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Modelling community response and perception to natural Hazards: Lessons learnt from hurricane Lenny 1999

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by

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Abstract

In this study a systems approach is used to evaluate community responses and perceptions to natural hazards following Hurricane Lenny, which impacted the entire Eastern Caribbean between 17th and 20th November, 1999. Drawing on disaster evidence from various researchers a conceptual framework is developed in which a community is viewed as an open system interacting with other systems across several levels and scales, from local to global. Within this framework, physical and environmental factors determine the nature of the hazard event and site-specific physical vulnerability, while socio-economic and political factors determine the resource base and networks available for responding to the hazard or resilience. These factors combine to influence perception to hazards in the environment and the responsive decision-making process. The framework was applied to evaluate response and perception in the most severely affected community in Grenada. Comparisons were also made of response and recovery efforts observed in other islands.

The community in Grenada exhibited an autonomous response mode, relying on their own resources, kinship ties, and non-governmental organisations to successfully reconstruct their lives. In other Islands that were affected by the same event, community response and recovery efforts were led by national government agencies. More than two years after the event, a number of communities have not been permanently relocated and are still trying to rebuild their lives. The role that community-based organisations and non-governmental organisations can play in disaster management in the Caribbean has been over-looked in present national and regional strategies. Their involvement in the process seems to be the way forward for bridging the disaster-development gap. The study concludes that a paradigm shift needs to occur in the present approaches to disaster management in the Caribbean, away from a top-down response ethic and towards bottom-up approaches that are inclusive and/or participatory.

Keywords:
Natural hazards, management & planning, vulnerability, disasters, small states.

1. Introduction – A Hurricane Season to Remember

"June too soon, July stand by, August come you must,
September remember, October all over, November…?"

November 1999, Hurricane Lenny wrecked havoc across the Eastern Caribbean. Traditionally the hurricane season lasts from June to October, and it is only rare that tropical cyclones are experienced in May or November. However, in recent times there has been a shift in the cycle with increased activity in November. Hurricane Lenny was the fifth category-four hurricane on the Saffir/Simpson Hurricane Scale (SSHS) of the 1999 season – a record (NHC, 1999). This system was the first storm to have an extended west-to-east track across the central and eastern Caribbean Sea in the 113-year Atlantic tropical cyclone record.

An examination of the official intensity forecasts for Lenny shows that the strengthening of Lenny was under-forecasted prior to its peak intensity and over-forecasted thereafter. These errors were attributed to the unusual strength of the tropical cyclone (NHC, 1999). Many are wondering if this is a signal of things to come, the looming threat of the consequences of global climate change on the tiny Caribbean Islands. Hurricane Lenny was thus viewed as a watershed event, a wake up call that placed strategies to reduce the vulnerability of the Caribbean at the top of political agendas (CDERA, 1999).

Lenny's approach from the west produced unprecedented wave and storm surge impact on westward facing coasts and harbours. Impacts were felt from Puerto Rico, the Virgin Islands and Antigua in the north, to Grenada, Aruba, Bonaire, Curacao and the Guajira Peninsula of Colombia in the south. There were a total of seventeen deaths and every island that was affected suffered damage to roads and infrastructure, coastal communities were flooded, homes destroyed, fishing vessels and property lost. While governments were able to find disaster assistance to repair roads and public infrastructure, communities are still striving to rebuild their lives (CDERA, 2001). Post-disaster assessments focused on response at the regional and national levels, with little or no emphasis at community level response. The results of these assessments have been influential in guiding future development aid and in designing the new strategy for "Comprehensive Disaster Management in the Caribbean". Yet one of the challenges, which still remain less understood, is how to address the persistent obstacles of public perception, political expedience, and the myth that "Our country is too poor to afford the required standards" (OAS, 1999). This challenge reflects the technical approach that continues to dominate disaster management strategies in the region.

Hurricane Lenny therefore presented a splendid research opportunity for cross-country comparison of community response and perception to natural hazards, as all islands were affected by the same event at the same time. This paper represents results from ongoing research in which community response and perception to natural hazards is evaluated by assessing response and recovery after Hurricane Lenny storm surge 1999, in four OECS countries. Here a case is evaluated for the island of Grenada and a conceptual framework for guiding future research is presented. The research is informed by the author's first hand experience having witnessed the storm surges on the island of Grenada.

2. Modelling Response to Natural Hazards and Disasters

For disaster managers, pre-disaster preparedness, forecasting and warning systems provide tools for enabling response across all levels (individuals, communities, organisations, society). Managing the crisis created during and immediately after a hazard impacts an area remains the forte of emergency officials. As a result most disaster management programs tend to focus on pre-crisis and the periods immediately following the disaster. In a review of more than 50 years of social science research findings Quarantelli (1999) recommends that response must be evaluated for all four stages in the disaster cycle (mitigation, preparedness, response, recovery) in order to design strategies that will lead to a reduction in the occurrence of disasters.

Regardless of the stage in the disaster cycle, several generalities can be made and common typologies identified to classify response to natural hazards and disasters. Research evidence has found that individual responses tend to be universal across socio-economic groups, but response varies across community and organization types. The mass media has been used as a surrogate to classify societal response to disaster, which varies from one stage of the cycle to the next. For all levels of society (micro to macro) response is greatest the more eminent a hazard and immediately after a disaster event.

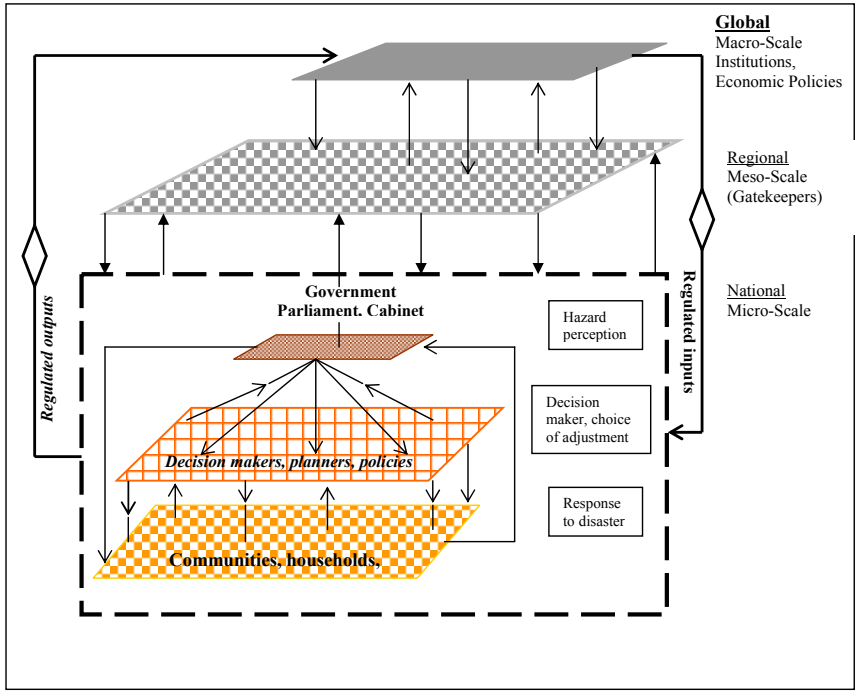
People's response to hazards in the environment is influenced by their perceptions of risk. In the study of people's perception to natural hazards the concept of bounded rationality is the model of decision taking most widely employed (Winchester, 1986; Smith, 2001). The model centres on individual choice and decision-making based on their own knowledge and experience ("personal prison of experience"). Research on hazard perception in the USA has revealed that perception is heightened by experience (Vitek and Berta, 1982). However, experience with natural hazards does not eliminate bias in risk-taking behaviour especially since most events vary in nature, and may be widely spaced in time. Therefore, if faced with a decision the individual will tend to aim for a satisfactory rather than maximum outcome.

While direct experience is one of the most powerful factors influencing perception and people's response to natural hazards, there is a body of evidence, which shows that other interrelated factors include knowledge/awareness of the hazard, present attitudes, personality, culture and values of society, access to resources, social status and future expectations (Smith, 2001; Blaike *et al*., 1994; Palm, 1990). These factors combine to enhance or constrain the ability to respond to natural hazards in the environment. Here response is broadened to include: a) land use plans and avoidance strategies such as relocation to safer areas, b) prediction, forecasting and warning systems, c) structural and non-

structural mitigation measures including safeguarding buildings and property, insurance against damage, savings to repair and replace loss, and social networks to assist in the recovery process (Berke and Beatley, 1997).

In addition to these factors, the work of Berke *et al*., (1993, 1997) and Palm (1990) provide evidence that the behaviour of individuals, communities and organizations must also be evaluated within the larger framework of society across scales and levels, micro to macro, national to global. In evaluating the response to earthquake hazards in California, Palm (1990), found that an individual's ability to respond was also influenced by the macro political economy as well as meso level factors such as policies and decision makers that regulate people's behaviour. These findings can be summarized through the use of a framework, which provides a roadmap to track the linkages and flow of responses at different levels following a disaster (Figure 1).

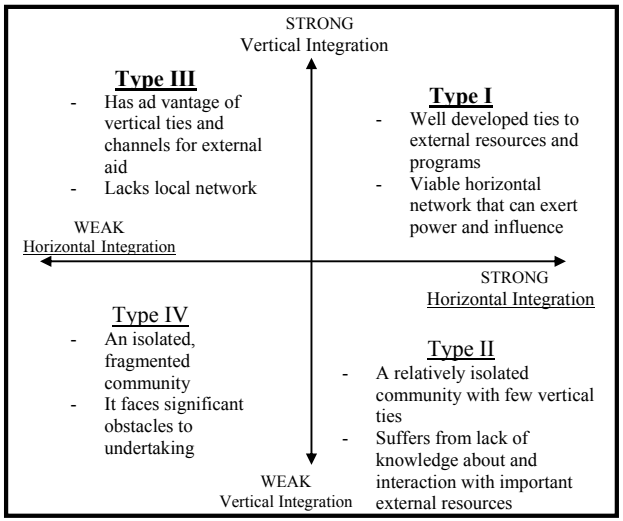
Figure 1: Integration model – levels of integration from micro to macro scales



The integration model attempts to explain the interactions between local, national, regional and global systems, through horizontal and vertical interplay between formal and informal institutions and organizations. The taxonomy of interplay between formal and informal institutions and organisations defines the policy spaces at which political, social and cultural relationships unfold (good verses poor) and hence where governance occurs. This gives rise to a continuum of symmetrical/asymmetrical verses unidirectional/reciprocal inter-actions and taxonomy of various forms of interplay that can be used to direct effective disaster management.

Not only is an individual or community's response influenced by site specific physical and socio-economic variables, but also by the degree of integration with intra and extra community institutions and organizations. These linkages are necessary for both formal and informal institutions and organizations. Based on the degree of vertical and horizontal integration, four typologies have been identified to classify communities and their mode of response to disasters (Figure 2).

Figure 2: Community types based on degree of horizontal and vertical integration (adapted from Berke *et al*., 1993)



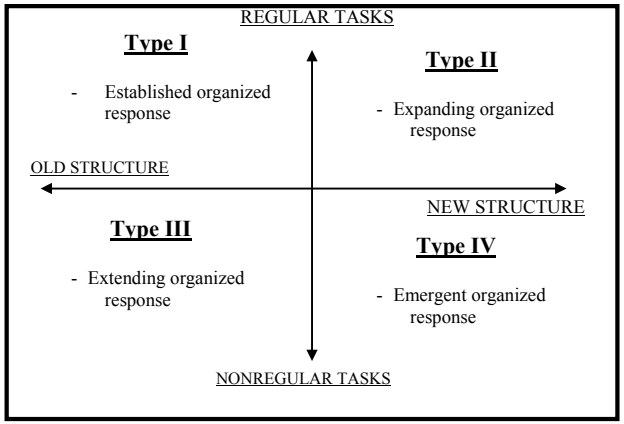
A community with a high degree of horizontal integration is a viable locally based problem-solving entity, with a tight knit among social networks and organizations. On the other hand a community with a low degree of horizontal integration is fragmented and unable to pull together to take control over its own affairs. In horizontally integrated communities there is an inherent lack of super ordinate-subordinate relationships and citizens are relatively equal in power. The opposite case is made for communities that are vertically integrated, where there are power differentials and inequality is evident. Where high vertical integration exists, the community has a large number of ties with larger political, social and economic institutions. As a result the amount of resources potentially available to the community is expanded, especially after crisis events. A community with low vertical integration suffers from a lack of knowledge about and interaction with important external resources (Figure 2).

In comparing disaster response among several Caribbean Islands that were affected by a hurricane, Berke *et al*., (1993; 1997) found that Type I and Type II communities exhibit an autonomous response mode in the period immediately following a disaster. Type I communities had the further advantage of being able to access external resources and used an institutional response mode to facilitate long-term recovery. Types III and IV communities are almost always driven by institutional responses to natural hazards and disasters. Type I communities had greater resilience and therefore better able to respond to and recover from disasters and undertake sustained development. Thus the ability of communities to cope in the face of change is determined not by the actual incidence of risks and threats, but by the degree of integration and taxonomy of interplay with organizations and institutions.

At the organizational level the degree of integration also affects response to natural hazards and disasters. In an evaluation of organizational behaviour in crisis events Quarantelli (1999) found that response diverged from the normal thinking that institutional inertia prevents organizations from change and taking new actions. Four typologies of organizational response were identified based on their task and structure (Figure 3). Tasks are characterized as either regular or non-regular and structure is characterized as old or new. Type I, or established organizations, rely on existing structure and carry out regular tasks during disasters. These organizations include disaster management organizations, police, fire and emergency departments that are expected to respond to disaster. Type II expanding organizations are also expected to be involved in disasters and carry out regular tasks, but in the process rely on new structural arrangements. Examples of such organisations include the Red Cross or local disaster management organizations that normally function with a few permanent staff but rely on formally trained volunteers during a disaster. Extending organizations, Type III, are not expected to respond to disasters. They are

characterized by an existing structure but during disasters they perform non-regular tasks such as cleanup operations. The emergent organizations, Type IV, represent the newly formed structures that are formed in the aftermath of a disaster and perform non-regular tasks.

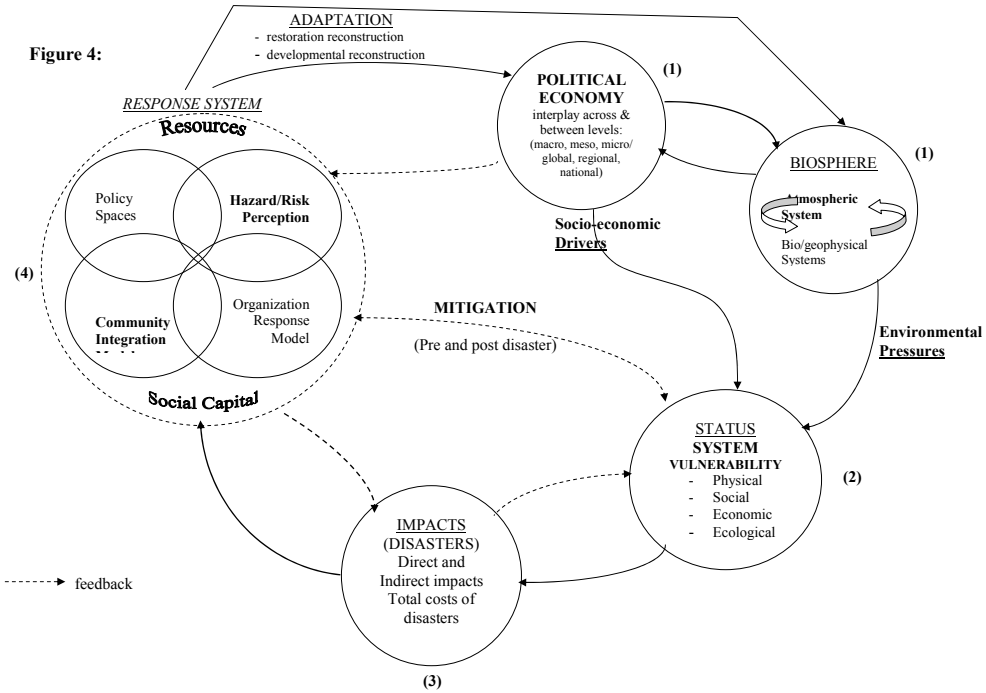
Figure 3: Disaster Research Center (DRC) Typology of Organized Responses to Disaster (Adapted from Quarantelli, 1999)



In light of the consequences of globalisation, no community can be thought of as being isolated, and disasters in one country can have rippling effects on communities far removed from the direct impact zones. Also, there tends to be a convergence of organizations towards the scene of a disaster to provide relief and assistance for recovery. This requires coordination of resources and information flow across and between levels of response.

Two terms can be used to sum up the preceding discussions, vulnerability (damage potential or resistance and ability to withstand risks) and its opposite resilience (the ability to recover). Models to predict response and perception therefore attempt to determine a community's vulnerability and/or resilience by assessing physical, environmental, socio-economic and political factors. A useful tool for demonstrating how the models presented earlier interacts to shape response to natural hazards is the DPSIR Framework (Figure 4) which is an adaptation of its application to assess costal zone management for sustainable development (Turner *et al*., 1998; Turner, 2000).

Figure 4:



Within this framework, physical and environmental factors determine the nature of the hazard event and site-specific physical vulnerability. Socio-economic and political factors determine the resource base and networks available for responding to the hazard or resilience, also termed human vulnerability. These factors combine to determine the total impact of disasters, influence perception to hazards in the environment and the responsive decision-making process. Response-measures must incorporate a long-term perspective to ensure reduced vulnerability (increased resilience) and adaptation to environmental change.
The questions of relevance to this study include:

1. What was the nature of the hazard event? (timing, intensity, duration, magnitude) Was there any warning?
2. What was the extent of the disaster zone? Was it localized or large scale?
3. At what stage in the disaster/risk management cycle was the affected community? What was the state of preparedness of affected communities? (forecasting and warning systems, mitigation measures, education, knowledge/awareness)
4. Who was at risk? (vulnerable locations and households/individuals)
5. What resources were available to guide the recovery process? (plans, local human, technical and financial resources, external aid agencies) How long did the process take? Who guided the process?
6. Did recovery lead to long-term development? (structural and non-structural mitigation measures, improvement of socio-economic conditions).

The above concepts and questions were applied to design the case study, evaluate responses to Hurricane Lenny 1999, and determine perceptions to natural hazards in the coastal community of Gouyave, Grenada.

3. Methodology and Data Collection

Details on community response and recovery efforts after the disaster event were gathered from interviews with personnel from local NGOs and the community disaster management committee. Interviews were also conducted with staff from the national disaster management office and other government departments involved in response and recovery efforts. Reports from these organizations and a review of the Hurricane Lenny Experience conducted by the Caribbean Disaster Emergency Relief Agency (CDERA) were also consulted.

Hazard perception was determined by observed behaviour or revealed preferences, based on the assumption that through trial and error society has arrived at an acceptable balance between the costs and benefits of utilizing hazard zones (Smith, 2001). Applying this concept, field surveys were conducted at the study site to observe present settlement patterns. Aerial photographs, cadastral and topographic maps of the study area were also obtained from the local Land Use Department of the Ministry of Agriculture. A recent community health and environmental profile was obtained from the Ministry of Health to gain insights on the predominant features of the community and its relationship with the surrounding physical environment.

A second approach for determining hazard perception is through expressed preferences obtained by a questionnaire survey where people are asked to verbally express their preferences (Smith, 2001). Twenty-three months after the Hurricane Lenny storm surge, 103 households were sampled in the coastal zone between the sea and the 25 ft contour line. There were no hazard events in the intervening period. The survey was designed to capture information on the household's knowledge and experience with hazards, attitudes, mitigation measures or practices, and future expectations. General information was collected on the number of persons in the household, age of respondent, number of years living in the area and occupation of the decision maker. Data from the cadastral survey on age and market value of property, field data on house type and condition, and responses on property ownership were used to determine the socio-economic status of a household. A focus group meeting was also held with members of the disaster committee prior to conducting the survey. They provided assistance to fine-tune the questionnaire and insights into the response and recovery process after the disaster. Local students familiar with the community provided assistance to conduct the survey.

4. Profile of Study Site – Gouyave, Grenada W.I.

The town of Gouyave is the main population centre for the Parish of St. John's, on the west coast of Grenada. The area of focus in this study is the northern coastal end of the town known as the L'anse, the town that never sleeps (Figure 5).

Figure 5: Northern coastal fishing community - Gouyave

This community accounts for approximately 14% of the population of the town of Gouyave (MOH, 2000). Transportation is very accessible as the western main road dissects the area, making travel to connecting towns very easy. Approximately 99% of the population is served with electricity, 99% have access to pipe borne water from the public system, and both public and private telephone service is available. A recent sanitation survey classified 50% of the housing as substandard, being old, very small and in poor condition. Of the substandard housing, about 80% had no toilet facilities and occupants utilized public toilets, buckets, the riverbank or the beach for this purpose (PAHO, 1999). As a result, the L'anse has a history of environmental problems with respect to human waste disposal, since most of the residents are renting the land and prohibited to erect permanent toilet facilities. The limited availability of land combines with these conditions resulting in congestion and poor living standards.

The life of this rural community is focused around its year round fishing activities and is well known for its annual Fisherman's Birthday festivities each June. At least 70% of the Gouyave population is involved in the fishing

industry as fishermen, vendors, boat builders, net makers, shopkeepers and restaurateurs. A postal and revenue station, police station, health centre, two pharmacies, commercial bank, nutmeg processing pool and several commercial shops, which provide employment for 20% of the population, serve the town and surrounding areas. Approximately 10% of the residents are unemployed. This community has the lowest poverty gap for the country, with the poor representing 23.9% of the population and 7% classified as indigent (national average is 32.1%), (CDB, 1999).

The majority of persons have at least a primary level education and access to two primary schools, one-pre primary school and day nursery, and two secondary schools within a 200 yards distance. Recreational facilities in the area include 15 pubs/bars, two clubs, two gyms, one cinema, two playing fields and a hard court. Four national weekly newspapers, cable TV, satellite TV, AM and FM radio stations, and the traditional "Negro-gram" or gossip provide information to the community. The residents have been described as "a very strong willed people who strongly believe in tradition and look after their own." (MOH, 2000)

5. Impacts of Hurricane Lenny on Gouyave

Between 17-20 November, 1999, 10 to 12 feet high waves generated by Hurricane Lenny then located approximately 500 miles to the north impacted the coastal community of Gouyave. Due to the location of the tropical cyclone, hurricane advisories were issued for only the islands within its direct path. As noted earlier, the strength of the system was under-forecast and the outward spirals of the cyclone, which extended to the south-eastern Caribbean were ignored. This resulted in a failure to predict and provide warnings of the storm surges that affected the western coast of Grenada. Coastal communities and infrastructure were had hit since the last major event to impact the island was Hurricane Janet in 1955, accounting for the state of disrepair and complacency to adopt mitigation measures.

The entire community was isolated for almost one week as the major access roads located along the coast were damaged and rendered impassable. Fourteen houses nearest to the shoreline were totally destroyed, displacing 54 persons including 29 children. There was also severe damage to other residential and commercial buildings as well as the fishermen's jetty. In some instances houses were swept away from their short concrete columns and timber posts, and residents were able to salvage portions of their wooden houses. The removal of the row of houses closest to the shoreline exposed the remaining houses to direct wave action and flooding. A local damage assessment conducted after the event, estimated over 40 of the low cost houses in the area to be highly vulnerable (GRENCODA, 2000).

During the first day of high waves fishermen were able to take precautionary actions such as removal of boats moored at the jetty, mooring of boats further from shore and hauling smaller boats to relative safety on shore. However, despite these measures about 26 fishing boats were destroyed, sunk or damaged, and ten seine nets destroyed. Within one week after passage of the storm surge, ten seine boats were salvaged from the seabed with relatively minor damage (GRENCODA, 2000). The estimated economic costs to local fishermen and vendors due to damage of fishing boats and equipment was EC$513,700[1] (Fisheries Dept., 2000 unpublished report). No cost estimates were available for the damage to roads and public infrastructure.

[1] 1 US$ = 2.7 EC$

6. Response and Recovery Efforts

To obtain a comprehensive picture on the response and recovery process in Gouyave after Hurricane Lenny, four levels - community, national, regional and international, must be examined. This is reflective of the various sources of assistance and support during and after the event.

6.1 Community level response and recovery

During the period of isolation, which followed the impact phase, community members were able to pull their resources together and conduct "self-help" repair work: of the 31 households who had to evacuate due to property damage, only 13 went to the emergency shelter the remainder finding board with friends and relatives. A large proportion of the damaged houses (87%) were re-constructed on the same spot within days. Seventy-four percent of the respondents stated that the house was made stronger. These households had no land title, and were renting the spot from the Anglican Church. Relatives, friends and neighbours provided the greatest level of assistance and funding. Two households obtained assistance from a bank or credit union, eight from a community group, and eight from the government. The assistance from the government was provided much later during the repair phase, some 3 months after the event.

Utilizing its long outstanding history of community development in Grenada, and Gouyave in particular, the Grenada Community Development Agency (GRENCODA) sort to coordinate local relief efforts. An *ad hoc* disaster committee comprising members from major stakeholder groups was formed, and a local engineer was employed to conduct a "damage and needs" assessment (DANA). The persons who were able to repair their houses during the isolation phase were not captured in this assessment, however, were sited as being highly vulnerable. Therefore only fourteen households were included in the proposal for relocation to a less vulnerable area. GRENCODA was able to use the DANA to secure funding from the Canada Fund for Local Initiative (CFLI) to assist fishermen who lost their equipment and persons whose houses were destroyed. Sixty percent of the funds were disbursed to community members based on needs, and forty percent was set up as a revolving loan fund at 5% interest per annum (national lending rates vary from 10-12%).

The St. John's Coastal Rehabilitation Ad Hoc Committee also served as a clearinghouse for financial assistance from local businesses and organizations. Consultations were held with the National Emergency Relief Organization (NERO), the parliamentary representative for the area, Physical Planning Unit, Housing Authority and a local insurance company to identify suitable locations for relocation. At the time of the community survey (September 2001), this

emergent organization was still active and working with the National Insurance Scheme to set up a savings and insurance scheme for local fishermen. House spots were provided for 13 households by the government, one by a community member, and fourteen houses were constructed in the new locations. Funding was provided for materials and householders were required to use community help to undertake construction.

Traditionally, GRENCODA had not played an active role in disaster preparedness initiatives, and is not included on the national disaster committee. A new role has emerged for the non-governmental organisation (NGO), and its Management is keen on becoming involved in initiatives to integrate disaster mitigation with their community sustainable development work. Another NGO, Agency for Rural Transformation, obtained support from its regional partner CARIPEDA and conducted training with community leaders in community disaster preparedness and vulnerability assessment. The Hurricane Lenny experience also provided the opportunity for the community to build stronger ties within and between several levels, for both informal and formal organizations.

6.2 National level response and recovery

Several west coast communities were isolated due to destruction of the major road network. Lifeline facilities such as the main petroleum depot on the island were isolated and unable to provide services to the rest of the country. This relegated the Gouyave community to lower national status, and the roads connecting the rural community were the last to be repaired. The government needed external support to undertake reconstruction of the roads, and moved to take advantage of the narrow window of opportunity for accessing disaster aid at low interest rates. With the exception of assistance provided for the relocation of damage households, none of the disaster aid received by the government went directly to the community.

Given the absence of existing development plans for Gouyave and its environs, the recovery process was ad hoc. One community member reported that this concern was raised at a community consultation on the environmental impact assessment of the reconstruction works for which only the government's party supporters were mobilized. Residents' recommendation to relocate the road inland thus opening new low risk areas for development thereby relieving present housing pressures was ignored. Coastal roads are constantly subjected to heavy wave action and are fringed by overhanging clips that landslide onto roads frequently, sometimes causing death and serious injury or disrupting the flow of vehicular traffic. Further, the reconstruction required the construction of sea-defence walls, which destroyed the coastal habitat of seine fishermen causing negative ecological and social impacts. A comprehensive hazard assess-

ment and benefit/cost analysis was not conducted in designing the projects. The opportunity to promote long-term sustainable development for the area and country was thus missed. Funding for reconstruction projects were provided by USAID, The World Bank and the Caribbean Development Bank.

The national budget for disaster management was significantly increased after Hurricane Lenny, increasing the priority of that sector. Resources have been allocated for coastal rehabilitation and sea-defence works, retrofitting of schools which serve as emergency shelters, equipping the emergency operations centre (EOC), improving computing and forecasting capacities of the meteorological office, and updating the national disaster mitigation plan. In an interview with personnel from the national disaster office and the government information service (GIS), it was learnt that there are still insufficient resources dedicated for community outreach. Education programs are done only on a voluntary and ad hoc basis by the local media.

6.3 Regional response and recovery efforts

The Caribbean Disaster Emergency Relief Agency (CDERA) played the lead role in coordinating response at the regional level. The agency was instrumental in disseminating information and weather advisories to the national disaster offices (NDO) and the regional response machinery. Financial assistance and supplies from international aid agencies were pledged to CDERA, who provided human and financial resources to mount rapid assessment teams to the States most severely impacted. There was no direct contact between the agency and the affected communities during the relief and repair phases. Five months after Hurricane Lenny, CDERA provided assistance with a recovery expert to evaluate lessons learnt from the experience as well as to put structures in place for effective recovery in the future (CDERA, 2000).

The resulting report of the recovery expert concludes that the experience was a fundamental challenge for national management in general and specifically for disaster management and there is limited capacity at the national level. The overall coordination of efforts by NDOs was weak and they were unable to provide comprehensive damage information. On the other hand, "Community disaster organizations were able to provide very detailed information on individuals and families most severely affected by the hurricane." (CDERA, 2000) Despite this observation, the role of community organizations was overlooked and not included as a vital part of strategies for future planning.

Other regional organizations that played a limited role in the repair and reconstruction phases were the OECS Natural Resources Management Unit (NRMU) and the Caribbean Peoples Development Agency (CARIPEDA). The NRMU's role was limited to providing assistance to one Member State to

conduct an environmental damage assessment. In the past, the Unit has not included disaster mitigation as part of its natural resources management strategy for the sub-region. Efforts are now being made to include disaster mitigation as part of new environmental management strategy (OECS, 2001). The CARI-PEDA seized the opportunity to launch a community disaster management program in several islands. This regional NGO works with partner community development organizations throughout the sub-region, with technical and financial support from international organizations.

6.4 International response and recovery efforts

The Eastern Caribbean Donor Group for Disaster Management acts as the focal point for securing international assistance for the sub-region. The group works along with individual members such as CDERA, The Pan American Health Organization (PAHO), UNDP and CDB. Disaster assistance was received from members of the international donor community including the Disaster Initiative of the European Commission Humanitarian Office (DIPECHO), The British Government Department for International Development (DFID), The Canadian International Development Agency (CIDA), CDB, OCHA/Norway and UNDP (CDERA, 2000). Funds were utilized for repair of schools, water cisterns, hiring of consultants, meetings of national disaster coordinators, regional and national consultations and workshops. Undoubtedly these initiatives are warranted given the inevitability of the recurrence of hurricanes in the region. However, the root causes of social vulnerability have yet to be addressed in mainstream approaches for disaster management in the region.

To facilitate future disaster management initiatives in the sub-region, DIPECHO and DFID conducted assessments of the capacity and arrangements for disaster preparedness, mitigation and post-impact recovery in the islands. Prior to financing disaster rehabilitation and emergency projects in the OECS States, the World Bank also undertook an evaluation of their institutional capacities. The findings of all three assessments point to weak capacity within national ministries and organizations (CDERA, 2001a). Emphasis was placed on the existence and scope of disaster management and mitigation plans, policies and human resources. These assessments failed to capture the experiences at the community level and examine the response/recovery which community organizations and NGOs were able to coordinate. As a result strategies for assistance and the point of intervention continue to focus on training workshops, development of plans and capacity building only at regional and national levels.

7. Hazard Perceptions after Hurricane Lenny

The community field survey and questionnaire were designed to capture revealed and expressed preferences respectively, and determine present perceptions to natural hazards in the Gouyave community. The survey did not include households in the relocated community. It is outside the limits of this paper to discuss perceptions of decision-makers at the national, and regional levels, which was also addressed in the wider research strategy. The same factors that influence individual/household perceptions also operate at these levels.

7.1 Revealed preferences

With the exception of the fourteen households that were relocated, there were no changes in the land settlement pattern subsequent to the storm surge. Four new houses were constructed along the coast after the disaster. Three of the houses were located on rented lands and of wooden construction. These represent low- income households with property values ranging from EC$6,300 to $35,000. The other house was located on private lands, constructed from concrete and had a total property value of over EC$162,000. Given the size and real estate value of this residence, the fact that the owner has insurance coverage and future hazard risks, it can be concluded that general perceptions of natural hazards has not changed on the part of the planning authority, financial institutions and individuals. The investment into coastal road rehabilitation and community development schemes, suggest an underlying feeling of safety in the environment.

7.2 Expressed preferences

Feedback from local residents presented deeper insights into what is happening in the community. Forty-one percent of the respondents were willing to relocate immediately if a spot was available. In the words of the residents the reasons for relocating included: "to avoid greater disaster; too near the sea; so that the family will be more secure; because I don't have a chance; afraid of the sea." Less than 25% of the residents were not willing to relocate, most of them having lived in the area since Hurricane Janet of 1955. The remainder were not sure, but willing to consider relocation if it meant a better place to live.

Fifty-four percent of the residents were worried about the risk of tsunamis from the eruption of the active submarine volcano located only 5km off the north-western coast of Grenada. Similarly, they were aware of the consequences of global warming, climate change and sea level rise, and the increased probability of coastal flooding. Over eighty percent of the respondents received their information and weather forecasts from local radio stations and cable television. After scientists, relatives and friends were the most trusted for reliable

information (32% and 21% respectively). Neighbours received the lowest rating, 19% trusted government sources, and 18% were willing to put their trust only in God.

Despite the past experiences, 77% of the residents had no emergency supplies on hand in the event of a hurricane.[2] Forty-six percent of the households had undertaken regular repair and maintenance of their building, the remainder claiming finance as their major constraint. In addition, 35% of the households were renting the house and therefore precluded from investing in mitigation measures. While they were willing to participate in a community preparedness program, only 27% of the residents had the opportunity to participate in an emergency/preparedness exercise in the past. Twenty-three percent of the residents believed that their homes were safer than the emergency shelter and would not go there in a crisis. Overall, the general impression of the community was that the level of preparedness in the country is very low (61% gave a preparedness rating of <50%).

The results of the survey intimate that while the hazard perception of residents favour the adoption of adjustment strategies, i.e. relocation, structural mitigation measures, their current socio-economic status dictates the choices that are made. The unavailability of affordable lands in less hazard-prone areas limit them to the poor environmental conditions. Further, the policies of the major landholder in the community have not allowed residents to acquire land title and improve their socio-economic status. Community advocates were unable to influence the direction of the road reconstruction project as a catalyst for long-term development. Combined with the low status Gouyave receives in national development planning, these factors help to perpetuate feelings of apathy and helplessness, and a restlessness that drives the high migration rates out of the area.

From the above, residents can be categorized as having two types of perceptions to natural hazards. One group of residents exhibit what is referred to as dissonant perception, in that they attempt to conceptualise reality in a way that makes the extended future risk from hazard event more comfortable on a day-to-day basis (Smith, 2001). This threat denial was observed mainly among persons who own property in the area and represent about 32% of the respondents. The other group exhibit what is referred to as probabilistic perception (Smith, 2001). They accepted that events will happen yet transferred the responsibility of dealing with hazards to the higher authority, government and to God. These findings have implications for ensuring maximum participation in community strategies for disaster management.

[2] The survey was conducted in September, at the height of the hurricane season.

8. Lessons Learnt

The nature of the hazard event was atypical such that there was an inability to forecast and activate preparatory measures, the direct impacts were short-lived and restricted to narrow coastal belts, and there was not the accompanied cyclonic winds and heavy rainfall associated with hurricanes. Terrestrial ecosystems were not affected by the passage of the atmospheric system. Consequently only a small segment of the human-use system was exposed to the direct hazard impacts and the affected households were able to draw upon local assistance in the unaffected communities for immediate relief efforts. The secondary impacts however affected the entire country and external support for recovery and reconstruction was required.

Hurricane Lenny has been described as a challenge for disaster management in the region. The capabilities of national emergency response systems were tested, and in all cases evaluated as being lacking, despite varying frequency and histories with past events. Poor coordination and lack of leadership was identified as a common problem. This intimates that experience with the event was not a good measure of the ability of OECS states to respond to natural hazards.

At the community level, the response and recovery process was enabled by the long history of working together on non-disaster related issues. Isolation did not mean inaction, as is typically thought of in disaster stricken communities. The NGOs were able to assume leadership roles, bring stakeholders together, form linkages with external social partners and start the process of sustainable natural hazard mitigation by championing the cause for relocation of vulnerable households, and establishing savings and insurance schemes. It is expected that the eventual land titling process will help to build the socio-economic status of the relocated communities. The opportunity for using disaster recovery to enable sustainable development was missed due to the absence of long-term development plans to guide the process.

A review of the list of stakeholders, who responded to the 1999 disaster, shows that the Caribbean Disaster Emergency Agency plays a vital role in co-ordinateing disaster management in the region. However, nongovernmental organizations seem to operate outside of that network, bypassing "gatekeepers" to form bridges between local communities and the international community. While direct response and recovery was enabled at the micro-scale by community-based organisations, the larger macro-political framework seemed to have a larger influence in directing long-term development and adaptation to environmental change.

The Gouyave community can thus be described as a variant of a Type I community with a high degree of both horizontal and vertical integration (Figure 2). The community had well developed ties with larger political, social and economic institutions and to external resources and programs. It demonstrated the ability to bring local networks together to sustain initiatives, however, had limited socio-economic power to exert influence at the national decision-making level. Drawing on the 1993 disaster experiences of the other islands in which the hazard impacted the entire island, one can conclude that had the impacts of Lenny been more widespread, the responses would not have varied.

Results from an evaluation of the responses to Hurricane Lenny in Dominica, St. Lucia and St. Vincent reveal that the communities showed lower degrees of integration and were unable to direct effective response/recovery despite their more recent hazard experiences. A direct opposite from the process observed in Gouyave, the recovery process was led from the top-down rather than from the bottom-up. At the time of the field survey, some 23 months after the disaster, displaced communities have yet to be permanently relocated in most of the other islands. These findings bring some new questions and issues to the fore. Of immediate concern is how these lessons can be used to guide the present strategy for "Comprehensive Disaster Management in the Caribbean", which already has resources allocated for its implementation (CDERA, 2001b).

The second issue is to identify the enabling procedures and instruments, from awareness to legislation, to increase the efficiency and effectiveness of present strategies at the community level. Thirdly, approaches for building linkages across levels and scales between informal and formal organisations and institutions must be addressed. The OAS Caribbean Disaster Management Program (1993-1999) has already addressed the technical issues of hazard vulnerability assessment and mapping. Strategies for reducing structural vulnerability have been addressed in several reports and studies (OAS, 1999; Berke and Beatley, 1997). What remains to be addressed is the incorporation of the institutional dimensions of risk management into the sustainable development process in the region.

9. Conclusions

These findings provide insights into both the functioning and structure of human systems, and help to explain why despite the best planning, disaster and risk management programs are often difficult to implement. The implications for Caribbean disaster and risk management are far reaching. People's response to natural hazards and disasters is only to a small degree affected by the objective risk associated with hazards in the environment. Socio-economic, political and institutional factors seem to be most important in influencing response at the community and organization level. Therefore to achieve effective risk reduction the organizational and institutional dimensions, including people's perception must be incorporated into current strategies.

The preceding discussions reveal that a paradigm shift needs to occur in the present approaches to disaster management in the Caribbean, from a top-down command and control response ethic to include a bottom-up approach that is participatory and inclusive. The role of community-based organizations and nongovernmental organisations in disaster management has been overlooked. Their involvement in the process seems to be the way forward for bridging the disaster-development gap, and achieving sustainable development.

References

Berke, P.R., Beatley, T., (1997). *After the hurricane: Linking recovery to sustainable development in the Caribbean*. John Hopkins University Press, London.

Berke, P.R., Kartez, J., and Wenger, D., (1993). Recovery after disaster: achieving sustainable development, mitigation and equity. *Disasters* Vol. 17 (2): 93-109.

Blaike, P., Cannon, T., Davis, I., Wisner, B., (1994). *At Risk: Natural hazards, people's vulnerability and disasters*. Routledge, London.

CDB, (1999). Poverty Assessment Report – Grenada, Vol. 1 and 2. Report prepared by Kairi Consultants Ltd., in association with the National Assessment Team of Grenada, Ministry of Finance and Planning.

CDERA, (2000). Review of the Hurricane Lenny experience with recommendations for improvements in operational planning. Caribbean Disaster Emergency Relief Agency, Barbados.

CDERA, (2001a). Status of Disaster Preparedness of CDERA Participating States. The Caribbean Disaster Emergency Response Agency, May 2001. Prepared by Arturo Lopez-Portillo, ID Number MIPR#OHCHS60120.

CDERA, (2001b). A Strategy and Results for Comprehensive Disaster Management in the Caribbean: Comprehensive Disaster Management Strategy Project. The Caribbean Disaster Emergency Response Agency, April 2001.

CDERA, (1999). Hurricane advisories and reports, November 1999. Caribbean Disaster Emergency Relief Agency ***(http://www.cdera.org/Archive/Archive.htm).***

Fisheries Department, (2000). Assessment of Economic Impacts of Hurricane Lenny on the Fisheries Sector. Unpublished report – Statistical Division, Fisheries Department Ministry of Agriculture, Grenada.

Government of Grenada, (2001). Estimates of Revenue and Expenditure, 2000. Economic Affairs Division, Ministry of Finance, Grenada.

GRENCODA, (2000). Proposal for Disaster Rehabilitation. Prepared by T.P. Smith Engineering for Grenada Community Development Agency, January 2000.

MOH, (2000). Gouyave Community Profile: Health and Environmental Health Project. Ministry of Health and the Environment, Grenada.

NHC, (1999). Hurricane Archives of the National Hurricane Center, Miami Florida, USA. (***http://www.wunderground.com/tropical***/).

OAS, (1999). Natural Hazards and Economic Development: Policy considerations. CDMP, Organization of American States Unit of Sustainable Development and Environment and USAID Office of Foreign Disaster Assistance and the Caribbean Regional Program.

OECS, (2001). OECS Sub-regional submission to the World Summit on Sustainable Development. OECS Secretariat, Castries St. Lucia.

PAHO, (1999). Global Water Supply and Sanitation Assessment 2000. Country Analytical Report – Grenada, July 1999. Pan American Health Organisation.

Palm, R., (1990). *Natural hazards: An integrative framework for research and planning.* Johns Hopkins University Press, Baltimore.

Quarantelli, E.L., (1999). Disaster Related Social Behavior: Summary of 50 years of Research Findings. Preliminary Paper No. 280, Disaster Research Center, University of Delaware.

Smith, K., (2001). *Environmental hazards: Assessing risk and reducing disaster*. 3rd ed. Routledge, London.

Turner, R.K., (2000). Integrating natural and socio-economic science in coastal management. *Journal of Marine Systems* 25: 447-460.

Turner, R.K., Lorenzoni, I., Beaumont, N., Bateman, I.J., Langford, I.H., and McDonald A.L., (1998). Coastal Management for Sustainable Development: Analysing Environmental and Socio-Economic Changes on the UK Coast. *The Geographical Journal,* Vol. 164, No. 3, November 1998, pp.269-281.

UN, (2000). Sub-regional common assessment of Barbados and the OECS. The UN Development System for the Eastern Caribbean (***http://www.cep.unep.org***/).

Vitek, J.D., and Berta, S.M., (1982). Improving perception of and response to natural hazards: the need for local education. Journal of Geography, Vol. 81, November-December 1982, pp. 225 – 228.

Winchester, P., (1986). Cyclone vulnerability and housing policy: In the Krishna Delta, South India, 1977-83. *PhD Thesis,* School of Development Studies, University of East Anglia.