the dynamic issues surrounding CEM within The Bahamas. The impact of two very active hurricane

seasons may have triggered an advocacy supporting action but it has been through strong community education that NEMA has been able to keep and strengthen support.

6.3.5 Necessary Institutional Resources

As with the evaluation of the pre-CEM phase, institutional resources are examined in two parts. First, does an accurate assessment of available resources exist within the Bahamas and second, are the necessary institutional resources accessible. During the post-CEM phase, a comprehensive inventory of NEMA assets housed at the disaster warehouse in New Providence, was assembled. Utilizing the SUPply MAnagement (SUMA) System established by the Pan American Health Organization (PAHO), NEMA assets were well documented. The SUMA system provided a central logistics data system to manage disaster response assets.

Lacking were detailed assessments of available resources provided by all ministries active in disaster response. During the response phase of a disaster it is critical to match emergency needs and assets accordingly. If resources are not accessible emergency needs can go unmet or at the very least delay the delivery of services. The lack of multiple agencies inventories means that resources that may be available can not effectively be utilized or coordinated.

6.3.6 Discussion of the Post-CEM Application of the Model

The application of the model to the post-CEM phase of this research identified both strengths and weaknesses within the emergency management

structure of The Bahamas. Leadership as compared to the pre-CEM phase was good. NEMA staff and members of government ministries were provided with training to help establish an emergency management system. A response plan was also written to provide guidance during response to a national disaster.

A foundation for supportive values for government action was and continues to be strong in the post-CEM phase. Individual Bahamians as well as established organizations are lending support to the Government in an effort to build a well coordinated emergency management structure.

During the time of response to all three post-CEM events, no legal authority to act existed. Since that time however, 'The Disaster Preparedness and Response Act, 2006' was established. Additional regulatory legislation is also being considered at this time with strong support from the Bahamian people.

Surveys of Family Island Administrators, informal discussion with residents, and interviews with NEMA staff revealed strong support from residents for Government action. Community education programs implemented by NEMA have helped to sustain support and increase awareness of the hazards in The Bahamas. Institutional resources during the post-CEM phase show improvement when compared to pre-CEM. However, the lack of multiple agency inventories limited NEMA's ability to coordinate assets.

6.4 Summary

The structured surveys, semi-structured interviews, as well the application of Quarantelli's (1997a) criteria for evaluating the management of response operations provide a foundation for evaluating CEM. What is missing however is

a full understanding of the dynamic political, social, and economic environment within The Bahamas before and after the implementation of CEM. The application of The Model of Community Response to Disasters (Figure 8.1) allows for an expanded understanding of emergency response within The Bahamas during both periods.

The application of the amended Model of Community Response to Disasters (Figure 6.1) was easily and effectively applied to the Bahamas. The model helped to identify strengths and weaknesses in the emergency management structure in both the pre- and post-CEM phase. Furthermore, it placed the response to the six study hurricanes in the large comprehensive setting allowing for a more complete understanding of the mechanisms impacting disaster response.

Chapter Seven

Summary, Conclusions, And Contributions

7.1 Introduction

This research sought to answer the following three research questions:

1. Can Quarantelli's (1997a) methodology for evaluating the management of disaster response be operationalized?
2. Can CEM, a United States emergency management strategy, be an effective strategy for The Bahamas, an archipelagic nation?
3. Did the implementation of a CEM system improve disaster response within The Bahamas?

This final chapter provides a summary and discussion of results associated with each of the research questions and places the findings within the current literature on hazards. A set of general conclusions and suggestions for future research are also provided.

7.2 Study Summary

Global trends show increasing losses from disasters as the number of people at risk grows by 70 to 80 million per year (United Nations, 2004).

Although the frequency of natural disasters may be constant the human interaction with the given hazard has shifted through changes in development practices, environmental protection as well as the distribution of population and

wealth. In an effort to combat the negative social, economic, and environmental impacts of hazards, strategies for identifying vulnerable populations and implementing mitigation measures is a high priority in hazards research. However despite our best efforts disasters have and will continue to negatively impact communities resulting in loss of life and property. To that end nations must establish effective emergency response capabilities to meet the needs of all residents potentially at harm.

This study examined the establishment of a comprehensive emergency management (CEM) system in the nation of The Bahamas. This exploratory research utilized a longitudinal study design to examine the six study hurricanes (Andrew '92, Floyd '99, Michelle '01, Frances '04, Jeanne '04, and Wilma '05). The goal of this research was two fold; first, to document the development of a comprehensive emergency management system within The Bahamas and second, to compare response operations under CEM with response operations prior to its implementation.

7.3 Overview of Methods

This study was designed to determine the impact of CEM on emergency response in The Bahamas. Being a relatively uncharted area of hazards research, this study took an exploratory approach that utilized a longitudinal study design, that allowed for the repeated observation of national response operations. Mixed methods were used to collect and analyze data. Data for the study were collected over a six year period from 2001-2007. The following data collection techniques were employed for this study: (1) archival research, (2)

structured surveys, (3) semi-structured interviews, and (4) participant observation.

Data collected through the above mentioned four methods were analyzed in several ways. First, the surveys and closed-ended questions associated with the interviews were analyzed using standard statistical techniques. The data was then applied to 8 of the 10 criteria for measuring the management of national disaster response operations as outlined by Quarantelli (1997a). Finally, data were applied to the Model of Community Response to Disaster (Hughey, 2003).

7.4 Key Research Findings

Research Question One: Can Quarantelli's (1997a) methodology for evaluating the management of disaster response be operationalized?

Quarantelli's (1997a) methodology for evaluating the management of disaster response operations was successfully operationalized and applied to the six study hurricanes. Each of the eight research criteria were well applied and the results are outlined below.

- Criterion One, adequately carrying out generic functions, appears not to have been impacted by the implementation of CEM. However, upon closer examination what emerged was a clear improvement in the early recognition of each of the ten generic functions, which are encompassed within the first criterion. The data displayed improvements that can be associated with the implementation of a CEM system in 2002 (see table 4.3) and the development of a national response plan that outlined responsibility and SOP's for each of the functions.
- Criterion Two, effectively mobilizing personnel and resources, showed improvements following the implementation of the CEM system. An association with the improvement in the function and the development of a national emergency response plan was noted. It is critical to identify however that the improvements associated to the CEM system

did not rule out or take away from the impact that experience may have played in improvements to response operations.

- Criterion Three, adequately processing information, displayed a pattern of improvement following the implementation of the CEM system. The implementation of a national response plan helped to develop clear lines of communication between citizens, the government, and response agencies that allowed for more accurate processing of information and improved response operations. Also associated with the improvement are experience and improved recording keeping.
- Criterion Four, the properly exercising decision-making, showed no pattern or association of improvement following the implementation of CEM. Response operations to Hurricanes Frances and Jeanne experienced the same problems with decision-making as the pre-CEM response operations.
- Criterion Five, developing overall coordination, showed a marked improvement after the implementation of the CEM system. Data indicates improvements are associated with the development of a nation response plan that required multi-agency coordination over a two-year period prior to the impact of Hurricane Frances.
- Criterion Six, Correctly recognizing differences between response and agent-generated demands, was dependent of the success of criteria 2 through 5. The data did not identify an association between criterion six and the implementation of a CEM system.
- Criterion Seven, providing appropriate and accurate reports for the news media, showed a clear pattern of improvement during the post-CEM response operations. The data showed the improvement was associated with the implementation of the national response plan (2002).
- Criterion eight, a well-functioning emergency operations center, showed no improvement associated to the implementation of a CEM system. Challenges to the physical requirements outlined by Quarantelli's (1997a) methodology indicated the EOC facilities utilized in response to each of the six study hurricanes were insufficient.

Although Quarantelli's methodology was operationalized some application difficulties do existed. The subjective nature of Quarantelli's criteria for evaluating the management of emergency response operations, limits its utility as a

practical tool. It is recommended that the methodology be refined for ease of application and to ensure consistency in use. A more detailed and structured application guideline is suggested to prevent subjective employment of the tool. The use of benchmarks would also provide emergency managers with the necessary apparatus to establish response goals and provide a metric to rate the overall improvement to response within a jurisdiction.

Research Question Two: Can CEM, a United States emergency management strategy, be an effective strategy for The Bahamas, an archipelagic nation? Quarantelli's (1997a) methodology was able to identify areas where the implementation of a CEM system improved disaster response operations in The Bahamas.

- Quarantelli's (1997a) methodology for evaluating the management of disaster response was able to identify area where the implementation of CEM improved the national management of disaster response. The research data indicated improvements associated with the implementation of a CEM system, in the following five criteria.
 - Adequately carrying out generic functions;
 - Effectively mobilizing personnel and resources;
 - Adequately processing information;
 - Developing overall coordination;
 - Providing appropriate and accurate reports for the news media;
- The amended Model of Community Response to Disasters was easily and effectively applied to the Bahamas, identifying strengths and weaknesses in the emergency management structure in both the pre- and post-CEM phases.

This research hypothesized that the implementation of CEM would improve all areas of disaster response within the nation of the Bahamas. Based

on Quarantelli's (1997a) eight criteria for evaluation improvements were noted in the following six areas following the implementation of CEM.

- Adequately carrying out generic functions;
- Effectively mobilizing personnel and resources;
- Adequately processing information;
- Properly exercising decision making;
- Developing Overall Coordination;
- Providing appropriate and accurate reports for the news media

Despite the improvement in these areas, there was not enough evidence to support the claim that the impetus for improvement in The Bahamas emergency response was the implementation of CEM. Furthermore, the subjective nature of the evaluation criteria limits its utility as a practical tool.

It was further hypothesized that CEM would be an effective and successful emergency management strategy for The Commonwealth of The Bahamas. To that end, based on anecdotal evidence from observation and interviews with NEMA staff CEM is a successful strategy for the management of disasters but continues to need work.

“To continue to improve we need to improve overall coordination as well as inter-island coordination. The island administrators are too be working in the capacity of disaster coordinator at the local level (Sub-NEMA) and there plans need to be in position and taken to operational mode, then it can come to the national level that is where it can be confusing. We have come along way but we still have a ways to go but it is going to workout...workout in time” (Bethel, 2006)

“Comprehensive emergency management provides a connection between all the components of disaster management. The training has really helped. We all know who to call and who has what job. Information comes through the national EOC and it allows for better coordination. We still have glitches and we are continuing to work on them, but the new

system and the passage of the disaster legislation has legitimized NEMA and provided us with recognition” (Outten-Moncur, 2006b)

Additionally, the data indicated an increase in mean score when asked to evaluate response operations on a 1 to 5 scale. An increasing mean score is identified between the pre-CEM and post-CEM response phases by both the Island Administrators and NEMA staff. (See Table 7.1) This further supports the anecdotal evidence that CEM has improved response operations within The Bahamas. However, the data are not strong enough to identify CEM as the exclusive reason for improvement. Variables such as experience cannot be ruled out as the trigger for improvement in national response operations.

	Hurricane	Island Administrators	NEMA
Pre-CEM	Andrew	2.27	2.58
	Floyd	2.44	2.83
	Michelle	---	2.66
Post-CEM	Frances & Jeanne	3.66	3.5
	Wilma	4.05	3.66

Table 7.1 – Comparison between the perceptions of Island Administrators and NEMA Staff with regards to the national response to the six study hurricanes.

The amended Model of Community Response to Disasters (Figure 7.1) was easily and effectively applied to this research study. The model was able to identify strengths and weaknesses in the emergency management structure in

both the pre- and post-CEM phases. The application of the model assisted in placing each of the six response operation in the appropriate context.

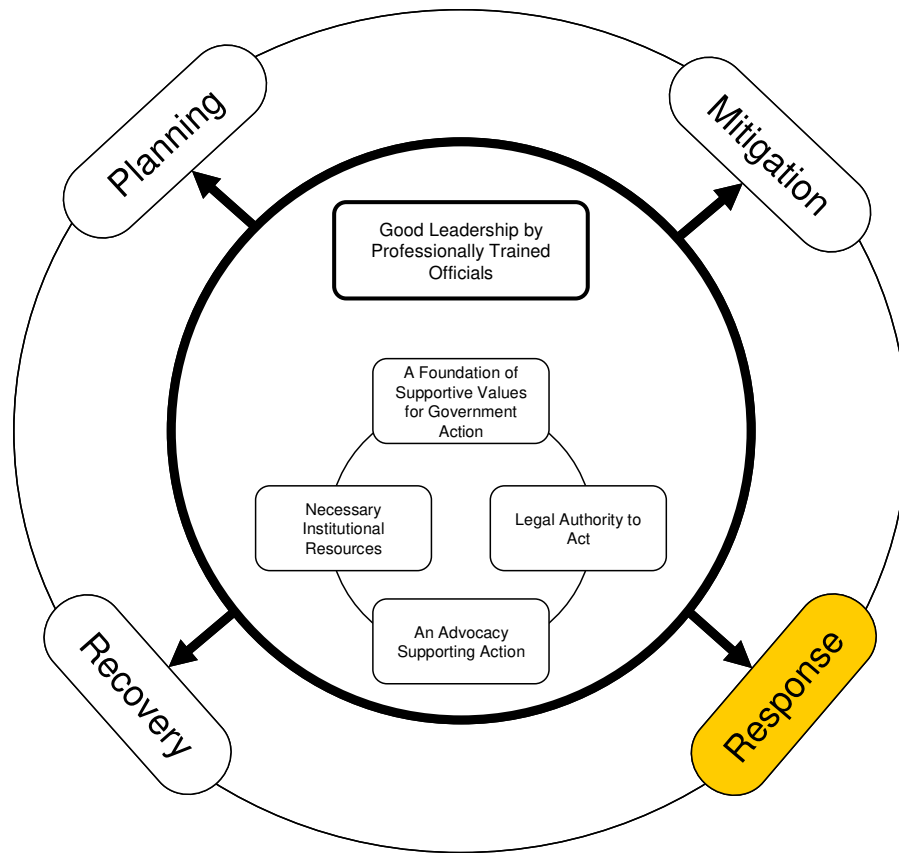


Figure 7.1 – Model of Community Response to Disasters (Source: Amended Hughey, 2003)

7.5 Contributions to Geography

This study provides one of the first longitudinal hazards research studies conducted by a Geographer. A criticism of the hazards literature has been that many researchers take only a snapshot of disaster events omitting the temporal component in turn preventing the necessary examination of the dynamic and intertwined relationships that impact all four phases of the emergency management cycle. Furthermore, this research provides the hazards literature

with an application and test of Quarantelli's criteria for evaluating the management of emergency response operations. The application of this methodology identified a need for a more concrete metric that does not allow for subjectivity in application.

This research additionally provides to the hazards research a theoretical model for evaluating community response to disasters. This model was previously tested at the local level in Falmouth, Kentucky and has now been successfully tested at the national level in The Bahamas. This model provides emergency managers and hazards researchers with a tool for exploring questions surrounding the four phases of emergency management.

7.6 Recommendations & Future Research

7.6.1 Recommendations

It is recommended that a metric be developed based on a time scale for key emergency response functions. For example, if general functions are carried out effectively all preliminary damage assessment report should be completed within forty-eight (48) hours of the impact area being designated safe for response personnel. Well established criteria would allow for the evaluation and comparison of response operations. This type of metric would also help to establish a concrete timeline of events which could be used to improve response operations within a jurisdiction.

It is also recommend that more longitudinal research studies be conducted in an effort to more thoroughly understand the dynamic nature of emergency

response. Necessary evaluation of the dynamic and intertwined relationships that exist. This study needs to be developed which does not allow for the

7.6.2 Future Research

This research, which began in 2001, continues today documenting and evaluating the development of the CEM system for the Commonwealth of The Bahamas. In June of 2008, at the annual NEMA conference in Nassau, additional surveys will be conducted with Family Island Administrators to gauge the effectiveness of the national response to Tropical Storm Noel. Noel significantly impacted the southeastern and central islands of The Bahamas in November of 2007 causing extensive flooding and requiring a full activation of the nation EOC. Mechanisms for evaluation and coordination with NEMA and the Government of The Bahamas continues to ensure future response operations can be evaluated and more data obtained in an effort to improve emergency response.

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Glossary Of Acronyms

BEC	Bahamas Electric Corporation
BTC	Bahamas Telecommunication Company
CDERA	Caribbean Disaster Emergency Response Agency
CDM	Comprehensive Disaster Management
CEM	Comprehensive Emergency Management
CEMP	Comprehensive Emergency Management Plan
CERT	Community Emergency Response Team
CIDA	Canadian International Development Agency
EOC	Emergency Operations Center
ICS	Incident Command System
NGA	National Governors' Association
NGO	Non-Governmental Organization
ODPEM	Office for Disaster Preparedness and Emergency Management
OFDA	Office of US Foreign Disaster Assistance
PAHO	Pan American Health Organization
PDA	Preliminary Damage Assessment
RBDF	Royal Bahamas Defence Force
SUMA	SUpply MAnagement System
W&SC	Water and Sewerage Corporation
UN	United Nations
UNDP	United Nations Development Programme
USSOUTHCOM	United States Southern Command
ZNS	The Broadcasting Corporation of The Bahamas

Appendices

Appendix A: Family Island Administrators Structured Survey

Family Island Administrator Disaster Management Survey

The following questions focus on Disaster Training, Planning and Response efforts within The Bahamas. Family Island Administrators are asked to please complete the following survey and fax or e-mail responses back to the National Emergency Management Agency (NEMA) Office at (242) 326-5456 or at NEMA@Bahamas.gov.bs by Wednesday, January 31, 2007. Thank you in advance for your assistance in this matter.

DISASTER TRAINING:

1. Has your island received disaster training from the NEMA office?
Yes____ **No**____
 - a. If yes, what type of training? _____

2. What type of training would you like to see offered by NEMA? _____

3. Did you or a representative from your office attend any of the NEMA Conferences held in 2004, 2005, and 2006? **Yes**____ **No**____
 - a. If yes, did you find the conference useful; why or why not? _____

DISASTER PLANNING & INFORMATION

4. Does your island have a disaster preparedness and response plan?
Yes____ **No**____
 - a. If yes, when was the last time it was reviewed and updated? _____

5. On a scale of 1 to 5 (*1 being not at all and 5 being completely*) how would you rate NEMA's efforts to inform the public of their role in disaster planning and response? **1** **2** **3** **4** **5**

DISASTER RESPONSE:

6. On a scale of 1 to 5 (1 being not at all and 5 being completely) how successful do you think the national response to 1992's Hurricane Andrew was?

1 2 3 4 5

7. On a scale of 1 to 5 (1 being not at all and 5 being completely) how successful do you think the national response to 1999's Hurricane Floyd was?

1 2 3 4 5

8. On a scale of 1 to 5 (1 being not at all and 5 being completely) how successful do you think the national response to 2004's Hurricanes Frances and Jeanne was?

1 2 3 4 5

9. On a scale of 1 to 5 (1 being not at all and 5 being completely) how successful do you think the national response to 2005's Hurricane Wilma was?

1 2 3 4 5

10. Were you aware that The Bahamas has been working since 2002 to develop a comprehensive emergency management structure in an effort to coordinate disaster planning and response activities? **Yes** ___ **No** ___

11. What do you see as the biggest challenge to disaster preparedness and response on your island? _____

12. What do you see as the biggest challenge to disaster preparedness and response for The Bahamas? _____

13. How do you think national disaster preparedness and response can be improved? _____

14. Do you think the passage of the National Disaster Preparedness and Response Act will improve disaster response within The Bahamas.

Yes ___ **No** ___

a. **Why or why not:** _____

15. What do you think other island nations in the Caribbean can learn from The Bahamas with regards to disaster preparedness and response? _____

RESPONDENT INFORMATION:

Island(s) Represented: _____

How many years have you served as an Island Administrator? _____

General Comments: _____

Appendix B: Understanding The Hazard - The Development and Impact of the Six Study Hurricanes

B.1 Introduction

Appendix B examines the development and impact of Hurricanes Andrew, Floyd, Michelle, Frances, Jeanne, and Wilma on the Commonwealth of The Bahamas. Provided is an overview of the development and physical parameters of each storm based on data gathered through official reports issued by The Bahamas Department of Meteorology, archival research, and personal correspondence with Meteorologist Trevor Basden.

Included in this chapter are the development characteristics of each storm and the impact to the Islands of The Bahamas. Maps are provided to display the historic path of each storm as it passed through the archipelago. Understanding the development of each hurricane is critical to examining the disaster response activities that resulted. Disaster response decisions regarding evacuations, sheltering, and movement of resources and supplies are directly linked to information obtained by officials. This chapter will provide the information that was available to decision makers at the time of each storm event as well as provide personal accounts of the impact of each storm on residents. A detailed discussion of the national response to each of the study hurricanes begins in Chapter 5 of this dissertation.

B.2 Hurricane Andrew 1992

Hurricane Andrew became the first named storm of the 1992 season and very quickly became the first major hurricane (category 3 or higher) to impact The Bahamas since Hurricane Betsy in 1965. As Andrew slammed into the Central Islands of The Bahamas, it caused major damage and destruction before continuing on to South Florida and South Central Louisiana. Map B.1 illustrates the historic path that Andrew took through The Bahamas.

B.2.1 Hurricane Andrew Storm Development

According to The Bahamas Department of Meteorology on August 14, 1992 satellite photos indicated a strong tropical wave off the African coast in the area of the Cape Verde Islands. Two days later (Sunday, August 16th) the satellite images indicated a tropical depression had formed and was located mid-way between Africa and the Lesser Antilles. Early reports on Monday, August 17th indicated that the depression was moving west at 21 mph and was located near 11.6N and 40.4 W. Within 24 hours the depression strengthened to become the first tropical storm of the 1992 season and was named Andrew. At this time, The Bahamas Department of Meteorology was reporting that Andrew had sustained winds of 40mph and was approximately 1,175 miles east of the Lesser Antilles.

Andrew moved west-northwest at 25 miles per hour with storm development alternating between periods of weakening and strengthening. For the next 30 hours (11pm on the 19th to 5am on the 21st) Andrew moved on a northwest course at 14 miles per hour. According to the August 21, 1992

11:00am report from The Department of Meteorology, Andrew was becoming better organized and was predicted to strengthen to hurricane force within the next 12 to 24 hours. Maximum sustained winds at the time of the report were measured at 60mph and the storm had shifted to a west-northwest course at 10 miles per hour.

Information gathered by the United States Air Force Reserve Unit Aircraft on Saturday August 22nd at 5am confirmed that Andrew had reached hurricane intensity. The Bahamas Department of Meteorology reported that the center of the storm was located near latitude 25.8 N and longitude 67.5 W. At this time Andrew was approximately 610 miles slightly north and east of Nassau, Bahamas and was still on a west-northwest course moving at 10 mph with sustained winds of 75mph. The 11am report placed the islands of the Northwest Bahamas under a hurricane warning until Monday August 24th at 7am.

On Sunday August 23rd official reports from The Bahamas Department of Meteorology noticed strengthening of the hurricane. By early morning Andrew reached category four strength with sustained winds of 135 mph. The storm was approximately 100 miles east of Harbour Island, Eleuthera and 160 miles east of Nassau. The course of the hurricane had shifted and Andrew was moving due west at 16 mph projected to cross northern Eleuthera, north of Nassau, through the Berry Islands, South of Bimini and south of Miami, Florida.

According to reports from The Bahamas Department of Meteorology Hurricane Andrew's central pressure fell steadily as it passed through the islands reaching a minimum of 922mb at about 2pm on Sunday, August 23rd

approximately 60 miles east of the Island of Eleuthera. The eye of Andrew moved over Harbour Island about 5pm the same day, with a central pressure of 935mb. (See Picture B.1)



Picture B.1 – Hurricane Andrew as it passes over The Bahamas. (Source: NOAA, 1992)

Hurricane Andrew officially moved through the Islands of The Bahamas as a category 4 hurricane. However damage to monitoring equipment limited data collection. After passing through the Bahamas Hurricane Andrew moved across Southern Florida where the National Hurricane Center (NHC) recorded gusts of 164 mph before the main radar at the NHC was destroyed. Hurricane Andrew crossed the State of Florida with sustained winds of 125 mph and a forward speed of 18 mph. Andrew then moved into the Gulf of Mexico and into Louisiana where it subsequently merged with a frontal trough and died.

B.2.1.1 Central Pressure and Intensity of Hurricane Andrew

Figure B.1 below shows the related wind speed and central pressure associated with Hurricane Andrew. The data illustrate the relationship between the drop in central pressure and the increase in wind speed. Hurricane Andrew impacted the Islands of The Bahamas on August 23rd when its winds were at their peak.

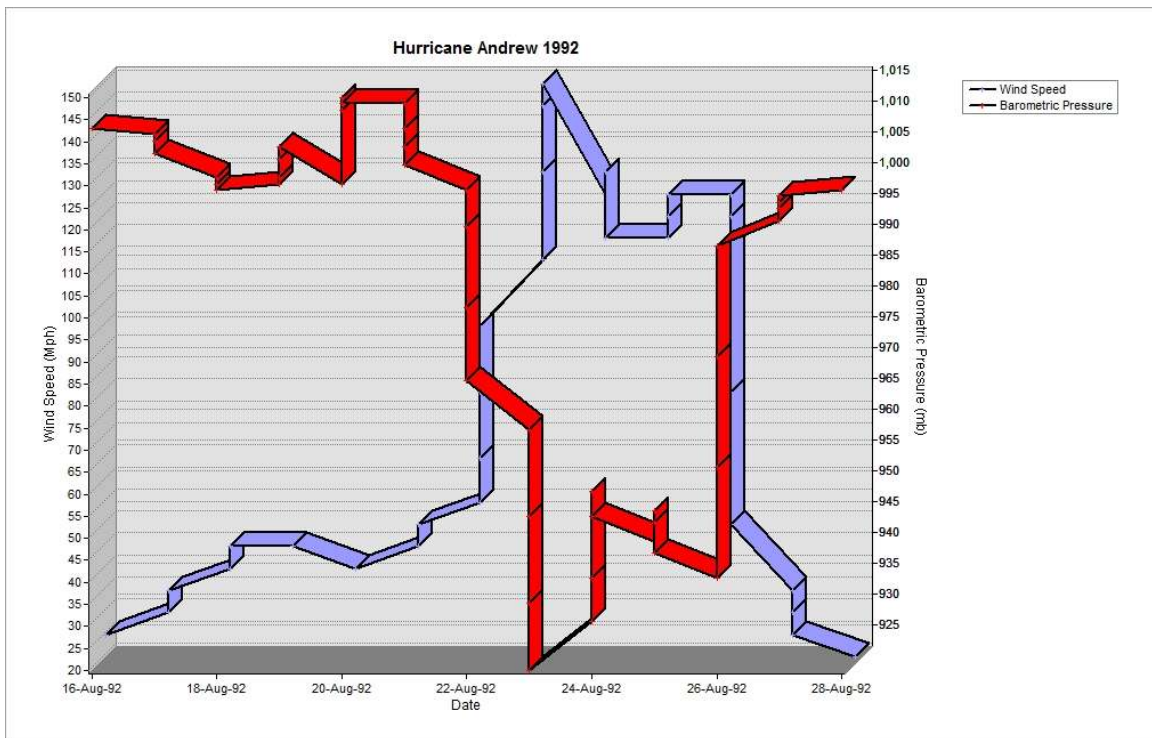


Figure B.1 – Hurricane Andrew Wind Speed and Central Pressure (Data Source: The Bahamas Department of Meteorology).

B.2.2 Hurricane Andrew Impact

According to The Bahamas Department of Meteorology (1992), Hurricane Andrew generated hurricane force winds outward as far as 30 miles from the eye and gale force winds for 105 miles. The Current and Lower Bogue, both

settlements of North Eleuthera, reported storm surges of 25 feet and 16 feet respectively. The Bahamas Department of Meteorology also reported numerous tornadoes were spawned from “thunderclouds associated with Hurricane Andrew” (The Bahamas Department of Meteorology, 1992:3).

Hurricane Andrew passed over Eleuthera, the Berry Islands and South Bimini on the 23rd of August, 1992. Flooding and property damage were reported on all of the respective islands and four (4) deaths were officially reported. Below are comments from Hurricane Andrew preliminary damage assessment reports (The Bahamas Department of Meteorology, 1992). (see pictures B.2 - B.4)

- The settlements of James Cistern, Gregory Town, Alice Town and Palmetto Point on the Island of Eleuthera suffered minor damages. Coastal roads were damaged by high seas, and docks throughout the island had been extensively damaged. Minor damage was also reported in The Bluff and Lower Bogue.
- The Current and Current Island were extensively damaged as a result of Hurricane Andrew. Twenty-four of the thirty homes on Current Island were destroyed. Government buildings were destroyed and docks were unusable. The islands were devastated and in need of immediate emergency assistance.
- On Spanish Wells, the bridge that joined Russell Island to Spanish Wells was destroyed while many other fishing boats were lost to the high seas. The two main food stores on the island were also completely destroyed, while others were seriously damaged. Movement throughout the island was impaired due to debris and damage to roadways.
- The Government Dock on Harbour Island was the only dock on the island left standing as a result of Hurricane Andrew. All buildings on the island suffered considerable damages and the main tourist destination, The Pink Sands Hotel, was destroyed.

B.2.3 Hurricane Andrew Discussion

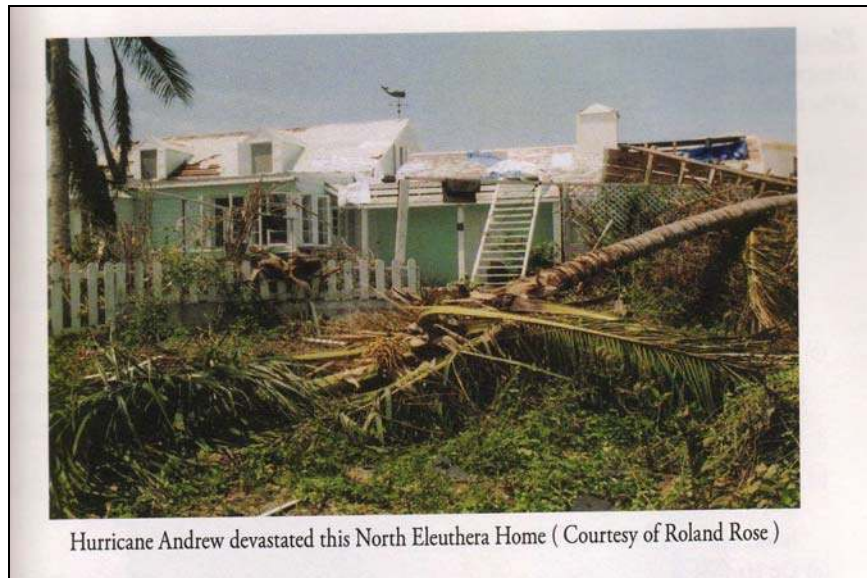
When Andrew swept through The Bahamas it was the first major storm to impact the Commonwealth in twenty-seven (27) years. The storm cost the nation an estimated \$250 million dollars, left 1,500 homeless, and killed four (4) residents (Caribbean Disaster Advisory Subcommittee, 1994). Also, during this period The Bahamas was adjusting to a new government. Just weeks before Hurricane Andrew made landfall, the Free National Movement lead by Hubert Ingraham won general elections, ending Prime Minister Lynden Pindling's 25 year rule. The Royal Bahamas Defence Force took the lead role in responding to Hurricane Andrew with strong support from Social Services. Additional agencies and organizations provided support in response operations but no centralized emergency management structure existed in 1992. These are important social and political components that influenced the national governments response capabilities. Hazards literature (Tobin and Montz, 1997) has shown that hazards experience can change perception and response and were examined as part of this research.



Picture B.2 – Hurricane Andrew Damage on the Island of Abaco, The Bahamas. (Source: The Bahamas Information Service published in Neely 2006)



Picture B.3 – Hurricane Andrew Damage on the Island of Eleuthera. (Source: The Bahamas Information Service published in Neely 2006)



Picture B.4 – Hurricane Andrew Damage on the Island of Eleuthera.
(Source: The Bahamas Information Service published in Neely 2006)

B.3 Hurricane Floyd 1999

Hurricane Floyd was a powerful Cape Verde hurricane that impacted The Bahamas during the 1999 hurricane Season. Floyd pounded the Central and Northwest Bahamas particularly Cat Island, San Salvador, Eleuthera, New Providence, Abaco and Eastern Grand Bahama. Floyd was a category four hurricane on the Saffir-Simpson Scale and was the most intense and destructive hurricane on record to impact the Bahamas. Map B.2 illustrates the historic path that Floyd took through The Bahamas.

B.3.1 Hurricane Floyd Storm Development

According to reports from The Bahamas Department of Meteorology, on Tuesday September 7th, 1999 tropical depression number eight formed approximately 1000 miles east of The Lesser Antilles, moving west at 14 mph. The following day the tropical depression was upgraded to a tropical storm and

given the name Floyd. As Floyd moved west northwest at 10-16 mph it began to slowly strengthen. The Friday, September 10th 8pm report from The Bahamas Department of Meteorology indicated that the United States Air Force Reserve reconnaissance aircraft confirmed that Floyd had strengthened to hurricane status with maximum sustained winds of 80 mph (*70 knots*) and a central pressure of 989mb.

The storm continued to intensify over the next day and by the 5am report on Saturday, September 11th Floyd had developed into a category two. Sustained winds were recorded at 105mph moving in a northwest direction at 10mph. In the very early morning hours of September 12th The Bahamas Department of Meteorology noted a rising mid- to upper-level tropospheric heights to the north of Floyd was forcing the storm to turn west. This westward turn marked the start of a major period of strengthening for the storm.

The 8am report on Monday, September 13th indicated that Floyd, had continued to strengthen and was currently a category three storm. By the 5pm report on the same day Floyd had again strengthened to a category-four storm with maximum sustained winds of over 131 mph. At this time Floyd was located 350 miles east-southeast of San Salvador, 580 miles east-southeast of Nassau, and 225 miles northeast of the Turks and Caicos Islands. A tropical storm warning was issued for the Southeast Bahamas and the Turks and Caicos Islands. A Hurricane Watch was also posted for the Central Bahamas. Floyd moved within 425 miles east-northeast of the Island of Mayaguana on a track that was taking it due west at 14 mph. Floyd continued to strengthen and before

the 13th came to an end Hurricane Floyd was packing sustained winds of 155 mph, the upper end of a category four hurricane. The Bahamas Department of Meteorology attributed the explosive strengthening of Hurricane Floyd to the very warm shallow ocean waters east of the archipelago.

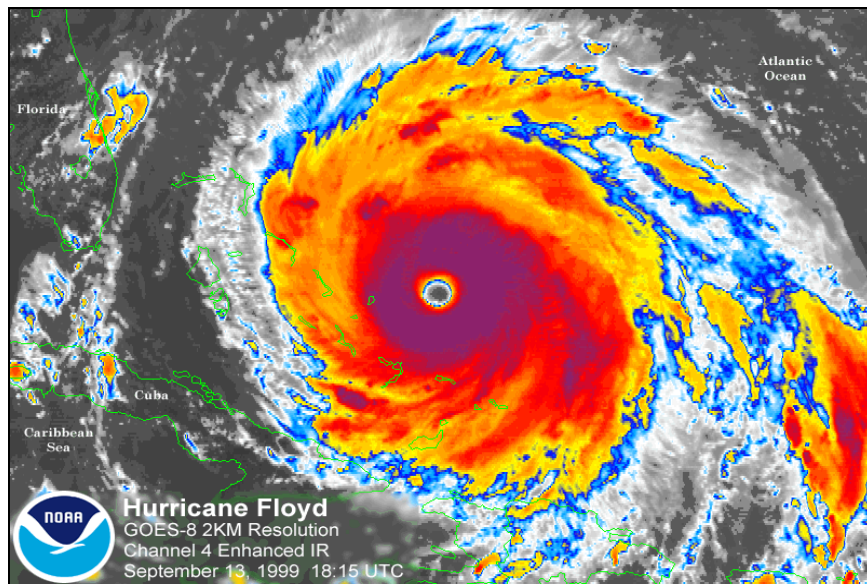
Floyd was in position to strike the central Bahamas when it began moving towards the west-northwest and moved some 20-30 miles north of San Salvador around midnight on Tuesday, September 14th. As the storm continued to move west-northwest it weakened slightly in intensity as it moved within 25 miles of Orange Creek and Arthur's Town, Cat Island.

Tuesday, September 14th Hurricane Floyd was moving at 14 mph in a west-northwest track parallel to Eleuthera. The eye of the storm was approximately 10 miles east of South and Central Eleuthera; with the western eye-wall of the hurricane crossing Central and North Eleuthera. The eye of Floyd made landfall near Alice Town, Eleuthera around 8am. In this position it passed some 65 miles northeast of New Providence by 11am.

After traveling across North Eleuthera and turning towards the northwest, Floyd struck Abaco making landfall around 2pm near Cherokee Sound, Abaco. According to The Bahamas Department of Meteorology, Floyd had weakened very slightly before hitting Abaco and was still a category four hurricane when it made landfall. The eye of the storm traversed Abaco moving south to north, pummeling the island with maximum sustained winds of 115 mph. The Bahamas Department of Meteorology reported downdrafts and tornadoes on Abaco as a result of Floyd. The eye of the storm crossed over Crossing Rock, Mastic Point,

Woolen Dean Cay, and Cooper's Town, Abaco. After three hours, the eye of Hurricane Floyd emerged over waters north of Cedar Harbour, Abaco, around 5pm on the 14th.

During the evening hours Floyd passed 30 miles northeast of Eastern Grand Bahama bringing with it 75 mph winds with gusts of 94 mph. Wednesday September 15th, Floyd left the waters of the Bahamas as it established a northwest and then a north-northwest course around 5am. Floyd followed the coast of Florida, Georgia, and South Carolina before making landfall in the United States on September 16th near Wilmington, North Carolina. (See Picture B.5)



Picture B.5 – Hurricane Floyd Satellite Image as it passes over The Bahamas. (Source: NOAA, 1999)

B.3.1.1 Central Pressure and Intensity of Hurricane Floyd

Figure B.2 below shows the related wind speed and central pressure associated with Hurricane Floyd. The data illustrates the relationship between the drop in central pressure and the increase in wind speed. Hurricane Floyd impacted the Islands of The Bahamas on September 13th and 14th when the winds were at their peak.

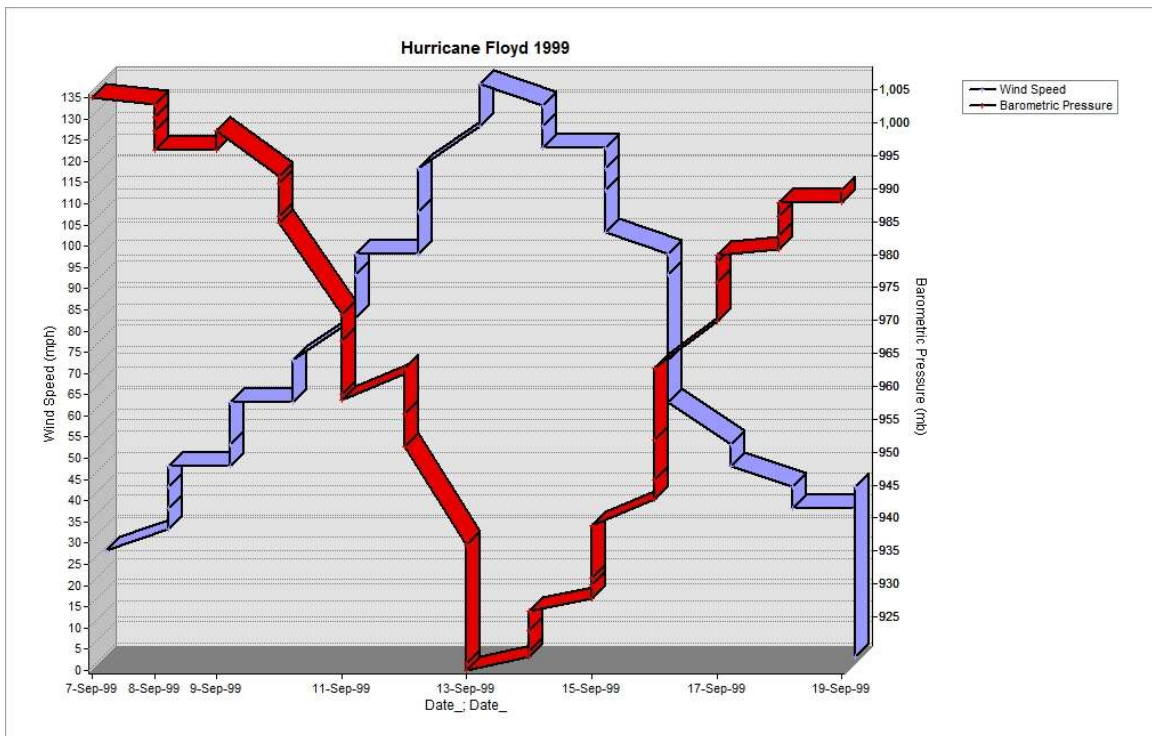


Figure B.2 – Hurricane Floyd 1999 Wind Speed and Barometric Pressure (Data Source: The Bahamas Department of Meteorology)

B.3.2 Impact of Hurricane Floyd on the Islands

With sustained winds of 155 mph, torrential rains, and over a 20 foot storm surge Floyd devastated the islands. Many coastal communities suffered from severe flooding and widespread damage. Toppled power and telephone lines throughout the islands disrupted electricity and communications. Initial damage

assessment reports estimated that around 27,000 persons living in the Family Islands were affected and were urgently in need of water, temporary shelter and food. The islands most significantly impacted included: Abaco, Eleuthera, Grand Bahama, The Berry Islands, Cat Island, San Salvador and New Providence. Provided below are brief overviews of the damage assessments made immediately following the passage of Hurricane Floyd.

B.3.2.1 New Providence (Nassau)

Experiencing less damage than the Family Islands, New Providence reported sustained wind of 80mph. Minor damage to buildings such as windows and roofs were reported, while landscaping throughout the island was badly impacted with hundreds of downed trees. Movement around the island was very difficult due to blocked roadways. The storm surge caused damage to marinas and ports on the island, and many small boats were beached or sunk in the Nassau Harbour. Two barges were also reported washed ashore. Over 2000 tourists weathered the storm in the capital city of Nassau. However, no deaths were reported on the Island of New Providence as a result of Hurricane Floyd.

B.3.2.2 The Abacos

Hurricane Floyd left over 2,000 people homeless in the Abacos. Approximately ten percent of the islands homes were destroyed and forty percent were severely damaged. Mud Town, a settlement of Haitian immigrants was destroyed. Settlements on the northern and southern extremes of the Abaco's suffered catastrophic damages with most, if not all, homes destroyed.

“Parliamentarian Mr. Robert Sweeting estimated that damage in Abaco alone was in the range of over \$750 million dollars” (Neely, 2006:130). Government reports indicated that seventy-five percent of the Moores Island’s homes were completely destroyed or uninhabitable. In Marsh Harbour many large buildings were completely destroyed and much of the area suffered considerable flooding.

Storm surge caused widespread beach erosion throughout the Abaco’s. In Hope Town, homes which sat on the ocean’s edge were completely submerged under water. Both airports (Treasure Cay and Marsh Harbour) sustained major damage from flooding and were forced to close for several days following the storm. The connecting road between Marsh Harbour (South Central Abaco) and Treasure Cay was impassable and areas of Perimeter Road ceased to exist. Agriculture in the area was also significantly impacted with the citrus harvest, an estimated 3,000 acres, losing the entire 1999 crop. Hurricane Floyd was so great that it changed the size and shape of many of the cays that make up the Abaco’s.

B.3.2.3 Grand Bahamas

On Grand Bahama, the storm produced extensive flooding and caused the closure of the Airport for several days. Flooding on the western end of the island stranded residents cutting off roads. Agriculture was significantly impacted with thirty percent of the broiler production for the nation destroyed and extreme reductions in the citrus crops reduced from 1,500 acres to 150 acres. Minor damage to homes throughout the island were also reported.

B.3.2.4 Eleuthera

Approximately 25% of Homes on the Island of Eleuthera sustained damage as a result of Hurricane Floyd, with 1% of the homes classified as destroyed. Major damage was assessed to all mail-boat docks as well as the Rock Sound Airport. Government structures such as the docks and customs warehouse located at The Bluff were seriously damaged. The dock at Jean's Bay was destroyed as were many of the roadways on the islands. The Spanish Wells fishing fleet was devastated, many of the vessels having been breached and others having sunk in the harbour. Of greatest concern following the passage of Hurricane Floyd was clean drinking water. Eleuthera, which is normally supplied with potable water by boat, could not receive water due to damage to the ports. Additionally, storm surge associated with the storm had severely impacted the water well fields, causing salt water intrusion making the water undrinkable.

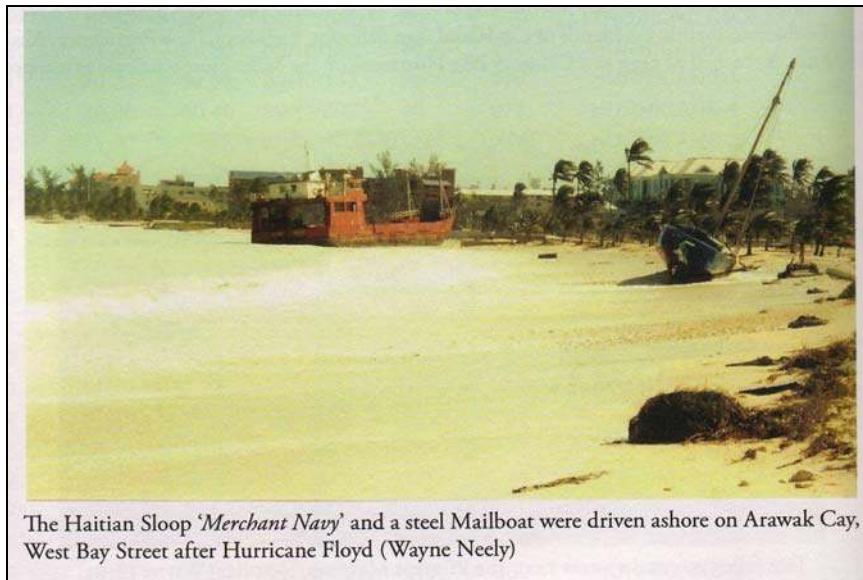
B.3.2.5 San Salvador

The eye of Hurricane Floyd passed just north of the island of San Salvador. The island sustained damage to most structures including tourist facilities, the Bahamian Field Station (BFS), Club Med Columbus Isle Resort, and the Riding Rock Inn. No injuries were reported on the island as a result of the storm. The island was without power and telecommunication systems for several weeks after the storm passed. Like in many of the other islands, damage to roadways and key transportation components such as airports and docks were also reported. San Salvador suffered significant beach alteration changing the

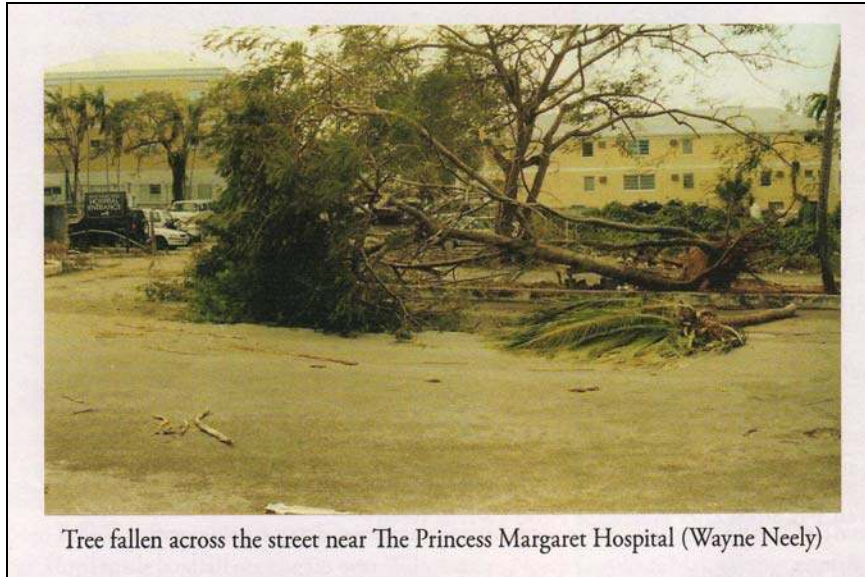
shape and size of the island. The main concern for residents of San Salvador immediately following the storm was drinking water.

B.3.2.6 Cat Island

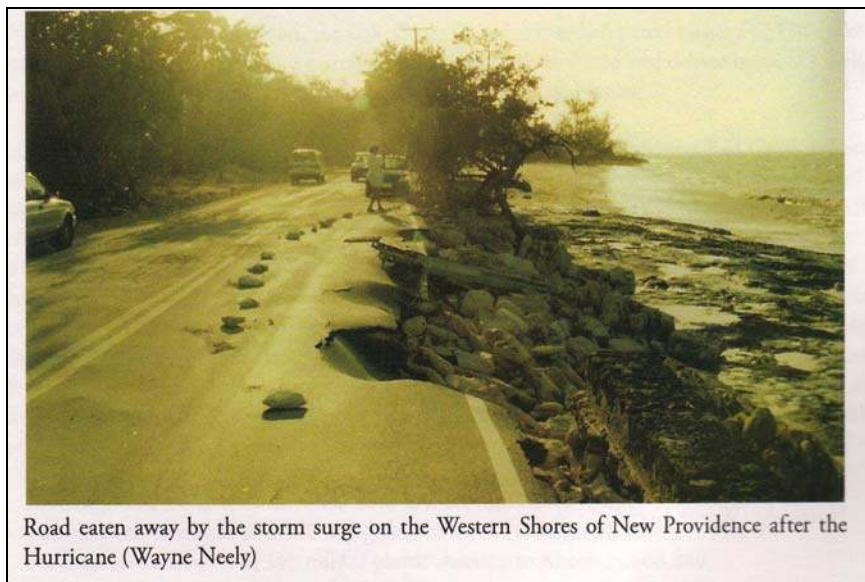
With A total population of 1,700 residents, Cat Island suffered significant damage to homes and government facilities, although no injuries were reported. However the two medical facilities on the island lost their roofs. Beach erosion, flooding and damage to roadways were considerable.



Picture B.6 – Hurricane Floyd Damage on Arawak Cay, The Bahamas (Source: Neely 2006)



Picture B.7 – Hurricane Floyd Damage on the Island of New Providence, The Bahamas (Source: Neely 2006)



Picture B.8 – Hurricane Floyd Damage on the Island of New Providence, The Bahamas (Source: Neely 2006)

B.3.3 Hurricane Floyd Discussion

Hurricane Floyd devastated the central and northern islands of The Bahamas. The key concerns for the nation were meeting immediate emergency needs of food and clean water to all areas impacted. Damage to well fields, and

transportation routes (airports, ports, and roadways) prevented the movement of emergency goods between islands as well as on the island.

The Royal Bahamas Defence Force led by Commander Steven Russell, activated an Emergency Operations Center (EOC) based at the Cabinet Office in Nassau. Although the response and eventual recovery of Hurricane Floyd required multiple ministries, agencies, and organizations the coordination of assets was not centralized.

B.4 Hurricane Michelle 2001

Hurricane Michelle was the first hurricane in over 35 years directly to impact the Island of New Providence. New Providence is not only the most densely populated island in the archipelago it is also home to the City of Nassau, the nation's capital. Interruption in government operations would devastate the economy of the nation and Hurricane Michelle served as a reminder to many residents of New Providence that the island is very much at risk to the impact of hurricanes. Map B.3 illustrates the historic path that Michelle took as she passed through The Bahamas.

B.4.1 Hurricane Michelle Storm Development

Tropical depression number 15 of the 2001 season, developed on Monday October 29th near the coast of Nicaragua. The depression remained virtually stationary until the very early morning hours of Wednesday, October 31st. According to reports by The Bahamas Department of Meteorology on the morning of October 31st, the depression began to move slowly towards the north

at 6mph, with no change in strength. Reports from Thursday, November 1st indicated a drop in the central pressure to 997 with a corresponding increase in the winds to 60mph. This resulted in the fourteenth tropical storm for the season and was given the name of Michelle. At this time Michelle was not of particular concern as the tropical storm continued to move north-northwest at 5 mph.

Morning reports on November 2nd showed Michelle had begun to slow to 3 mph as it intensified to hurricane strength. The maximum sustained winds were measured at 75 mph, and a central pressure of 980 millibars. By the next morning Hurricane Michelle, which was somewhat erratic, began to intensify rapidly becoming a category four hurricane, with sustained winds of 135 mph. Near the end of the day on November 3rd Hurricane Michelle slowly picked up forward speed with a shift in track towards the north-northeast. A hurricane watch was posted at 11pm on the 3rd for the Northwest and Central Bahamas to include: Bimini, Grand Bahama, Abaco, The Berry Islands, Andros, New Providence, Eleuthera, Exuma, Cat Island, Ragged Island, Long Island, Rum Cay and San Salvador. The Bahamas Department of Meteorology “urged residents in the Northwest and Central Bahamas to monitor the progress of Michelle closely and be prepared to take quick action” (Dean & Rolle, 2001:3).

The afternoon report on Sunday November 4th noted that Hurricane Michelle’s forwards speed had accelerated to 13 mph. While over Cuba late around 7pm, Michelle began to lose strength and her maximum sustained winds decreased to 125mph. By 10 pm that night reports indicated that the weakening

trend was continuing and Michelle's sustained wind speed decreased to 110 mph.

According to The Bahamas Department of Meteorology at around 1am on Monday, November 5th the leading edge of Michelle began to impact the island of Andros. While still on the northern shore of Central Cuba, about 175 miles southwest of Red Bays Andros, tropical storm force winds began to batter the island of Andros. Approximately an hour later the first tropical storm force winds were recorded on the Island of New Providence. By 7am that morning, the eye of Michelle was over the island of Andros. Maximum sustained winds outside of the eye were around 80-85 mph with higher gusts and very heavy rain showers. Michelle continued tracking northeast at 19 mph and by 9:30am the eye of the hurricane moved over the island of New Providence. According to Reports from The Bahamas Department of Meteorology, "the passage of the eye over the island caused some persons to believe that the hurricane had passed" (Dean & Rolle, 2001:3). Just before 11am the second assault began with winds shifting northwest to north and increasing from 16 mph to sustained winds of 46 mph sustained with peak winds up to 103 mph.

By 4pm on the 5th Hurricane Michelle passed over North Eleuthera, as the storms track shifted towards the east-northeast at 21 mph. The Bahamas Department of Meteorology reported that by 10pm on November 5th all warnings were dropped as Michelle moved away from The Bahamas and back into the open ocean. (See Picture B.9)



Picture B.9 - Hurricane Michelle Satellite Image as it approaches The Bahamas. (Source: NOAA, 2001)

B.4.1.1 Central Pressure and Intensity of Hurricane Michelle

Figure B.3 shows the related wind speed and central pressure associated with Hurricane Michelle. The data illustrate the relationship between the drop in central pressure and the increase in wind speed. On October 29th Michelle, a tropical depression at the time had a central pressure of 1005 mb. Michelle's pressure slowly began to fall reaching a low of 933 mb on November 3rd. At this time Michelle was a category four hurricane and was moving towards Cuba and The Islands of The Bahamas. The storm impacted The Bahamas on the 4th and 5th of November as the wind speed began to diminish.

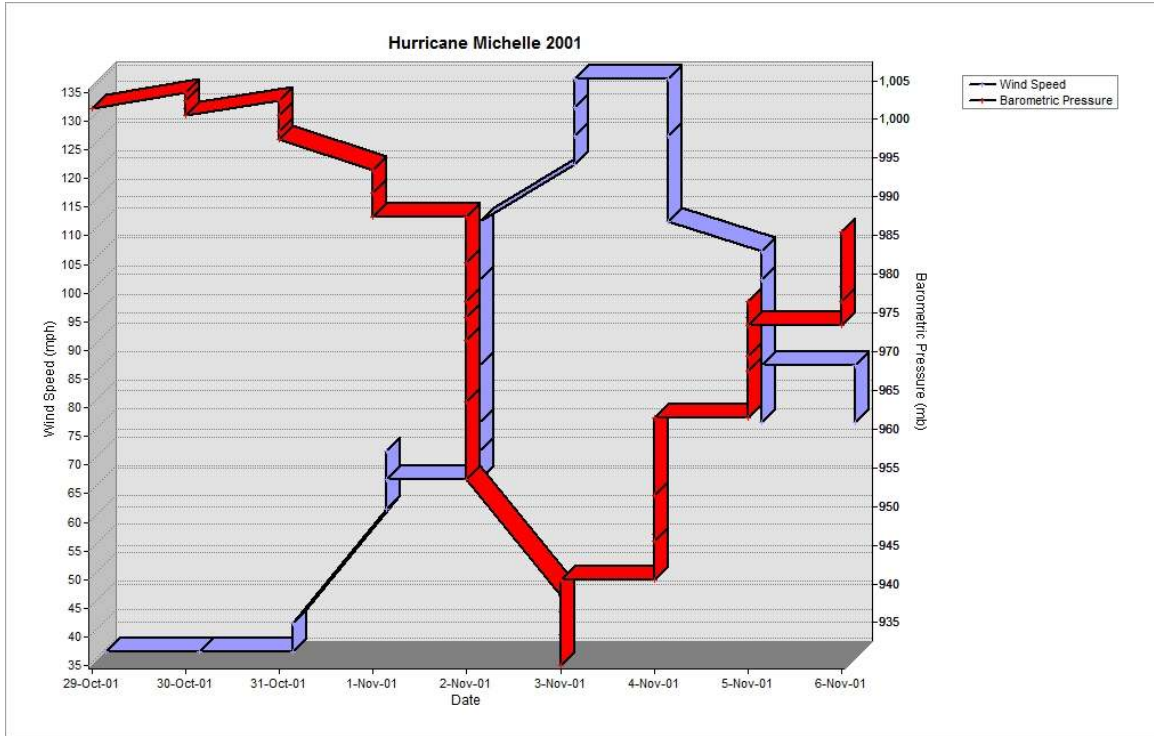


Figure B.3: Hurricane Michelle Wind Speed and Central Pressure (Data Source: The Bahamas Department of Meteorology).

B.4.2 Impact of Hurricane Michelle on the Islands

According to The Bahamas Department of Meteorology (2001), Hurricane Michelle produced a 10 foot storm surge. Many of the islands suffered moderate to severe coastal flooding as a result. Washed out roads on the islands of New Providence, Andros, Eleuthera, Cat Island, Exuma and Abaco were reported. Damage to roofs throughout the islands were also noted in preliminary damage assessment reports. Government buildings reported minor to major damage, with missing roofs and broken windows. Damage to communication equipment and broadcast towers were severe with many radio stations being put out of commission as a result of the storm.

There was no loss of life in The Bahamas associated with Hurricane Michelle. The storm caused extensive flooding throughout the islands dumping more than thirteen (13) inches of rain in some areas. As with Andrew and Floyd the well fields, located in low-lying areas, suffered extensive flooding. Saltwater intrusion occurred and contaminated the main supply of fresh water.

Reports from the Bahamas Electric Company (BEC) indicated that two days following landfall of Hurricane Michelle, the island of New Providence remained in darkness with 60% of the population without electricity. Additionally, The Bahamas Telecommunications Company (BTC) also reported that thousands of telephones were still out of order a week following the storm. Many residents were also struggling with no water or low water pressure a week following Michelle's impact.

For several days following Michelle banks and government offices remained closed, with the Police and Royal Bahamas Defence Force calling for people to remain in their homes to allow for the clearing of the roads and the restoration of utilities. (See Pictures B.10 – B.12)



Picture B.10 – Hurricane Michelle Damage on the Island of New Providence, The Bahamas (Source: Neely 2006)



Picture B.11 – Hurricane Michelle Damage on the Island of New Providence, The Bahamas (Source: Neely 2006)



Picture B.12 – Hurricane Michelle Damage on the Island of New Providence, The Bahamas (Source: Neely 2006)

B.4.3 Hurricane Michelle Discussion

Although Hurricane Michelle was not as destructive as Hurricanes Andrew or Floyd, the impact to Nassau highlighted the gaps in emergency response capabilities at the national level. Hurricane Michelle response activities were spearheaded by the Royal Bahamas Defence Force with disjointed support from a variety of ministries and organizations. The impact of Michelle on the citizens of Nassau and daily government activities shed light on the need for a well coordinated emergency management structure. The impact to the nation's capital, created the necessary advocacy seeking action helping to initiate the birth of a coordinated and centralized emergency management structure.

B.5 Hurricane Frances 2004

Hurricane Frances was the sixth named storm of the 2004 Atlantic hurricane season and the fourth hurricane. Frances was also the first hurricane since 1866 to impact the entire Bahamian Archipelago. Frances was a slow moving storm with a very large eye, approximately 80 miles across, which impacted the island chain for over 72 hours. The center of circulation remained in the northwest Bahamas for an extraordinarily long time causing substantial damage to the northern islands (Rolle & Simmons, 2004a). Map B.4 illustrates the path that Frances took as he passed through The Bahamas.

B.5.1 Hurricane Frances Storm Development

According to the Bahamas Department of Meteorology, Tuesday, August 24th satellite images indicated that a tropical depression had formed from a strong tropical wave in the Eastern Atlantic, approximately 870 miles west-southwest of Cape Verde. Movement of the depression was to the west at 17 mph. Within less than 24 hours the depression gained strength and was upgraded to a tropical storm and given the name Frances. By Thursday August 26th, Frances was again upgraded to hurricane status (Rolle & Simmons, 2004a).

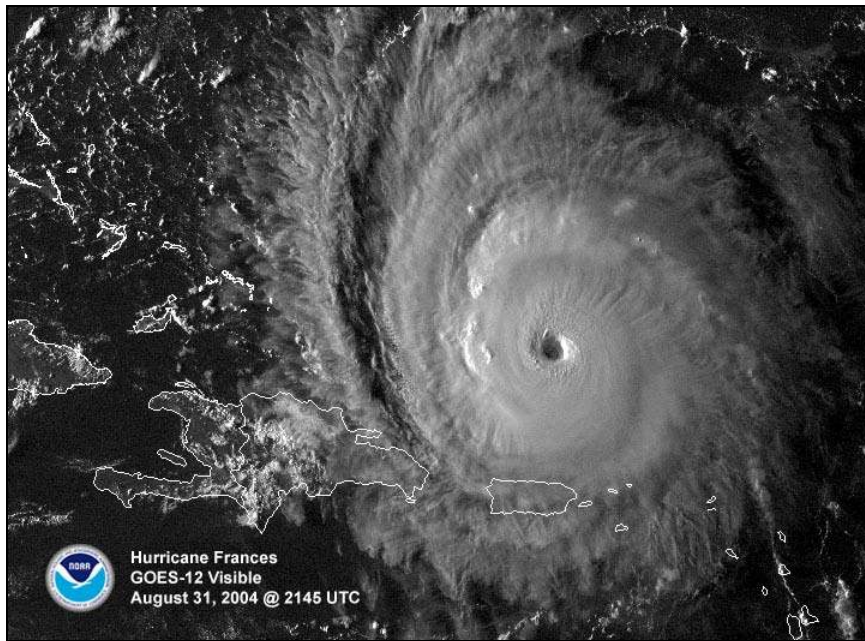
Frances continued to strengthen rapidly and by Friday, August 27th it reached category 3 status (winds of 111-130 mph). Exactly twenty-four hours later Frances was upgraded to category 4 status (winds of 131-155 mph). On August 31st, a hurricane warning was issued for the Turks and Caicos Islands and the Southeast Bahamas as Frances was approximately 600 miles east-southeast of the island of Inagua. A hurricane watch for the central Bahamas

and a Hurricane Alert for the Northwest Bahamas was also issued by The Bahamas Department of Meteorology (Rolle & Simmons, 2004a).

At noon on September 1st, a hurricane warning for the entire archipelago was issued. At this time Hurricane Frances was about 80 miles east-southeast of the island of Mayaguana. Frances' intensity fluctuated over the next few hours before winds peaked at 145mph on September 2nd.

With sustained winds measuring 145mph Frances moved directly over the Island of San Salvador near to Cat Island. Frances was moving on average 13mph in a west to west-north-west direction. However, on September 3rd as Frances moved over James Cistern, Eleuthera the forward speed decreased dramatically to 5 mph. Frances began to stall as it passed into the vicinity of Abaco and directly over Grand Bahama. Although Frances was downgraded to a category 3 and later to a category 2 storm the slow forward movement and the abundance of rain created devastating flooding to the northwest islands.

Sunday, September 5th the center of the broad eye of Frances finally moved inland over Florida providing relief to The Bahamas. Frances impacted the whole of the Bahamas and according to data from The Bahamas Department of Meteorology sustained hurricane force winds were experienced in the islands of Abaco, Grand Bahama, San Salvador, Rum Cay, Cat Island and Eleuthera as the eye passed near or over. New Providence and many of the other islands received sustained tropical storm force conditions. (See Picture B.13)



Picture B.13 - Hurricane Frances Satellite Image as it approaches The Bahamas. (Source: NOAA, 2004a)

B.5.1.1 Central Pressure and Intensity of Hurricane Frances

Figure B.4 shows the related wind speed and central pressure associated with Hurricane Frances. The data illustrate the relationship between the drop in central pressure and the increase in wind speed. Hurricane Frances impacted the Islands of The Bahamas over a 72 hour period September 1st – 3rd when the hurricane was at peak intensity.

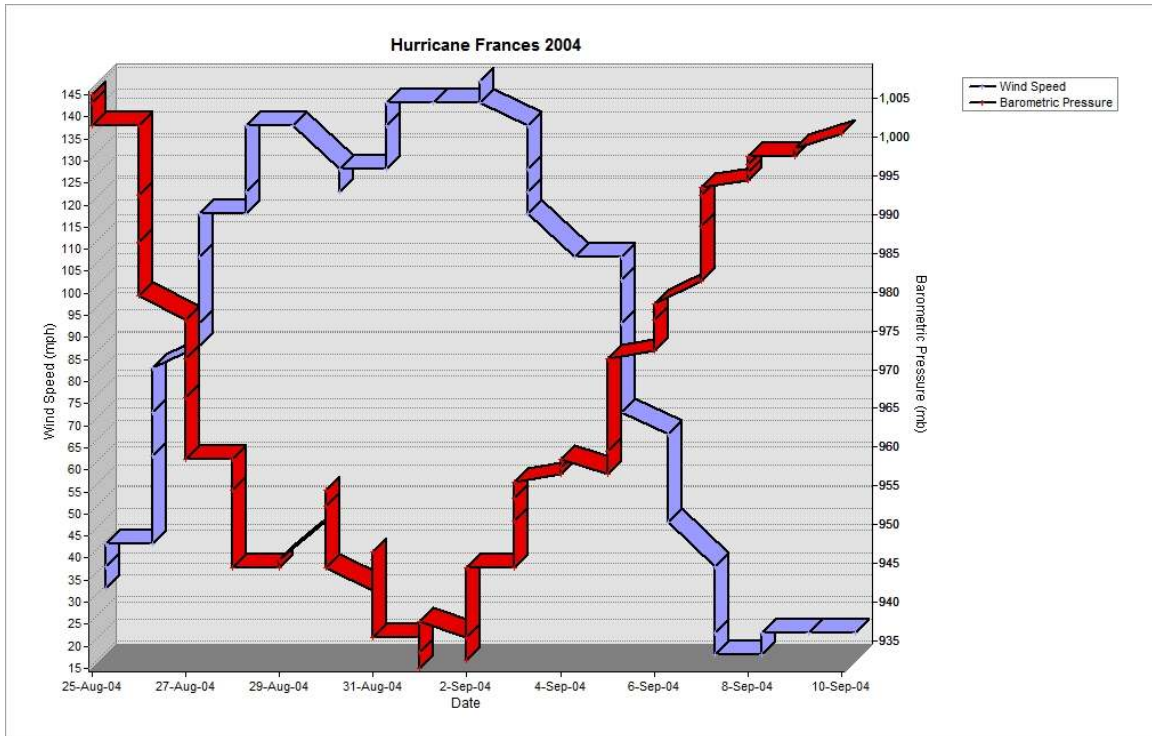


Figure B.4: Hurricane Frances Wind Speed and Central Pressure (Data Source: The Bahamas Department of Meteorology).

B.5.2 Impact of Hurricane Frances on the Islands

Hurricane Frances is a perfect example of why disasters should not be classified merely by the number of deaths directly associated with the event. Although the loss of life was small the livelihoods of many were destroyed. For instance, Hurricane Frances was the first storm since 1866 to impact the entire archipelago. Frances strong winds and heavy rains caused substantial damage especially to Grand Bahama where the storm stalled for over 24 hours.

According to the Bahamas Water and Sewerage Corporation (2004) storm surge from Frances caused dramatic increase in chlorides in the trenches in the North Andros Wellfields and the Grand Bahama Wellfields. The water supply to New Providence, where over sixty percent of the population resides, was

seriously affected due to the fact that the wellfields were inoperable as was the Reverse Osmosis plant, due to power outages.

Further compounding water availability issues, damage to ports on almost all the islands prevented the barging of water between islands. Freshwater supplies were delayed for several days and in some cases several weeks. (Bahamas Water and Sewerage Corporation, 2004)

Island infrastructure was heavily impacted by Hurricane Frances. According to the Ministry of Public Works (2004), New Providence sustained major damage to roadways as a result of inadequate storm surge protection. Extensive damage was also done to the roads in James Cistern and Governor's Harbour, Eleuthera and Elbow Cay, Abaco. Other islands notably impacted were Cat Island, Long Island and Mayaguana all suffering damage to roadways.

Docks and Ports throughout the country were heavily damaged and in some cases they were completely destroyed. According to the Bahamas Port Authority (2004) three docks in Lower Bogue, South Palmetto Point and James Cistern, all settlements of the island of Eleuthera were destroyed. Similar damage was seen on the island of Abaco. Docks in Cat Island, Long Island and Mayaguana also suffered some degree of damage.

According to the Bahamas Airport Authority (2004) damage to airport facilities at Freeport, Grand Bahama and Marsh Harbour, Abaco were completely inundated with water as a result of storm surge and compromised the structural integrity of the facility. There was no major damage to the Control Tower in Grand Bahama closing the airport for more than a week.

The Bahamas Ministry of Education (2004) reported major damage to public school facilities on the Berry Islands, and Grand Bahama. As a result school opening were significantly delayed.

Bahamas Electric Corporation (BEC) (2004) reported widespread power outages throughout the islands. Damages included downed power lines, downed poles and structural damage to power station sites on many of the islands. The impacts were minimized due to preplanning and mitigation efforts which allowed for the shutting off of power before and during the storm. Grand Bahama, which is part of a private electrical supply had the most extensive damage with over 1300 power poles downed (NEMA, 2004). (See Pictures B.14 - B.22)



Picture B.14 – Hurricane Frances Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.15 – Hurricane Frances on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.16 – Hurricane Frances Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.17 – Hurricane Frances Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.18 – Hurricane Frances Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.19 – Hurricane Frances Damage in the settlement of Gregory Town on the Island of Eleuthera, The Bahamas (Source: NEMA, 2004)



Picture B.20 – Hurricane Frances Damage on the Island of Andros, The Bahamas (Source: NEMA, 2004)



Picture B.21 – Hurricane Frances Damage on the Island of New Providence, The Bahamas (Source: Erin Hughey, 2004)



Picture B.22 – Hurricane Frances Damage on the Island of New Providence, The Bahamas (Source: Erin Hughey, 2004)

B.5.3 Hurricane Frances Discussion

Hurricane Frances impacted the whole of The Bahamas. The key concerns for the nation were meeting immediate emergency needs of fresh drinking water and shelter. Extensive damage to well fields, and transportation routs (airports, ports, and roadways) made difficult the movement of goods between the islands as well as on the island. Hurricane Frances was the first NEMA coordinated emergency response. Strong support came from the Royal Bahamas Defence Force as well as a variety of ministries.

B.6 Hurricane Jeanne 2004

Hurricane Jeanne was the second hurricane of the 2004 season to hit The Islands of The Bahamas, making landfall less than three weeks after Hurricane Frances. The tenth named storm of the 2004 season, the sixth hurricane, and the fifth major hurricane (category 3 or greater) Jeanne developed as an open water hurricane east of the Lesser Antilles. With plenty of time to develop Jeanne gained and lost speed, twisted and turned, all before slamming into the Northwestern Islands of The Bahamas. This erratic storm caused problems for forecasters and emergency management officials who were not sure where it was headed. While watching Jeanne, officials were also continuing with Hurricane Frances response operations. Map B.5 illustrates the path that Jeanne took through The Bahamas.

B.6.1 Hurricane Jeanne Storm Development

According to the 5pm tropical report on Monday, September 13th issued by The Bahamas Department of Meteorology, tropical depression eleven had formed from a tropical wave 70 miles east-southeast of Guadeloupe in the Lesser Antilles. By the next morning the storm had been upgraded to a Tropical Storm and was named Jeanne.

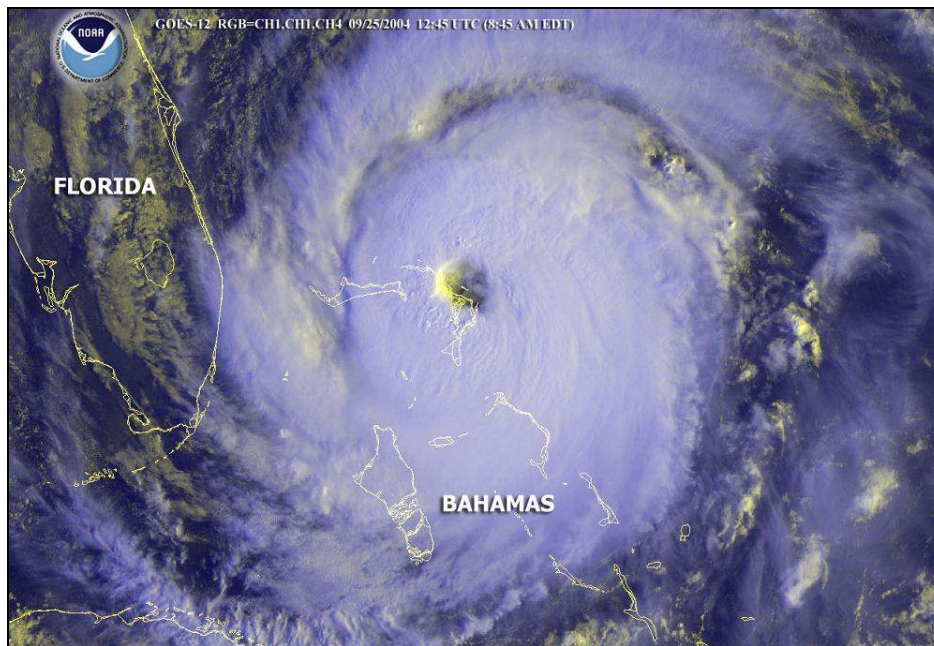
Jeanne was moving in a west-northwest direction at 8-12 mph and attained hurricane strength two days later on September 16th. It was not long before Jeanne lost strength and on September 17th it was downgraded to a tropical depression as it moved across the Dominican Republic.

On September 18th, while near the southern Bahamian Island of Great Inagua, a new center formed to the northeast and the previous circulation dissipated. The 5pm report issued by The Bahamas Department of Meteorology on September 20th indicated that the newly developed center of Jeanne had strengthened again and becoming a hurricane for the second time.

Hurricane Jeanne meandered for days before moving in a westerly direction towards the Northwest Bahamas. "This behavior was similar to that of Hurricane Betsy of 1965 and presented numerous challenges for forecasters and their models" (Rolle & Simmons, 2004b:3). Continuing to strengthen Hurricane Jeanne headed toward the west, making landfall on the Island of Abaco in the early morning of September 25th. "Shortly thereafter, it reached category 3 status on the Saffir-Simpson scale and maintained this intensity as it passed over

Grand Bahama during the remainder of the day” (Rolle & Simmons, 2004b:3).

(See Picture B.23)



Picture B.23 - Hurricane Jeanne Satellite Image as it impacts The Bahamas. (Source: NOAA, 2004b)

B.6.1.1 Central Pressure and Intensity of Hurricane Jeanne

Figure B.5 shows the related wind speed and central pressure associated with Hurricane Jeanne. The data illustrates the relationship between the drop in central pressure and the increase in wind speed. Hurricane Jeanne impacted the Northwestern Bahamas on September 25th when the storm was at peak intensity.

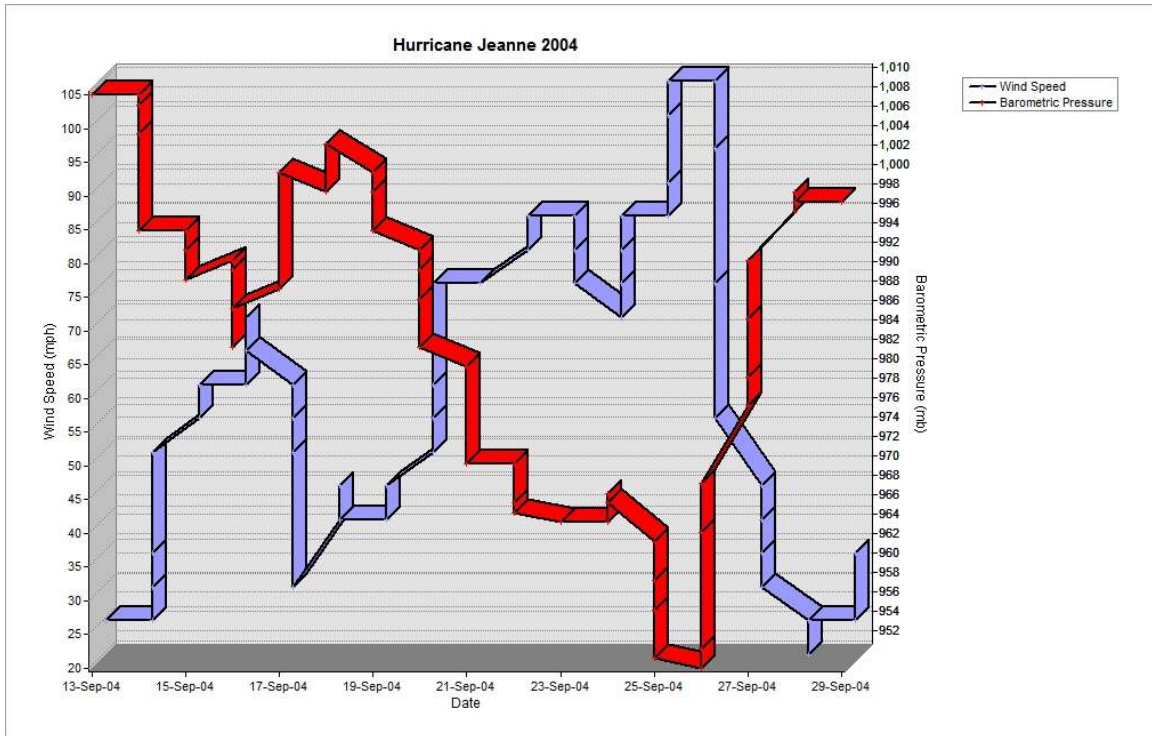


Figure B.5: Hurricane Jeanne Wind Speed and Central Pressure (Data Source: The Bahamas Department of Meteorology).

B.6.2 Impact of Hurricane Jeanne on the Islands

There were no deaths or reported injuries in association with Hurricane Jeanne. However according to a report issued by The Bahamas Department of Meteorology, “many residents in the extreme northwest Bahamas (Abaco and Grand Bahama, in particular), had to undergo psychiatric evaluation after experiencing two hurricanes in approximately three weeks and losing all of their belongings” (Rolle & Simmons, 2004b:7).

Attempting to attribute damages exclusively to Hurricane Jeanne was difficult since Frances impacted the same islands less than three weeks prior. The northwestern Bahamas received the brunt of Hurricane Jeanne and extensive flooding occurred. As a result local and national resources were

heavily taxed during the 2004 hurricane season in response to both storms.

(See Pictures B.24 – B.29)



Picture B.24 – Hurricane Jeanne Damage on Treasure Cay, The Bahamas
(Source: NEMA, 2004)



Picture B.25 – Hurricane Jeanne Damage, Abaco (Source: NEMA, 2004)



Picture B.26 – Hurricane Jeanne Damage on the Island of Abaco, The Bahamas
(Source: NEMA, 2004)



Picture B.27 – Hurricane Jeanne Damage on the Island of Abaco, The Bahamas
(Source: NEMA, 2004)



Picture B.28 – Hurricane Jeanne Damage, Haitian Community on the Island of Abaco, The Bahamas (Source: NEMA, 2004)



Picture B.29 – Hurricane Jeanne Damage, Haitian Community on the Island of Abaco, The Bahamas (Source: NEMA, 2004)

B.6.3 Hurricane Jeanne Discussion

Hurricane Jeanne impacted the northern islands of the Bahamas just three weeks after the archipelago was impacted by Hurricane Frances. The key concerns for the nation continued to be meeting the immediate emergency needs of fresh drinking water and shelter. Logistics and communication were extremely challenging as transportation routes and communication lines were damaged. Hurricane Jeanne was the second NEMA coordinated emergency response and it occurred simultaneously to the Hurricane Frances response. Strong support came from a variety of ministries and organizations and was coordinated through the National Emergency Operations Center in Nassau.

B.7 Hurricane Wilma 2005

The 2005 Hurricane Season experienced a record breaking 26 tropical cyclones and two tropical depressions, it also also marked the first time that meteorologists had to utilize the Greek alphabet for the naming of storms. Five tropical cyclones impacted the Bahamian archipelago that year: *Franklin, Katrina, Ophelia, Rita and Wilma*. However, it was Hurricane Wilma that “wreaked havoc on the nations second largest city Freeport, in Grand Bahama” (The Bahamas Department of Meteorology, 2005:1). Wilma was also the only storm of the season that required a national response. Map B.6 illustrates the path that Wilma took through The Bahamas.

B.7.1 Hurricane Wilma Storm Development

According to The Bahamas Department of Meteorology, on Saturday, October 15th Hurricane Wilma developed from a tropical depression that formed about 195 miles southeast of Grand Cayman. The system was monitored over the next few days as the system moved slowly between a west and northwest direction in the Western Caribbean Sea. The 11am report from the Department of Meteorology on Tuesday, October 18th indicated that Wilma had officially become the twelfth hurricane of the season. Hurricane Wilma struck Cozumel, Mexico and Honduras before making a turn to the northeast and accelerating towards Florida on Sunday, October 23rd.

The Bahamas Department of Meteorology reported on Monday, October 24th that Hurricane Wilma was moving to the northeast near 25 miles per hour and was passing within 60 nautical miles northwest of Freeport, Grand Bahama. "Tropical storm force winds (sustained 39-73mph) were experienced by residents in Grand Bahama from 7:00am through 8:00pm. However, during the period of 11:00am to 2:00pm hurricane force winds (winds of 74 mph or greater) were experienced. The later event appeared synchronous with the intensification of Wilma to Category 3 (115 mph) status around 1pm of the same day" (The Bahamas Department of Meteorology, 2005:1). It was high tide (1:49pm) when Hurricane Wilma hit the southwest shoreline of Grand Bahama and the Lucayan Harbour. These areas sustained major damage from strong waves and high storm surges. (See Picture B.30)



Picture B.30 - Hurricane Wilma Satellite Image as it impacts The Bahamas.
(Source: NOAA, 2005)

B.7.1.1 Central Pressure and Intensity of Hurricane Wilma

Figure B.6 below displays the relationship between wind speed and central pressure associated with Hurricane Wilma. The data illustrate the relationship between the drop in central pressure and the increase in wind speed. Hurricane Wilma impacted the Northwestern Bahamas on October 24th luckily, this was not at its peak intensity.

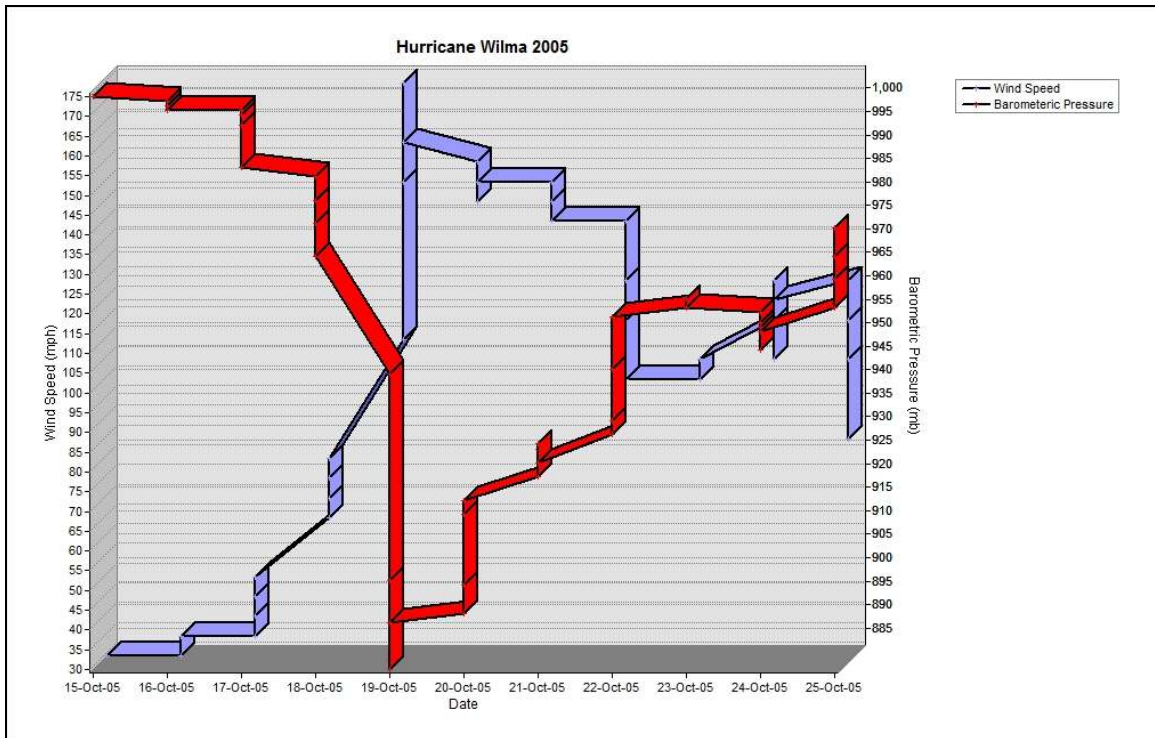


Figure B.6: Hurricane Wilma Wind Speed and Central Pressure (Data Source: The Bahamas Department of Meteorology).

B.7.2 Impact of Hurricane Wilma on the Islands

Hurricane Wilma was the only storm to cause any significant damage to The Bahamas during the 2005 Hurricane Season. One death was reported as a result of Hurricane Wilma and was directly related to storm surge inundation. The concentration of damages was mainly in the vicinities of the northwestern coastal areas. It was in this area that storm surge was measured at 12 feet (The Bahamas Department of Meteorology, 2005). Early damage estimates were in the amount of \$6.5 million and ranged from widespread destruction of roofs and vehicles to the uprooting of poles and trees and the displacement of tombs from the graveyard near the coast (The Bahamas Department of Meteorology, 2005). (See Pictures B.31 – B.36)



Picture B.31 – Hurricane Wilma Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.32 – Hurricane Wilma Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.33 – Hurricane Wilma Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.34 – Hurricane Wilma Damage on the Island of Grand Bahama, The Bahamas (Source: NEMA, 2004)



Picture B.35 – Bahamas Telecommunications Company Building Hurricane Wilma Damage, Jones Town, Grand Bahama (Source: NEMA, 2004)



Picture B.36 – Hurricane Wilma Damage. Ray of Hope Church, Hanna Hill, Grand Bahama (Source: NEMA, 2004)

B.7.3 Hurricane Wilma Discussion

Hurricane Wilma significantly impacted the northwestern Bahamas with concentrated damage on the western portion of Grand Bahama. The islands of Abaco and Bimini also sustained considerable damage. The key concerns for the nation were meeting immediate emergency needs of fresh drinking water and shelter. The response to Hurricane Wilma was coordinated by NEMA.

B.8 Conclusions

Chapter 5 provided the development characteristics of each hurricane events as well as the impact each storm had on The Bahamas. Table B.1 provides a summary of the key characteristics of the six hurricanes. Of important note is Hurricane Michelle, although Andrew and Floyd both violet category four storms caused major destruction, it was the category two storm making landfall in Nassau that triggered an overhaul to the emergency response structure.

The impact to government and 60% of the nations population highlighted the within The Bahamas. response only a category two storm it was the first storm to impact Nassau, the nation's capital. Michelle, interrupted the business of government raising

SUMMARY TABLE					
Hurricane Name	Date of Landfall in The Bahamas	Category at Landfall	Sustained Wind Speed At Landfall (mph)	Barometric Pressure At Landfall (mb)	Number Dead
Andrew	8/23/1992	4	150	922	4
Floyd	9/14/1999	4	135	921	2
Michelle	11/05/2001	2	105	965	0
Frances	9/2-5/2004	4	145	936	2
Jeanne	9/25/2004	2	105	952	0
Wilma	10/24/2005	3	125	950	1

Table B.1 – Study Hurricane Summary Table (Data Source: Bahamas Department of Meteorology)

Appendix C: Interview With Prime Minister Perry G. Christie

C.1 Interview with Prime Minister Perry G. Christie (January 25, 2007)

To assess the national governments position on emergency management an interview was conducted with Prime Minister Perry G. Christie in January of 2007 (See Picture 5.1). The transcript and discussion of the interview is provided below.

Question: What is your vision for NEMA and emergency management in The Bahamas?

“Firstly, it is of critical importance that The Bahamas applies the same level of interest in developing a disaster preparedness entity that it does in developing its economy, because our ability to respond and manage disasters will be directly related to our ability to secure our future. The fact that we are a different kind of country than most countries in the region, and in the hemisphere, in that we are a chain of islands separated by expanses of water with sparse population centers throughout makes our task even more onerous as well as more important. Therefore, the people who are invited to be a part of NEMA must be prepared to be special people in terms of the initiatives that they take, really the preparations that they make to prepare themselves. They must ‘know’ the Bahamas and so the government must be committed and in its commitment the government must be sure to recruit the right people with the right qualifications to lead NEMA. Those qualifications must be beyond academic qualifications, they must I think, give a lot of weight to leadership. The ability to lead and inspire people, get people to listen to you and to understand is critical. They must have special qualities of being able to ensure that they are able to lead a coordinated and integrated sort of effort to ensure that all of the sectors of government and private sector are working together. My vision is that we begin... I think I should also add that through the leadership must also have people who can easily work with persons from outside the country. It is necessary for us to have good working relationships with those international agencies at the regional level, or across border in the United States of America. NEMA personnel must have the stature and ability to lead NEMA in that direction on a sustained basis. Having done all of those things, having

ensured that the right legislation is in place, the government must demonstrate its continuing support for the strengthening of NEMA, because of that level of importance that I have assigned when I spoke of it being directly linked to the economy of the country, and therefore the survival of our people. The final point I want to make about it is, because we are a chain of islands we have to put a lot of effort into planning. So the most important aspect of NEMA is anticipating the varying types of disasters that could impact our country and creating models for the necessary response that would be there. For example, when we are confronted by the enormity of the potential impact; like an island really having 200mph force coming into it. What do we do in terms of evacuation? If one were to therefore look at the fact that we are a chain of islands the question for the country is do we have an organization in place that is efficiently empowered and funded to go through the various studies and determinations that would be there to protect our country. It therefore requires the political will and the political commitment to ensure the success of that. Hopefully I have given you the right feel for my vision". (Prime Minister Perry G. Christie, January 25, 2007)

Prime Minister Christie's response illustrates a clear awareness of the importance of emergency management, and the economic and political impact a major disaster could have on the Nation. Also revealed is his understanding that the geography of The Bahamas places it at a high and recurrent risk of hurricanes. Weeks after Prime Minister Christie took office Hurricane Michelle impacted the nation's capital. The interruption to government caused by Michelle as well as the impact of September 11th on the world, created within the nation an advocacy supporting action. As a result, the Prime Minister pushed for the development of a national agency focused on managing disasters. Financial support for the development of NEMA was provided by the office of the Prime Minister and later legislated under the 2006 Disaster Preparedness and Response Act.

Strong support from the Prime Minister for the creation of NEMA and the implementation of a CEM system has brought disaster awareness to the forefront. Through this process resources have been made available to develop planning and training initiatives in an effort to improve disaster response. The political support provided by the Prime Minister has made emergency management a national priority.

Question: The Bahamas has a unique Geography with over 700 islands and cays covering over 100,000 square miles. Is there one thing that you think other island nations could learn from how The Bahamas are managing disaster preparedness and response?

“Again it is difficult for me to comment on what other nations are doing in terms of their levels of preparation. I would like to believe The Bahamas in terms of our recent experiences, has gone about using all of our resources and international help, like the International American Bank, to affect an understanding to the entire country of the importance of working together and not underestimating a potential impact always knowing that the country could be cut-off and that we have to be prepared to deal with that. I think if one were to look at The Bahamas over the last five to ten year and see the rapid progress that we have made forging an understanding that we have to be strong and we have to integrate the necessary forces in the country. NEMA will never have the manpower available to it, in terms of its own 1000 staff members and so therefore it needs to forge relationships and models of participation that will be triggered when disasters strike. Blend everyone into a working instrument that would properly coordinate and properly manage, is the goal of NEMA. So, I think the challenge for us is that that we look to the future to develop a model of each island taking into consideration all of their peculiarities so that this coordinating body at the center in the capital would be able to coordinate. I think currently there are levels of that, but we need to continue to move in that direction. My job would be to ensure that those who are leading NEMA are in fact making progress and are moving forward not just waiting for the next hurricane season and so it is a full time preoccupation and something that we will manage effectively.”
(Prime Minister Perry G. Christie, January 25, 2007)

Prime Minister Christie's responses illustrate his understanding of the critical nature of emergency management. He is committed to a comprehensive preparedness and response campaign that requires an understanding of the unique physical and social environment of the nation. His commitment has been articulated through legislation and financial support for NEMA. He believes strongly that his job is to ensure NEMA is properly equipped to effectively manage disaster and protect the nation.



Picture 5.1 – Prime Minister Perry G. Christie and Erin Hughey, January 25, 2007. (Photographer: Gayle Outton-Moncur)

The intent of the interview with the Prime Minister was to assess the national governments position on emergency management. Through strong political and fiscal support for NEMA position of the government with regards to emergency management is a proactive one. Prime Minister Christie personally provided strong support to NEMA in response to Hurricanes Frances, Jeanne,

and Wilma through participation in media briefings, active involvement in discussions with Family Island Administrators, and contributions to the national EOC. His involvement has raised awareness within the nation and facilitated the development and implementation of a CEM system.

About the Author

Erin Hughey received a Bachelor's Degree in Government from Morehead State University in 1998. Following Graduation Ms. Hughey began her work in the field of disaster management as a Disaster Specialist with the American Red Cross. Upon completion of her tenure with the Red Cross Ms. Hughey began work on her Master's degree in Geography at the University of South Florida. While working towards her Master's degree, Ms. Hughey was a researcher and instructor with the Global Center for Disaster Management and Humanitarian Action at the University of South Florida. She earned her MA in geography in 2002. Ms. Hughey began the Ph.D. program in Geography & Environmental Science and Policy at the University of South Florida in 2005. Her research has focused on the political and social challenges associated with developing a comprehensive emergency management system for The Commonwealth of The Bahamas. Ms. Hughey's work has been published in *The Southeastern Geographer* and the *Florida Geographer*.