MITIGATION, PREPAREDNESS AND RESPONSE TO THE HURRICANE THREAT: THE CASE OF NEVIS IN THE AFTERMATH OF HURRICANE HUGO

by

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Alexis Nathaniel Hobson

A thesis

presented to the University of Manitoba
in partial fulfilment of the
requirements for the degree of
Masters of Arts
in
Geography

Winnipeg, Manitoba

ISBN 0-612-13191-2

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MITIGATION, PREPAREDNESS AND RESPONSE TO THE HURRICANE THREAT: THE CASE OF NEVIS IN THE AFTERMATH OF HURRICANE HUGO

BY

ALEXIS NATHANIEL HOBSON

A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF ARTS

ABSTRACT

Research suggests that preparedness levels tend to be higher in communities and societies that have repeatedly and recently experienced the same kind of disasters (Fritz, 1961). The adoption of mitigation measures has also been found to vary with the intensity of the damage experienced and the socioeconomic characteristics of respondents (Jackson, 1981). In fact, the literature also suggests that preparedness level tend to be high immediately following a storm because of increased awareness. This study investigates the extent to which residents of Nevis adopted preparedness measures during the passage of Hurricane Hugo in 1989 and the nature and extent of the adoption of mitigative measures in the post-Hurricane Hugo era.

A structured questionnaire was successfully administered to 206 respondents on Nevis during the latter half of the 1994 hurricane season. Chi-square tests and descriptive statistics were used to analyze the data. The survey suggests that the lack of disaster experience and the quality of warnings received by respondents resulted in the relatively low rate of preparedness adoption during Hurricane Hugo. Contrary to expectation, socioeconomic variables were not significantly associated with preparedness adoption. However the intensity of damage sustained during Hurricane Hugo was found to be significantly associated with the adoption of mitigative

measures. Age was the only socioeconomic variable found to be significantly associated with the adoption of mitigative measures. An evaluation of scores on a hurricane preparedness checklist suggests that respondents were comparatively well prepared during the 1994 hurricane season. Given the general unwillingness of residents to evacuate, the inadequate warning received and the low level of insurance coverage reported, hurricane proofing and improved warnings should be pursued by disaster protagonists.

ACKNOWLEDGEMENT

During the preparation, writing and completion of this study, I have benefitted tremendously from the help of relatives, friends, colleagues, professionals and well wishers. To all those who have assisted me in one way or another, I wish to express my sincere gratitude, and in particular I would like to thank:

Dr. John Rogge, my supervisor without whose guidance and critical support throughout the various phases, this thesis would not have been possible. The other members of my thesis committee Drs. Chowdhury Haque adjunct professor of Geography and Richard Lobdell of the Department of Economics. Their comments and suggestions have been invaluable during the final stages of the thesis. Dr. John Brierley for his contribution towards my questionnaire design and field work techniques and also his suggestions throughout the various phases of the thesis.

Mr. Ray John and Mr. Llewellyn Newton of the National Emergency Management Committee for sharing information about the national and local response to disasters and their future plans. Mr. Norman Jones, and Lester Blacket for discussing building plans and practices of the Building Board and Public works. Messers Samuel and Eustance Hunkins for sharing information about building practices on the island.

I am also grateful to the Nevis Teachers Union (NTU) for the use of their computer and xerox machine to prepare my questionnaires. Laurie Richards and Wilroy Gerald who diligently assisted during the preparation and copying of the questionnaires. Mr. Morrison Ward and John Hanley for assistance with sample and questionnaire design. Mr. T. B Kennedy at the Nevis Water Department for the use of his light table to locate my sample units. The librarian and library staff at the Nevis Public Library and staff at the Alexander Hamilton Museum for their support and assistance in locating useful information.

I am also indebted to the respondents who willingly answered my questions and engaged in valuable discussions; and to the Canadian Commonwealth Scholarship and Fellowship Program for making my studies possible. My sincere thanks to my parents, relatives, friends and well wishers whose encouragement often helped me overcome adversity throughout my studies. Special thanks to John Collins for preparing the maps. David Farrell and Hugh Semple for their critical suggestions and timely assistance throughout. I also thankful the support provided by the Disaster Research Institute and the lecturers and ancillary staff at the Geography Department.

Finally, to my fiance Marcella for her undying support and inspiration especially in times of despair.

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INTRODUCTION

Probably the greatest challenge facing mankind is finding effective solutions to reduce the increasing losses from natural disasters. Despite remarkable progress in science and technology in different spheres of life and controlling domains of the natural world today, only limited progress has been attained in preventing natural events from adversely affecting human and its habitat (Haque, 1989). In the past 20 years alone, disasters have killed about three and a half million people and have caused more than $400 billion in losses worldwide (Duguay, 1994). While most of the material losses have occurred in the Developed World, the overwhelming majority of fatalities have been confined to the Developing World. It is academic consensus that the Developing World is becoming more vulnerable to disasters. Some researchers (Susman, et al., 1982 and Baird, et al., 1975) have explained the increased vulnerability of the Developing World using dependency and marginalisation theories. Moreover, the increased vulnerability of people to extreme physical events seems intimately connected with the continuing process of underdevelopment throughout the world (Susman, et al., 1983). The Caribbean region is one such area that is increasingly becoming vulnerable to disasters.

The Caribbean has a multi-hazard history: floods, hurricanes, storm surges, landslides, earthquakes, droughts, and volcanic eruptions have all impacted the islands. Among these hazards, earthquakes, hurricanes and volcanic eruptions have been the most destructive. Each has caused loss of life running into many thousands and property losses equivalent to hundreds of millions of dollars at present-day value (Tomblin, 1981). The last major volcanic eruption in the region affected Martinique and St. Vincent in 1902 with 29,000 and 1,565 fatalities respectively[1], albeit minor eruptions occurred in St. Vincent in 1979 and 1985 and Montserrat in 1995. Similarly the most recent major earthquake stuck the Dominican Republic in 1946, killing 75 people and leaving 20,000 people homeless although several others have caused minor damage across the region. However, unlike earthquakes and volcanic eruptions, hurricanes have frequently ravaged the Caribbean islands in contemporary times.

According to Lewis (1990) small island states can be expected to be in the path of tropical cyclones perhaps two or three times a decade and often more frequently. Although this prognosis has not held true for the individual islands, collectively, the Caribbean is often affected by several hurricanes and severe tropical storms in a single decade. Consequently, given their small size, vulnerable population and narrow resource base, when hurricanes do strike they have

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[1] **The information is taken from Tomblin, 1992:11.**

often severely aggravated the socioeconomic conditions in the region. The destruction caused by these storms makes recovery a daunting task especially in light of the parlous state of their economies. For instance, some poor island communities (the Dominican Republic in 1979, Haiti, St. Lucia and St. Vincent in 1980) have suffered damage from hurricanes equivalent to 15 percent of their gross natural product (Smith, 1992). The human and social ramifications of these losses make increased vigilance at reducing future losses imperative.

Despite improved hurricane warning throughout the Caribbean and despite increased losses from hurricanes, there appears to be low preparedness adoption levels among residents. The reason for the generally low preparedness levels is not fully understood. However, some studies (Burton, Kates and Snead, 1969) have shown that even when residents of hazardous areas knew of the hurricane threat or even had past experience, there is much variation in the adjustment measures adopted. Conversely, in their study of human adjustment to the earthquake hazard in San Francisco, (Jackson and Mukerjee, 1974) found that the number of adjustments adopted was related to the number of earthquakes experienced in the past. Other factors which are known to affect the adoption of mitigative measures include awareness of the hazard, frequency of the event, age and education. However, several studies have shown that these demographic factors do not consistently affect

either perception or response to hazards (Palm and Hodgson, 1992). Nevertheless, there is some premise for investigation into human response to the hurricane threat in the Caribbean.

While human response to hurricanes has been researched for a long time, studies have been largely confined to the USA (Baker and Patton, 1974; Baumann and Sims, 1974) and Bangladesh (Islam, 1974; Haque and Blair, 1992). There is little evidence that similar studies have been conducted in the Caribbean despite its having suffered immensely from hurricanes throughout its recorded history. In response to the devastation caused by recent hurricanes, a few studies have been undertaken but mainly to assess the impact of these storms (Williams, 1988; Baker and Miller, 1990; Oliver and Trollope, 1981) and long term recovery of households (Berke, et al., 1993). There is an apparent lack of research into understanding the extent to which households prepare for and implement mitigation or precautionary adjustment measures to reduce hurricane damage in the region.

This study seeks to explore the factors affecting the adoption of hurricane mitigation and preparedness measures on the Caribbean island of Nevis. It specifically seeks to investigate the extent to which households implemented preparedness measures prior to the onset of Hurricane Hugo. Also, the study seeks to explain the extent to which the experience of Hurricane Hugo has resulted in the adoption mitigation and preparedness measures. In addition, aspects of

disaster management on the island are also examined.

1.1 Caribbean Hurricanes - History and Origins

The history of hurricanes and severe tropical storms in the region is not a recent one. The earliest reference to these storms date back to the second voyage of Christopher Columbus (Lobdell, 1989). While the exact number of storms that have traversed the region is not known, various estimates have been advanced. For instance, Lobdell (1989) suggests that there are references to as many as 500 hurricanes over the period 1494-1938. Based on the data reported by Dunn and Miller, Lobdell has estimated as many as 3,500 storms over the same period. Conversely, the Caribbean Cyclone-Resistant Housing Project Bulletin (1991) proposed that over 2,000 cyclones ranging from tropical depressions to major hurricanes have occurred in the region over the last 500 years, with over 500 hurricanes between 1886-1990 (Table 1.1). While the frequency of these storms is questionable, their importance as a persistent threat to the social and economic viability of the islands is undoubted.

Despite their persistent threat, the frequency of storms in any individual country is relatively low. This means that in individual island populations, substantial portions of the population reach well into adulthood without ever experiencing, at first hand, the devastation which can follow in the wake of catastrophe (Mathurin, 1992:3).

TABLE 1.1

Summary of Caribbean Tropical Storms and Hurricanes

(1886-1990)

Type	Total Number 1886-1990	Example	Date of event	Island affected
TS	368	Alma	Aug. 1974	Trinidad
HC1	151	Katrina	Nov. 1981	Cuba
HC2	174	Edith	Sep. 1963	St. Lucia
HC3	108	Eloise	Sep. 1975	Hispaniola
HC4	64	Flora	Sep. 1963	Tobago
HC5	24	Gilbert	Sep. 1988	Jamaica

Note: TS = Tropical Storm HC = Hurricane Category[2]

Source: Caribbean Cyclone-Resistant Housing Information Bulletin Issue No.1

Consequently, the development of a well established subculture[3] has not emerged throughout the islands to enable them to effectively cope with hurricanes. Therefore, efforts

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[2] The Saffir Simpson Scale categories hurricanes on a five point scale based on the speed and damage potential, five being the highest and one the lowest. Category 1 = Minimal (120 Km/h), Category 2 = Moderate (160 km/h), Category 3 = Extensive (180 Km/h), Category 4 (200 km/h), Category 5 = Catastrophic (240 km/h).

2 The concept of disaster subculture was first developed by Moore who described it as 'those adjustments, actual and potential, social, psychological and physical, which are used by residents of such areas to cope with disasters which have struck or which tradition indicates may strike in the future', (Hannigan and Kueneman, 1978:131).

at reducing losses from future hurricanes and severe tropical storms will depend on the implementation of effective mitigation and preparedness programs in individual territories.

Earlier accounts of hurricanes often lamented the destructiveness of these "ill fated" storms and the hardship and misery which followed. The destructiveness and ramifications of hurricanes and tropical storms throughout the region is well documented. It was not uncommon to have famines following hurricanes in the islands. For instance, one visitor in Jamaica during the great hurricane of 1780 later observed:

> [I]t is not the destruction of whole districts---the complete loss of produce---the ruin of stock, and the demolition of all kinds of works and buildings on each estate, that we are principally to consider. It is the total destruction of those provisions, which constitutes the support and existence of your Negroes---it is the inability, and impossibility of procuring other provisions in time to keep them alive---it is sick without a hospital---your infirm without shelter, and it is the misery of beholding hundreds of wretched beings wasting around you, clamouring for food, and imploring that assistance which you cannot bestow (Sheridan as cited in Lobdell, 1989:5).

Other accounts simply described the wanton destruction that these storms usually leave across the islands. However, while quick response from international relief agencies often avert famines in contemporary times, the physical destruction caused by hurricanes have continued largely unabated.

Apart from the obvious destruction to capital and housing stocks, roads, ports and machinery, is the loss of lives and

total cost by which hurricanes taxed the region. Based on data provided by Tomblin (1992), major events have accounted for 42,626 fatalities between 1722-1990, with another 594 fatalities resulting from minor events over the same period. As many as 22,000 fatalities resulted from the 'Great Hurricane' of 1780 (Hubbard, 1992). While the number of fatalities which result from hurricanes has decreased significantly over the last generation, the cost of damages has increased astronomically, albeit at the current exchange rates. Nonetheless, the apparent increase in capital losses over time is, almost certainly, the result of growth in their capital stock rather than an increase in the severity of Caribbean hurricanes (Lobdell, 1989). Tomblin (1992) data indicate that between 1960 and 1990, six major events resulted in property losses of US$3.090 billion in the Caribbean, losses that these islands can ill afford.

More importantly, due to its relatively small size, several Caribbean islands are usually ravaged by the same storm. However, the most southerly islands such as Trinidad and Tobago are less susceptible to their periodic onslaughts. Therefore, it is not surprising that every Caribbean island has been adversely affected by hurricanes and tropical cyclones throughout its recorded history. The increased toll of natural disasters in the region has been met with efforts at hurricane preparedness and mitigation.

However, despite various attempts at improving preparedness, the widespread destruction caused by recent storms (Hurricane Gilbert in 1988, Hurricane Hugo in 1989 and Tropical Storm Chris in 1994) throughout the Caribbean, attest to the continued physical, economic and social vulnerability of these islands to natural disasters. The volatile and largely monocultural nature of the Caribbean economies suggests that a major event can retard economic development for extended periods. What is instructive is that these islands simply lack the financial resources to absorb repeated storm impacts, neither is there adequate planning to prepare for their consequences. Consequently, world wide relief efforts in the Caribbean has become routine following hurricane storms. Increasing population, greater concentration of the populace in coastal locations and decreasing real income in some islands have increased the vulnerability of inhabitants in recent years. The unprecedented social and economic setbacks that have been caused by hurricanes and tropical storms over the last two decades have evoked various responses from institutions and governments in the Caribbean.

1.2 Regional Disaster Response

In response to the increased damage caused by floods and hurricanes, especially Hurricane David in 1979, Hurricanes Frederick and Allen in 1980, the Pan Caribbean Disaster Preparedness and Prevention Project (PCDPPP) was established

in 1980. The Project was implemented to increase the mitigation and preparedness capabilities of the individual islands and to establish National Disaster Committees where they did not exist. The main activities of the project fall into four major categories: technical assistance; training of island nationals; surveys and assessments and the preparation of training material (Toulmin, 1987:221). Although PCDPPP has significantly increased the awareness and institutional support needed within the region, the top-down approach at mitigation and preparedness has precluded an understanding of the concerns of the individual or the household level.

In addition, there is little evidence that PCDPPP was able to effectively forge the link between preparedness and mitigation and development. As Mathurin (1992) averred:

> The general consensus after its ten years of operation, however, is that while considerable progress has been achieved, the necessary linkages between preparedness and development have not been cemented, and that the concept of mitigation measures being incorporated into the ordinary procedures of planning for development, requires a good deal more effort before it becomes the accepted norm (1992:4).

Nevertheless, by the completion of the project in 1990, there was some evidence that disaster management committees and improved preparedness existed throughout the region. More importantly, PCDPPP created a structure and established a precedence for increased regional cooperation in disaster management. However, there is need to accommodate local knowledge within the overall disaster management context in

the region.

Similarly, the establishment of the Caribbean Disaster Emergency Response Agency (CDERA) in 1991 to replace PCDPPP may well continue to reinforce mitigation and preparedness at the institutional level without understanding the individual knowledge and mitigation preferences. It appears that the approach of CDERA is reactionary, facilitating the allocation of resources after an event rather than efforts at integrating preparedness and mitigation into the actual development process in the region. The principal expectation of the agency are the mobilization and deployment of those resources which will be required to provide relief and early restoration measures, based on early and qualified assessment, in the aftermath of any disastrous occurrence (Mathurin, 1992). In an era of scarce resources, efforts are therefore needed at implementing mitigation and preparedness at all levels throughout the region. What may be needed is the collection of data on a country basis which can be used to guide policy implementation at the country and regional level. Such information will foster appropriate institutional response to the persistent threat of hazards in the region.

1.2.2 Hurricanes, Origins And Characteristics

Tropical cyclones or hurricanes are among the most destructive of all natural disasters. Conceived over warm tropical oceans, born amid torrential thundershowers, and

nurtured by water vapour drawn inward from far away, the mature tropical cyclone is an offspring of the atmosphere with both negative and positive consequences for life (Anthes, 1982). Their strong winds, torrential rainfall, thunderstorms and induced storm surges have destroyed many settlements in vulnerable areas in tropics. The destruction that result from the passage of a hurricane is often incredible as Burns explains:

> The damage that can be done by a severe hurricane almost passes belief. Houses of substantial construction are often damaged, while buildings of flimsier construction are completely destroyed, large trees are blown down, and heavy articles moved for considerable distances. Sheets of corrugated iron have been torn from the roofs of houses by the wind and been wrapped like paper round trees and telephone posts and wooden planks have been driven through the trunks of trees (Burns, 1965: 29).

Although storms are most obviously associated with high wind speeds and even tornadoes, the main cause of damage and loss of life is actually due to heavy rainfall, flooding and, in coastal areas, the tidal surges which often accompany the storms (Smithson, 1993). Conversely, many hurricanes have brought much needed rainfall to areas over which they blow. Such was the case of Antigua in 1924 when the hurricane affecting the island ended three years of serious drought (Lewis, 1990). However, their awesome destructive forces have left indelible effects on many countries across the globe.

Cyclones occur in six major zones across the globe (Figure 1.1) and are known by a variety of names.

In the Caribbean they are known as hurricanes, a term which originated with the native Indians. According to Hubbard (1992) the word "hurricane" itself derives from the name of the Carib Indian deity "Hunrakan" who according to legend, sent the winds when he was angry. Conversely, Anthes (1982) explains that the name originated from an ancient tribe of aborigines in Central America known as the Tainos, for whom "huracan" was a "God of Evil." Other popular names are "typhoon" in the Western Pacific, "cyclones" in the Indian Ocean and "bagiuos" in the Philippines. However, despite variation in names at the local scale, the characteristic features of awesome force and destruction are ubiquitous.

Unlike volcanic eruptions and earthquakes, hurricanes are annual events which occur during a designated hurricane season. In the Caribbean, the hurricane season officially starts on the first day of June and finishes at the end of November, albeit many storms have occurred outside the designated season[4]. However, many residents on Nevis still consider October to be unofficial end of the hurricane season.

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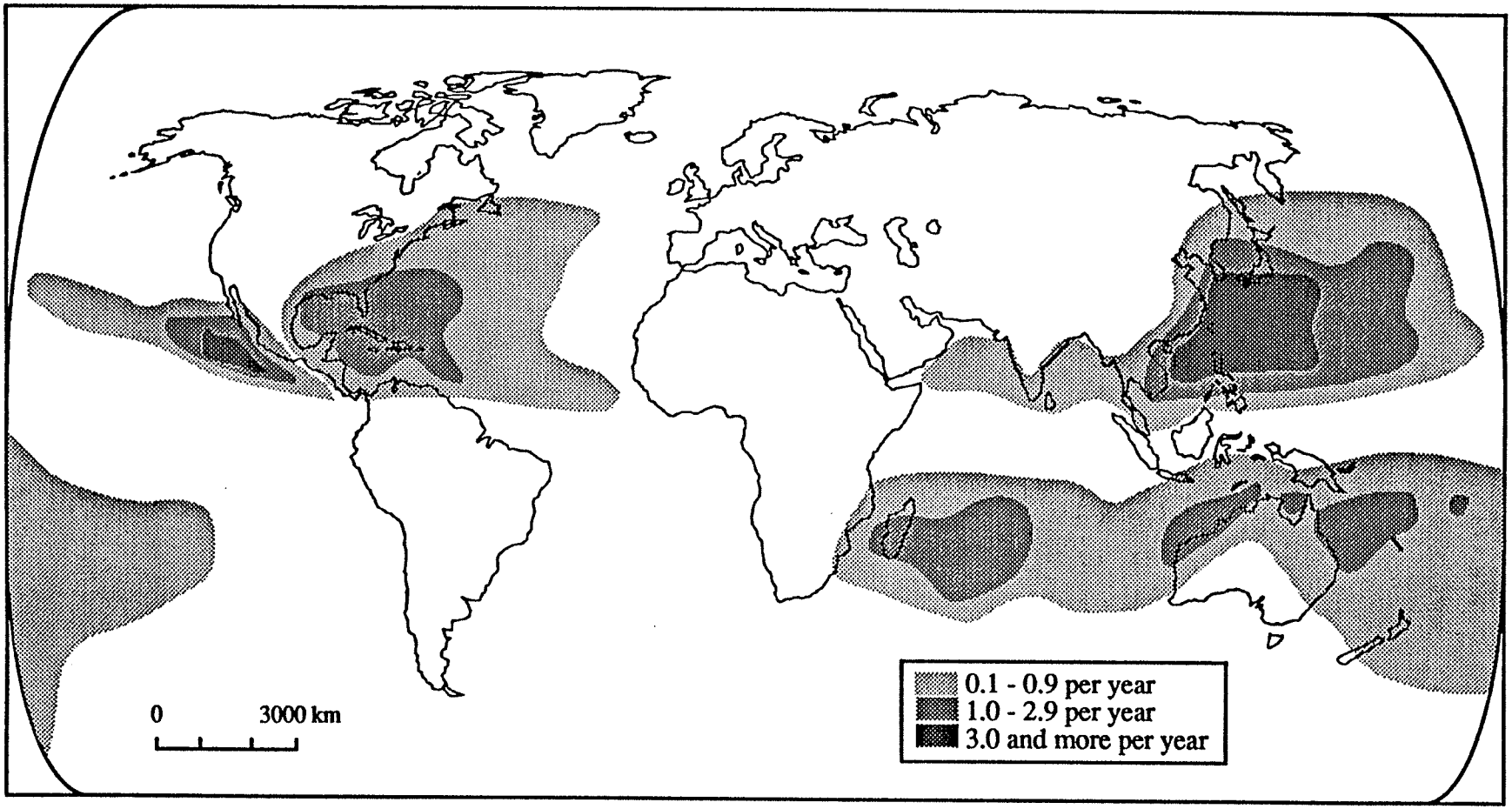
[4] **Hurricanes have occurred outside the designated hurricane season. However there are only three occasions during the present century, March, 1908, January, 1951 and January, 1955 (see, Dunn and Miller, 1964:34). The number of severe storms recorded as occurring in each month in the West Indies is shown in Burns, A., 1965. History of the British West Indies, Appendix B: 757.**

Figure 1.1 Location and Average Annual Frequency of Tropical Cyclones



Adapted From: Smith, 1992

Hence the following jingle was repeated for me several times during my fieldwork:

June too soon,
July stand by,
August is a must,
September remember,
October it is all over.

During this period several storms and travel westwards to the islands some of which develop into hurricanes. The number of storms which originate vary from year to year but on an average about seven or eight storms develop. Smithson (1993:167) confirms that the long-term average (1885-1900) for tropical storms and hurricanes in the Atlantic region is about eight per year.

1.2.3 Hurricane Formation

Over the North Atlantic hurricane formation is linked to the presence of summer weather systems. The three major systems which provide spawning grounds for hurricanes are: easterly waves; the Intertropical Convergence Zone (ITCZ); and the trailing southerly portions of old polar troughs. These systems provide the convective mechanisms and instability needed during the development of these storms. However, the formation of hurricanes require high sea-surface temperatures which must be maintained for a number of days in order for the system to sustain itself. Palmen (1948) mentioned 80^0 F(26.5^0 C) as the critical value (cited in Anthes, 1982). The system gains energy from the latent heat generated during the

condensation of sea water. Consequently, hurricanes normally subside when they pass over large continental areas.

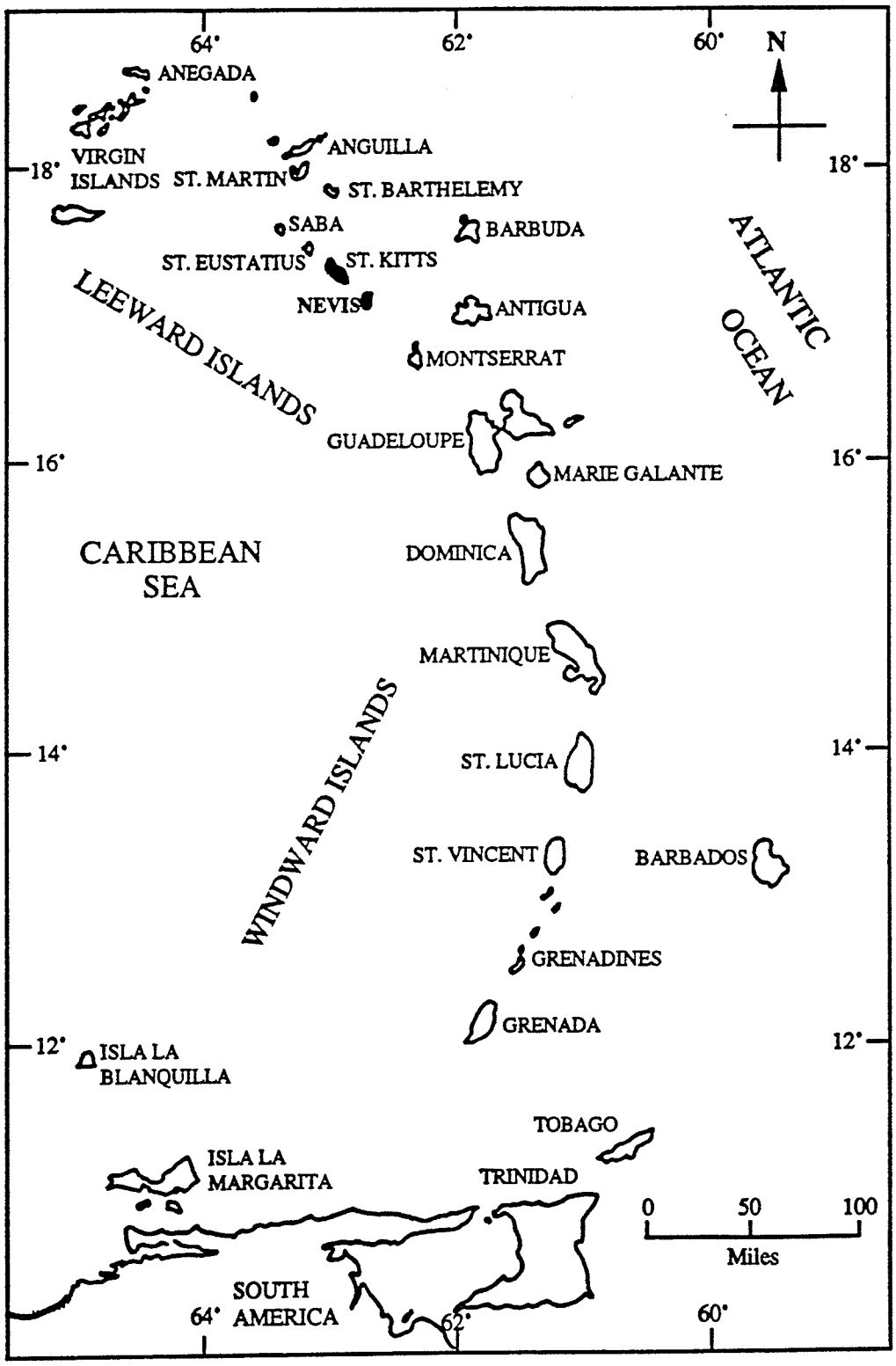
1.3 The Setting of The Problem

The island of Nevis forms part of the volcanic chain of islands which make up the outer arc of the Lesser Antilles. It is located approximately 17 degrees north and 61 degrees west (Figure 1.2). The island is roughly oval in shape with a central volcanic cone and covers 90 km^2 (36 square miles). The climate is tropical marine with an average temperature of 26^0C. The year is normally divided into two seasons based on the quantity of precipitation. The dry season occupies the first part of the year and lasts from January to June while the normally wetter season is from July to December. Droughts have historically been a serious threat to the development of the island. The rainfall in Nevis is relatively low with an average of about 115 cm (46 ins) annually with much variation from the coastal lowlands to Nevis Peak in the centre of the Island.

1.3.1 Economic Development

Traditionally the island has supported an agricultural based monocultural economy. At the time of European colonisation in 1628, the island was home to the Amerindians who practised little or no agriculture. However, the arrival of Europeans soon led to the establishment of small commercial

Figure 1.2 Eastern Caribbean Showing the Location of Nevis



Source: St. Kitts and Nevis Environmental Profile, 1992

farms which produced cash crops, mainly indigo, cotton and tobacco. The introduction of sugar-cane cultivation from Pernambuco, Brazil, by the Dutch in the 1640s led to a revolution of organised space on the island. Large plantations replaced small farms, each with its own works, usually a mill, great house, and slave quarters consisting of huts, along with a road network which facilitated the import of food and the export of sugar. By 1652, sugar production was well entrenched on the island and the economy became integrated into the mercantilist system. Sugar production soon became a very lucrative venture and the island's main export.

Nevis, during the late seventeenth century was rich, extravagant and ribald (Hubbard, 1992). The prosperity of the island made it a frequent battle ground for the European powers during the seventeenth and eighteenth centuries. The wars among European powers were major interruptions in the economic vicissitudes on the islands. In addition, natural disasters often intervened and altered the pace of development. Such was the impact of hurricanes, earthquakes, droughts and fires which ravaged the island sporadically, leaving indelible impacts on the forms of human habitation on the island.

Despite fluctuations in fortunes, sugar production remained the main economic pursuit until the turn of the present century when falling sugar prices forced many

plantations out of production. The closure of sugar factories persisted into the latter half of the present century. Following the demise of estate agriculture, small-scale village farmers have sought to extend their own activities (Watts, 1973) usually through mixed farming which dominated the landscape of the island. With the demise of sugar, sea island cotton became the main economic activity until it was surpassed by tourism as the main foreign exchange earner over the last two decades. What is instructive here, is the fact the island economy has remained largely monocultural, changing from one main economic activity to the next and reflecting the importance of the international economics on the landscape of the island. The continued monocultural orientation of the island's economy, underscores its vulnerability to disasters.

1.3.2 Vulnerability to Disasters

Although the island is vulnerable to hazards such as volcanic eruptions, storm surges and landslides, they have not affected the island over the last century. Conversely, hazards such as earthquakes, droughts, fires, hurricanes and tropical storms have been much more prevalent. As a result of their impacts, settlements on the islands have historically been adapted to the local environment. For instance, by the early eighteenth century, some planter families, routinely sought refuge from hurricanes in their specially constructed "hurricane houses" (Richardson, 1983). These houses had a

stone foundation and a wooden second storey. Similarly, "the disastrous earthquakes of the 1680's had taught the people of Nevis that two storey stone buildings were very susceptible to damage by earthquakes" (Hobson, 1987). Consequently, there are very few two storey stone structures on the island.

1.3.3 Earthquakes

According to legend, the first town on Nevis, Jamestown disappeared during an earthquake and tidal wave in 1680. However, no primary records have been located confirming the supposedly disappearance of Jamestown and it remains one of Nevis' mysteries (Hubbard, 1992). Nevertheless, the present capital, Charlestown, was established around 1700 to facilitate mercantile trade.

Although earthquakes have generally been infrequent, they are known to have caused significant damage on the island. For instance, in 1690, an earthquake rocked Nevis, destroying all the stone buildings in Charlestown (Richardson, 1983). In addition, during the nineteenth century severe earthquakes occurred in 1833 and 1843 causing widespread damage to housing stock (mainly stone structures). These two earthquakes coupled with the fire of 1837, led to the reconstruction of many of the major buildings in Charlestown. The earthquakes reported during the present century have not caused any significant damages. A series of earthquakes occurred in 1950 but did not cause any major damage but terrified residents and caused many

to speculate about the possibility of a volcanic eruption. Since then other tremors have occurred in 1974, and the early 1980s without any notable damage.

1.3.4 Droughts

The island has suffered immensely from droughts. In 1725 and 1726 a bad drought struck the island (Hubbard, 1992), many Negroes and cattle were said to have died in Nevis for want of provisions and water during the severe drought of 1726[5]. In addition, severe droughts affected the island between 1836 and 1838. As Hubbard (1992) described, these years were almost totally lacking in rainfall. Similarly a drought of 1863 was so intense that a 'day of fast and humiliation' was observed in Nevis (Richardson, 1982). Two severe droughts also affected the island during the present century. In 1947, drought in Nevis killed several cows and their calves and in some parts of the island water for public use was available one hour per day (Richardson, 1982). Eight years later, "in 1955, six months of drought followed Hurricane Alice[6], which had destroyed much of Nevis's cotton crop" (1982:163). While droughts have continued to adversely affect the island, recent improvements in water distribution have tended to cushion their impact.

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[5] Sheridan R. B, Sugar and Slavery, 1973:165.

[6] In fact, Hurricane Alice was an out of season hurricane which affected the northern Leeward Islands in January, 1955. January normally marks the beginning of the annual dry season.

1.3.5 Fires

While there have been several severe droughts on the islands, there is little evidence that they were often accompanied by fires. Actually, only two major fires apparently affected the island. According to Hubbard (1992) during the dry years between 1836 and 1838, fires ravaged the land. More significantly, "in 1837, a roaring out-of-control blaze swept through Charlestown destroying many buildings" (1992:75). Apart from isolated cases of house fires, there has not been any major fires on the island during the present century.

1.3.3 The Hurricane Threat and Vulnerability

By far the single most recurring and historically most destructive disaster that have affected the island has been the hurricane. Based on information provided by Hubbard 1992, hurricanes were more frequent during the 17th and 18th century. A total of 15 hurricanes struck the island during the seventeenth century, 26 during the eighteenth century and six during the nineteenth century. Only four hurricanes have struck the island during the present century, in 1924, 1928, 1989 (Hurricane Hugo) and 1995 (Hurricane Luis). Although the frequency of storms has decreased, the island remains highly vulnerable to hurricanes.

The relatively low frequency of storms affecting Nevis

during the past century belies the number of times that residents have been expecting hurricanes and tropical storms to strike the island but only to hear that the storms had changed their courses. However, data provided by the Boundary Layer Wind Tunnel Laboratory (Devenport, personal communication) in Western Ontario, show that as many as many as 105 storms passed within 250 km of the island of Nevis between 1986 - 1994 (see, Appendix A). At times, they passed close enough for the island to have been affected by the torrential rains and strong winds accompanying such storms. The overwhelming majority (74.3 percent) of these storms had hurricane force winds. Similarly, in their study of climatic vulnerability of OECS ports, Novaport and Vaughn (1993), determined that 19 storms passed with a 80 x 80 km grid of the island with a return period of 5.6 years between 1886-1992 (Table 1.2). These data underscore the persistent threat of tropical storms and the physical vulnerability of the island.

Although the whole island is vulnerable to tropical storms, there is some evidence that storm intensity varies depending on topography and orientation. Given that hurricanes are more prevalent on the eastern side of the island, it is reasonable to expect stronger winds on the windward side. In addition, due to its central location, Nevis Peak acts as a buffer, thereby reducing wind speed on the leeward side of the mountain. Similarly, there is some evidence which indicates that local topography influences vulnerability.

TABLE 1.2

Storm Frequency for OECS Ports 1886-1992

Average Frequency of Storm Occurrence for 15 OECS Ports				
	400 x 400 km Grid		80 x 80 km Grid	
	No. of Storms	Frequency (Years)	No. of Storms	Frequency (Years)
Tortala, BVI	82	1.3	18	5.9
Codrington, Barbuda	84	1.3	18	5.9
St. John's, Antigua	91	1.2	13	8.2
Basseterre, St. Kitts	92	1.2	17	6.3
Charlestown, Nevis	95	1.1	19	5.6
Plymouth, Montserrat	86	1.3	20	5.4
Portsmouth, Dominica	92	1.2	18	5.9
Roseau, Dominica	94	1.1	21	5.1
Vieux Fort, St.Lucia	83	1.3	20	5.4
Castries, St. Lucia	81	1.3	24	4.5
Kingstown, St. Vincent	82	1.3	11	9.7
Bequia, St. Vincent	77	1.4	14	7.6
Union I., St. Vincent	65	1.6	16	6.7
Carriacou, Grenada	63	1.7	15	7.1

Source: Climatic Vulnerability of OECS Ports, Nevis

For instance, simulation exercises conducted by The Boundary Layer Wind Tunnel Laboratory of the island of Nevis demonstrates that wind speeds are accelerated by an upward slope of the terrain (see, Davenport, et al., 1985). Therefore, houses which are located on hilly sites are more vulnerable than those on the less exposed sites since the wind

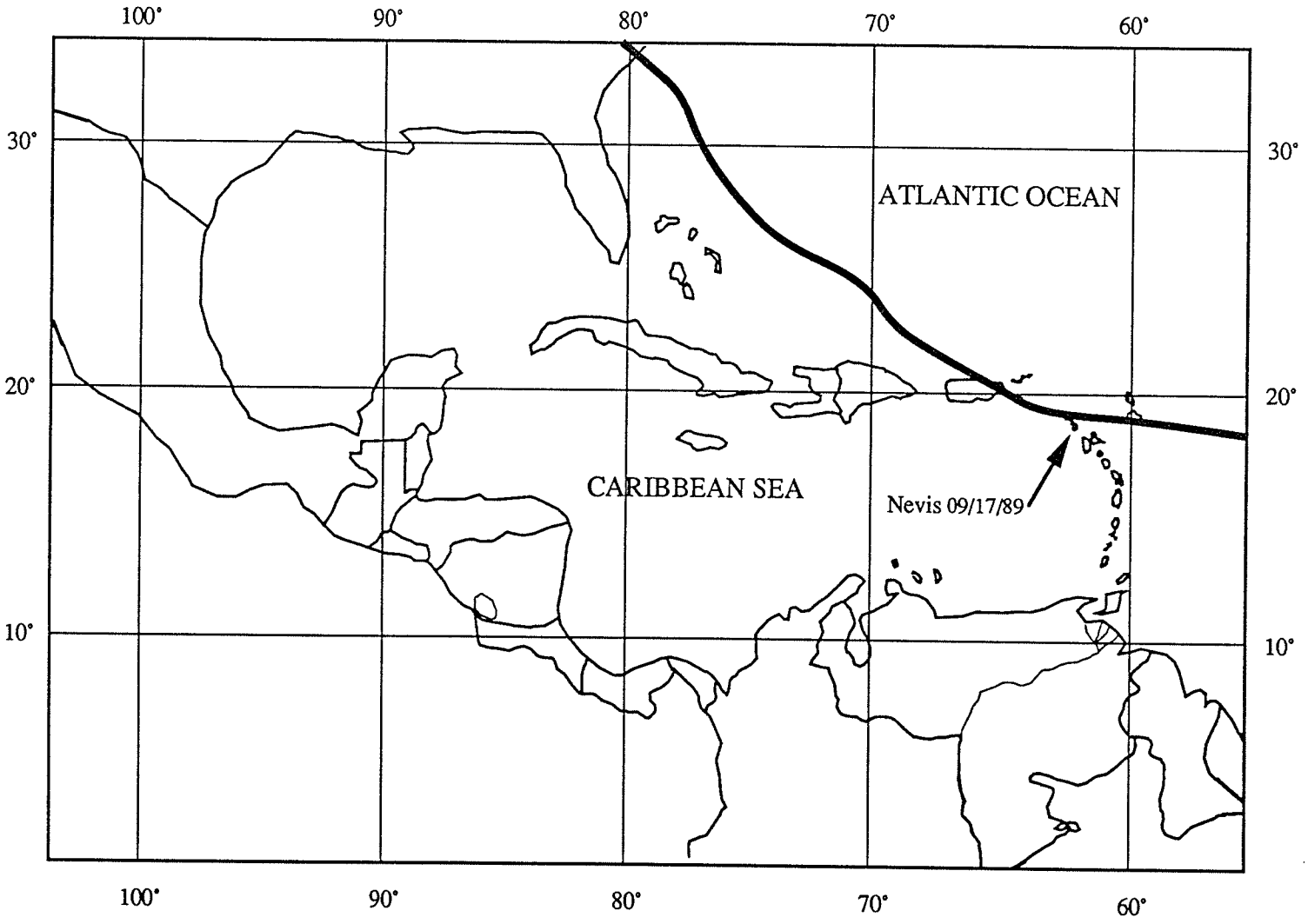
speed tends to be greater slightly above the land. In addition, given the increasing attraction of the hilly locations, residents should be cognisant of the need to construct more resistant homes on such exposed sites.

At the time of Hurricane Hugo, the 'it can't happen here syndrome' may have prevented many residents from implementing cheap yet effective preparedness measure. The long absence of hurricanes on the island, may have eroded any development of an individual subculture on the island. However, the trail of damage left by Hurricane Hugo will linger in the minds of residents well into the future. Consequently, any future hurricane warnings are likely to be taken much more seriously than they were during the passage of Hurricane Hugo.

1.3.4 Hurricane Hugo

Hurricane Hugo was one of the most destructive storms to affect the Caribbean region, with winds gusting up to 125 miles per hour. Conceived over the Atlantic as a tropical disturbance on 10th September, 1989, the system intensified to a hurricane by Wednesday 13th September. The hurricane affected several islands (Figure 1.3) and left millions of dollars worth of damage in its path. Nevis was affected by Hurricane Hugo on the early morning of September, 17th. It was the first time in 61 years that the island was directly affected by and ravaged by a hurricane.

Figure 1.3 Portion of Storm Track of Hurricane Hugo, 1989



Adapted From: Hanley, 1993

Consequently, it impacted on a highly unprepared and shaken populace. By any standard, Hurricane Hugo was a major event, especially for a very small and economically vulnerable island. Although people knew of the approaching hurricane, it was apparent that few took it seriously. This apparent false confidence that Hurricane Hugo might not have affected the island may be explained by the fact that Hurricane Dean had missed the island just two weeks earlier.

While no loss of life was sustained, the hurricane caused substantial damage to houses, infrastructure, agriculture and tourism. The housing stock on the island suffered immensely. A total of 1,945 (65 percent) houses were damaged at an estimated cost of EC $ 27,525,000[7] (Economic Development Unit, 1989). An important observation was the fact that many small traditional houses withstood the storm, while the some modern buildings were severely damaged.

One major concern after the passage of Hurricane Hugo, was the extent to which damage at the household level could have been prevented or at least reduced. Given the persistent threat of tropical cyclones and periodic devastation of other Caribbean islands, residents should have been aware of precautionary measures that could be adopted to reduce hurricane damage. In addition, the extent to which residents received official warning about the storm is not fully understood. Among the options available to resident are:

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[7] **Approximately 14 million Canadian dollars.**

boarding windows and doors, reinforcing roofs, stocking food and water and evacuating to shelters. Longer term mitigation measures include building stronger homes and purchasing hurricane insurance. While this study will focus on the adoption of precautionary measures prior to Hurricane Hugo, it also seeks to explain the extent to which mitigation measures have been implemented in the post-Hurricane Hugo era and the level of hurricane preparedness during the 1994 hurricane season.

1.4 Research Objectives and Hypotheses

The formulation of objectives and hypotheses for this study is based on the review of literature and upon personal experience gained by living in the Caribbean. The present study deals with the hurricane threat on the island of Nevis. Specifically it focuses upon understanding traditional coping mechanisms in relation to the implementation of preparedness of measures prior to Hurricane Hugo in 1989 and the extent to which residents have undertaken mitigation measures since Hurricane Hugo.

In an environment that is periodically ravaged and persistently threatened by natural hazards and given the devastation caused by Hurricane Hugo in 1989, circumstances should dictate that mitigation and preparedness measures should be adopted, especially at the household level. Considering these facts, the specific objectives of this study

are:

1) to identify the physical factors making the population vulnerable to hurricanes and find out what traditional coping mechanism exists on the island;

2) to assess the extent to which residents took preparedness actions to reduce the impact of Hurricane Hugo;

3) to find out whether the experience of Hurricane Hugo has resulted in the adoption of precautionary measures to reduce the impact of future hurricanes.

4) to examine the Government's hurricane preparedness strategy, especially people's willingness to evacuate or hurricane proof their homes in the event of a hurricane warning.

5) to assess how residents were economically affected by Hurricane Hugo and how they tried to recover.

In examining these objectives the following hypotheses have been formulated;

Hypothesis I: That the relatively low level of hurricane preparedness reported during Hurricane Hugo may be explained by a general lack of disaster experience, quality of warning and the socioeconomic characteristics of respondents.

There is some evidence that past experience with a disaster affects preparedness level. According to Fritz (1961:659) the most highly organised preparation exists in communities and societies that have repeatedly and recently experienced the same kind of disaster. The repeated impact of

a disaster may lead to the emergence of a disaster subculture. The term disaster subculture refers to a complex interconnecting set of meanings, norms, values, organisational arrangements, and technological appurtenances which have emerged in response to repeated disaster threat and impact (Mileti, et al., 1975:18). While there is reason to believe that a hurricane subculture existed on Nevis in the past, the prolonged absence of any hurricane impact, may have led to its decline. In fact, there was no organisational structure in place to effectively disseminate warnings and effectively respond to the threat posed by Hurricane Hugo in 1989.

In addition, there is some evidence that the adoption of protective response after warning is received vary with the quality of warning and the socioeconomic variables. However, before residents adopt protective behaviour they must be convinced that they are at risk. Studies have shown that warnings from official or credible sources are more likely to be believed. In addition, the more accurate and consistent the warnings (Mileti, et al.,). Similarly, the socioeconomic characteristics of respondents have been reported to affect the adoption of emergency preparedness. For instance, studies suggest, in general that persons with higher socioeconomic status tend to better prepared for disaster (Sims and Baumann, 1972 and Turner, et al., 1980). Therefore, one can expect the adoption of preparedness during Hurricane Hugo to be significantly related to socioeconomic characteristics such as

age, occupation and education level of respondents.

Hypothesis II: The adoption of precautionary measures in the post Hurricane Hugo era will vary with the intensity of damage and the socioeconomic characteristics of the respondents.

In order for an individual to take precautionary measures, that person sometimes needs to have suffered personal loss, property damage or injury. In his study Jackson (1981) found that the intensity of experience significantly influenced the adoption of earthquake adjustments. He also found that the intensity of experience determined the number of earthquake adjustments adopted. Similarly, Bumnam and Sims (1978) reported that the purchase of flood insurance was also influenced by the intensity of flood damage experienced by residents. In a study of urban snow hazard, Earnie and Knowles (1974) showed that the more intense and persistent the damage previously sustained, the more likely respondents were to undertake adjustments to reduce similar future occurrences.

The socioeconomic characteristics of an individual have also been reported to influence the adoption of precautionary measures. Studies such as Jackson (1981); Haque (1988) and Buamann and Sims (1978) have reported positive relationships between socioeconomic variables and the adoption of adjustments. These reports contrast with earlier findings of studies such as Kates (1962) and Islam (1974) which did not report any significant relationships between socioeconomic variables and human response to hazards. Therefore, since the

majority of respondents sustained damage to their homes, during Hurricane Hugo, it is expected that the intensity of the damage sustained and the socioeconomic characteristics of the respondents will influence the adoption of adjustment strategies to reduce the risk of damage from future hurricane. ***Hypothesis III:*** The level of preparedness among residents is expected to be higher during the post Hurricane Hugo era, specifically during the 1994 hurricane season.

Although there is a limited amount of literature on hurricane preparedness levels, studies of the preparedness levels of other hazards have reported varying levels of preparedness. For instance, Holder (1982) found that 81 per cent of the respondents reported having a disaster plan and responded accordingly during the Kalamazoo tornado, Michigan. Conversely, Neal, et al., (1982) found relatively low blizzard preparation plans among residents of Wood County, Ohio. There was not a single instance in which as many as 50 per cent of the respondents planned to engage in any particular additional preparatory activity (1982:71). Other studies in normal situations have reported relatively low preparedness levels (Jackson, 1981 and Turner, et al., 1980). However, given the major impact of Hurricane Hugo on the island of Nevis, it is reasonable to expect residents to exhibit a higher level of preparedness during the 1994 hurricane season than in 1989. If reality is any guide residents are more aware now than ever that not only can preparedness save their lives but it can

also mean the difference between having a home and 'begging shelter' after a disaster. The experience of Hurricane Hugo should reduce uncertainty about hurricanes and increase salience of the event thereby increasing preparedness during the hurricane season.

1.5 Organisation of Study

This study is organised into five chapters. Following this introductory chapter, the second chapter reviews the general literature on factors affecting human response to hazards. It will be divided into sections focusing on overview of hazards research, mitigation and preparedness, factors affecting response to hazards, response to cyclones and trends in disaster management in Nevis. The third chapter focuses on the methods analysis included are the rationale for the study area, selection of sample, method of analysis and limitations of primary data. Chapter four provides an analysis of the data and the testing of the hypotheses. Chapter five discusses policy implications of the findings, and provides a summary, recommendations, conclusions and possible directions for future research.

CHAPTER II

LITERATURE REVIEW AND PROBLEM STATEMENT

This chapter gives a general survey of the literature on human response to natural hazards. The first part of the chapter focuses on an overview of the natural hazards research, the hazard management context and mitigation and preparedness. In the second section, the factors affecting human response to natural hazards are examined. The final section focuses on disaster management on the island of Nevis with reference to the status of disaster management and overt policies such as warnings, hurricane proofing and evacuation.

2.1 Overview of Natural Hazards Research

Much of the research on natural hazards has been conducted in North America since the 1950s. Although the research has been multidisciplinary, there has been a notable dominance by geographers and sociologists. While sociologists researched human behaviour immediately before, during and after a disaster, geographers have focused on human adjustments to future hazards and the hazard processes. Distinction is sometimes made between the disaster research undertaken by sociologists and natural hazards research which is dominated by geographers. According to Mileti (1980:328), hazards research is different from disaster research in that the latter seeks explanations for response to disaster impact (Fritz, 1968; Barton, 1970; Mileti, et al., 1975), while the

former seeks explanations for adjustments to the risk of future disaster prevalent in everyday life (White and Hass, 1975; Burton, et al., 1978). Consequently, human response to natural hazards remains a central focus in natural hazards literature.

Natural hazard studies were pioneered by Gilbert White's 1945 investigation of human response to flooding in the US. Earlier investigations of natural hazards by geographers centred upon the questions of why people occupy hazardous floodplains and what would be the effects of public action to reduce flood losses upon local land use and national economy (White, 1974). This led to the development of a "human ecological" model of flood hazard, and the identification of additional points of intervention for the application of public policies (Mitchell, 1988:411).

Researchers have since extended human response studies to other natural hazards. Prominent studies include farmers perception of flood risks in the US (Burton, 1962), residents' perception of coastal flood hazard (Burton, Kates and Snead, 1962), and the perception of drought on the Great Plains of the US (Saarinen, 1966). Earlier research into human response to natural hazards was dominated by the University of Chicago. Within this early tradition, disasters were viewed as environmental extremes, and models were developed to predict human behaviour during disasters and explain variation in the adoption of adjustment measures. According to Meliti and

Sorensen (1987), a number or theorists have attempted to identify the mechanisms that lead people to take precautions (Burton, 1962; Kates, 1962; Simon 1956; White, 1964). Individual attributes, such as past experience, attitudes, personality and perception were studied to explain human response strategies to natural hazards. The development of models resulted in an expansion of hazards research to non-traditional areas and hazards.

Not only has the scope of natural hazard research diversified but models have been applied to non-traditional hazards such as drought in Africa and man-made or technological hazards. Some of these studies were undertaken in the Developing World with emphasis on the slow onset drought in sub-Saharan Africa (see, Watts, 1983). In the 1970s investigators began to address hazards of technology, hazards that were international in scope, and hazards that occur on time scales of decades to centuries (Mitchell, 1988:413). Topics included environmental degradation (Blaikie, 1985), nuclear energy risks (Pasqualetti and Pijawka, 1984), Hohenemser, Kasperson, and kates, 1977; Preston, Taylor and Hodge, 1983). This wider range of research has generally moved away from the natural hazard perception model to the adoption of more generalised risk assessment frameworks (Whyte, 1986:244).

While geographical studies focused on the long-term adjustments to natural hazards, research within the

sociological tradition focused on human behaviour in disaster situations. Explanations of disaster responses have been based on theories of collective behaviour and social organization and disorganization (Dynes, 1970; Mileti and Sorensen, 1987). Studies have been behaviour-oriented and deal mainly with the reaction of victims to evacuation (Drabek and Boggs, 1968; Drabek, 1969; Aguirre, 1991). Other researchers in the sociological tradition have focused on behaviour immediately before, during and after a disaster has struck, usually group or organized behaviour (Barton, 1963; Dynes, 1974; Haas, Kates and Bowden, 1977 and Quarantelli, 1979). This research orientation among both geographers and sociologists from the 1950s to the 1970s resulted, according to Hewitt (1983), in the development of a distinctly "technocratic" approach for mitigating hazards in the forms of disaster preparedness, evacuation plans, relief and rehabilitation efforts (Zaman, 1988:8).

The expansion of research in the Developing World during the 1970s led to the development of a new paradigm, commonly referred to as the structuralist paradigm. It was a radical Marxist interpretation of disaster which envisaged solutions based on the redistribution of wealth rather than on the application of science and technology (Smith, 1992:42). Several researchers with field experience in the Developing World (Baird, et al., 1975; Hewitt, 1983; Susman, et al; 1983; Winser, 1986) challenged the fundamental tenets of the

dominant or behavioural view. Generally, the structuralists questioned the parochial (North American) bias and the assumed universal applicability of the dominant view. Some critics (Hewitt, 1983; Torry 1979c; Waddell, 1979) have asserted that this research assigns the active role in the human-environment relationship to geophysical and climatological factors and the passive role to human systems (Oliver-Smith, 1988). It is argued that cultural, social, economic and political factors determine the vulnerability of individuals. Consequently, Baird, et al., (1975) claimed that the tendency has been to view hazards as extraordinary events, whereas they argued that it was more realistic to see diasters as extreme versions of circumstances present in the everyday condition of the population (Gold, 1980:215). Subsequently, extreme measures routed in science and technology have invariably been suggested as solutions to the resultant disaster. The structuralists argue that hazard mitigation can be best achieved by socioeconomic changes within the Developing World. The reliance on external relief beyond the emergency phase was seen as reinforcing the dependency syndrome and increases the vulnerability in such areas.

Oliver-Smith (1988) outlined the main criticisms of the dominant paradigm, namely: (1) the lack of research oriented toward true theory construction and testing on issues of social resiliency and change; (2) the lack of holistically and historically grounded perspective in disaster analysis, which

has produced a narrow behaviouralist perspective among sociologists and an environmentally embedded determinist view among geographers; and (3) a deeply embedded ethnocentrism regarding the world's most vulnerable regions, resulting in analyses and policy recommendations based on modernization models and strategies, many of which place people at greater risk. Despite the widespread criticisms of the dominant view, research within this tradition has continued to dominate the hazards research spectrum, although some researchers have incorporated political economy into their approach to hazard studies.

2.2 Hazard Management Context

The traditional approach to dealing with disasters has been to compensate victims, rather than to reduce losses through mitigation projects, increased community and household preparedness, or mandated disaster insurance coverage (Tierney, 1988:31). Although emergency-management action and post-disaster relief are still important adjustments to hazards, significantly greater emphasis is now placed on preparedness measures such as warning systems, and mitigation measures like land-use management and development controls (Mitchell, 1988:417). Specifically, disaster management has taken on a proactive rather than reactive approach. In addition, there has been a movement away from a primary focus on technological or structural solutions to greater emphasis

on non-structural approaches (Drabek, 1986).

'Hazard management usually is viewed as a four-staged process centred on an emergency event or disaster. Those temporal stages before the disaster are typically identified as mitigation and preparedness, while those after the disaster as response and recovery' (Godschalk and Brower, 1985). Drabek (1986) employed a similar four phase temporal dimension to disaster management: Preparedness (planning and warning); Response (evacuation and other forms of post-impact mobilisation); Recovery (restoration and reconstruction); and Mitigation (hazard perceptions and adjustments). While there are slight variation in definitions, 'researchers and policy makers tend to agree on a convention that divides the disaster problem and its management into four phases' (Tierney, 1989).

However, within the geographical tradition, disaster management is often approached within the adjustment context. By adjustment is meant "all those intentional actions which are taken to cope with risk and uncertainty of natural events" (White and Hass, 1975; Burton, et al., 1978; Britton, 1989). Three major classes of positive interventionist adjustments, developed from the work of White and Haas are proposed by Britton (1989). These adjustment classes are:

> *Modifying the hazard. The desired purpose here is to reduce potential losses by changing the harmful characteristics of the hazard agent (such as cloudseeding) [prevention].
>
> *Modifying the human-use system the aim here is to reduce vulnerability by altering the social landscape (for instance, building levees, designing seismic-resistant

structures) [preparedness].

*Reducing hazard losses through re-distributing the effect of the impact (for example, procuring insurance or developing post-impact relief and rehabilitation operations) [response and recovery] (Lindsay, 1993:19).

Similarly, much of the geographical research has focused on the traditional response and adjustments to natural hazards. Nevertheless, both mitigation and preparedness strategies are incorporated in adjustment typologies (White and Haas, 1975; Burton, et al., 1978; Mileti, 1980). Mitigation and preparedness will be examined further in the rest of the chapter.

2.2.1 Mitigation and Preparedness

Despite their common usage in the lexicon of hazards research, there is a lack of consensus on what constitutes mitigation and preparedness activities. Disaster mitigation is the term used to refer to all actions to reduce the impact of a disaster that can be taken prior to its occurrence, including preparedness and long-term risk reduction measures (UNDP/UNDRO, 1991). Mitigation activities are often long-term, institutionally based activities which often require legislation for adoption. Mitigation measures can be of different kinds, ranging from physical measures such as flood defence or safe building design to legislation, training and public awareness (Maskery, 1989:39). Some writers (Alexander, 1991) make the distinction between structural mitigation projects such as dams and coastal protection schemes and non-

structural mitigation such as building codes, landuse zoning and hazard insurance.

While 'mitigation' is often a more generic term, preparedness conjures a more specific and temporal meaning. It connotes a time-ordered phase which follows mitigation and precedes the impact of a disaster event (Gillespie and Streeter, 1987). However, Smith (1992:88) defines preparedness as 'pre-arranged emergency measures which are to be taken to minimise the loss of life and property damage following the onset of a disaster'. They amount to logistical activities prior to a disaster which facilitate effective response immediately after a disaster. Such activities include, inter alia, stock-piling of food and supplies, evacuation and early-warning. Mitigation and preparedness measures can be adopted at various levels of society, viz; governments, regions, communities, households and individuals. Many of the studies on mitigation and preparedness have been undertaken within the context of human adjustment to natural hazards.

Most hazard adjustment research has focused upon flood settings, and in particular upon the purchase of flood insurance (Drabek 1986, Perry and Lindell, 1990). However, studies on mitigation have largely been policy oriented. Tierney (1989) identified three main trends in mitigation research, namely; (1) studies on public perception of mitigation measures; examples include the work of Rossi, Wright, and Weber-Burdin (1982); Mitler (1989); Turner, Nigg,

and Paz (1986), and Kunreuther and his associates (1978); (2) research on agenda-setting, adoption, and the implementation of hazard mitigation measures (Alesch and Petak (1986), and Drabek, et al., (1983) on earthquake hazard mitigation in Washington and Missouri; and (3) studies assessing the impact of hazard mitigation measures. Examples include Palm (1981) on the impact of Special Zone Legislation in California and Burby and French (1980). Besides flood and earthquake insurance adoption, studies have mainly focused at the community level. In most cases 'floods and earthquakes, costly hazards that have been the focus of Federal programs and research initiatives, have received most emphasis in the literature' (Tierney, 1989:369). In effect, there is not much focus on non-institutionally based attempts at coping or mitigating hurricanes in the developing world context.

While non-structural measures such as flood and earthquake insurance, flood plain management and coastal management have received much attention in the USA, such developments are either non-existent or at a platitude stage in most of the Developing World. The top-down approach, with stress on physical protection of vulnerable areas, forecasting, early warning system, evacuation, and loss reduction strategies may, indeed, often increase risks more by giving people a false sense of security (Zaman, 1994). However, given that most of the disaster reduction projects are funded by international agencies, little attention is

given to local knowledge and traditional coping strategies. Even with the absence of any established building codes, traditional houses in the Caribbean were designed to withstand hurricane force winds. The lack of organised hazard management strategies means that individual mitigation and preparedness strategies are important aspects of human response to hazards in the Developing World context. Therefore, it is crucial to understand how residents in these areas respond to risks of environmental extremes.

Researchers have reported much variation among the levels of preparedness. In his study of residents preparedness during the Kalamazoo tornado in Michigan, Hodler (1982), found that 81 percent of the families had a prior plan and nearly all of the them responded according to their pre-arranged plan. Conversely, after analysing data collected after the 1971 earthquake in Los Angeles (Bourque, et al., 1973), found that very few people had made prior disaster preparations (cited in Drabek, 1986:24). Similarly, Palm and Hodgson (1992) have reported that survey after survey has shown that few California residents adopt mitigation measures such as storing emergency supplies or developing a family emergency plan (Palm, et al., 1990; Turner, et al., 1979; Mileti, Farhar, and Fitzpatrick 1990:1058-60). However, factors which may help explain variation in individual adjustments are normally examined in the context of human response to natural hazards.

2.3 Human Response to Natural Hazards

Human responses to natural hazards are generally related both to perception of the phenomena themselves and to the awareness of opportunities to make adjustments (Burton, et al., 1978: Haque, 1988). However, neither perception nor hazard awareness has been able to adequately explain why adjustments are adopted. Information gleaned from the literature shows that hazard experience, personality, attachment to place, and socioeconomic status influence human perception of hazards and the adoption of adjustment strategies. However, the extent to which these factors influence the adoption of hazard adjustment remains inconclusive.

Personal experience of a hazard generally causes hazard perception to be more accurate (Mileti, et al., 1975; Kates, 1971; Saarinen, 1982; Tierney, 1988). Nevertheless, perception or awareness of a hazard does not necessarily result in the adoption of any adjustment strategies. While people learn from experience, they tend to believe they have a better picture of the truth than they really do, especially in dealing with rare events (Saarinen, 1982). Some studies (Kates, 1962; Turner, et al., 1980) have demonstrated that the adoption of adjustments is related to the frequency of these experiences. For instance, Kates (1962) found that where flooding was recurrent enough that people were almost certain it would occur, adjustments were likely to be adopted. Conversely, in the

areas with greater uncertainty, the adoption of adjustments was also less certain (Kates, 1962:4). Thus Gold (980:206) concluded that 'extreme events tend to act as a fixed point in experience, obliterating memories of earlier occurrences and acting as a standard against which later ones will be compared, although the poignancy of the recollection will fade if the extreme event happens only very rarely'. Generally, for infrequently occurring hazards, the public tends to perceive the risk as very low, and cultural adaptation processes operate to encourage discounting the risks as defined by scientists (Burton, et al., 1978; Perry and Greene, 1983).

Contrary to the conventional wisdom that experience leads to awareness, some studies have shown that experience does not necessarily translate into the adoption of adjustments. In his study of storm perception among coastal residents Kates (1967) found that although half of them suffered damage in the past, only one third expected a future storm that entail damage for themselves. However, Kates (1962:140) also argued that although people on floodplains appeared to be very much "prisoners of experience," the effect of such experience does not consistently proceed in the direction of taking individual action to reduce damage. Nevertheless, Jackson and Mujkerjee (1974) and Jackson (1981) found that the intensity of earthquake experience was associated with the adoption of precautions and the range of adoptions. Similarly, in their study of flood insurance (Baumann and Sims, 1978:193) found

that 85 percent of residents who experienced very serious damage were insured compared to 43 percent for those with not serious damage. The seriousness of previous hazard events, the extent of loss of life and property damage, the recency of the event, and the extent of personal loss to the individual, all have an impact on individual awareness (Palm and Hodgson, 1992). Consequently, the nature or intensity of the experience may help explain variation in the tendency to adopt precautionary adjustments.

But even in areas where the adoption of adjustment strategies is expected to be high, levels have been generally low. For instance, Jackson and Mukerjee (1974) and Turner, et al., (1980) found low level of earthquake preparedness among California residents despite their either experiencing earthquakes or being exposed to the threat through public awareness programs. According to Palm (1990), several studies have found that those who had experienced a natural disaster in a relatively mild form became overconfident about their ability to survive much more serious versions of this same event (Baumann and Sims, 1974; Jackson, 1981). Furthermore, research has shown that the recall of hazard experience tend to be less than perfect. For instance, Kirkby's (1974) study of individual and community responses to rainfall variability in the Oxaca Valley of Mexico confirms that people's memory of specific natural event tend to be limited in duration as well as confined to larger events. However, Haque (1988) indicated

that awareness and action relating to hazards do not necessarily solely develop from lessons learned from previous experience.

2.3.1 Socioeconomic Variables

Although socioeconomic variables were included in human response studies, the influence of these factors on adjustment behaviour is not conclusive. Haque (1988:46) identified two trends in the earlier studies. First, these studies usually excluded an examination of socioeconomic indicators as determinants of human response to hazards because of their over-emphasis on individual personal characteristics from a behavioral standpoint (e.g., Murphy, 1958; Burton, 1962; Sewell, 1965; Saarinen, 1966). Second, the common finding of the few empirical studies which did incorporate socioeconomic variables, was that there is no significant relationship between these factors and human responses to natural hazards (for example, Roder, 1961; Burton, 1961; Kates, 1961). However, more recent research has established significant relationships between socioeconomic variables and response to hazards (Haque, 1988; Baker and Patton, 1974; Baumann and Sims, 1978).

In his study of flood plain residents in Bangladesh, Haque (1988) found that individual status in the socioeconomic structure was one of the most significant variables in explaining variation in perception of and the adjustment to

riverbank erosion. Similarly, Baker and Patton (1974) found that better educated people had a more positive attitude towards the prevention and adoption of hurricane adjustments. Baumann and Sims (1978) also reported that the adoption of flood insurance correlated with education level and income. Nevertheless, other researchers have reported that demographic factors do not consistently affect either perception or response to hazards (Palm, 1990; Palm and Hodgson, 1992; Drabek, 1986).

2.3.3 Personality

Some researchers have examined the extent to which individuals belief in how much control they possess over events in their life influences the adoption of adjustments. Researchers have suggested that this personality characteristic, known as "locus of control", relates in some way to the adoption of mitigation measures (Simpson-Housely and Bradshaw, 1978; Palm and Hodgson, 1992). Generally, persons with internally-oriented personalities tend to feel more in control of themselves and are thus more likely to adopt precautionary measures than those with externally-oriented personalities. When an event is interpreted to be mainly if not entirely contingent upon chance, luck, fate or factors outside the actors control, this indicates a belief in external control. If the consequences of an event are conceived by the actor as contingent upon his own decisions or

actions, this credence may be labelled as a belief in internal control' (Simpson-Housely and Bradshaw, 1978:65).

Studies which have investigated locus of control include Simpson, Housely and Bradshaw (1978); Baumann and Sims (1974 and 1978). Baumann and Sims (1978) classified respondents based on their scores on Rotter's I-E Scale[8]; internals, externals and those in between. They reported that sixty percent of the internal-oriented had purchased flood insurance; 43 percent of those who scored mid-range were insured; and only 35 percent of the external-oriented were insured (1978:195). Respondents with higher incomes and higher levels of education are more likely to be internally-oriented (195). Nevertheless, evidence supporting the idea that personality trait can explain who will adopt preparedness or mitigation measures remains inconclusive.

2.4 Human Response to Hurricanes

A number of studies have investigated human response to hurricanes (Islam 1974; Baumann and Sims 1974; Baker and Patton 1974). However, there is a lack of consensus explaining why people are at variance in adopting precautionary measures to reduce the impact of hurricanes. Generally, investigations have attempted to determine whether socioeconomic characteristics and past experience of hurricanes influence

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[8] **Refers to Rotters (1966) Internal-External Locus of Control Test (cited in Baumann and Sims, 1978)**

individual perception and adjustments to hurricanes.

Islam (1974) studied cyclone response in coastal Bangladesh and concluded that perception of storm hazards does not vary appreciably with educational level or occupation. In addition, there was no statistical difference in attitudes toward future cyclones and associated flooding by socioeconomic class. However, Baker and Patton (1974) studied attitudes toward hurricane hazards at Galveston, Pass Christian and Tallahassee along the Gulf Coast of the US and had different findings. They concluded that better-educated respondents were more likely to have a positive attitude toward damage prevention adjustments. They also reported that a positive attitude towards the possibility of avoiding hurricane-related damage varied directly with frequency of past hurricane occurrence (Baker and Potter, 1974:35) but such attitudes do not necessarily result in the adoption preparedness measures.

Other studies (Baumann and Sims, 1974) focused on predicting individual behaviour using the locus of control test. The premise of the locus of control test is that people who believe they can control what happens to them are more likely to adopt precautionary measures. Baumann and Sims (1974) investigated the locus of control using a cross cultural study of residents in three American cities and two communities in Puerto Rico. It was found that although respondents in both areas were strongly religious, their locus

of control differed. It appears reasonable to argue that those who feel more in control of their lives would be more specifically active in coping with the threat of an approaching hurricane and similarly that they would be more instrumental in dealing with the storm aftermath (Baumann and Sims, 1974). However, there is little evidence that locus of control does indeed transfer into the adoption of adjustment measures.

Other studies have examined the impact of past experience of hurricane on evacuation. There is however, a lack of consensus on the extent to which hurricane experience influences evacuation. Ruch and Christensen (1981) for example, found that respondents who had past hurricane experience were less likely to evacuate or take extreme responses to hurricanes. Similarly, Baker (1979) concludes that per se, experience is not related to evacuation, including recency of one's experience, and the number and magnitude of these experiences. Windham et al., (1977) found what they termed an "Experience Adjustment Paradox" among residents of the Florida Panhandle in the aftermath of Hurricane Eloise. They reported that new comers were more likely to evacuate when faced with hurricane warning than those who have lived in the area for a few years and adjusted to the hurricane experience or the 'culture'.

Even in Bangladesh where cyclones have repeatedly ravaged the coastal areas and houses tend to be highly vulnerable to

cyclone damage, evacuation does not seem to be a popular response strategy. Haque and Blair (1992), reported that 49 of 69 at Halishahar and 38 of 47 at Jahanabaj stayed at home during the April 1991 cyclone even though they received warnings about the cyclone. The main reason cited by respondents at both sites was fear of having their homes burgled during the evacuation (1992:225). The authors also suggested that the loss of their meagre belongings would mean facing worse poverty, more hunger and perhaps even death. Therefore, socioeconomic conditions of the respondents may in fact determine whether or not they evacuate their homes during the passage of a tropical cyclone.

2.4.1 Adjustments to Hurricanes

Adjustments to the hurricane hazard have been outlined by Whyte, (1974:260) using the hazard adjustment framework proposed by Burton, Kates and White (1978). The solutions advanced by Whyte (1974), have been criticized by Winchester (1992) as being anchored in the geophysical aspects of hazards and technically-based adjustments. Hurricane adjustment measures are diverse and range from actions that can be adopted at the individual level to community wide projects. Beatley, et al., (1984) distinguished between what constitutes individual as opposed to community mitigation and preparedness actions:

> Individual hurricane mitigation and preparation responses include: storm proofing and other construction practices

> and building improvements, investment decisions about location and purchase of homes and other buildings, enhancement of the hurricanes resistant or natural features of a site or location..., preparing and planning individual evacuation routes and procedures, and insuring one's homes and possessions against hurricane damages. Mitigation and preparatory responses to hurricanes at the community or collective level include: the setting of hurricane-resistant buildings and construction standards, the management and control of development, the construction of protective works., the protection of hurricane-resistant natural features...the establishment of systems of hurricane insurance, the provision of hurricane shelters, the planning and securing of adequate evacuation routes and services, and the planning of emergency services and strategies in the event that a hurricane occurs (1984:77).

It was also noted that evacuation, the provision of hurricane shelters and emergency assistance, the establishment of building standards, and the construction of protective works have been the collective responses to receive the greatest emphasis in the USA (1984:77).

While most of the adjustments discussed by Whyte (1974) and Beatly, et al., (1984) are largely representative of the US, many are applicable to the Caribbean context. However, it is apparent that much of the mitigative measures adopted in the Caribbean occur at the individual level. Traditionally, the institutional response to hurricanes in the Caribbean has been re-active rather that pro-active. Consequently, individual islands often embarked on mitigation programmes only in the aftermath of a major storm. Because hurricanes occur during a specific season, there are a number of mitigation and preparedness activities that residents can adopt. Long-term mitigation measures include insurance,

building stronger foundations, renovating homes or building stronger homes. Similarly, during the hurricane season routine checks of roofs, windows and doors along with preparedness activities can mitigate a hurricane's impact.

This study focuses on a specific event, Hurricane Hugo, and attempts to establish whether individuals were aware of precautions which can be taken prior to the event and the extent to which such precautions have been taken. In addition, questions are asked to illicit information on any mitigation measures adopted to reduce future hurricane threats. Finally, given that interviews were conducted during the hurricane season, respondents were questioned about their level of preparedness. The results from the study may help in understanding the status and concepts of disaster management on the island of Nevis.

2.5 Disaster Management in Nevis

Concepts of disaster management have been outlined in section 2.2. Although disaster plans have been drafted on two occasions, 1989 and 1994[9], neither of these plans has been debated or become legislation to date. Similarly, while the disaster plans make references to a plethora of disasters, disaster management can be summarised primarily in the context of hurricane preparedness activities. At present, disaster

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[9]**The 1989 disaster plan refers to the Nevis Disaster Plan which was an annex to the National (St.Kitts & Nevis) Disaster Plan. The 1994 Disaster Plan refers to a draft National Disaster Plan.**

management is nebulous and normally confined to the annual hurricane season. While there has been some improvements over the last few years, there is need for an integrated approach to hazard and disaster management on Nevis. The passage of Hurricane Hugo may have exposed the general inadequacies of our preparedness activities. The absence of literature on disaster management in Nevis has necessitated descriptions of disaster management trends on the island.

Despite having draft disaster plans, there is little evidence of community involvement in planning. 'Experience has shown that programs planned and executed from the national level without extensive involvement of local people (ie., top-down approaches) are only marginally successful (Cuny, 1988:9). In addition, based on information provided Mr. Newton (Disaster Co-ordinator for Nevis) during my field work, the 1989 draft National Disaster Plan was being revised by the Nevis Disaster Committee which comprised mainly of departments heads on the island. Furthermore, it is rather ironic that of over 40 members on the draft National Disaster Committee there is only one representative from Nevis. Similarly, there is no reference to Nevis throughout the draft National Plan nor is there any reference to the 1989 Disaster Plan. In short, it is not explicitly stated whether each island will have its own plan or whether the disaster plans will be combined to form a single document. There is little evidence to suggest that local groups and organisations are involved in the planning

process.

However, neither of the draft disaster plans has been debated in the House of Assembly or has become legislation. Even more important, is the fact that at the time of writing the Disaster Coordinator for Nevis operates without a budget. In spite of the inchoate status of the disaster plans, three main thrusts have been observed about disaster development on the island of Nevis involving hurricane proofing, warning and evacuation.

2.5.1 Hurricane Proofing

Although the strength of a building is constrained by a number of factors such as cost and the quality of workmanship, several measures can be implemented prior to the storm onset to reduce damage. These include, reinforcing roofs, clinching nails, barring windows and doors, along with other preparedness measures. Long-term structural mitigation measures can be incorporated during the design and construction stages. Specific guidelines or building codes may be necessary to enure standards are adhered to during the construction of new buildings. Moreover, older buildings which do not meet specific requirements can be retrofitted in order to make them hurricane and earthquake resistant. Smith, (1992) defines retrofitting as "the act of modifying an existing building to protect it, or its contents, from a damaging event".

There is some evidence that efforts are been made to ensure that hurricane resistant structures are build on Nevis. Firstly, a Hurricane Resistant Construction Manual was prepared by UNCHS in 1991 for the Government of St. Kitts and Nevis. The Manual is intended to assist small scale contractors and home builders in adopting appropriate hurricane resistant construction techniques (UNCHS, 1991:1). Secondly, a draft copy of the Organisation of East Caribbean States Building Codes has been circulated to member states for review. It is hoped that these guidelines will eventually be made mandatory thereby providing the standard for the construction of buildings on the island. However, given the political rhetoric involving legislation throughout the Caribbean, improved public education and warning may prove more effective in the short-run. Generally, the adoption of mandatory building codes depends on the political will to implement them.

Moreover, the presence of building codes does not necessarily lead to the adherence of standards nor are buildings standards present throughout the Caribbean. For instance, although Jamaica had building codes since 1983, much of the damage caused by Hurricane Gilbert in 1989, can be attributed to poor standards of buildings. As Clement (1990) explained, "lamentable standard of building construction in many ways contributed greatly to the degree of destruction experienced throughout the island". On too many occasions have

short cuts in building quality been taken (1990:20). Similarly, Gibbs (1992), succinctly summarises the state of the building industry in the Commonwealth Caribbean:

> The Commonwealth Caribbean is an area where the building industry is largely unregulated with respect to structural safety. Mandatory building codes exist in only a minority of countries. In effect, buildings are designed and constructed to a variety of standards. There is little uniformity in practice. No two firms in any one country use the same codes. No two engineers in any one firm use the same design criteria. And it is rare for any one engineer to adopt a uniform approach for all his projects. Such excessive individuality is counterproductive and wasteful(1992:2).

In short, much efforts are needed to upgrade the status of the building industry throughout the caribbean and more importantly on a very small and less organised island like Nevis.

2.5.2 Hurricane warnings

Hurricane warnings are pivotal in the disaster management efforts on the island, successful warnings will ensure the protection of life and property. The standard procedure is to air bulletins at the start of the hurricane season and throughout, reminding residents to take precautions during the season. Bulletins are aired at regular intervals throughout the season. In the event of a threatening tropical storm or hurricane, more frequent advisories and warnings are given. While warnings have been apart of the pro-active response to threatening hurricanes, the absence of an official Disaster Co-ordinator prior to 1993, may have nullified the impact of

such messages.

The fact that there is an appointed Disaster Co-ordinator on the island does suggest that somebody is officially in charge of collecting and disseminating hurricane warnings to the public. At the time of Hurricane Hugo, there was no such authority to alert and warn the populace of threatening storms and hurricanes. During my research it was evident that the warning system was much more organised than it was in 1989. However, there may be a need to have some form of warning system established in each district. This may take the form of sirens or the ringing of church bells. These types of warning are likely to reach more people, especially the elderly who may not be able follow hurricane warnings on the radio and television.

Studies have reported that the warning source does impact on the belief and response to disasters. Warnings from official sources (police, state patrol, fire department) and more likely to be believed (Mileti, et al., 1975:21). Similarly, Perry (1982) reported that the higher the credibility of the sender, the more likely the individual is to believe that he is at risk simply on the word of the authority. Within the context of Hurricane Hugo in Nevis there is little evidence that there was any authoritative warnings about the pending catastrophic storm.

2.5.3 Evacuation to shelters

Evacuation remains the main pre-impact response to hurricanes in affected areas. However, even when warned of pending hurricanes residents are often reluctant to evacuate their homes to seek shelters. In Nevis, the annual preparation for the hurricane season involves the formation of disaster management committees and the designation of public emergency shelters with shelter managers to man the buildings. Since the appointment of a Disaster Co-ordinator in 1993, steps have been taken to improve shelters. For instance, signs have been placed on all the buildings designated as shelters. In addition, the Public Works Department was in the process of evaluating the suitability of designated shelters. While shelter provision appears to be a difficult proposition, the extent to which residents are willing to evacuate to shelters needs to be understood. In addition, the fact that some shelters were either completely destroyed or severely damaged during Hurricane Hugo may have resulted in a lack of confidence in the security offered by these shelters.

Studies on evacuation behaviour during hurricanes has been inconclusive. For instance, Moore's (1963) comparison of the evacuation responses of the residents of Cameron Parish (Louisiana) and Chambers County (Texas) to Hurricane Carla suggest that apprehension about the hurricane threat, and in turn heightened evacuation, may be enhanced in a community that has recently experienced a previous hurricane of a

substantial magnitude. Because the experience of a devastating Hurricane Audrey was still fresh in the minds of Cameron residents, the author hypothesised this to have caused significantly greater apprehension about the oncoming hurricane and thus more extensive evacuation (1984:96). Similarly, the concept of subculture was posited to explain the unwillingness of large numbers of coastal residents to evacuate in the face of clear hurricane threats.

However, Barker (1979:17) in his review of four studies of hurricane evacuation on the east coast of the USA, reported that taking the results at face value it seems clear that presence or absence of previous experience, per se, is unrelated to evacuation. The same is true with respect to the number of hurricanes experienced, recency of one's experience and whether damages or injuries were suffered by one's household.....Residents who had evacuated in previous hurricanes were also the most probable to evacuate during Hurricane Carla. There is also some evidence that individuals are inclined to judge the probable destructive effects of an incoming hurricane upon the basis of the last one that affected the area and are more often not inclined to evacuate (Moore et al., 1963 and Quarantelli, 1980b).

Given that storm surges are a major threat during hurricanes, there is some evidence that the location of residents will influence evacuation behaviour. According to Mileti, et al., (1975), the propensity to evacuate varies

directly with selected site characteristics and physical proximity to predicted impact areas. Baker (1979) has also reported that elevation of the respondent's home above mean sea level exhibited one of the strongest associations with evacuation produced by any of the four studies. The relationship was clearly monotonic with people living in lowest-lying areas being the most likely to leave (1979:19). However, there is little evidence that storm surges have historically been a major threat on Nevis although severe beach erosion has occurred even during the passage of tropical storms.

Chapter II has outlined some of the main issues and concepts reported in the literature on human response to natural hazards and hurricanes. Factors affecting the adoption of adjustments strategies has also been discussed. In addition, a basic description of disaster management on the island of Nevis has also been attempted. Chapter III will explain the sampling procedure and methods of data collection used in this study.

CHAPTER 3

METHODOLOGY

This chapter describes the research methodology which includes the sampling procedure employed in the collection of primary data. The chapter is divided into two sections, sources of data and methods of data collection and analysis.

3.1 Sources of Data

Despite the fact that the island of Nevis has been devastated by various hazards in the past, there is a general paucity of disaster related information. Until 1993, there was no established office or agency to coordinate disaster activities on the island. Consequently, at the onset of Hurricane Hugo in 1989, there were no organised efforts at formally evaluating the households response to the hurricane and the extent to which they have adopted precautionary measures to reduce the impact of future hurricanes. Even with the establishment of a Disaster Preparedness Office, the scarcity of resources makes data collection at the household level a daunting task. Given the general lack of data, the collection of primary data at the field level was considered essential for the purpose of this study.

3.1.2 Primary Data Sources

Given the paucity of research material in Nevis, data for the study were obtained solely from primary sources. The

survey instrument used in this research was successfully administered to 206 respondents out of a target of 220. The questionnaire survey was undertaken during a two-month period from the last week in September to the middle of November, 1994. In order to reduce errors associated with the use of different interviewers and to standardise recordings and observations, all interviews were conducted by the researcher. The questionnaire data were supplemented by five case studies of respondents who were purposively selected to provide additional information not covered by the questionnaire. All the case studies were of respondents whose homes were totally destroyed during Hurricane Hugo.

Additional insights were gathered through personal observations of building designs across the islands. Interviews were also conducted with the Disaster Coordinator in Nevis, the Deputy Federal Disaster Coordinator in St. Kitts and several informal interviews with members of the construction industry and the chairman of the Nevis Building Board. These interviews provided insights into the challenges of managing disasters on the island and the response of building fraternity since Hurricane Hugo. For instance, it was realised that the strongest buildings are often designed to withstand hurricane winds of up to 125 miles per hour. In addition, there was consensus among the contractors interviewed that poor building construction can be blamed for much of the damage caused by Hurricane Hugo. It was also

revealed that since Hurricane Hugo, contractors have been encouraged to incorporate traditional roof designs to strengthen buildings.

3.1.3 Questionnaire Design

A questionnaire was designed to illicit the information required to meet the objectives of the study and consisted of three major sections (see, Appendix B). The first section focused on the past hurricane experience of respondents, aspects of evacuation to shelters, traditional coping mechanisms, the perception of hurricanes and whether or not respondents had hurricane insurance. In the second section, the questions were limited to their experience with Hurricane Hugo. This section focused on their receipt of warnings, the quality of warning received and whether hurricane preparedness measures were adopted prior to the arrival of Hurricane Hugo. Information on the type and extent of damage, how affected respondents recovered and the type of precautionary measures adopted since the passage of Hurricane Hugo. Section three focused on household characteristics, housing structure, along with a checklist of household preparedness levels.

3.2 Methods of Data Collection and Analysis

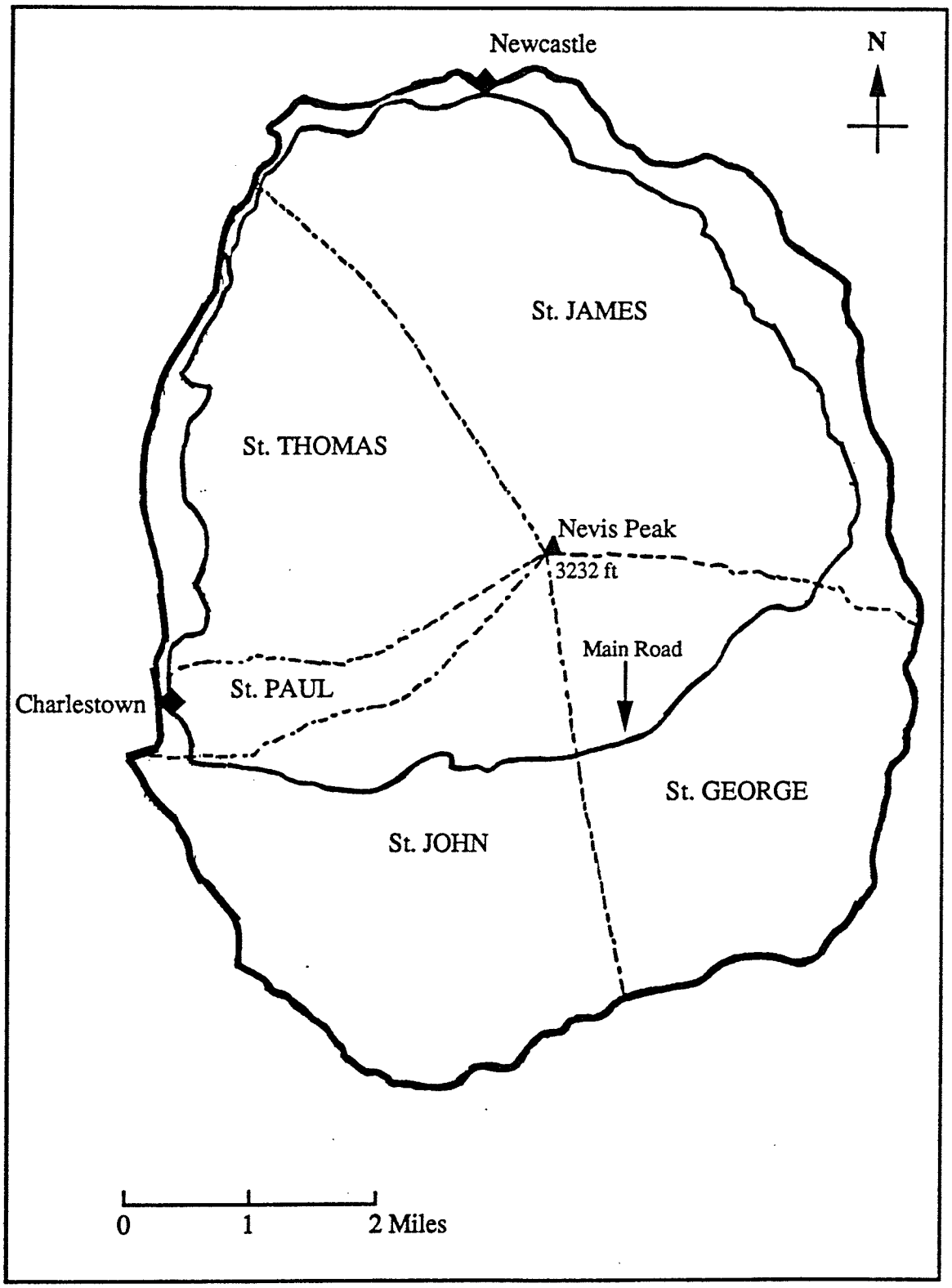
3.2.1 Selection of study Area

The island of Nevis was selected for this study because it has been periodically ravaged by hurricanes throughout

history. In addition, given its small size, the entire island can be wiped out by a single event if adequate preparations are not adopted. Although only four hurricanes have directly affected the island during the present century, their impact has been dramatic and has affected the social, economic and political development on the island. Similarly, the ravages caused by Hurricane Hugo 1989 suggest that residents were overwhelmed by the severity of the storm. Since 61 years had elapsed since the 1928 hurricane and the onset of Hurricane Hugo in 1989, the study can provide a point of reference to assess the extent to which mitigation and preparedness measures have been adopted since 1989. There is some evidence that traditional buildings were designed to withstand hurricane force winds. However, there was a dramatic shift away form the traditional designs prior to the onset of Hurricane Hugo. The absence of any mandatory building codes means that there is much variation in the quality of construction on the island.

Nevis is administratively divided into five parishes (Figure 3.1). Although there is much variation in the physical size of the parishes, there is little variation in actual population sizes. However, given its minuscule size and location within the hurricane zone, the whole island remains vulnerable to future storms.

Figue 3.1 Parishes of Nevis



3.2.2 Selection of Sample Population

Based on preliminary reports from the 1991 census, Nevis has a total of 2,686 household and a total population of 9,130. Given the fact that decisions related to hazard mitigation are made at the household level, it was decided to conduct interviews with a sample of heads of households. Although a sample in excess of 400 households would have proven statistically ideal, the harsh reality of conducting research with the constraints of time and minimal finances dictated that a more pragmatic number be selected. Consequently, it was decided that a target of 220 households (12.2 percent of all households) would be adequate for the study.

Given the small physical size of the island, and the fact that the whole population is vulnerable to hurricanes, it was decided that all the households on the island be included in the sample frame. Consequently, the target population was all the heads of households on the island. Based on preliminary results of the 1991 population census, the number of households in each parish was:

St. Paul	460
St. John	663
St. George	601
St. James	477
St. Thomas	485

The number of households per parish was used to calculate the proportion (percentage) of households living in each parish (Table 3.1). Once these proportions were established, the

sample size to be selected in each parish was arrived by calculating the percentage of households in each parish as a proportion of the desired sample size (220). The individual households were selected by the use of a stratified simple random sample[10] using the point sampling technique.

TABLE 3.1

Sample Size and Respondents per Parish

Parish	% of household per parish	Sample of households per parish	Successful Interviews
St. Paul	17.1	38	36
St. John	24.4	54	53
St. George	22.3	49	49
St.Thomas	18.0	40	31
St.James	17.7	39	37
TOTALS	100	220	206

This technique was used in order to determine the number of households to be selected per parish and point sampling to reduce the number of households who may have been excluded if

[10] See Moser and Kalton (1972:107) for explanation of this technique.

they were selected using a non-spatial technique.

In order to locate the sampling units, a standard point sampling procedure was followed. Thus, a gridded (1" squares) transparent paper was superimposed on a 1989 Ordinance Survey topographical (1:25000) map of Nevis. With the use of a light table, the map of Nevis was traced onto the gridded squares. The grids covering the map area were numbered, that is, from west to east and from south to north, so that the values increased eastwards and northwards away from the point of origin. Numbers from a random number table were used to locate the sample units which are represented by small squares on the map. Given that the values exceeded 100 in each direction, the first six values in each group of random numbers were used in the same way as eastings and northings. Therefore, the first three numbers were counted to the right (west to east) and the next three numbers were counted from south to north. The point arrived at was used to locate the sample units, that is the building closed the point. The procedure was repeated until the desired number of units were selected.

In order to reduce some of the problems usually encountered with the use of the point sampling technique, it was decided that points located more that one mile (straight line) away from any residential areas would be discarded and another point located. This was useful especially in the forested central (mountainous) region and the largely uninhabited south and south west portion of the island.

Similarly, where the sampling units had non-residential functions (eg. schools, churches, vacant houses etc.) the closest occupied dwelling was to be selected.

However, as is evident from Table 2.1, there were some unsuccessful attempts at interviewing the respondents. There were two main reasons for this lack of success. Firstly some of the respondents openly refused to answer because they claimed to be too busy at the time or were sceptical of sharing their experiences. While in other cases it was difficult to find the respondents even after futile efforts at rescheduling the interviews.

3.2.3 The Pre-test

A pre-test of the questionnaire was conducted prior to the survey. Three heads of household were purposefully selected from each of the five parishes and were tested with a draft copy of the questionnaire. The pre-test provided some useful information which led to some changes and additions to the original questionnaire. For instance, from the pre-test it was realised that the heads of households often appeared perplexed when they were asked about severe tropical storms. This may be attributed to the fact that it is not customary for Nevisians to respond to tropical storm warnings. The fact that the majority of interviewees in the pre-test asked what was meant by severe tropical storm suggested that distinctions between the different phases in the development of a hurricane

are not fully understood. In effect, residents were much more comfortable with the word "hurricane". Discussions during the pre-test with members of the building fraternity suggest that there was some relationship between the shape of the roof and susceptibility to storms. As a result the section on building structure was elaborated to include structure, roof shape (style) and roof pitch. The pre-test also facilitated the coding of some of the uncoded questions.

3.2.4 Method of Data Analysis

Survey data were processed using the Statistical Package for Social Scientists (SPSS). SPSS was used because it provides an efficient way of processing large data sets and with much scope for manipulating coded data.

Due to the nominal nature of most of the data collected, chi-square significance tests were applied to hypotheses I and II. In addition, hypothesis III was tested by the use of descriptive statistics (e.g., mean and standard deviation).

3.2.5 Limitation of the Primary Data

Although the sample frame implemented in the study was designed to reduce sampling errors in the survey results, some errors were impossible to eliminate since they were only identified during the course of the survey. For example, the varying educational level of respondents often rendered questions designed in standard English impractical. As a

result the local dialect had to be used at times to illicit the required information. This was more common among the older and less formally educated respondents. Furthermore, because five years has elapsed since Hurricane Hugo, it was sometimes difficult for the respondents to recall factual information. This was particularly important with respect to the approximate cost of property damage sustained by respondents and may have resulted in some inaccurate answers to this question. In addition, some of the information (eg. perception) collected would have been more appropriately collected through longitudinal studies. Other possible limitations to the primary data set are:

1) Although respondents were informed that the questionnaire would last about twenty five minutes, their inquisitive minds often resulted in much lengthy discussions during the interview which at times resulted in a rush towards the end. This, of course, may have affected the accuracy of some of the responses to later questions.

2) Respondents often viewed the asking of questions about Hurricane Hugo as a kind of inventory for government to give assistance even where it was not needed. Consequently, many respondents sometimes forgot the purpose of the survey and often reminded the interviewer of the fact that they did not get any assistance after Hurricane Hugo. Therefore, estimates of damage may have been inflated in some cases as may be the case with respect to the receipt of assistance for recovery.

3) Sometimes respondents agreed to answer question while they were occupied with household chores, consequently their concentration invariable lapsed from time to time during the interview.

4) The nature of questions often led to political as well as religious overtones; discussions about local politics was a common climax of the interviews. One such issue was the Government airport extension relocation project in New Castle Village. Residents quite often had mixed reaction to what they consider a waste of tax-payers money.

5) Given the Developing World context, it was not uncommon for respondents to view surveys with suspicion since surveys are sometimes seen as the basis for increased taxes sources, especially with regard to questions relating to land tenure and housing structure. Others complained of the fact that people are always coming to ask questions and they do not receive any feedback. The 1991 population census was the main case in point since after four years the results had not been released to the public.

6) It became obvious at times that informants tried to impress the investigator. This was evident among some of the more educated who felt that they had to appear knowledgeable and well organised in terms of the adoption of preparedness and mitigation measures. This may have resulted in inaccurate or exaggerated information.

7) It was quite common for the respondents to solicit the

assistance of a relative or spouse in providing information which may have affected the accuracy of the information in such cases.

However, despite these limitations, the survey on mitigation, preparedness and response to the hurricane threat on the island of Nevis provided pertinent information. The data provide insight on the nature of their experiences, beliefs and perception of hurricanes, as well as attempts at adopting precautionary measures since Hurricane Hugo and on their preparedness levels. It also provided information on household characteristics and the housing characteristics on the islands. The results of the survey will be presented in the following Chapter.

DATA ANALYSIS

This chapter consists of the data analysis focusing on the traditional coping mechanisms, willingness to evacuate and perception of hurricane threat. The three hypotheses are tested firstly, that lack of hurricane experience, inadequate warning and socioeconomic variables contributed to the low preparedness level during Hurricane Hugo. Secondly, that the adoption of precautionary measures in the post-Hurricane Hugo era is related to the intensity of hurricane impact and socioeconomic characteristics of the respondents. Thirdly, that given the recency and major economic impact of Hurricane Hugo, a higher level preparedness existed on the island during the 1994 Hurricane Season. Aspects of household recovery are also discussed.

4.1 Hurricane Experience and Traditional Coping Mechanisms

The majority of respondents reported hurricane experience while living on Nevis. Of the 206 respondents, 193 had experienced a hurricane while living on Nevis while there were thirteen respondents without any hurricane experience. Those respondents who did not have any hurricane experience were either away on vacation during Hurricane Hugo or were migrants who have returned home during the post-Hurricane Hugo era. Similarly, there were only fourteen respondents who did not experience Hurricane Hugo. Nevertheless, Hurricane Hugo

provided the sole hurricane experience for the majority of respondents.

Since the two earlier hurricanes in this century occurred in 1924 and 1928, those who experienced them were small children or young adults at the time, albeit many had vivid recollections. A total of 26 (12 percent) and 34 (17 percent) respondents experienced the hurricanes of 1924 and 1928 respectively. In addition, in the 1920's most of the homes were of thatched roof and were therefore easily ravaged by hurricanes and tropical storms. Nevertheless, residents with conventional homes were accustomed to taking hurricane precautions during the hurricane season, even without sophisticated hurricane warning devices.

In the 1920s' warning was minimal and residents often had to rely on nature for cues or official warnings when there was an approaching hurricane. As Byron (1988) commented 'there was no superior radio warning systems, though there were wise men, notably Mr. Henville in St. Kitts and Mr. W. G. Selkridge in Nevis who, with the help of barometers and other weather-watching devices could usually forecast when a hurricane was due to strike the island'. One respondent mentioned that once villagers heard that the 'barometer was low' they would bar up and take other precautions. In effect, when the barometer is low, warnings were given, usually by 'word of mouth', the ringing of church bells or the sound of a siren. As one respondent remarked:

> "Mr. Francis Claxton of Gallows Bay used to go around with a bell and ring the bell, passing and speaking, informing people of the latest development in the weather. Then people hook down their doors and windows and run by somebody with a big size house. Some people even used wire or ropes and tie their house to a tree."

Byron (1988) also supports this type of warning, "then the police would go through the villages warning people to bar up their houses and to move out to emergency shelters such as the Court House, Police Station, Methodist Church etc. until it has passed." However, some residents often relied on cues from nature.

Nevertheless, when asked whether there were signs which indicated when a hurricane is approaching, the majority (60 percent) of the respondents were unaware of these signs, while 26 percent were aware and 13 percent were uncertain. The relatively low level of awareness of environmental cues reported by the respondents was not surprising since only a small minority had "hurricane experience" prior to Hurricane Hugo in 1989. However, research has shown that "such 'environmental cues" impact the perceptions of understanding, believing, personalising, as well as the actual action (Drabek, 1969: Mileti, et al., 1975 and Fitzpatrick and Mileti, 1991). Thus the inability of many respondents to identify environmental cues may have influenced their actions during the warning phase of Hurricane Hugo. The most commonly reported signs were the very dark clouds and fitful gusts (Table 4.1).

TABLE 4.1

Natural Signs of an Approaching Hurricane*

Signs	Frequency	Percentage
Very dark clouds	22	28.6
Horizon turns red	4	5.2
Very calm conditions	17	22.1
Unusual animal behaviour	2	2.6
Fitful gusts	19	24.7
Roaring sea	5	6.5
Flying weather birds	5	6.5
Leaves on 'trumpet' tree in the mountain turn white	3	3.9
TOTALS	77	100

*Multiple responses possible

In the past residents had often tried to reduce the forces of hurricanes and tropical storms by adopting various precautions. However, given the low frequency of hurricanes in the years prior to Hurricane Hugo in 1989, it was not surprising to learn that many respondents do not normally take precautionary measures during the hurricane season, albeit the passage of Hurricane Hugo may have reversed this trend. Nonetheless, discussions with several older residents revealed that it was once customary for people to store valuables in

boxes and prop houses with 'Y' shaped posts"[11] at the start of the hurricane season. In addition, shelter was often provided for domesticated animals. In some cases the spaces under the houses were used to shelter animals during stormy conditions. Similarly, the large domesticated animals such as cattle and donkeys are often untethered during stormy weather.

It appears that a hurricane subculture once existed at the individual level, that caused residents to voluntarily take precautionary measures at the start of the hurricane season. As one respondent indicated, it was common for villagers to secure their roofs and do minor repairs to their homes in anticipation of the hurricane seasons. The ringing sound of hammers pounding on the house roofs often signalled the start of the hurricane season. Such practice was still common even during the early 1970s[12]. However, changing lifestyles and building materials along with the prolonged absence of hurricanes, may have been the main causes for the disappearance traditional preparedness practices in recent years. The general move to masonry in place of the traditional wood or tapia as a building material has resulted in houses with greater mass and hence greater resistance (except for the roof) to destruction by hurricanes, but conversely much

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[11]These are simply large poles with two prongs at one end. A stick or pole with such a shape is locally referred to as a "fork stick." These were prevalent when many residents had chattel houses.

[12] Recounting personal experience, precautionary measures were mainly adopted by the older people in the communities.

greater exposure to damage by earthquakes (Tomblin, 1981:343). Similarly, the popular use of louvres and decorative glasses to replace traditional shutters on doors and windows has increased the vulnerability of modern homes to hurricanes. For instance, there were many complaints of water entering the house through the louvres during Hurricane Hugo. However, the post Hurricane Hugo era has witnessed a rebirth of traditional construction designs with protective shutters for windows and doors.

Although there is a paucity of literature on construction for hurricanes in the region, reports on hurricane damage in the Caribbean often describe the resilience of the indigenous homes (eg., Oliver and Trollope, 1980 and Consulting Engineering Partnership Ltd, 1989). Compared to the more elaborate modern buildings, indigenous buildings were constructed to withstand hurricane force winds. More importantly, traditional roof shapes such as the hip and gable have been incorporated into building codes in the Caribbean (see, Government of St.kitts and Nevis Construction Manual, 1991). The double gable roofs often form a tunnel through which wind passes with reduced frictions. Similarly, the short overhang and high pitch of the hip roof, provide a low vulnerability to hurricanes by reducing the openings to the roof. However, legislation may be needed to made traditional roof designs mandatory on new buildings on Nevis. Generally, the increase in structurally stronger homes makes the

possibility of evacuation less likely among residents on the island.

4.2 Evacuation to Shelter

Since hurricane warnings have changed over time, it was not surprising that the majority of respondents relied on radios and televisions for hurricane warning. When asked about the quality of hurricane warnings in Nevis the overwhelming majority of respondents (79.6 percent) reported that they were easy to understand. Therefore, it was rather ironic that only 61 percent of respondents actually adopted any preparedness measures during the passage of Hurricane Hugo. However, the relatively low level of preparedness may be attributed to the general lack of previous experience and the pervasive atmosphere of disbelief that existed prior to the onslaught of Hurricane Hugo.

Although evacuation is a common pre-impact planning measure in the literature on hurricane adjustments (see Drabek, 1986, Beatley, et al., 1993) not many respondents have ever evacuated or expressed any interest in evacuating their homes in the event of future hurricanes. For instance, only 4.9 percent of the respondents who took emergency measures during Hurricane Hugo evacuated their homes (Table 4.6). The poor performances of some designated shelters during Hurricane Hugo, appeared to have been a significant factor in shaping the opinion of some respondents. In addition, some respondents

recounted a story told by their parents of a 1889 hurricane, when the roof of the Methodist Church School in Gingerland, caved in and killed the shelter manager who was reluctant to allow people to leave. Nevertheless, the respondents had various reasons for their reluctance to evacuate their homes. However, when asked whether they were willing to evacuate if warned of a threatening hurricane, 127 respondents (62 percent) answered in the negative, 54 respondents (26 percent) were affirmative, while 23 respondents (12 percent) were unsure if they would evacuate. In an attempt to understand the reasons why public shelter use in the event of future storms is not a popular option, respondents were asked to give reasons for their expressed opinion on their willingness to evacuate. The main reasons given by those who expressed willingness to evacuate are my house is not strong enough, it depends on the strength of the hurricane and I don't want to be by myself (Table 4.2). It was common for respondents who indicated that they will evacuate depending on the strength of the hurricane, to qualify their answer with 'once the next hurricane is stronger than Hurricane Hugo'. This is consistent with evacuation studies which suggest that once residents are able to ride out a storm in their homes, that storm becomes the standard of severity for future storms (see., Saarinen, 1982).

Conversely, the main reasons why respondents were unwilling to evacuate to shelter were because they felt that

their house was either strong enough or stronger than the hurricane shelter in their district and that they prefer to stay at home (Table 4.3).

TABLE 4.2

Reasons Why Respondents Will Evacuate to Shelters in the Event of a Future Hurricane

Reasons	Frequency	Percentage
House is not safe	22	40.8
Shelter is close to my home	2	3.7
It depends on the strength of the hurricane	26	48.1
Don't want to be by myself	4	7.4
TOTALS	54	100

The survey established that over one third of the respondent felt that their homes were strong enough or stronger than the designated shelter in their districts. This suggests that greater emphasis should be placed on individual precautionary and preparedness measures by the officials.

However, the issue of evacuation may have been compounded by the fact that some respondents did not know the name of the designated hurricane shelter in their district. Nevertheless, the majority of respondents (73 percent) knew the designated shelter in their area. Conversely, only 35 percent of the respondents knew the shelter managers for the designated

shelter in their communities. Similarly, only 37 percent of the respondents knew the Disaster Coordinator for Nevis compared to 63 percent who did not know the Disaster Co-ordinator.

TABLE 4.3

Reasons Why Respondents Will not Evacuate in the Event of a Future Hurricane

Reasons	Frequency	Percentage
Have to protect my home	12	8.5
Lack of transportation	1	.7
The shelter is too far	3	2.1
House is strong enough or stronger than shelter	87	61.2
Prefer to stay by a friend	2	1.4
Prefer to stay at home	37	26.5
TOTALS	142	100

Not surprisingly, only 29 percent of respondents ever checked the conditions of the designated shelter. While relevant information about evacuation and disaster preparedness is relatively low, continued awareness programs may enhance the awareness among the respondents. However, the fact that hurricane shelters often lack facilities may contribute to the generally low willingness among respondents to evacuate. In addition, the ability of the Nevis Island

disaster situation is questionable. However the low level of planned evacuation is consistent with other studies which have reported low evacuation levels during hurricanes (see., Haque and Blair, 1992). Therefore, the shelter policy in Nevis may need to be overhauled to accommodate residents reluctance to evacuate to shelters. Therefore, a greater focus on improved warning and hurricane proofing should be pursued.

4.3 Perception, Salience and Awareness of Hurricane

Although hurricanes are a persistent annual threat to the island, only 53 percent of the respondents knew the duration of the hurricane season and 42 percent did not know the duration of the hurricane season. The other five percent of the respondents were uncertain. It was not surprising that the more vulnerable groups comprising the elderly and the uneducated dominated the later category. Nevertheless, every respondent was able to tell some of the common month during which hurricanes usually occur. However, as Britton (1981:36) averred "awareness of cyclone hazards by the population, however, cannot be directly translated into undertaking appropriate mitigatory action, or even understanding appropriate mitigatory procedures." Nonetheless, when asked whether hurricanes present a very serious threat to the Caribbean, 78 percent of the respondents strongly agreed with the statement, 12 percent agreed, seven percent were undecided and less that three percent disagreed or strongly disagreed.

The recent experience of Hurricane Hugo may have been a factor in the overwhelming agreement with this assertion.

While the majority of the respondents considered hurricanes to be a serious threat, only a small minority (14 percent) felt that it was very likely for another hurricane to strike Nevis within the next five years. Another 14 percent felt that it was likely and 64 percent were uncertain, while the remaining six percent felt that it was either unlikely or very unlikely. This relatively low expectation for another hurricane within five years, may be attributed to the fact that five years had elapsed since the last hurricane and 61 years had elapsed prior to the passage of Hurricane Hugo. However, studies have shown that residents living in high risks areas tend to discount the reality of the threat (see., Kates, 1962). More so "people think in terms of a 'law of averages' or the "gambler fallacy" rather than independent probability (Neal, et al., (1982). Therefore, by this logic, the probability of another hurricane affecting the island in the near future should be low. Nevertheless, the recent passage Hurricane Luis (1995), attest to the fact that natural hazards are indeed random occurrences.

The majority (68 percent) of respondents were uncertain whether they would sustain any damage in a future hurricanes. Furthermore, only 21 percent of the respondents felt that they would suffer damage in the event of another hurricane. It was not surprising that only eleven percent of the respondents

not surprising that only eleven percent of the respondents were confident that they will not suffer any damage in the event of another hurricane. However, when asked whether they can do anything to reduce hurricane damage, an overwhelming majority (75 percent) of the respondents were positive, while 14 per cent answered in the negative. The most common mitigation measure suggested by respondents was to bar up windows and doors (Table 4.4).

TABLE 4.4

Hurricane mitigation Measures Suggested by Respondents*

Reasons	Frequency	Percentage
Make my house stronger	50	14.8
Reinforce house roof	37	10.9
Bar up windows and doors	122	35.9
Pray to God	5	1.5
Insure home	3	0.9
Other Precautions	123	36.1
TOTALS	337	100

*Multiple response possible

Although insurance was only mentioned by a few respondents, there is a generally low proportion of the population with hurricane insurance. Only 24 percent of the respondents reported that they had hurricane insurance. However, this should be viewed with caution since insurance

was often a pre-requisite for mortgage purposes. One respondent supports the importance of mortgages, with the remark, "I insured in 1989, not because of Hugo but because I needed to borrow." In addition, a few respondents were quick to point out that wooden houses were not eligible for insurance. In fact a chi-square test shows that there is a significant ($p < .001$) relationship between building structure and whether or not the respondents had hurricane insurance.

Furthermore, unlike the North American context where there are specific floods and earthquakes insurance, there is no Government supported hurricane insurance scheme in Nevis. Instead, hurricane insurance falls into the category of "Acts of Nature," which include other natural hazards. Thus, an individual with house insurance is entitled coverage once the house is damaged during a hurricane. The main reason given by respondents for not having hurricane insurance is the generally high costs (Table 4.5). As one respondent remarked "I don't even have money to buy bread much less to insure house." This was consistent with the finding of (Palm and Hodgson, 1992) who also reported cost as the primary reason why respondents did not purchase earthquake insurance in California. Of even greater concern is the fact that a few respondents even mentioned that they cancelled their insurance after Hurricane Hugo because of the large increase in costs. However, increasing hurricane awareness and the prospects of having to rebuild after a storm, may well force many residents

to purchase hurricane insurance, albeit the economic reality involved may dictate otherwise. The low level of hurricane insurance may have crucial consequences for residents who are unemployed or are among the elderly. However, this low level of insurance coverage suggests that residents may be more willing to adopt mitigative and preparedness measures to reduce damage from future hurricane.

TABLE 4.5

Reasons Why House is not Insured Against Hurricanes*

Reasons	Frequency	Percentage
Too expensive	88	59.1
Insurance is much trouble	8	5.4
Insurance companies rob people	10	6.7
It won't help	14	9.4
House is strong enough	3	2.0
Don't believe in insurance	12	8.1
It is better to save the money	12	8.1
The house is not mine	2	1.3
TOTALS	149	100

*Multiple response possible

Nevertheless, some of the reasons given by the respondents reflect a negative image of the insurance companies on the island. Furthermore, a few respondents

mentioned that they had problems getting money from their insurance companies to cover repairs from the ravages of Hurricane Hugo. There appears to be some need for increased public awareness about the importance of insurance, especially to recover from destructive natural forces such as hurricanes. However, in the absence of hurricane insurance, there are several other measures which can be adopted to reduce damage from future hurricanes.

4.3 Hurricane Hugo: Warning, Preparedness and Response

The literature on adjustments to natural hazard is often grounded in the concept of theoretical range of adjustments (see., Burton Kates and White, 1978). Following the work of Jackson (1981), adjustments can be conveniently divided into two categories: response during and after an event (preparedness or emergency), compared with precautions that can be adopted long before the event (long-term adjustments). The fact that hurricanes have an advance warning phase, indicates that residents should have time to take certain emergency actions such as evacuating their homes, bar up window and doors, reinforce the roof and clear debris from their yard prior to the onset of the storm. Similarly, longer term mitigative measures such as building stronger structures, repairing homes, purchasing insurance, strengthening foundation form part of the long term adjustment process for future risks. Both preparedness and mitigation measures are

examined, respondents were asked to recall events prior to the onset of Hugo and after.

It is postulated that the adoption of preparedness measures at the time of Hurricane Hugo is related the general lack of previous hurricane experience, inadequate warning and socioeconomic vulnerabilities. Only a very small minority (17 percent) of the respondents had any previous hurricane experience dating back to 1928. Similarly, two generations had grown and sixty one years had elapsed without the island being affected by a hurricane. The literature suggests that communities with are repeatedly impacted by a disaster are likely to be more organised to respond. As Fritz (1968:204) explained, "it is difficult, however, to establish and maintain an adequate state of preparation under normal conditions, especially if there has been no recent disaster experience." Therefore, this lack of disaster experience may have contributed to the generally low preparedness level both at the institutional level and among residents. In fact, the lack of institutional preparedness may have resulted in the relatively inadequate community preparation. This was evident in the dissemination of warning and the evacuation of residents in vulnerable areas.

The fact that Hurricane Hugo occurred one year after Hurricane Gilbert, made it a very highly publicised storm. Therefore, it was not surprising that the majority (92 percent) of respondents who experienced Hurricane Hugo had

actually received warnings or knew of the approaching hurricane. Only two percent of these respondents indicated that they had not received any hurricane warning. Of those who received warning, 65 percent indicated that they believed that the hurricane would strike the island compared to the 31 percent who did not believe the warnings and four percent who were undecided. However, before people can act, they must hear the warning, understand the warning, believe it, personalise the information, decide and then take action (Mileti and Sorensen, 1987). They further outlined ten variables which largely determine public response, one of which is the source of the warning which must be credible and should contain endorsements by scientists, organisations and officials (1987:196). However, given the defunct nature of disaster management in Nevis in 1989, neither the then Disaster Coordinator nor the Premier of Nevis made any emergency declaration of the pending disaster. The literature also suggests that more specific messages produce higher levels of warning belief and perceived risks (Perry, Lindell and Greene, 1982a). Therefore, the absence of any specific warnings by the authorities in Nevis during Hurricane Hugo may help explain why many residents did not take the warnings from the radios and televisions stations in neighbouring islands very seriously.

In order to gauge the quality of warning received, respondents were asked to describe the quality of warning that

they received on a five point scale, one being very inadequate and five being very adequate. The majority of the respondents felt that the warning had been either inadequate (40 percent) or very inadequate (30 percent). Conversely, a very small minority of respondents felt that the warning had been either very adequate (1 percent) or adequate (5 percent) while 16 percent of the respondents were undecided about the quality of warning they received. The absence of any official disaster warning by the Premier or the Chairman of the Disaster Committee may help explain the sense of apathy that pervaded on the island at the time of Hurricane Hugo. There were no sirens, nor ringing of bells or any local level warnings to convey the feeling of an imminent emergency situation.

Although the majority of the respondents had received warning, over one third (39 percent) of the respondents did not take any preparedness measures to reduce damage from Hurricane Hugo. In fact, all of the respondents who experienced Hurricane Hugo indicated that they were aware of the preparedness measures prior to the onset of the storm. Of those who took measures, conventional preparedness measures such as reinforcing sheetings, barring windows and doors and stocking emergency food supplies were adopted. The only unusual measure was the two respondents who indicated that they 'tied down' their house (Table 4.6).

Furthermore, those who moved to shelter basically sheltered with friends and families. In some cases people

moved during the storm once their house was damaged. For instance, one respondent explained that his house roof was blown off when wind entered his house when he opened a door to provide shelter for some neighbours whose home was destroyed. Other preparedness measures include putting stones on the roof during the eye of the storm, moving fishing boats away from the sea and tieing them to a tree. Several respondents even suggested that if they had known that the storm would be so dangerous they would have adopted preparedness measures.

TABLE 4.6

Preparedness Measures Adopted by Respondents

Precautionary measures	Frequency	Percentage
Moved to shelter	13	4.9
Reinforced Sheetings	72	26.7
Bar windows and doors	108	40.3
Clear debris/cut overhanging trees	10	3.7
Stocked supplies	63	23.5
Tie down roof	2	.7
TOTALS	268	100

*Multiple response possible.

The fact that only the elderly respondents had experienced either the 1924 or the 1928 hurricanes, makes it understandable that most of other respondents could not fathom

the magnitude of the damage that could be caused by Hurricane Hugo. In addition, there was no emergency organisation which existed to coordinate activities before, during and after the hurricane. When asked about the about the impact of Hurricane Hugo, the majority of respondents (53 percent) felt that it was more than they expected. Similarly, almost one third (30 percent) felt that the impact of Hurricane Hugo was much more that what they expected while five percent thought that the impact was less that what they had expected. In short, the absence of first-hand hurricane experience contributed to the relatively unprepared state which existed on the Nevis at the time of Hurricane Hugo.

Given the general lack of hurricane experience among the respondents, it was expected that variation in adoption of preparedness measures during Hurricane Hugo would be significantly related to the age, occupation and educational level of the respondents. The adoption of preparedness measures varied with the socioeconomic characteristics of the respondents (Appendix C). However, Chi-square tests revealed that the calculated value for each variable is less than the critical value (Table 4.7). Therefore, this allows for the rejection of H_0, which stated that the decision to adopt preparedness measures was related to the age, educational level and occupational categories of the respondents, and the acceptance of H_1. The results suggest that the observed differences in the adoption of preparedness measures during

Hurricane Hugo was not significantly related to the socioeconomic characteristics of the respondents. Therefore, the general lack of hurricane experience and inadequate warning may account for the relatively low level of preparedness among respondents regardless of socioeconomic characteristics. This result contradicts other research that has reported associations between preparedness and socioeconomic variables (e.g., Palm 1981 and Neal, et al., 1982).

The concept of disaster subculture is increasingly being used to describe the behavioural outcomes and coping mechanisms portrayed by those who are subjected to repetitive natural disaster impacts (Britton, 1981:57).

Table 4.7

Adoption of Preparedness During Hurricane Hugo by Socioeconomic Variables

Variables	Calculated Value	df	Critical Value	Significance Level
Age	2.28	3	7.82	.31 ns
Education	1.00	3	7.82	.79 ns
Occupation	.55	3	7.82	.90 ns

ns = not significant

While the island of Nevis is threatened annually and missed frequently by hurricanes and tropical storms prior to 1989,

there had not been any major natural hazard impact on the island for over two generations. Although a subculture may have existed in the past when hurricanes were more frequent, the hitus of hurricane events had overwhelmed the tendency to expect hurricanes in Nevis. Weller and Wenger have pointed out that the development of a subculture within a community is facilitated by three factors: repetitive disaster impacts, a disaster agent which regularly allows a period of forewarning, and the existence of a consequential damage that is salient to various segments of the community (Hannigan and Kueneman, 1978:132). Based on these features, it can be argued that the absence of repetitive disaster impact and consequential damage that is salient to various segments of the community influenced the low level response to Hurricane Hugo.

The findings of a Disaster Investigative Report by Oliver and Throllope (1981) on the impact of Hurricane Allen on St. Lucia in 1981 give credence to the attitude which pervades in areas which have had a prolonged absence of major storm impact. They stated that:

> "The survey concluded that whilst awareness of the storm was high, public response was low and poor. The explanation was suggested to be I) lack of hurricane experience, II) lack of public education about natural hazards, III) the carefree attitude of the public and IV) insufficient detailed advice at the time of the hurricane approach" (1981:57).

This contrasts sharply with the well organised and high level response in Darwin (Australia) to Cyclone Max as reported by

Britton (1981). However, the operational factor here was the fact that the people of Darwin had learnt their lessons from their experience with the passage of Cyclone Tracy which devastated Darwin in 1974. Therefore, not only was the emergency organisations more organised but the people were a lot more cooperative and responsive than they were in 1974. In short, in the absence of disaster experience, even when near misses are common, the 'it can't happen here syndrome' tends to pervade, culminating in low preparedness levels for pending disasters.

In an attempt to understand the reasons why some respondents did not take preparedness measures during the passage of Hurricane Hugo, they were asked what were the main reasons for not doing so? Some did not believe in the hurricane warning, which is most likely attributable to the lack of hurricane experience among the majority of respondents. Others indicated that they felt their house was strong enough, while for some respondents they simply did not receive any warning (Table 4.8). A few respondents indicated that is was God's work which may reflect ingrained religious disposition or fatalism of these respondents. In fact it was common for some respondents to say 'when God is doing his work, nobody can stop him'.

TABLE 4.8

Reasons Why Preparedness Measures Were not taken During Hurricane Hugo

Reasons	Frequency	Percentage
Did not receive warning	2	3.1
Thought house was strong enough	13	20.6
Did not believe warning	28	44.4
Underestimated hurricane strength	8	12.7
It was God's work	12	19.1
TOTALS	63	100

For some respondents they simply underestimated the damage potential of the hurricane. However, some of the respondents may have adopted the Sit-Back-And-Wait (SBAW) approach as reported by Britton (1989:109), or were affected by the 'it can't happen here syndrome'. Whatever the motive, the number of times the island has had near misses may in some way justify any false confidence displayed by residents.

4.4 The Adoption of Mitigative Measure After Hurricane Hugo

Although no amount of warning might have adequately prepared residents for the onslaught of Hurricane Hugo, the experience should have been adequately graphic to encourage residents to take precautions for future hurricanes. In order to gauge the impact of the experience on the respondents, they

were asked if they had done anything to make their home more resistant to future hurricane damage. A large proportion of respondents (59 percent) indicated that they had taken some form of mitigation measures to reduce the impact of future hurricanes. The general comments from the respondents suggest that concerted efforts have been made to reduce future hurricanes. The strengthening of homes embodies the majority of adjustment suggested by those respondents who had taken action to reduce future hurricane damage (Table 4.9). While the threat of future hurricanes was taken into consideration during the construction or renovation phases, socioeconomic factors are equally important. In short, there is a general trend towards converting wooden and semi-concrete structures to stronger concrete structures. Therefore, it would be dangerous to presume that the experience of Hurricane Hugo was solely responsible for such changes, albeit it was a significant factor, especially where repair were necessitated by the hurricane.

In order to understand the extent to which respondents have been influenced by their experience of Hurricane Hugo, they were asked to indicate whether they had certain 'hurricane proof' building features at the time of Hurricane Hugo and which they currently have?

TABLE 4.9

Precautionary Measures Adopted After Hugo*

Mitigative measures	Frequency	Percentage
Change or repair roof	51	33.8
Build hurricane shutters	2	1.3
Reinforce roof during hurricane season	13	8.6
Plant shelter trees	2	1.3
Repair or renovate home	50	33.1
Make new house hurricane resistant	3	2.0
Build new home	21	13.9
Insure my house	5	3.3
Strengthen house foundation	4	2.6
TOTALS	151	100

*Only some of the respondents adopted these measures

There was a general increase in the number of respondents having some features (Table 4.10) and a slight decrease in others. However, some of these features may be classified as incidental adjustments as outlined by Burton, et al., (1978). Several respondents also indicated that simply anchoring the rafters in concrete was inadequate against hurricane force winds. Consequently, lengths of steel bars were often pushed through the rafters in order to secure them to the walls and reduce the vulnerability of the roofs to hurricane winds. Approximately one third (33 percent) of the respondents

indicated that they have steel bars passing though their rafters. In addition, discussions with local builders revealed that the poor performance of the roof of some concrete structures during Hurricane Hugo has popularised the use of purlins[13] and steel rods to help secure roofs.

However, the slight decrease in clinching can be attributed the fact that many residents on Nevis are substituting galvanised sheetings with asphalt tiles. It should be noted that features such as hurricane straps, shutters, diagonal braces and anchor bolts are unique to wooden structures. The thrust towards concrete homes tends to make such features obsolete. Furthermore, people who had to repair their homes because of hurricane damage incorporated safety features for fear of losing their property in the event of another hurricane. The large increase in the use of hurricane straps can be attributed directly to the impact of Hurricane Hugo. This is especially true for those persons who lost their homes during the storm and received assistance from the Government in the from of building supplies.

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[13]**These are horizontal beams which are flatter than the main beams and are usually 2"x 2" or 1" x 4" in size. The main purpose of purlins is to provide support for the main beam and a greater surface area to affix the galvanised sheetings to the roof. Purlins are common on concrete structures because the other forms of cladding (eg., panel board) are usually structurally weak and prevents the nails from penetrating the ceiling.**

TABLE 4.10

Safety Building Features Reported by Respondents

Safety Features	Before Hugo	After Hugo	Change (%)
Clinching	109	107	-2
Hurricane shutters	39	35	-5
Hurricane straps	5	19	+28
Diagonal braces	86	71	-17
Bolts (roof)	17	19	+11
Anchor bolts	15	26	+73
Rafter anchorage	81	108	+33
Purlin	43	61	+42

*Multiple response possible + increase - decrease

Similarly, the slight decrease in those reporting clinching can be attributed to two main factors. Firstly the increase in the use of roof titles and the greater use of purlin on concrete structures with galvanised sheeting. Other reasons given by the respondents are the susceptibility of galvanised sheeting to sea blasts in coastal areas, the relative cheapness of titles compared to galvanised sheeting and the fact that asphalt tiles do not provide crevices like galvanised sheeting in which bats live[14].

[14]Bats often make their homes in the grove provided between the galvanised sheetings and the ceilings. Since they are nocturnal mammals, they tend to make irritating noise when they enter or leave their spaces.

4.4 The Impact of Hurricane Hugo on the adoption of mitigation Measures

As mentioned before, it is conventional wisdom, that the experience of a hazard to leads to the greater adoption of precautionary adjustments. However, some studies have shown that prior experience does not necessarily lead to the adoption of such measures. Weinstien 1987, argued little distinction is often made between peripheral experience and core experience in disaster studies. However, studies of flood hazards have reported that experience was a determining factor in the adoption of mitigation measures (Kunreuther, et al., 1978 and Burby, et al., 1988). In addition, there is some evidence that the intensity of experience significantly affects the adoption of flood insurance (Baumann and Sims, 1978) and precautionary earthquake measure (Jackson, 1981).

The review of literature also suggests that studies using socioeconomic variable have not been conclusive in the relationship between these variables and the adoption of adjustment strategies. For instance, Kates (1962), and Islam (1974) did not find any significant relationship between the socioeconomic variables and the human responses to hazards Conversely, others (Barker and Patton, 1974: and Haque, 1988) have reported positive relationships between the socioeconomic features of the respondents and their response to natural hazards.

The following section examines the extent to which the

adoption of mitigation measures in the post-Hurricane Hugo era is related to the intensity of the experience and socioeconomic factors. The factors tested are (1) intensity of experience (damage) and (2) education, occupation, and age of respondents. It is hypothesised that variation in the intensity of hurricane experienced and socioeconomic variables will significantly influence whether or not respondents adopted mitigative measures.

Contrary to expectation, a surprisingly large proportion (38 percent) of the respondents indicated that they have not taken any protective measures to reduce damages in the event of future hurricanes. However, 47 percent the those respondents who had not taken any precautionary measures felt that their homes were safe enough, while another 40 percent indicated that the measures were too expensive. Other reasons given were, it won't help or hurricane won't come again. While the latter represents a minority view, as Mileti, et al., suggested "there seems to be a tendency for persons to underestimate the danger posed by a hazard and a belief that a disaster which occurred in the immediate past will not repeat itself" (1975).

Just over one half of the respondents (52 %) reported damage to their homes during the passage of Hurricane Hugo. While the other respondents did not have any notable damage apart from water entering their homes. It is expected that the respondents who suffered damage during Hurricane Hugo are more

likely to adopt mitigation measures. Of the 76 respondents who did not take any precautionary measures, 49 (64 percent) did not suffer any damage while 27 (36 percent) sustained property damage. Conversely, of the 120 respondents who had adopted precautions, 39 (32.5 percent) did not report damage compared to 81 (67.5) who sustained damage. Chi-square test shows that there is a significant ($p < .001$) difference between the respondents who suffered damage during Hurricane Hugo and the adoption of mitigative measures when compared to those respondents who did not suffer any damage.

The respondents who indicated that their house was damaged during the passage of Hurricane Hugo were asked to indicate the proportion of the house damaged. Much of the damage can be considered minor since the majority of respondents (72 percent) had less than 20 percent damage to their homes (Table 4.11). The relatively low proportion of damage reported may be reflective of the fact that the majority of respondents sustained roof damage. However, a large proportion (94 percent) of the respondents who reported more than 20 percent damage have adopted precautionary measures since Hurricane Hugo.

Since the calculated value (12.27) is greater than the critical value (9.49), the research hypothesis that the adoption of adjustments in the post Hugo era is significantly ($p < .05$) related to intensity of hurricane experience is accepted. This result supports the finding of Jackson (1981)

and (Baumann and Sims (1978) that the adoption of preventive measures is related to the intensity of damage experienced by respondents. While this result does not indicate the number of adjustments adopted since Hurricane Hugo, it gives some indication of the severity of damage intensity on the adoption of adjustments.

Although the adoption of mitigation measures are generally expected to vary with socioeconomic status of the respondents, there is no significant difference between education level and occupational categories on the adoption of precautionary measures in the post Hurricane Hugo era (Table 4.9). Furthermore, while there are variation in the percentage of adoption in each category (See, Appendix C), there was no significant association between the adoption of mitigation and the educational level and occupation of the respondents.
In both cases the research hypothesis was rejected and the null hypothesis accepted. The results however, suggests that the adoption of mitigative measures is significantly related to the age of the respondents. In fact the proportion of respondents who adopted precautionary measures was inversely related to the age of the respondents. This suggests that older respondents are financially and physically less able to adopt certain strategies.

TABLE 4.11

Damage Intensity and the Adoption of Mitigative Measures

	Intensity of damage			
Adoption of Precautions	< 20 % Damage	21-41 Damage	%>40% Damage	Total
No	25	02	00	27
Yes	49	20	10	79
Totals	74	22	10	106

X^2 12.27

The results in Table 4.12 suggest that variations in the adoption of precautionary measures are not significantly related to differences in education and occupational category of respondents. The fact that all classes experienced damage means that no single group was more vulnerable than the other.

TABLE 4.12

Adoption of Precautions by Socioeconomic Variables

Variables	Calculated Value	df	Critical Value	Significance Level
Age	7.39	3	7.82	.02*
Education	4.31	3	7.82	.76 ns
Occupation	4.22	3	7.82	.23 ns

*significant at .05 level ns = not significant

In addition, many respondents who did not sustained damage during Hurricane Hugo adopted mitigative measures because it was evident that their homes would not be able to withstand another hurricane. As a result, people of varying backgrounds adopted various adjustment strategies in the post-Hurricane Hugo era.

4.5 Hurricane Preparedness Level

As indicated in the literature review, studies of hazards have reported varying levels of preparedness among respondents in hazardous areas. For instance, Holder (1982) found that most of the respondents who experienced the Kalamazoo tornado acted according to some pre-arranged plan. Similarly Perry and Lindell (1986) reported substantial levels of household planning for the Mt. St. Helens volcano, with 69.9 and 48.8 percent of the individuals in their two sample communities indicating high levels of personal planning activity (cited in Faupal, et al., 1992). Nevertheless, several reports of earthquake preparedness in California has generally been low (see Palm and Hodgson, 1992). However, given the catastrophic impact of Hurricane Hugo in 1989, it is expected that the preparedness level among respondents would be high.

The seasonal nature of hurricanes means that routine preparedness measures are often advocated as a major attempt to prevent loss of lives and reduce damages in the event of a hurricane. Although studies have reported varying levels of

preparedness, it is expected that given the recency of Hurricane Hugo and its major impact on housing, a high level of prepared will exist on the island. The hypothesis that a higher level of hurricane preparedness existed among residents during the 1994 hurricane season than at the onset of Hurricane Hugo is tested by the use of descriptive statistics.

Information about the preparedness was collected by the use of a twelve point checklist and each item was given a score of one. Respondents were reminded that they were still in the hurricane season and were asked whether they have taken specific actions or possessed certain items (Table 4.13). The results suggest that the majority of respondents had taken action or possessed items that will help reduce damage during a storm and cope in a subsequent emergency. However, the results should be assessed with caution since Weinstein (1989) has suggested that some preparedness activities, such as having a portable radio or flashlight, may be taken reasons other than preparedness. Nevertheless, other measures are less ones of daily routine and concerted efforts are required to implement them. Some studies have found prior planning and preparedness activities by households and individuals to facilitate favourable response in disaster situations (e.g., Holder, 1982 and Perry and Greene, 1982).

The average score among respondents was six of the twelve items on the checklist with a standard deviation of 2.1. The small standard deviation is indicative of a cluster of the

values about the mean score. (see., Table 4.14).

TABLE 4.13

Hurricane Preparedness Checklist

Preparedness Measures	Frequency		Percentage	
	Yes	No	Yes	No
Cut overhanging trees*	14	192	07	93
Checked shutters, hooks etc.	77	128	38	62
Firmly fastened down roof	105	101	51	49
Secured items in the yard	72	134	35	65
Have a battery powered radio	177	28	86	14
Have a working flashlight	165	41	80	20
A hurricane lamp	132	73	64	36
A supply of board and nails	140	66	68	32
A first aid kit	154	51	75	25
Containers to store water	197	09	96	04
Have a family evacuation plan	40	166	19	81
Is your insurance coverage up to date*	49	02	98	02

*Not applicable to all respondents

Furthermore, 42 percent of the respondents had a score of seven and over. Generally, the hurricane preparedness checklist reflects a high level of preparedness among the respondents. In fact, there were only there cases in which less than 50 percent of the respondents either possed the item or had taken the specific action (Table 4.13)

However, the very low number of respondents who indicated

that they have a family evacuation plan reflects the reservation respondents have of leaving their homes prior to storm impact. However, of the few who had evacuation plans, it basically involved moving into their cellars or lower level of the house. This may be cause for concern since respondents can easily over-estimate the strength of their homes in the event of a hurricane which is stronger than Hurricane Hugo. This might have been the case had Hurricane Luis (1995) with 140 mph winds passed directly over the island.

In addition, the cutting of overhanging trees and the fastening of roofs are activities which require physical strength. Some respondents, mainly the elderly and women indicated that they will have pay someone to check their house roofs since they were unable to do so. Thus economics may have been a factor in the ability of some respondents to possess or implement some of the precautionary activities. Nevertheless, since hurricanes have a long advance warning period, such measures can be undertaken prior to the onset of the storm.

Although evidence on disaster preparedness varies from very low to very high, the data presented here must be considered in the context of the seasonal nature of hurricanes compared to earthquakes and volcanic hazards. Consequently, residents in hurricane prone areas are aware of the period during which a hurricane is likely to strike. Whereas earthquake and volcanoes are more random in occurrence.

TABLE 4.14

Frequency of Checklist Scores

Score on Checklist	Frequency	Percent
1	4	1.9
2	5	2.4
3	12	5.8
4	25	12.1
5	31	15.0
6	42	20.4
7	37	18.0
8	24	11.7
9	14	6.8
10	8	3.9
11	3	1.5
12	1	.5
TOTALS	206	100

Furthermore, the fact that only five years had elapsed since the passage of Hurricane Hugo means that the recent experience is a major factor in explaining the generally high preparedness level even outside a disaster situation. Nonetheless, there is some evidence that protective behaviour is high after a disaster, because risk perceptions are high, but are discarded or ignored only a few years later (Mileti

and Sorensen, 1987). Because Hurricane Hugo was probably the worst storm to affect the island, it would be a long time before residents of Nevis discard protective behaviour. However, in the absence of another hurricane in the near future, hurricane awareness and education programs can be introduced to ensure continued high hurricane preparedness levels among the populace.

The data presented suggest that the residents of Nevis generally were well prepared in 1994 for the possibility of a hurricane striking the island. The results compare favourably with other preparedness studies (eg., Neal, et al., 1982, Jackson, 1981). Even when the results are compared to the adoption of preparedness measures during Hurricane Hugo, the results are impressive (see, Table 4.6). For instance, of the preparedness measures reported during Hurricane Hugo, only in case had more than fifty percent of the respondents adopted that measure. Therefore, the hypothesis that a higher level of disaster preparedness existed on the Nevis during the 1994 hurricane season can be accepted. One can therefore conclude that the experience of Hurricane Hugo is still fresh in the minds of Nevisans, and it will many take years before the 'it can't happen here syndrome' revisits the island.

Similarly, the low level of hurricane insurance reported by residents helps explain why the preparedness level in relatively high. Furthermore, a disaster situation in the Caribbean does not guarantee victims any government assistance

in the same way as the USA where federal assistance is virtually mandatory. Within the Caribbean the responsibility of the disaster recovery rests primarily with the respondents.

4.7 Damage and Recovery

An estimated 65 per cent of the housing stock was affected by Hurricane Hugo (Economic Planning Unit, 1989). Based on the information provided, there was some disparity between the impact of Hurricane Hugo on the low income houses compared to the middle and high income houses. Generally, low income houses were removed from their impermanent foundations, overturned destroying the floors and roofs and in other cases were simply torn apart by the winds. Conversely, the main type of damage for both high and low income houses was damage to the roof and windows. Over 80 per cent of the respondents who reported damage sustained roof damage. However, everybody who experienced the hurricane was affected by water entering their homes through crevices and louvres which were easily opened by the ferocious winds during the storm.

The survey results established that just over half of the respondents (52 percent) sustained structural damage to their homes during the passage of Hurricane Hugo. The damage ranged from partial damage to the total destruction of the house. There were seven respondents whose houses were totally destroyed during the storm. The majority of respondents (76.8 percent) sustained damage had roof damage. Other damages were

less frequent and include; walls (9.5 percent), windows (2.1 percent) and floor (10.5 percent). Respondents who reported floor damage often had wooden houses which were pushed off their impermanent foundations during the storm. Similarly, the estimated value of these damages ranged from as low as 50 East Caribbean (EC) dollars[15] to as high 40, 000 dollars. The fact that the majority of respondents had damage in excess of 2000 EC dollars suggests that the damage overwhelmed their coping capacity (Table 4.15). In addition, without hurricane insurance, many respondents who reported damage had to rely on assistance to rebuild or repair their homes.

TABLE 4.15

Estimated Cost of Damage Sustained by Respondents

Amount of EC Dollars	Frequency	Percentage
Less than 2000	29	47.7
2000 - 9999	13	20.9
1000 - 19999	19	14.5
20000 and above	11	17.7
TOTALS	62	100

*Some respondents were unable to give estimates of damage

[15]**The East Caribbean dollar is used by members of the Organization of East Caribbean States (OECS). The value of the dollar hovers around 0.5 CD dollar.**

Respondents had various means of coping with recovery period. It appears that many of the respondents initiated their own recovery during the early days after the storm. This was inevitable since relief supplies (building material) took over one month before they arrived on the island and a much longer period before the victims received the assistance. While many respondents who had minimal damage were able to restore their homes without major assistance, those with more seriously damaged homes or who simply lacked the resources to rebuild had to rely on various sources of assistance. This assistance was critical to the respondents with severely damaged property, since only very few respondents had insurance coverage. Of the 75 respondents who received assistance to rebuild their homes, 40 percent received from the government. Friends and relatives (37.3 per cent); churches (12 percent); insurance (8 percent); and NGOs (1.3 percent) represent the other sources of assistance.

Nevertheless, many respondents of those who suffered damage during Hurricane Hugo indicated that they did not receive any form of assistance for rebuilding. However, it was not uncommon for respondents to complain about the inequitable distribution of building material by the government, especially those implying evidence of political discrimination. The most common complaint was that some of the residents who did not sustain damage received building

material while some people with damage were overlooked. A few respondents even indicated that they got building materials from neighbours who received supplies but did not suffer any damage. It was a bit disturbing to find that even after five years had elapsed since Hurricane Hugo, there some respondent who have not been able to repair the homes. The political aspect of the recovery process is akin to the findings of (Berke et al., 1991) where political affiliation was found to be a major factor in the distribution of building material by the Jamaican Government following the passage on Hurricane Gilbert in 1988.

Discussions with the case study respondents suggests that the recovery was a painful experience. For instance, a female recounted her experience after the family house was destroyed. The respondent explained that she was 'not far from hanging herself' since she was pregnant at the time of the hurricane when the family house was blown away and lost everything since no preparedness measures were taken. She initially stayed with a neighbour and was asked to leave after two days, then another neighbour allowed her to live in a small room in the yard even after the child was born for most of the two years that it took to rebuild the house. Like the other cases, the Government provided her with building supplies. Her boyfriend who is a carpenter rebuild the home, usually on weekends. Three of the five respondents had the same two room house with material provided by respondents.

Another respondent spent three years living with her mother before the family was able to rebuild a stronger home. In another case, the family got a loan of $EC 18000 dollars from the bank and built the home through self help, albeit she had to employ a few workmen. Three of the respondents had to live with friends while two others lived with relatives. The time it took the respondents to return to their homes varied from one year two three years after the hurricane. One lady indicated that she had to rent a house for three months before a friend provided her family with shelter until the family home was rebuilt. The case study also revealed that the respondents did not take the hurricane seriously. However, each one vowed to take any future any warning seriously.

Unlike many disaster stricken areas, the island of Nevis did not have any mechanisms in place to respond to the hurricane. Firstly, there was no active disaster preparedness committee at the time nor was there any formal channel to evaluate damage and distribute assistance. Secondly, while the Economic Development Unit evaluated the damage, the politicians and their associates were the ones who decided who received the building material and other supplies. Therefore, it is not surprising that some of the people who really needed the assistance were overlooked since political affiliation and social networking were prevalent during the distribution of relief building. In fact, there were some respondents whose homes were still damaged form the passage of Hurricane Hugo.

In a few instances, the respondents were promised assistance by the government but never received the assistance.

Beyond the loss of property, only a small proportion (18 percent) of the respondents indicated that their livelihood was directly affected by Hurricane Hugo. Although most respondents reported loses to tree crops and vegetables most of it was considered to be minor damage. However, in terms of occupations, the fishermen seemed to have been the most affected. The loss of fish pots was the main problem for the fishermen. In order to resume fishing after the hurricane, fish pots (traps) had to be made which required about three months away from work. However, while the recovery process might have been stressful, discussions with the fishermen revealed that the government received assistance in the form of fishing implements from the Organisation of the Eastern Caribbean States (OECS) which were distributed to the affected fishermen. Some of the fishermen indicated that they received varying quantities of fishing implements such as wire and ropes, etc.

The survey suggests that given the magnitude of the damage to the housing stock, respondents had often had to rely on formal sources of government assistance. The findings here are similarly to those of Berke, et al., (1991) in Jamaica, where they found that Jamaican households relied on formal sources more extensively than informal sources. However, since hurricanes are apparently becoming more frequent aerial extent

and affecting more countries, another devastating hurricane may make the recovery process an even more daunting undertaking.

The data analysis suggests that while traditional coping mechanisms existed on the island at the time of Hurricane Hugo, many respondents did not adopt preparedness measures. The generally low level of preparedness is explained by the lack of hurricane experience which resulted in the 'it cant' happen here syndrome' and the inadequate warning received by the respondents. Socioeconomic variables were not found to be significantly related to the adoption of preparedness and mitigation measures. Nevertheless, the data suggest that residents were generally well prepared for the 1994 hurricane season. However, Government should institute legislation to improve the status of disaster management and mandatory building codes.

Chapter V

SUMMARY AND CONCLUSIONS

The prime objective of this study was to understand the nature and extent of residents response to the hurricane threat on the island of Nevis with special focus on the passage of Hurricane Hugo in 1989. The study also focused on the traditional coping strategies and attitude towards evacuation on the islands. The result of the study suggests that the lack of disaster experience prior to Hurricane Hugo in 1989 and the quality of warning contributed to the generally low level of preparedness prior to the onset of the storm. Furthermore, the decision to adopt preparedness measures during Hurricane Hugo was not found to be significantly related to socioeconomic variable tested. Nevertheless, there was a significant relationship between the severity of damage experienced during Hurricane Hugo and the adoption of precautionary measures. In addition, the age of the respondent was significantly associated to the adoption mitigation measures in the post-Hurricane Hugo. Conversely, educational levels and occupational categories were not found to be significantly related to the adoption of precautionary measures in the post Hurricane Hugo era. An evaluation of the results on shows that the respondents were generally well-prepared during the 1994 hurricane season.

5.1 Major Findings

The data analysis and testing of hypothesis presented in Chapter IV provide some insights into disaster preparedness, mitigation and response on the island of Nevis. The data also facilitated an understanding of the factors influencing the response to a specific event, Hurricane Hugo in 1989 and the extent to which residents have adopted precautionary measures in the post-Hurricane Hugo era.

The final chapter summarises the research findings, suggests recommendations for further action, and identifies various prospects for future research on human response to the hurricane threat on the island of Nevis and the wider Caribbean.

5.2 Summary of Research Findings

In Hypothesis I, it was stated that the lack of hurricane experience and inadequate warning contributed to the relatively low preparedness level which existed on the island during the passage of Hurricane Hugo. The data suggest that while vestiges of a hurricane subculture still existed, the long absence of hurricanes on the island coupled with economic vicissitudes have resulted in its demise. The lack of experience was reflected in the inadequate dissemination of warning at the local level and the failure of many respondents to adopt adequate preparedness measures. Only a small minority (17 percent) of the respondents experienced the 1928 hurricane

which was the last hurricane to impact the island prior to 1989. In addition, for many of the respondents there was no previous experience to provide the standard against which to gauge their response to Hurricane Hugo.

The data also established that the quality of warning received was generally inadequate. Over two thirds of the respondents felt that the warning that they received was either inadequate or very inadequate. Furthermore, the literature suggests that warning source and quality influence warning response (Mileti, et al., 1975). However, there is little evidence that any official disseminated warning during the passage of Hurricane Hugo.

Contrary to expectation, the adoption of preparedness measures during Hurricane Hugo was not significantly related to the age, occupation and educational level of respondents. However, chi-square tests suggest that there was no significant difference between the adoption of preparedness measures during Hurricane Hugo and the respondents age, occupation and educational level. Consequently the Null Hypothesis was accepted and the research hypothesis rejected. With the long absence of hurricanes on the islands the vestiges of a disaster subculture had been eroded. Consequently at the time of Hurricane Hugo there was no disaster preparedness mechanism in place to effectively warn residents of the pending disaster. The small size of the island suggests that everybody heard of Hurricane Hugo prior

to its onset. However, the generally inadequate warning received by respondents may help explain the insignificant association between socioeconomic characteristics and the adoption of preparedness during Hurricane Hugo.

In Hypothesis II, it was postulated that the adoption of precautionary measures in the post-Hurricane Hugo era will vary with the intensity of damage experienced and the socioeconomic variables of the respondents. A chi-square test supports the proposition that the adoption of mitigation measures varies with the intensity of damage sustained by residents. It also suggests the notion that people who sustained damage during a disaster are more likely to adopt mitigative measures that those who did not. This supports the findings of Baumann and Simms (1978), Jackson (1981), and Earney and Knowles (1974) that the more severe the nature of damage sustained in the past, the more likely respondents were to take adjustments to prevent similar occurrences in the future.

However, the influence of socioeconomic variables was not fully confirmed. Both educational level and occupational categories were not found to be significantly associated with the adoption of mitigative measures in the post Hurricane Hugo era. In each case the research Hypothesis was rejected and the null hypothesis was accepted. Conversely, age was found to be significantly related to the adoption of mitigative measures. Therefore, the research hypothesis was accepted and

the null hypothesis was rejected. The fact that all social classes of respondents were affected by Hurricane Hugo, residents of varying socioeconomic background were involved in the recovery process and adopted basic building techniques as a main precautionary measure against future hurricanes. Thus, it can be surmised that the adoption of precautionary measures was related to the severity of experience and the age of the respondents but not their educational level and occupation.

In Hypothesis III, it was stated that the level of preparedness among residents will be high given that the island was recently ravaged by Hurricane Hugo. The results confirmed that given a non-disaster situation, the respondents had a generally high level of preparedness. This contrasts with the results reported by Neal, et al., (1982) who reported low levels of preparedness in their study of planned blizzard preparation in Woods Country Ohio where there was a less that 50 percent response for each of the item tested. Furthermore, the respondents appeared to be better prepared in 1994 than they were at the time of Hurricane Hugo. The data in this study suggest that the experience of Hurricane Hugo is still fresh in the minds of the respondents. Therefore, one can conclude that the residents of Nevis were generally well prepared for the onset of a hurricane during the 1994 hurricane season.

5.3 Recommendations

The experience of Hurricane Hugo tested the resilience of residents and may have exposed some of the inadequacies of disaster management on the island or the lack of disaster management on the island. In order to gauge the type of improvements respondents would like implemented, they were asked whether there was anything that they thought that the government can do to better prepare people for hurricanes. The majority (62 percent) answered yes, 13 percent no compared to 25 percent who did not know. However, several respondents were of the opinion that people will have to help themselves since the government can't help anybody. However, of those who felt that the government can help, education, improved warnings and enforce building codes were the most common options (Table 5.1). One respondent even suggested that the government should give duty free concessions in order for people to build stronger homes. Some of these suggestions are further developed below.

5.4 Remedial Policies

The above findings on the response to the hurricane threat on the island of Nevis have far reaching implications for disaster preparedness policy formation on the island. The survey suggests that residents in Nevis are more likely to hurricane proof their homes in the event of a hurricane than to evacuate to shelters. Therefore, legislation is needed to

implement mandatory building codes and to upgrade the status of disaster management of the island. While the status of disaster management of the island is still uncertain there are several areas of concern and avenues for improvements. These include improved warnings, building codes legislation, diaster management and insurance.

TABLE 5.1

Suggested Government Mitigative Actions*

Mitigative Action	Frequency	Percentage
Educate people	34	22.2
Improve warning	25	16.3
Enforce building codes	27	17.6
Build and Maintain Shelters	23	15.0
Improve disaster training	20	13.1
Help poor people build stronger homes	24	15.7
TOTALS	153	100

*Multiple response possible

5.3.1 Effective Warning

Much of the improvements in the response to hurricanes in the US has been attributed to general improvements in hurricane tracking and improved warnings. The fact that the majority of respondents felt the warning they received during Hurricane Hugo was either inadequate or very inadequate

suggests that improvements are necessary in this area. Firstly, there is need for the Disaster Coordinator or more importantly the Premier to declare a disaster or emergency situation or address residents of any pending diaster. This is of critical importance since various studies have shown that where warnings are issued by an authority, belief and consequently response tends to be higher. Furthermore, traditional warning methods such as ringing of a church bell or the sounding of a siren should be incorporated. These will ensure that more people hear the warning and more importantly that they understand the implications of the warnings. In addition, a vehicle equipped with a public address system can be used in a similar manner.

5.3.2 Building Code Legislation

The data suggest that many respondents have repaired or renovated their homes since Hurricane Hugo, however, there is no established guidelines to be followed by contractors and builders. In addition, the generally poor performance of modern buildings during the passage of Hurricane Hugo has raised questions about the quality of buildings being constructed on the island. While there is evidence of an increase in hurricane resistant buildings since the passage of Hurricane Hugo, there is need for building code legislation to be implemented. Building codes would ensure building strengths are regulated, thereby ensuring that buildings whether

dwellings or public structures are not constructed to a variety of standards. The draft OECS Building Codes should be addressed expeditiously and implemented as soon as it is possible. There will also be a need for a complement of building inspectors. At present, the Building Board inspects building plans but there is no follow-up inspection to ensure that regulations are complied with.

The fact that there is no formal training for contractors and builders on the island should make regulations imperative. Furthermore, low level of willingness among residents to evacuate their homes in the event of a hurricane suggests that dwellings must be hurricane proofed. However, much of this can only be meaningful if there are guidelines for the builders to follow. It is evident that one of the main approaches to reduce household damage is to ensure that hurricane resistant homes are constructed. In addition, the absence of hurricane insurance among the populace suggests that recovery form a major hurricane will be a daunting task.

Once instituted, building codes will ensure that much of the Government owned buildings that are often designated as shelter will be relatively safe for potential evacuees. Many of these buildings will need to be retrofitted if they are to be expected to house people in the event of a disaster. Given the stringent economic reality, such projects may span several years but it is also important that they be initiated in the short run.

5.3.3 Disaster Management

Disaster management in Nevis is still at a formative stage and is largely a post-Hurricane Hugo (1989) concept. This suggests that there is much work to be done in terms of implementing awareness programmes to facilitate the dissemination of information about the vulnerability of the island to various hazards. As mentioned before, disaster management in Nevis reflects a hurricane bias event though the island is vulnerable to several types of natural hazards. The recent volcanic eruptions in neighbouring island of Montserrat is testimony to the fact that we must be cognizant of the threat posed by other natural hazards. One way of ensuring awareness among the populace is through the implementation of programmes using different avenues to get information to the people.

While improved disaster preparedness may involve incurring expenses, there are various low cost alternatives. Coordinator on the island. Nevertheless, the schools are an ideal setting to incorporate disaster preparedness skills into the curriculum thereby imparting the knowledge to the children in very much the same way as environmental awareness has been targeted in recent years. Similarly, the churches can be used to disseminate information about various hazards at different points throughout the year. Other NGOs and private sector organisations can be targeted to sensitise the public about disaster preparedness. In short, if the island is going to be

prepared for disaster, major efforts will have to be expended to facilitate the development of the Disaster Coordinating Office. In addition, the passage of Hurricane Luis a few months ago will suggest that the disaster plan should be become legislation in the short run.

5.3.4 Insurance

The low level of insurance reported by respondents suggests that they either lack the means or are not keen on purchasing insurance as an adjustment strategy. While there is need for the insurance industry to improve its image, building certificate of standard should be a prerequisite for home insurance. The recent passage of Hurricane Luis should convey a clear message to residents that insurance should be pursued as a means of recovering from hurricane damage. Furthermore, with increased disaster on the world scale on the one hand and the inability of the local government to provide emergency relief in the effect of disaster on the other, insurance may soon become increasingly attractive to residents.

5.4 Future Research

This study has focused on a small aspect of the ambit of disaster management of the island of Nevis; mitigation preparedness and response to the hurricane threat. It does not attempt to unravel all aspects of the hazard management context. Additional research will be needed if other aspects

of diasters management on the island of Nevis are to be fully understood. The following areas are identified as possible directions for future investigation.

In light of the recent passage of Hurricane Luis, a follow-up study of residents response to the hurricane warning systems on the island should be undertaken; specifically to determine the extent to which residents understand the developmental phases of the hurricane and associated warning terminologies such as 'storm alert', 'storm watch' and 'storm warnings.' This should suggest ways of improving the quality of warnings on the islands.

The preparedness levels of residents should be investigated in the context of comparing preparedness for Hurricanes Luis with Hurricane Hugo. In addition, the extend to which mitigation measures adopted after Hurricane Hugo were effective in reducing damage at the household level during the passage of Hurricane Luis. The relative effectiveness of both preparedness and mitigative measures during the passage Hurricane Luis could help to guide policy orientation, especially elements of the building codes. Furthermore, residents awareness of and adjustments to other natural hazards should be investigated.

There is need for investigation into the operation of shelters, focusing on the suitability of these shelters and their quality in terms ability to withstand a category 4 or 5 hurricanes. Such a study should also assess the need for

shelters to house people in the event of disasters other than hurricane.

Finally, research on the long term recovery of residents is critical. This is important because the majority of residents are unable or unwilling to purchase hurricane insurance. Furthermore, the fact that during the recovery following Hurricane Hugo some people who needed assistance were unaided during the recovery process. Since political affiliation often determines who receives relief, an investigation into the distribution of relief supplies following Hurricanes Hugo (1989) and Hurricane Luis (1995) should be undertaken. In short, since disaster management on the island is a relatively recent, adequate research can provide solution to much of the problems which confront disaster managers throughout the Caribbean.

The findings presented here, although tested only at the nominal and descriptive levels have interesting implications for disaster research on Nevis and the wider Caribbean area. Warning systems must be improved and building guidelines implemented in order to ensure that residents are adequately prepared for pending hurricanes and other hazards. In short, it is imperative that disaster management be linked to or integrated into the overall development of the island. Therefore, in order to avert a repeat of the Hurricane Hugo fiasco, appropriate disaster management strategies should be implemented in the short run.

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APPENDIX A

TROPICAL CYCLONES PASSING WITHIN 500 KM OF NEVIS
(1887-1994)

STORM #	DATE	NAME	STRENGTH
1.	1887 10 9	Not Named	Hurricane
2.	1888 11 2	Not Named	Tropical Storm
3.	1889 9 3	Not Named	Hurricane
4.	1899 9 12	Not Named	Hurricane
5.	1891 10 2	Not Named	Tropical Storm
6.	1891 8 19	Not Named	Hurricane
7.	1891 10 2	Not Named	Tropical Storm
8.	1891 10 13	Not Named	Hurricane
9.	1893 8 16	Not Named	Hurricane
10.	1894 9 21	Not Named	Hurricane
11.	1894 10 13	Not Named	Hurricane
12.	1896 10 13	Not Named	Hurricane
13.	1896 9 19	Not Named	Hurricane
14.	1896 9 22	Not Named	Hurricane
15.	1898 9 12	Not Named	Hurricane
16.	1898 9 21	Not Named	Tropical Storm
17.	1898 9 26	Not Named	Hurricane
18.	1898 10 27	Not Named	Tropical Storm
19.	1899 8 8	Not Named	Hurricane
20.	1899 8 30	Not Named	Hurricane
21.	1899 9 9	Not Named	Hurricane
22.	1900 8 31	Not Named	Hurricane
23.	1901 7 6	Not Named	Hurricane
24.	1901 9 11	Not Named	Tropical Storm
25.	1901 10 9	Not Named	Tropical Storm
26.	1903 7 19	Not Named	Hurricane
27.	1906 9 2	Not Named	Hurricane
28.	1908 3 8	Not Named	Hurricane
29.	1908 9 10	Not Named	Hurricane
30.	1908 9 25	Not Named	Hurricane
31.	1909 9 22	Not Named	Hurricane
32.	1910 9 6	Not Named	Hurricane
33.	1915 8 11	Not Named	Hurricane
34.	1916 7 12	Not Named	Hurricane
35.	1916 8 21	Not Named	Hurricane
36.	1916 8 10	Not Named	Hurricane
37.	1916 10 9	Not Named	Hurricane
38.	1917 9 21	Not Named	Hurricane
39.	1918 9 10	Not Named	Tropical Storm
40.	1919 9 2	Not Named	Hurricane

/appendix A continued

41.	1922	9	16	Not Named	Hurricane
42.	1923	10	24	Not Named	Tropical Storm
43.	1924	8	18	Not Named	Hurricane
44.	1924	8	28	Not Named	Hurricane
45.	1926	7	23	Not Named	Hurricane
46.	1928	9	13	Not Named	Hurricane
47.	1930	9	2	Not Named	Hurricane
48.	1931	8	17	Not Named	Tropical Storm
49.	1931	9	10	Not Named	Hurricane
50.	1932	9	26	Not Named	Hurricane
51.	1932	10	31	Not Named	Hurricane
52.	1933	7	14	Not Named	Tropical Storm
53.	1933	7	25	Not Named	Hurricane
54.	1933	8	29	Not Named	Hurricane
55.	1933	8	28	Not Named	Tropical Storm
56.	1934	8	21	Not Named	Tropical Storm
57.	1934	9	18	Not Named	Tropical Storm
58.	1937	8	24	Not Named	Tropical Storm
59.	1938	8	8	Not Named	Tropical Storm
60.	1940	8	5	Not Named	Hurricane
61.	1943	8	14	Not Named	Tropical Storm
62.	1945	8	3	Not Named	Tropical Storm
63.	1945	9	12	Not Named	Hurricane
64.	1947	10	16	Not Named	Hurricane
65.	1949	8	23	Not Named	Hurricane
66.	1949	9	21	Not Named	Hurricane
67.	1950	8	22	Baker	Hurricane
68.	1950	9	1	Dog	Hurricane
69.	1951	8	16	Charlie	Hurricane
70.	1953	9	14	Edna	Hurricane
71.	1954	9	4	Edna	Hurricane
72.	1955	1	2	Alice	Hurricane
73.	1955	9	11	Hilda	Hurricane
74.	1955	9	14	Ione	Hurricane
75.	1956	8	12	Besty	Hurricane
76.	1958	8	31	Ella	Hurricane
77.	1958	9	13	Gerda	Tropical Storm
78.	1959	8	18	Edith	Tropical Storm
79.	1960	9	5	Donna	Hurricane
80.	1961	10	1	Frances	Hurricane
81.	1961	11	1	Jenny	Hurricane
82.	1962	10	1	Daisy	Hurricane
83.	1963	10	28	Helena	Tropical Storm
84.	1964	8	23	Cleo	Hurricane
85.	1965	8	29	Besty	Hurricane
86.	1966	8	26	Faith	Hurricane
87.	1966	9	28	Inez	Hurricane
88.	1969	9	20	Holly	Hurricane
89.	1971	8	23	Doria	Tropical Storm

/appenxix A continued

90.	1973	9	4	Christine	Tropical Storm
91.	1974	8	30	Carmen	Hurricane
92.	1975	9	15	Eloise	Hurricane
93.	1979	7	17	Claudette	Tropical Storm
94.	1979	8	30	David	Hurricane
95.	1979	9	3	Frederic	Hurricane
96.	1981	8	12	Dennis	Hurricane
97.	1981	9	4	Floyd	Hurricane
98.	1981	9	8	Gert	Hurricane
99.	1984	9	2	Arthur	Tropical Storm
100.	1988	8	24	Chris	Tropical Storm
101.	1988	9	10	Gilbert	Hurricane
102.	1989	8	13	Dean	Hurricane
103.	1989	9	17	Hugo	Hugo
104.	1990	10	6	Klaus	Hurricane
105.	1993	8	15	Cindy	Tropical Storm

Source: The Boundary Layer Wind Tunnel Laboratory
The University of Western Ontario
London, Ontario
Canada

APPENDIX B

HURRICANE PREPAREDNESS SURVEY

NEVIS

PARISHES

ST. GEORGE_____

ST. JOHN_____

ST PAUL_____

ST. THOMAS_____

ST. JAMES_____

Sample Number_____

Date of interview_____

SECTION ONE: PAST HURRICANE EXPEREINCES

The questionnaire has three sections. In the first section you will be asked questions about hurricanes. In the second section questios will be asked specifically about Hurricane Hugo and section three will deal with information regarding your household.

Questions About Hurricane Experiences

I am now going to ask you some questions about your past experience with hurricanes and severe tropical storms.

1. Have you ever experienced a hurricane in Nevis?

   No...0 Yes...1 NR....9

   If no go to question 7

2. What type of loses have you experienced as a result of the hurricanes?

House destroyed	No...0	Yes...1
Damage to walls	No...0	Yes...1
Damage to roof	No...0	Yes...1
Damage to window	No...0	Yes...1
Damage to door	No...0	Yes...1
Damage to furniture	No...0	Yes...1
Loss of crops	No...0	Yes...1
Loss of animals	No...0	Yes...1
Loss of fishpots	No...0	Yes...1
Loss of fihing boat	No...0	Yes...1
House pushed off foundation	No...0	Yes...1

3. Can you tell me some of the things you did to reduce the impact of hurricanes after warnings have been issued.

Reinforce your house roof	No....0	Yes....1
Bar up windows and doors	No....0	Yes....1
Stock up supplies	No....0	Yes....1
Tie down house with wire/rope	No....0	Yes....1
Help older neighbours	No....0	Yes....1

4. From what source(s) do you normallly get information about approaching hurricanes?

Radio	No.....0	Yes....1
Television	No.....0	Yes....1
Neighbour/friends	No.....0	Yes....1
Politican	No.....0	Yes....1

5. Are there any signs which indicate to you when a hurricane is approaching?

No....0
Yes...1
DK....97
NR....98

6. If yes what signs indicate to you that a hurricane is an approaching?

Dark clouds	No....0	Yes....1
Horizon turns red	No....0	Yes....1
Very calm conditions	No....0	Yes....1
Unusual animal behavior	No....0	Yes....1
Fitful gusts	No....0	Yes....1
Roaring sea	No....0	yes....1
Fying weather birds	No....0	Yes....1

7. In your opinion, hurricane warnings in Nevis are:

Very easy to understand.....1
Easy to understand.....2
Very difficult to undserstand.....3
Difficult to understand.....4
Uncertain.....5

QUESTIONS ABOUT EVACUATION TO SHELTERS

When a hurricane warnings are issued people are often advised to go to hurricane shelters

8. If a hurricane warning is issued for Nevis would you leave your home to stay at a hurricane shelter?

No....0 Yes...1 DK....97 NR....98

If no, go to question 10

9. If yes, why would you evacuate to a shelter?

House is not safe	No....0	Yes....1
Shelter is close to home	No....0	Yes....1
Depends on hurricane strength	No....0	Yes....1
Don't want to be by myself	No....0	Yes....1

10. If no, why would you not go to a shelter?

Have to protect my home	No....0	Yes....1
Nobody is there to take care of me	No....0	Yes....1
Lack of transportation	No....0	Yes....1
Shelter is too far	No....0	Yes....1
House is stronger than the shelter	No....0	Yes....1
Prefer to stay by a friend	No....0	Yes....1
Prefer to stay at home	No....0	Yes....1

11. Have hou ever evacuated your home after receiving such warnings?

No....0 Yes....1 NR....98

12. Can you name the hurricane shelter in your area?

No.....0 Yes.....1 NR.....98

13. Do you know the shelter manager in your area ?

No.....0 Yes....1 NR.....98

14. Have you ever visited and checked the conditions of the hurricane shelter in your area?

No...0 Yes...1 NR....98

15. Do you know the Disaster Coordinator for Nevis?

No....0 Yes....1 NR...98

16. Can you recall the name and year (s) when you experiencd these hurricanes?

1924 Hurricane	No.....0	Yes....1
1928 Hurricane	No.....0	Yes....1
Hurricane Hugo	No.....0	Yes....1

PERCEPTION OF HURRICANES

17. How would you respond the statement that "hurricanes present a very serious threat to the Carribbean"

Strongly Disagree.....1
Disagree.....2
Uncertain.....3
Agree.....4
Strongly.....5

18. How likely do you think it is for another hurricane to occur in Nevis over the next five years?

Very unlikely.....1
Unlikely.....2
Uncertain.....3
Likely.....4
Very likely.....5

19. If there is another hurricane, do you think that you will suffer any damage?

No....0 Yes....1 DK....97 NR....98

20. Do you think that you can do anything to reduce the damage that can be caused by hurricane?

No....0 Yes....1 DK....97 NR....98

21. If yes, what can you do?

Make my house stronger	No....0	Yes....1
Reinforce house roof	No....0	Yes....1
Bar up windows and doors	No....0	Yes....1
Pray to God	No....0	Yes....1
Take other precautions	No....0	Yes....1

22. Do you know when the hurricane season begins and ends?

No....0 Yes....1 DK....97 NR.....98

INSURANCE

People sometimes insure their homes against natural hazards such as earthquakes, floods and hurricanes.

23. Is your home insured against hurricanes?

No...0 Yes...1 DK...97 NR....98

If yes, go to question 24

24. If no, why have you not insured your home against hurricanes.

Too expensive	No....0	Yes....1
Not available	No....0	Yes....1
Insurance rob people	No....0	Yes....1
It won't help	No....0	Yes....1
Don't believe in insurance	No....0	Yes....1
House is strong enough	No....0	Yes....1
It won't help	No....0	Yes....1

25. If yes, in what year was your home first insured against hurricanes?

---------- (Year) code actual year

SECTION TWO

QUESTIONS ABOUT YOUR EXPERIENCE WITH HURRICANE HUGO

In this section I will ask specific questions about your experience with hurricane Hugo.

26. Did you experience hurricane Hugo?

Yes...1 No....0 NR....98

If no, go to SECTION 3, If yes go to the next question

27. Did you receive any warnings before hurricane Hugo?

No...0 Yes...1 DK....97 NR....98

If no go to question 30

28. If yes, did you believe that the hurricane would strike Nevis?

No....0 Yes....1 DK....97 NR....98

29. What was your main source of information about the hurricane?

Radio	No....0	Yes....1
Television	No....0	Yes....1
Neighbours/friends	No....0	Yes....1
Politician	No....0	Yes....1

30. How would you describe the quality of warning received?

Very adequate.....1
Adequate 2
Neither adequate nor inadequate.....3
Inadequate.....4
Very inadequate.....5

31. Do you think that the impact of hurricane Hugo was:

Much less than expected.....1
Less than expected.....2
About what was expected.....3
Much more than expected.....4
More than expected.....5
DK..... 97
NR.....98

32. Before the hurricane, were you aware of any precautions that could have been taken to reduce the impact of hurricanes?

No...0 Yes...1 DK....97 NR...98

If no, go to question 34

33. If yes, what type(s) of precautionary measures did you take?

Moved to shelter	No....0	Yes....1
Reinforced sheeting	No....0	Yes....1
Bar up windows and doors	No....0	Yes....1
Stocked up food & water	No....0	Yes....1
Clear debris from yard	No....0	Yes....1

34. If none, what was the main reasons for not doing so?

Did not receive warning	No...0	Yes...1
Thought house was strong enough	No...0	Yes...1
Did not believe warning	No...0	Yes...1
Underestimated hurricane strength	No...0	Yes...1
It was God's Work	No...0	Yes...1

DAMAGE AND RECOVERY

35. Was either your house or its contents damaged during hurricane?

No....0 Yes....1 DK....97 NR....98

If yes, go to question 37

36. If no, why do you think that your house was not damaged?

House was sheltered	No....0	Yes....1
House was strong enough	No....0	Yes....1
I prepared for Hugo	No....0	Yes....1
God spared me	No....0	Yes....1
Other.....		

Go to question 42

37. If yes, why do you think that your house was damaged?

House was not strong enough	No....0	Yes....1
Hurricane was too strong	No....0	Yes....1
Did not take precautions	No....0	Yes....1
It was God's work	No....0	Yes....1
Other.....		

38. Which part of your home was most damaged?

Roof.....1
Walls..... 2
Windows.....3
Doors.....4
Furniture.....5
Sill.....6
Floor.....7
NA.....8
NR.....9

39. What proportion of your house was damaged?

0 - 20%.....1
21 - 40%.....2
41 - 60%.....3
61 - 80%.....4
81 - 100%.....5
DK.....97
NR.....98

40. What was the approximate cost of the damage to your house?
$EC------(total damage) Code actual figure.....

41. Do you think that the damage to your home could have been prevented in any way?

No...0 Yes....1 DK...97 NR....98

42. Did you incur damage to any ofthe folwing?

Livestock	No....0	Yes....1
Cash crops	No....0	Yes....1
Vegetables	No....0	Yes....1
Tree crops	No....0	Yes....1
Fishing boat	No....0	Yes....1
Fish pots	No....0	Yes....1
Vehicle	No....0	Yes....1

NR.....98

43. Did you receive help in money or kind to repair your home?

No....0 Yes...1 DK....97 NR....9

If no, go to question 47

44. If yes, what type (s) of assistance did you receive?

Money	No....0	Yes....1
Reduced Rates on Loans	No....0	Yes....1
T-1-11 Plywood	No....0	Yes,...1
Lapboard	No....0	Yes....1
Galvanised sheeting	No....0	Yes....1
Labour	No....0	Yes....1
Nails	No....0	Yes....1
Tools	No....0	Yes....1
Wood	No....0	Yes....1
Hurricane clipps	No....0	Yes....1
Fishing wire/rope/balls	No....0	Yes....1

45. What was your source of assistance?

Government	No....0	Yes....1
Church	No....0	Yes....1
Relatives	No....0	Yes....1
Friends	No....0	Yes....1
NGO's	No....0	Yes....1
Insurrance	No....0	Yes....1
NR....98		

46. Was your livelihood disrupted in any way by the hurricane

No....0 Yes....1 NR...98

MITIGATION

47. Since hurricane Hugo have you done anything to ensurre that your house will be more resistant to damages from future hurricane damages.

No....0 Yes....1 NR....98

If no, go to question 49

48. If yes, what have you done to reduce storm damage?

Make house stronger	No...0	Yes...1
Purchase/built shutters	No...0	Yes...1
Reinforce roof during hurricane season	No. .0	Yes...1
Plant trees to shelter home	No...0	Yes...1
Repair home	No...0	Yes...1
Make new house hurricane resistant	No...0	Yes...1
Built new home	No...0	Yes...1

49. If no, why haven't you taken steps to protect your home?

Too expensive	No....0	Yes....1
House is safe	No....0	Yes....1
It won't help	No....0	Yes....1
Hurricane won't come again	No....0	Yes....1
Other.....		

50. Do you think that the government of can do anything to better prepare people for hurricanes?

No....0 Yes....1 DK....97 NR....98

If no, go to section 3

51. If yes, how do you think that the government can help?

Educate people	No....0	Yes....1
Improve warning	No....0	Yes....1
Enforce building codes	No....0	Yes....1
Build and maintain shelters	No....0	Yes....1
Improve training	No....0	Yes....1
Other.....		

SECTION THREE

QUESTIONS ABOUT HOUSEHOLD CHARACTERISTICS

In order to relate the given information about hurricanes and severe tropical storms to the different kinds of people interviewed I will now ask some questions about your household.

52. How many people live permanently in your household?.....
code actual numbers

NR....98

53. Sex of Respondent
Male.....1 Female....2

54. Age of respondent.....
Code actual age

55. Level of education attained by respondent

No formal education.....1
Primary.....2
Some secondary.....3
Completed secondary.....4
Post secondary.....5
University.....6

56. Occupation of respondent

Professional.....1
Civil servant.....2
Teacher.....3
Unskilled worker.....4
Skilled worker.....5
Domestic worker.....6

Farmer.....7
Fisherman.....8
Policeman.....10
Businessman.....11
Service Industry.....12
Unemployed.....13
Retired.....14

57. Are you a member of a church? If, yes which denomination?

Anglican.....1
Baptist.....2
Wesleyan Holiness.....3
Methodist.....4
Seventh Day Adventist.....5
Roman Catholic.....6
Penticostal.....7

HOUSING STRUCTURE

58. What is the main material from which the house is made?

Blocks.....1
Stones.....2
Wood/board.....3
Blocks & wood.....4
Stones & wood.....5
Blocks, wood & stones.....6

59. Roofing Material

Galvanised sheeting	No....0	Yes....1
Shingle	No....0	Yes....1
Asphalt tile	No....0	Yes....1
White pine	No....0	Yes....1
Plywood	No....0	Yes....1
Pannel board	No....0	Yes....1

60. What is used to attach the roof to the walls?

Concrete	No...0	Yes...1
Nails	No...0	Yes...1
Screws	No...0	Yes...1
Wire	No...0	Yes...1
Brackets	No...0	Yes...1
Bolts	No...0	Yes...1
Steel through rafter	No...0	Yes...1

61. What type of windows does your house have?

Metal louvres	No....0	Yes....1
Glass louvres	No....0	Yes....1
Glass windows	No....0	Yes....1
Awning windows	No....0	Yes....1
Wooden windows	No....0	Yes....1

62. Do you have glass doors?

No....0 Yes....1 NR...98

63. If yes, what arrangements do you have to protect them in the event of a hurricane?

Permanent Shutters	No....0	Yes....1
Removable shutters	No....0	Yes....1
Board and Nails	No....0	Yes....1
Taping	No....0	Yes....1
Other.....		

64. What is the main shape of the roof?

Hip.....1
Gable.....2
Lean to.....3
Flat roof.....4
Hip & Gable.....5
Hip & shed.....6
Gable & shed.....7
Hip, gable & shed..... .8

65. What is the length of your roof overhang

Less than 18 inches...1
More than 18 inches...2
NR...98

66. How steep is your roof/pitch?

< 10.....1
10 - 19.....2
20 - 34.....3
35 - 45.....4
Over 45.....5

67. Is your house foudation?

Permanent.....1
Partial 2
Impermanent.....3

68. Type of land tenure.

Personally owned.....1
Rented.....2
Family owned.....3
Leased.....4
Caretaker.....5

69. Is the house?

Personally owned.....1
Rented.....2
Family owned. 3
Leased.....4
Caretaker.....5

70. Did you have any of the following safety features before hurrucane Hugo?

Clinching	No....0	Yes....1
Hurricane Shutters	No....0	Yes....1
Hurricane straps	No....0	Yes....1
Diagonal braces	No....0	Yes....1
Bolts (roof)	No....0	Yes....1
Anchor bolts	No....0	Yes....1
Rafter Anchorage	No....0	Yes....1
Purline	No....0	Yes....1

71. Which do you have at present?

Clinching	No....0	Yes....1
Hurricane Shutters	No....0	Yes....1
Hurricane Straps	No....0	Yes....1
Diagonal braces	No....0	Yes....1
Bolts (roof)	No....0	Yes....1
Anchor Bolts	No....0	Yes....1
Rafter Anchorage	No....0	Yes....1
Purline	No....0	Yes....1

72. Age of home.
Code actual age.....

73. When was the home last repaired?
Code actual year.....

74. Number of storeys.....
code actual number

HOUSEHOLD PREPAREDNESS CHECKLIST

75.

We are in the middle of the 1994 hurricane season, please indicate whether you have taken the following actions or have the following items.

Cut over hanging trees	No...0 Yes...1
Checked all hurricane shutter shooksetc?	No...0 Yes...1
Firmly fastened down your roof?	No...0 Yes...1
Secured items in your yard?	No...0 Yes...1
A battery-powered radio?	No...0 Yes...1
A working flashlight?	No...0 Yes...1
A hurricane lamp?	No...0 Yes...1
A supply of board and nails?	No...0 Yes...1
A first aid kit?	No...0 Yes...1
Containers to store clean water?	No...0 Yes...1
A family evacuation plan	No...0 Yes...1
Is your insurance coverage up to date?	No...0 Yes...1

PERSONAL OBSERVARIONS

76. Condition of home

Poor.....1
Moderate.....2
Average.....3
Good.....4
Excellent.....5

77. Chances of withstanding hurricane force winds

Poor.....1
Moderate.....2
Average.....3
Good.....4
Excellent.....5

78. Exposure of Home

Very exposed.....1
Exposed.....2
Average.....3
Sheltered.....4
Very sheltered...5

79. Attitude to questioning

Deceptive.....1
Reluctant.....2
Open and willing.....3

80. Is there anything else that you would like to tell me about hurricanes and Hurricane Hugo?

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.....

.....

End of Questionnaire

APPENDIX C

Prepared for Hurricane Hugo by Age Categories

Prepared	Age Categories			Totals
	Under 36	36 - 60	Over 60	
No	9	32	34	75
Yes	19	56	40	115
TOTALS	28	88	74	190

Prepared for Hurricane Hugo by Level of Education

Prepared	Level of Education				
	Primary	Some Secondary	Completed Secondary	Post-Secondary	Totals
No	44	14	9	10	77
Yes	71	16	14	19	120
TOTALS	115	30	23	29	197

Prepared for Hugo by Occupational Categories

Prepared	Occupational Categories				
	Civil Servants	Primary & Construction	Business & Service	Retired & Umemployed	Totals
No	7	24	16	28	
Yes	13	43	24	40	
TOTALS	20	67	40	68	

Adoption of Mitigation by Age Categories

Adoption of Mitigation	Age Categories			Totals
	Under 36	36 - 60	Over 60	
No	5	35	35	75
Yes	22	56	39	117
TOTALS	27	91	74	192

Adoption of Mitigation by Level of Education

Adoption of Mitigation	Level of Education				
	Primary	Some Secondary	Completed Secondary	Post Second -ary	Totals
No	51	10	5	12	77
Yes	68	21	17	15	120
TOTALS	119	31	22	27	199

Adoption of Mitigation by Occupational Categories

Adoption of Mitigation	Occupational Categories				
	Civil Servant	Primary & Construc-tion	Business & Service	Retired & Unem-ployed	Totals
No	8	33	13	23	77
Yes	12	35	27	46	120
TOTALS	20	68	40	69	197