# ASSESSING THE VULNERABILITY AND ADAPTIVE CAPACITY OF COMMUNITIES TO HAZARDS AND CLIMATE CHANGE IN SIDS

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**Abstract**

It is estimated that disaster costs and losses are increasing globally. The increase has been attributed to a number of factors including population growth, urbanisation and an increase in the frequency and severity of meteorological events driven by accelerated climate change. This paper assesses vulnerability and adaptive capacity in relation to hazards and climate change and the implications for Small Island Developing States (SIDS) in the Caribbean. Climate change impedes efforts to achieve sustainable development and is likely to have serious negative impacts on SIDS, such as the Caribbean.

This paper is based on a survey of almost 400 participants from 4 communities, one in each of the Anglophone Windward Islands of Dominica, Grenada, Saint Lucia and St Vincent and the Grenadines. The survey was complemented by a semi structured interviews with key informants and focus group discussions of some survey participants. A historical analysis of hazards which affected the 4 islands between 1911 and 2011 was also completed. There are issues of poverty, low educational achievement, inadequate housing, limited livelihood options and unemployment that make disaster risk reduction a challenge. These conditions limit the ability to undertake the necessary and longer-term risk reduction measures, such as the purchase of insurance.

Participatory Assessments make provision for at risk communities to be integrally involved in identifying their vulnerability and enhancing their adaptive capacity to live with hazards and the implications of climate variability. Additionally, global models can project climate impacts and estimate costs of expected investments. Decision-makers in Developing Countries also require national assessments that take a bottom-up, pro-poor perspective, integrated across sectors, and reflective of local stakeholders' experiences and values, in order to determine appropriate Disaster Risk Reduction and climate responses.

**Key words:** Vulnerability, adaptive capacity, hazards, Caribbean, communities

# Introduction

Disaster deaths have decreased, except for unusual events such as the Haiti earthquake (2010) and Japan earthquake (2011), but disaster costs, loss and population affected are increasing globally [1]. This increase can be attributed to factors such as population growth, urbanisation, biodiversity loss and an increase in the frequency and severity of meteorological events driven by accelerated climate change. Climate change impedes efforts to achieve sustainable development and is likely to have serious negative impacts on SIDS, such as the Caribbean. The consequences will likely include higher temperatures, declining precipitation, rising sea levels and potentially adverse changes in the patterns of extreme weather event [2]. Climate change is being blamed for droughts in Sahel and crop failures in the US [3]. That being the case the livelihoods of many islanders who depend on natural resources are also threatened. Efforts to address the negative impacts of hazards and climate change are usually broad based and may not holistically address issues affecting smaller more vulnerable communities. Mapping vulnerability to hazards and climate change can provide a better understanding of the implications of climate change on society and guide capacity building initiatives. Addressing climate change is a challenge for Small Islands Developing States (SIDS) with their unique set of vulnerabilities. SIDS are spread over several regions which include the Caribbean, Pacific and African, Indian Ocean, Mediterranean and South China Seas (AIMS).

The Caribbean SIDS consists mainly of small states with most of their population and critical infrastructure located in coastal areas vulnerable to multiple hazards. The hazards are dominated by storms and hurricanes, flooding, landslides and drought. In addition, the exposure to hazards, socioeconomic factors such as insecure livelihoods, poverty, poor housing construction and unsafe locations render some Caribbean states highly vulnerable to disasters. Vulnerability is generally understood as the susceptibility to encounter loss or harm. The degree of the impact depends on the capacity to withstand the impact or the ability to manage with little or no assistance from others. The ability to manage without support is limited to a few people but the poor often suffer the most. The vulnerability of the poor is inextricably linked to low educational achievement, unemployment or low paid employment, large household sizes and other factors. These circumstances determine the risk reduction choices people are likely to make.

This paper assesses vulnerability and adaptive capacity in relation to hazards and climate change and the implications for Small Island Developing States (SIDS) in the Caribbean. Building capacity to hazards and climate change is most effective if communities are integrally involved in assessing risks and reducing vulnerability. There are many useful tools used to assist communities with the assessment process and although there are challenges, many good practices exist. Key to the success of these approaches is communication, collaboration and multi stakeholder partnerships that are community driven.

This paper is based on fieldwork collected as part of a larger research in the Anglophone Windward Islands of Dominica, Grenada, Saint Lucia and St Vincent and the Grenadines. A questionnaire survey was conducted with residents of a community in each island, key informant interviews and focus group discussions were conducted. This was complemented by a historical analysis of hazards which affected the Windward Islands between 1911 and 2011. The field data is supported by a review of recent of reports from the disaster of 24 December, 2013 which affected Dominica, Saint Lucia and St. Vincent and the Grenadines.
Vulnerability and Capacity

Disaster research has shifted from focusing on hazards and trying to control nature with technical solutions to a broad focus on physical exposure and social vulnerability [4]. O'Keefe et al. (1976), [5] were instrumental in shifting the focus from hazards to people and their socioeconomic status. This research has adopted a comprehensive approach of assessing socioeconomic and biophysical vulnerability. This approach takes into consideration the exposure to hazards of different scales and the damage likely to be incurred. Consideration is also given to the ability of the built and natural environment to withstand hazards with little or no damage, which represents a lack of capacity [6,7] Vulnerability can also be viewed in terms of the capacity of different social groups to deal with the impacts of hazards. Some of the vulnerable social groups include the elderly, sick, disabled, women, pregnant mothers and children.

## Vulnerability of Small Island Developing States (SIDS)

The Caribbean Islands share the vulnerabilities of Small Island Developing States with their diverse cultural heritage and geography but share similar sizes, social and economic sustainable development challenges [8]. A healthy, productive and well sustained environment, strong social systems and stable economies are at the core of human wellbeing and sustainable development. M many small island nations are at peril of never attaining sustainable development which has in many cases become an almost overused word in public discussions today.

The mainstay of many SIDS rests heavily on the limited natural resources. The poor, living in rural areas, in the mountains, or on the coastlines are most dependent on these resources for their livelihoods. The cries of farmers and the fisher folks are evident from the mountain to the valleys and the coasts. Facing an uncertain future whose only certainty is change, SIDS experiences many challenges and difficulties. The challenges that impede sustainable development for SIDS such as those in the Caribbean region include: low availability of resources, small but rapidly growing populations, remote locations, frequent natural disasters, over-dependence on

international trade, and susceptibility to global developments [8]. As the common saying in the Caribbean goes "If America sneezes, the Caribbean catches a cold".

The social vulnerabilities of SIDS include high population density, which puts pressure on a few limited resources. These limited resources are often over used and are at risk of being depleted at a faster than normal rate. In addition, there is limited institutional capacity, which is constrained by high migration of skilled human resources [9]. SIDS economic limitations are a result of their smallness, geographical dispersion and remoteness as well as their dependence on a narrow range of crops and services. These income sources are subject to international trade liberalisation and unstable market conditions, which affect prices and production. Their domestic markets are too small to support economies of scale and the volume of export is limited, which results in high transportation costs and limited competitiveness [10]. The vulnerability of SIDS is further compounded by their exposure to a wide range of natural hazards. The challenges sets back social and economic development and reduce the ability of SIDS to achieve Sustainable Development goals [11, 10, 12].

The Caribbean is unique by virtue of its rich and diverse biodiversity but it is also characteristic of very fragile ecosystems. There are concerns about the availability of fresh water and protection to biodiversity. Many scientists believe that climate change may just be the tipping point for biodiversity, not to mention the threats associated with warmer climates as it relates to sea- level rising, flooding and an increase in violent storms. It could be argued that climate change is being used as a cover for all the problems in the society. While this can distract from the underlying causes of vulnerability it can also be beneficial if the attention effect positive changes in other areas [13].

The vulnerability of fragile ecosystems of the SIDS in the Caribbean does not lend support to sustainable development but being recognized as some of the most vulnerable places to climate change [9, 14, 15, 16, 17, 18, 19] some characteristics of SIDS and SIDS populations also yield advantages and opportunities for addressing the challenges faced, including climate change. Vulnerability creates an excellent opportunity to get things right. Not only does it make a pathway for the Caribbean states to become Stewards of the very things we depend on for life, but it also provides an opportunity to become resilient states, able to withstand the many hazards which threaten the islands. SIDS advantages include tight kinship networks, unique heritage, a strong sense of identity and community, creativity for sustainable livelihoods, remittances from islander Diasporas supporting life on SIDS, and local knowledge and experience of dealing with environmental and social changes throughout history [18].

## Community participatory assessment

Community-based approaches have been developed as a more effective means of promoting community development as opposed to top down approaches. The more common of the approaches include community based disaster management, community based disaster risk reduction and community based risk management. Community-based risk management has traditionally dealt with variability in weather conditions; however, long-term climate change and increasing variability will require more proactive behaviour at the community level. Communities globally, especially in developing countries have been involved in assessing their communities to inform risk reduction and capacity building programmes. Two of the most widely used community assessments are community risk assessment and vulnerability and capacity assessments supported by the Red Cross and Red Crescent Societies [19]. These tools are rolled out internationally at the community level using participatory methods to identify vulnerabilities and build capacity to hazards [19].

Participatory Assessments allows at risk communities to be integrally involved in the process and bring about change in behaviour as it relates to hazards and climate change. Changing behaviour will be challenging and requires a shift in the way local government and NGOs interact with local communities, a shift from reactive and often non-transparent modes to proactive approaches to build community resilience. The barriers to resilience building are broadly centred on capacity building which can be in conflict with local political

aspirations and election cycles. This means that unless certain issues do not form part of the priority of the national development agenda they can be overlooked. This forces communities to work closer together to find the support they need to address vulnerability reduction and capacity building. Capacity building requires integrated and multi-sectoral approaches along with regional cooperation for successful implementation. However greater success will be realised if adaptation is integrated into development policies, plans and projects that are consistent with national social, economic and environmental goals [2].

# Results and Discussion

The study focused on one community each in Dominica, Grenada, Saint Lucia and St Vincent and the Grenadines. Almost 400 residents participated by completing surveys and participating in focus groups discussions on vulnerability and capacity. The aspect of vulnerability highlighted in this paper includes exposure to hazards and socioeconomic factors affecting participants and the communities.

## Hazard Vulnerability in the Windward Islands

Table 1 provides a summary of the main hazards and frequency of occurrence for each Anglophone Windward Island. The gaps in the data on hazards for the 100 year period limited the level of analysis that could be completed on the data. However, tropical weather systems which include tropical storms and hurricanes, storm surges, rainstorms are the most common and have been responsible for the most devastation. These are complex hazards since the devastation could result from a single or a combination of rain, wind, storm surges, landslides and flooding.

| Hazard | Dominica | Grenada | Saint Lucia | St Vincent & the Grenadines | Total |
|---|---|---|---|---|---|
| | Freq. | Freq. | Freq. | Freq. | |
| Tropical Weather Systems | 28 | 15 | 33 | 18 | 94 |
| Earthquakes | 7 | 1 | 4 | 5 | 17 |
| Landslides | 3 | | 7 | 1 | 11 |
| Volcanic Activity | 1 | - | - | 2 | 3 |
| Floods | 2 | 1 | 4 | 4 | 11 |
| Fires | 2 | | 7 | - | 9 |
| Drought | 1 | 1 | 2 | 2 | 6 |
| Civil Unrest | 3 | 3 | 4 | - | 10 |
| Oil/Chemical Spills | - | - | 3 | 1 | 4 |
| Transport Accidents | 2 | - | 5 | - | 7 |
| Others | - | - | 1 | - | 1 |
| Total No. of events | 49 | 21 | 70 | 33 | 173 |

**Table 1: Frequency of the main hazards affecting the Windward Islands between 1911 and 2011, [20].**

Considering the nature of the small island states the entire island could face disaster while recovering from previous impacts. The mountainous nature of the islands and coastal settlements also means that most people both rich and poor and critical infrastructures are exposed to hazards [21]. Despite that the poor are still likely to suffer more since they are more unlikely to possess insurance, cash reserves or have access to resources to aid recovery. A lack of or existence of land use planning and regulation have allow many people to take up residence in high risk areas [22]. This haphazardness in settlements can hinder evacuation and planning and

increase disaster risk. People in these communities not only face risk from frequent hazards but infrequent events such as earthquakes and volcanic eruptions can have a greater and longer term impact on small states than the more frequent events.

The deaths from hazards in the Windward Islands have been generally low however the number of persons affected and the cost of the impacts appear to be on the increase. This trend is similar to the global trend. Despite the international and national focus on reducing risk to disasters, more people and properties appear to be in harm's way. The key sectors generally affected by hazards in the study areas include housing, agriculture, infrastructures and tourism. In small islands with limited productive sectors which are constantly affected by hazards, development becomes retarded. The loss of homes or livelihoods or both especially by the poor places the responsibility for recovery almost solely on governments. Researchers have suggested that climate change will increase the intensity and severity of weather events. Increasing exposure to hazard makes it difficult for people who already face socioeconomic challenges to increase their capacity. Increasing their capacity will take combined efforts of to address vulnerability and reduce disaster loss and costs.

## Social Vulnerability in the Windward Islands

A summary of the key socioeconomic variables of participants in the study can be found in Table 2. The household questionnaire revealed a higher percentage of female participants than males for each island. This is perhaps reflective of the generally higher female participation but could also represent the willingness of more females to participate and get involve in developmental activities than men. There was good representation across the different age groups of participants in each community.

| Variables | St Joseph/Layou Dominica (%) | Soubise/Marquis Grenada (%) | Soufrière Lucia (%) | Fancy St. Vincent (%) |
|---|---|---|---|---|
| Gender | | | | |
| Male | 40.8 | 47.1 | 35 .7 | 35.5 |
| Female | 59.2 | 52.9 | 64.3 | 64.5 |
| Age | | | | |
| Under 20 | 3.1 | 5.8 | 3.1 | 4.3 |
| 20 – 29 | 14.3 | 26.9 | 20.4 | 16.1 |
| 30 – 39 | 19.4 | 17.3 | 19.4 | 20.4 |
| 40 – 49 | 22.4 | 13.5 | 21.4 | 26.9 |
| 50 – 59 | 20.4 | 11.5 | 18.4 | 19.4 |
| 60 + | 20.4 | 25.0 | 17.3 | 12.9 |
| Occupation and Employment | | | | |
| No paid Employment | 26.5 | 30.8 | 22.4 | 34.4 |
| Self Employed | 22.4 | 17.3 | 12.2 | 9.7 |
| Primary Sector | 12.2 | 10.6 | 5.1 | 26.9 |
| Government Service | 3.1 | 4.8 | 22.4 | 12.9 |
| Construction | 6.1 | 11.5 | 6.1 | 1.1 |
| Retired | 14.3 | 7.7 | 18.4 | 7.5 |
| Other Occupations | 15.3 | 17.3 | 13.3 | 7.5 |
| Education | | | | |
| None | 2.0 | 0.0 | 0.0 | 2.2 |
| Primary | 59.2 | 56.7 | 40.8 | 60.2 |
| Secondary | 25.5 | 30.8 | 35.7 | 28.0 |
| College & above | 12.2 | 12.5 | 23.5 | 9.7 |
| Number of Participants | 98 | 104 | 98 | 93 |

**Table 2: Socio-economic characteristics of household participants, [20].**

The focus was on adults 18 years and older and household heads but in their absence the adult at the time participated. Most of the participants were either in no-paid employment, self-employed or working in the primary resources sector. Those in the primary sector such as fishing and farming are those most likely to be affected by hazards and subject to international trade agreement and globalisation which are not usually favourable to small producers. These sectors are also the ones most vulnerable to overexploitation and open to disasters. Addressing the social needs of people such as increase employment, better housing and other areas contributes to vulnerability reduction [23, 24].

Participants were asked about preparedness and insurance measures. In terms of the four islands the communities in Saint Lucia and St. Vincent were slightly more prepared than the communities in Dominica and Grenada. Further research indicates that the level of preparation is very basic survival strategies rather than longer term risk reduction measures. Kapucu [25] observed that in Florida even when residents felt they were prepared they were not; this is because their preparations were so basic. At the family level there is even less actions taking place to prepare for adverse events. In terms of insurance very few of the participants have insurance and most have indicated that they lack the financial capacity to get insurance. Generally participants face a number of challenges both at the family as well as the community level which limits their ability to reduce vulnerability and build capacity. This includes low educational achievement, inadequately located and constructed housing, fragile livelihoods and either low paid or no paid unemployment. Table 3 provides a summary of the participant's level of preparedness.

People's concern for their own survival and wellbeing can result in the overexploitation of natural resources, social ills and a lack of interest in important issues such as hazards and climate change. This is linked to the level of awareness and education of people. Most participants have attained at least primary education but very few have gone beyond secondary level education. This is the common trend in three of the island communities except that in St Lucia.

| Island | Preparedness | | Family Emergency Plan | | Insurance | | |
|---|---|---|---|---|---|---|---|
| | Yes (%) | No (%) | Yes (%) | No ( %) | Yes (%) | No (%) | Don't Know (%) |
| Dominica | 41.8 | 58.2 | 17.3 | 82.7 | 10.2 | 82.2 | 7.7 |
| Grenada | 48.1 | 51.9 | 17.3 | 82.7 | 4.8 | 89.4 | 5.8 |
| St Lucia | 58.2 | 41.8 | 22.4 | 76.6 | 16.3 | 80.6 | 3.1 |
| St Vincent | 66.7 | 33.3 | 22.6 | 77.4 | 11.8 | 82.8 | 5.4 |

**Table 3: Preparedness measures, Family emergency plans and insurance, [20].**

The research found that factors affecting vulnerability differs at the national scale to that at the community scale. At the community level poverty can leave communities in a double bind which makes them more vulnerable. Firstly vulnerability at the community level is tied to people's socioeconomic conditions with little opportunities for improvements therefore keeping persons in a perpetual state of poverty [26]. This state of poverty results in communities that have strong internal bonds and little dependence on outside support. Secondly poverty forces people to develop their own coping strategies which are basic survival mechanisms. They simple manage but are no more in a better position to withstand future hazards. They are prepared to do whatever it takes to survive if hazards strike. This double bind of poverty resists opportunities for better DRR to be implemented as shown in Figure 1. As noted by Phillips and Fordham (2010) [27 conditions such as poverty limits what people can do and what they are willing to do to reduce risks.

Vulnerability is a complex issue which changes constantly and is affected by past and present circumstances and will affect present and future vulnerability. This research adopts Blakie et al (1994) [28 ] Pressure and Release (PAR) model to capture the complexity of the vulnerability of the Anglophone Windward islands as show in

Figure2. The root causes of their vulnerability are mainly driven by external sources such as globalisation and trade liberalisation. These factors pose a challenge especially for states that are dependent on a single crop such as bananas or fragile and limited productive sectors such as tourism. Past circumstances such as the colonial history of islands determined much of the land use and settlement pattern that developed even long after independence and are still evident today.

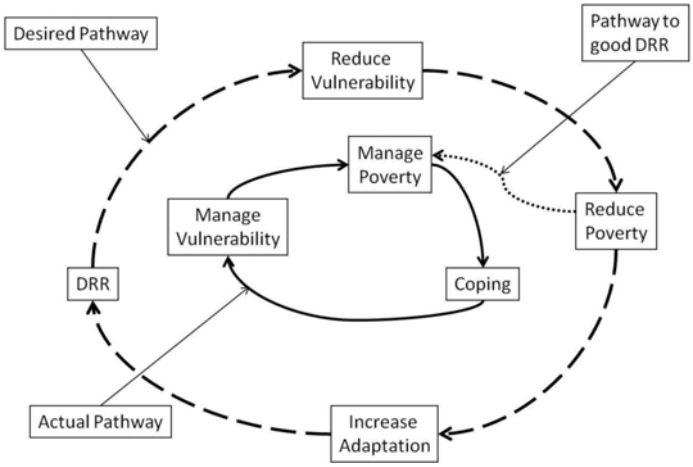


Figure 1: The double bind of poverty [26].

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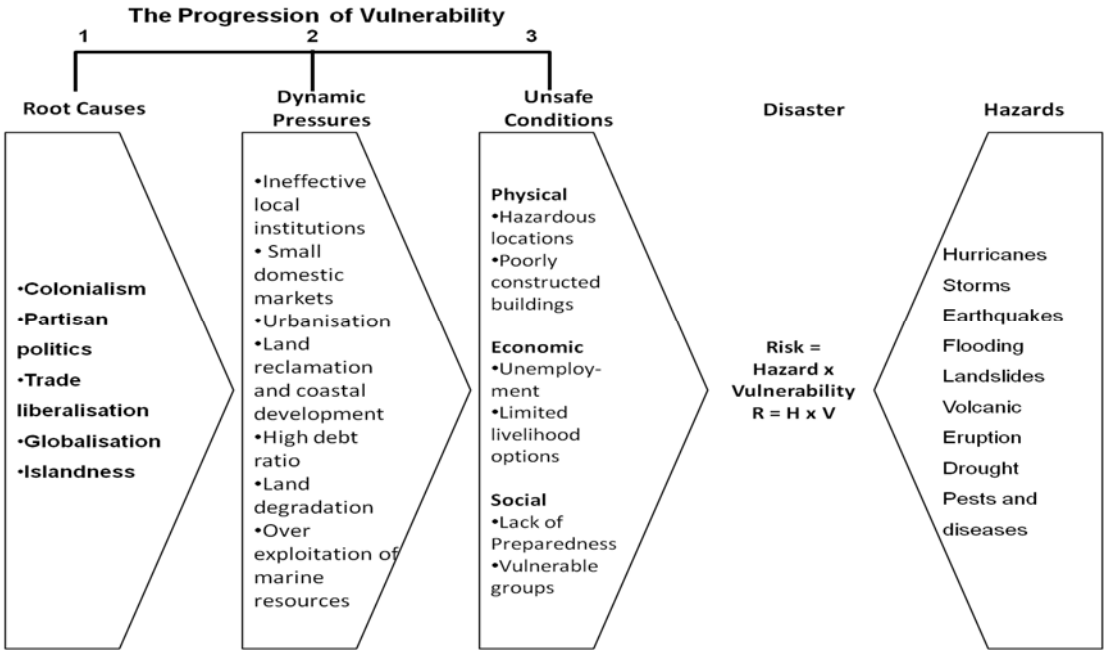


**Figure 2: PAR model of vulnerability in the Windward Islands, [20].**

The root causes of vulnerability influence the dynamic pressures which are evident at the national scale. These dynamic pressures further create economic, social and physical shortcomings. These shortcomings vary from community to community but contribute to the overall vulnerability of the island states. An assessment of these

conditions at the community level along with will help to build capacity, so that when hazards occur people would be able to cope, manage and recover in a timely manner. If communities are incapable of such response the result will escalate to a disaster.

### Community Capacity

The communities in the study can be a rich source of capacity for reducing risk and enhancing capacity but there is need for guidance and support from key stakeholders. These stakeholders include government, nongovernmental organisations (NGOs), community based organisations (CBOs), neighbouring communities, the academic and scientific communities as well as the private sector. There are a wide range of community organisations in the study areas ranging from faith based, health based, youth based, neighbourhood watch groups, environment related groups, farmer and fisher cooperatives and other development groups. Having a large number of these organisations in a community does not represent a rich capacity. Capacity is limited by a range of factors including the size of the group relative to their tasks, the ability to function effectively, and the level of organisation and internal dynamics of the group. These factors limit involvement of some people and the ability of the group to implement plans and programmes. The research found that established and well connected groups and organisations were more effective in working with communities than newly formed groups with little or no linkage. However the established groups sometimes face challenges such as financial and human resource deficiencies.

Notwithstanding the resource challenges, evidence of good practices indicates that community buy in, ownership and participation are instrumental to the success of efforts to reduce vulnerability and build capacity. In Soufriere, Saint Lucia the Community Disaster Emergency Response (CDRT) was instrumental in taking charge of the response after hurricane Tomas. The severely impacted community was cut off from the rest of the island for days but the newly formed group organised and managed shelters, conducted damage assessments, performed search and rescue and provide relief and social support to the community. The members of the team attributed their success to their training and preparations prior to the event. The Community Disaster Committee in Fancy, St Vincent was very proactive after hurricane Tomas by conducting assessment and passing the information to the national authority to ensure quick response to the needs of the affected residents. There is need for continuous vulnerability assessments and risk reduction and not one off processes that are not sustained beyond their project life.

The success of the Management of Slope Stability in Communities (MoSSiaC) was attributed to the empowerment of marginalised and vulnerable community to take ownership and implement slope stabilising mechanism with support of key stakeholders [28]. The project was conducted across the Eastern Caribbean with success being evident in the reduction of slope failures, proper drainage, model homes and further implementation in several countries and communities. People are adjusting their surroundings to take into consideration changing environmental conditions.

## Conclusion

Disaster lost, cost and population affected seem to be on the increase while disaster deaths except in major events seem to be on the decrease. This is due to a range of biophysical, socioeconomic and political factors. These challenges are further compounded by the inherent vulnerability of SIDS. Developing holistic measures to address the socioeconomic challenges of people will reduce vulnerability and build the capacity to natural hazards and climate change disasters. Programmes to address these challenges need to be embedded in the long term development plans and engage a wide range of stakeholders. This paper looked at the vulnerability of 4 communities to hazards and their capacity to cope and adapt to the hazards and climate change. The research showed that tropical weather systems such as hurricanes and storms is the most common hazard yet people

seem to live with the risk as very little long term measures are put in place to cope and adapt with adverse events. The risk of these systems is likely to pose greater challenges because of climate change.

Building capacity to hazards and climate change is most effective if communities are integrally involved in assessing risks and reducing vulnerability. Developing integrated strategies that address multiple problems can get to the core of the conditions of vulnerability is critical for enhancing community capacity. The greatest community capacity is the social relationships and network common in small closed knit communities including kinship ties. These relationships are important in supporting national assessments and promoting a bottom-up, pro-poor perspective that incorporates multiple sectors, local stakeholders, experiences and values, to determine appropriate Disaster Risk Reduction and climate responses.

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