Chapter 13.

Disaster Management

There have been many statements of commitment to strengthening capacity and arrangements for disaster management in the Caribbean region particularly in the wake of earlier major disasters such as Hurricane Hugo in 1989 and more recently Hurricanes Georges and Mitch in 1998. This commitment is reflected in regional initiatives such as the USAID-OAS Caribbean Disaster Management Project between 1995 and 1999 that provided many useful inputs into this study and the new UNDP/USAID/CDERA Comprehensive Disaster Management Project. Regional institutions such as CDB, CDERA, which was established by CARICOM in 1991, and the ECCB consulted in the course of the study also provide further evidence of that growing commitment. Funding agencies such as the World Bank, the EC and DFID are also seeking to support improved disaster management in the region.[81] Although the primary focus of this study is economic and financial, it was felt that the report would be incomplete without discussing briefly three disaster management issues which came up repeatedly in the course of the team's visit to Dominica and regional institutions in June 2000 and which concern:

- Institutional arrangements and the lack of an overall strategy for disaster reduction in Dominica;
- Information on hazard risks and public and private sector choices in risk management,
- Effective building and planning regulation for reducing disaster risks.

13.1 Institutional Arrangements for Disaster Management

The contrast between the near chaotic situation following Hurricane David in 1979, as described by many of those who were affected and then involved in relief and rehabilitation, and the current state of preparedness is a measure of the considerable progress that has been made in disaster management. Dominica has institutional arrangements and plans for disaster preparedness. These broadly reflect the evolution of disaster management thinking and practice within the region, influenced by experience in several hurricanes, and the training and technical cooperation provided at a regional level by CDERA , PAHO and other agency initiatives.

Disaster preparedness is organized within the Ministry of Communications, Works and Housing (MCWH). That arrangement brings most of the public sector's disaster mitigation and rehabilitation expenditure and preparedness under one ministry. However, this gives the role for national coordination to a line ministry and that may not enable disaster management policy issues to receive sufficiently high priority in overall economic planning and budgetary policy or the activities of other ministries. For example, seven months later, in June 2000, the government had still not prepared an overall assessment of the effects of Hurricane Lenny or a rehabilitation plan. Nor is it clear where responsibility lies for establishing needs and priorities and then ensuring that social assistance or support for rehabilitation is provided to affected groups.

The national Office of Disaster Management (ODM) is currently a small unit within the MCWH, headed by an Assistant National Disaster Coordinator, who carries out most responsibilities, as there is no National Disaster Coordinator, apart from the Permanent Secretary, MCWH. The unit is probably insufficiently staffed, as reflected in the implementation of the World Bank's disaster preparedness project. The considerable scope for strengthening the ODM is implied in the proposals for equipment and human resources in the various components of the project (See box 13.1).

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[81] For example the World Bank approved in 1998 a program to support rehabilitation and disaster preparedness in the OECS countries (see Box 13.1) and is seeking to develop insurance mechanisms for risk spreading (World Bank, 2000b). The EC has established a Disaster Preparedness (DIPECHO) program, based in the Dominican Republic and covering the region (CRED, 1997) DFID is currently reviewing ways to support strengthening of capacity and arrangements in both the independent Commonwealth Caribbean countries (Davis and Michael, forthcoming) and UK Caribbean Overseas Territories.

Box 13.1 World Bank OECS Emergency Recovery and Disaster Management Program

In 1998 the World Bank approved the first phase of US$23 79m of a three phase program of US$54.89m, combining IBRD and IDA credits in favor of the five members of the OECS, Dominica, Grenada, St Kitts-Nevis, St Lucia and St Vincent & the Grenadines (World Bank, 1998c). The Dominica component of Phase 1, with approximately equal IBRD and IDA contributions of US$2.5m each of total projected costs of 6 03m covers:

1 Physical prevention and mitigation measures, including a section of sea defense works, river control and flood damage reduction, road protection and shelters $4.12m

2. Strengthening emergency preparedness and response through the National Office of Disaster Management, the Meteorological Office and community based disaster management $1 22m

3. Institutional strengthening $0 17m

The project usefully contributes to the whole range of ways in which disaster management can be strengthened - to physical investment in mitigation, hardware, information systems and training. However, the project has been slow to implement, with both borrower and lender attributing delays to a range of institutional problems that have been identified by the joint Task Force of the Commonwealth Secretariat and the World Bank (2000) as characteristic of small state donor relationships. The Bank and other agencies are giving separate support to segments of the sea defenses program, in this case to the most southerly section between Soufrière and Scotts Head which accords with the Bank's priority for poverty reduction in use of IDA funds (See Section 6.5) This project and other segments have to be separately designed and tendered according to Bank and other donor such as CDB and DFID procedures Such an approach leads to overstretch for the GoCD's limited management capacity in the civil works area. The other sub-components involve officials without previous familiarity with Bank procedures for project management. An example of the delay is the island-wide emergency communications system under the preparedness subcomponent which was not in place for the beginning in July of the 2000 hurricane season. Slow progress is attributed to procedures and lack of management capacity on both sides dedicated to the project. Possible ways in which these problems could be addressed are suggested in Chapter 14

Dominica has a *National Disaster Plan* and multi-hazard plans updated in the last five years (GoCD, 1996a) In addition, following the volcanic alert in September 1998 a volcanic emergency preparedness plan was quickly drafted with support from CDERA, funded by DFID and drawing on experience in Montserrat (GoCD 1999b).These plans described in Box 14.2, suggest that disaster management policy has recently begun to recognize the need to include measures to sustain livelihoods and reduce economic impacts, but has not proceeded very far in giving concrete form to this thinking.

The *National Disaster Plan*, which was issued in 1996, is a substantial and detailed document, which is basically concerned with disaster preparedness It outlines the duties and responsibilities of various government civil and private organizations such that the country will be in a constant state of preparedness, that necessary precautions can be taken after warning of an imminent hazard, that immediate relief efforts are effective and that post-disaster restoration of essential services is as rapid as possible. In contrast, the Plan largely overlooks responsibilities with regard to long-term hazard mitigation and prevention, despite the foreword stating that the effects of Hurricane David 'could have been mitigated and that recovery would have been faster and more orderly if we had all been prepared' (GoCD, 1996b: 2). According to the Plan, each Government agency is also responsible for drawing up its own internal disaster manual but it is not clear to what extent this has actually been done. It also focuses on immediate and shorter term, primarily humanitarian, requirements

The Plan provides little guidance on measures to address the economic impacts of disasters and promote economic recovery after the event. The few notable exceptions where aspects of mitigation are addressed relate to the need for

hurricane proofing of buildings (p37) and for the protection of beaches and dive areas against pollution, including dispersed oil (pD1)

The Department of Local Government and Community Development and the Government Information Service are also tasked with arranging dissemination of information on disaster prevention, but the scope and nature of this material is not indicated.

Contained within the *National Disaster Plan,* is the volcanic evacuation plan, which includes amongst its objectives the development of the capability to enhance the effectiveness of mechanisms for the mitigation of the impact of geological disasters generated by volcanic activity but, again, there is no further indication of any specific measures that could be taken towards this end. The more recent *Volcanic Contingency Plan* (GoCD, 1999b) issued following seismic swarms in the latter part of 1998 again primarily focuses on preparedness, including contingency arrangements for evacuation of the population at risk. The eleven objectives of the plan include to 'reduce the potential loss of personal effects' and to 'assist the population to re-establish personal independence' (p7) in the event of an eruption. Importantly, this plan recognizes that economic impacts should be minimized and livelihoods sustained, but gives very limited consideration as to how this should be done The Ministry of Agriculture is assigned responsibility for developing a sectoral plan for the relocation and care of livestock in the hazard areas and for assisting relocated people in continuing agricultural related activities. There is, however, no mention of measures to protect non-capital assets (e.g. fishing equipment) that are important for sustaining livelihoods. The Plan also recognizes the adverse impact that an evacuation could have on the private sector and indicates that assistance has been offered to private sector organizations to develop plans specific to their requirements. It anticipates that 'these plans will focus attention on distribution services and the establishment of linkages with local and international agencies for the provision of emergency supplies' (p19).

Damage assessments

According to the 1996 *National Disaster Plan*, individual government departments are responsible for undertaking post-disaster damage assessments of impacts on sectors and sub-sectors within their jurisdiction. The Ministry of Finance is responsible for collecting and collating damage statistics and producing an overall assessment.

In practice, although sectoral damage assessments are undertaken, with individual departments producing reports relating to their particular areas of responsibility, an overall damage assessment report is not usually produced. Donors interested in supporting a particular aspect of relief or reconstruction then approach the relevant ministry Moreover, the Ministry of Finance's has not produced any assessment of the overall macro-economic impacts of a disaster, instead it has simply integrated sectoral reports into an overview document without any further analysis. There is also no systematic collation and archiving of sectoral and overall damage assessments for future reference

A notable exception was a report prepared following the three storms in 1995 by a task force composed of both public and private sector representatives under the coordination of the Ministry of Finance. This report included some analysis of the broader impact of the disasters on factors such as the level of unemployment, inflation, public sector finances, the balance of payments, and the commercial banking sector as well as on infrastructure and assets and productive sectors. However, it was prepared in October 1995, only a month after Hurricane Marilyn and was apparently not revised as the precise natural and scale of the impact of the disasters clarified. An overall assessment was produced following the 3 storms in 1995 with the assistance of the three major lending agencies (GoCD, 1995). Nothing comparable was produced after Hurricane Lenny in 1999 (See Annex Section A 4)

Risk assessment appears to be still in the early stages of development. Volcanic and seismic monitoring are considered more fully in section 13 2. The various CDMP project components draw attention to issues of vulnerability in the island's infrastructure (See Chapter 6) and also the failure in project design to make full use of the scientific information that is available, for example on landslide hazard (OAS, 1996b). Land use planning and building approval are not the responsibility of MCWH but of the Physical Planning Division within the Ministry of Agriculture, Environment and Planning (see below Section 13.3).

There appears to be relatively good inter-agency community organization and good NGO cooperation. Overall, there seems to be a good awareness of disaster issues, but that generalized concern and commitment has not been translated in to a coherent, overall strategy for disaster reduction. There is an annual cycle of preparedness linked to the hurricane season. But when disaster struck, as in November 1999, the organizational arrangements within government and the level of political support has not ensured that there was follow-through in key areas – a comprehensive, robust assessment of damage and social impacts; preparation and implementation of appropriate social assistance and rehabilitation measures for affected groups such as fishing households; and the preparation of a comprehensive rehabilitation plan including mitigation measures that had been shown to be necessary. The latter would also require extensive consultation with local stake-holders such as the private sector and NGOs, and then cooperation with regional bodies and potential funding agencies

The damage done by Hurricane Lenny drew attention again to the weaknesses of the island's sea defenses and limited progress made in implementing the sea defenses upgrading plan drawn up in 1990 (Mouchel, 1991) and revised in 1997 (Mouchel, 1997). Apart from the problem of funding, there appear to be have institutional problems impeding progress.

Experience in Dominica after Hurricane David and more recently in the region during and after hurricanes in 1998 and 1999 (Michael, 2000) and also the Montserrat volcanic emergency (Clay and others, 1999) suggests that a high-level inter-departmental task force would contribute to more effective disaster management both in a crisis and in planning for disaster reduction.

13.2 Natural Hazard Assessment and Monitoring

The environmental assessment of natural hazards poses particular difficulties for smaller developing countries. Hazard assessment and monitoring are naturally public goods The economies of scale in organizing scientific research and monitoring necessitate regional or international arrangements which can be combined with a focus at country level or a few key areas such as forestry where a multi-purpose capacity can be maintained. Concerns about exposure of an increasingly large capital stock resulting from economic development and of higher level risks from climatic change both highlight the need for increasing expenditure on hazard assessment and monitoring.

There are also institutional issues to be addressed in ensuring adequate support for monitoring. Scientific hazard monitoring and information dissemination have been organized in the Caribbean at a regional level in ways that reflect colonial history. For example, for seismic -volcanic monitoring, Dominica contributes to and relies on the Seismic Research Unit (SRU), based in Trinidad.[82] The islands of Martinique and Guadeloupe, between which Dominica is sandwiched, are part of the French national monitoring system, and are not part of the same seismic network. The US territories rely upon the US Geological Service. CDERA, which supports disaster preparedness and disseminates information is an organization confined to the former UK colonies and remaining UK Overseas Territories. The OAS, which supports disaster mitigation and loss reduction, does not include European overseas territories.

The SRU had successfully monitored volcanic alerts in the 1970s and 1980s and initiated risk assessment and risk mapping (Wadge, 1985) However, when a new volcanic alert began in September 1998, the monitoring arrangements were found to have been not properly maintained (SRU, 1998). Two of the four seismographs on Dominica were out of action The monitoring network had to be refurbished as well as enhanced to provide the appropriate level of seismic monitoring Through CDERA, the UK provided both equipment and technical assistance, suggesting that the SRU network was insufficiently funded to enable it to provide enhanced crisis monitoring without additional external support

[82] The SRU is an autonomous entity within the University of the West Indies, St Augustine Campus, Trinidad. It receives its core funding from Trinidad and Tobago, 20% from Barbados and 30% from 6 other countries, Antigua, Dominica, Montserrat, St Lucia, St Vincent, and St Kitts Additional funds are obtained from specific contracts such as that to provide seismic monitoring for Netherlands Overseas Territories (Clay and others, 1999)

The 1998-99 alert and the way it was handled (Box 13.2) raise the difficult but important issue of how scientific information should be disseminated to the wider public to ensure that both public and private sector institutions make rational decisions on natural hazard risk:

- What forms of information is it appropriate to make available to various stakeholder groups?
- How can scientific information be disseminated in an easily understandable form?
- How should scientific information be used and with what implications, bearing in mind that it will be probabilistic and so difficult to take into account?
- What role should scientists play in informing the general public and other stake-holders directly about natural hazard risk and uncertainty?

Box 13.2: Public Information And Hazard Risk : The 1998-1999 Volcanic Alert

The current practice in Dominica and other eastern Caribbean states is for the SRU monitoring seismic and volcanic hazards to report to government as their client. The government then decides when and in what form information should be made available to the general public or specific stakeholder groups. Concerns that influence decisions include minimizing risks to life and property and avoiding unnecessary damage to domestic and international investor confidence.

From September 1998 to April 1989 Dominica experienced a series of seismic swarms in the south of the island that could be precursory to an eruption and earth tremors were widely felt by the population. Little information was made available to the general public other than that contained in a GoCD *Volcanic Contingency Plan* (GoCD, 1999b) prepared in response to the crisis and an initial scientific assessment conducted by SRU (1998). There were preparedness exercises for a possible evacuation which could involve 11,500 persons in the event of an eruption in the Morne Pays Plat area (Area 1 in Map 2). However, the public have not been provided with further explanatory risk assessments, and risk-zoning maps, such as those in the Contingency Plan, have not been made widely available.

There has been considerable uncertainty about the precise nature and level of risk posed, how the crisis might evolve and appropriate responses. This resulted in a confused range of reactions. For example, some insurance companies apparently temporarily stopped taking on new business in the southern part of the island whilst a few did not renew existing (annual) policies. However, others continued to provide cover, in part reflecting concerns about their credibility and reputation. Some foreign-owned commercial banks were also reported to have suspended new lending operations temporarily in the immediately endangered area, but others were happy to step into the breach and seize any opportunity – even though temporarily reduced by the crisis - for increased business. The National Commercial Bank, in particular, took the view that as a local bank it was expected to take higher risks than foreign commercial banks. The National Development Foundation (see Box 9.1) also continued lending activities in the south, taking the view that should commercial banking operations halt, then it should continue its own operations, but endeavor to do this by securing grant assistance for on-lending. All banks have now resumed new lending operations conditional on insurance coverage remaining available.

The Dominica Association of Industry and Commerce (DAIC) and the DHTA took the initiative in requesting a briefing by SRU and then in drawing the attention of their members to the possible consequences of relocation from Roseau and the south of the island, or of the loss of facilities in the event of an eruption. The DAIC also issued a circular encouraging members to ensure that accounts were in order, titles and other valuable documents in an accessible, safe place and so forth. However, in acting thus, the DAIC was accused by the GoCD of overreacting and causing unnecessary concern. In the absence of the regular dissemination of updated information on volcanic risk, there was by mid 2000 a sense outside of government that the crisis had probably passed.

Following independence for many Caribbean states, wider regional arrangements for scientific research on strengthening disaster management are emerging under the auspices of OAS, in practice supported with international and US financial and human resources. These projects have played a role in enhancing scientific hazard assessment and monitoring. For example, concerns about sea level rise within the Caribbean Sea and the

absence of reliable benchmarks have highlighted the past lack of sea level and wave monitoring within the region. Dominica itself had no capacity to undertake such monitoring independently Consequently only qualitative assessments of the coastal sea conditions associated with the impact of individual storms up to Hurricane Lenny are available. To provide benchmarks for determining the effects of climate change, the OAS has launched a regional program for sea level monitoring supported by the Global Environment Facility(GEF).[83]

Hurricane David in particular gave impetus to environmental monitoring to provide the data for understanding the ecological effects of natural hazards on Dominica's forests and fauna. These investigations also depended substantially on external funding and human resources and that has posed problems of sustainability and ensuring that longer term ecological effects are monitored.

13.3 Building and Planning Regulation and Mitigation

Various estimates have been made of the cost of vulnerability reduction measures in the Caribbean and their expected return, highlighting the low costs of mitigation and thus the potentially considerable financial benefits of hazard proofing. For instance, the World Bank (2000b) reports that regional civil engineering experts have estimated that spending 1% of a structure's value on vulnerability reduction measures can reduce probable maximum loss from hurricanes by, on average, a third. As a further example, a CDMP study (Wason, 1998) of four infrastructure projects in the Caribbean that had failed due to the impact of natural disasters found that the additional costs required to mitigate the damage suffered by the four projects varied from less than 1% to under 12% of the original project cost. Similarly, OAS (1996a) cites a Barbados civil engineer who reported in 1995 that, after five years of involvement in designing and implementing structural vulnerability reduction measures (including retrofitting), he considered that many buildings could be made virtually invulnerable to Category 3 hurricanes at a cost equivalent to only 1-2 years' insurance premiums.

However, despite various initiatives to establish one, there is currently no formal Building Code in Dominica. During the 1980s, the GoCD received technical support from the Commonwealth Fund for Technical Cooperation to assist in the development of a building code (CCA, 1991), but no such code was apparently produced. At a regional level, a Caribbean Unified Building Code (CUBiC), which was drawn up with support from USAID and CARICOM and finalized in 1985, was also developed with the intention that it would be adopted by Caribbean governments (Poncelet, 1997) The Code was, indeed, subsequently developed into useable codes in several nations, but typically without any effective enforcement practices (World Bank, 2000b), and not in Dominica. A more recent model building code drawn up with Habitat and CDMP support, and intended for application by all OECS states is awaiting approval by the Dominica Parliament

In the absence of any formal building codes, the GoCD's Physical Planning Division - which has responsibility for land use change and development and for the enforcement of building codes - reviews plans for individual buildings, including with regard to their strength against hurricanes.[84] However, it was suggested during the course of this study that site supervision from the Planning Division could be improved as, although the building profession receives basic training, shortcuts are often taken to reduce costs.

Land use planning is also weak, with detailed physical plans apparently only having been prepared for selected urban and industrial areas, whilst a countrywide land use plan is not available. Moreover, according to CCA (1991), the Physical Planning Division has only limited control over broader planning and regulatory aspects of major development projects and programs and is not necessarily consulted about their location, including with regard to environmental and land suitability issues. Similarly, detailed hazard risk mapping of the island has not been undertaken.

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[83] Monitoring units have been installed, one in each participating country Such a project raises problems of sustainability, so trust funds of US$50,000 has been agreed for the maintenance of each unit. In light of damage suffered by some units during Hurricane Lenny, further expenditure will also be required to improve storm resistance (information derived from www.*cpacc org*) .

[84] Some foreign-owned commercial buildings are built to standards specified by the owner company concerned.

Complete data are not available on the extent of vulnerability of the island's infrastructure to tropical storms. However, the CDMP has completed a probable maximum loss (PML) study of hurricane vulnerability in three islands including Dominica, covering airports and runways, electricity generation, utility and high voltage poles, health service buildings, public buildings, schools and colleges, ports and wharves, main road networks, waste management sites and refuse collection (OAS, 1999). The PML, defined as an estimate of the monetary loss expressed as a percentage of total value experienced by a collection of structures, their contents and equipment, when subjected to a maximum credible event, was estimated at 64% for a hurricane event of 119 mph, based on a mean return period of 50 years and a 90% prediction limit, suggesting significant vulnerability.[85] Further evidence of high structural vulnerability is provided by the 1991 census, which found that some 22% of the island's housing stock was sub-standard, needing replacement, and 72% not in good condition (CCA, 1991). The ODM (GoCD, 1999b) also reports that the typical construction method in use implies that the majority of houses in Dominica are not resistant to earthquakes. Meanwhile, OAS (1996a) reports that small builders and contractors in the Caribbean construct much of the housing, with little attention to or awareness of appropriate standards for structures and materials. Suite (1996: 266-267) additionally states that 'as if in defiance, new houses in the region continue to be built without adequate fastening of roofs to walls. The present engineering practice, with respect to dwellings, has not demonstrated much benefit from the collective but unfortunate experience of the region'. The World Bank (2000b: 45) attributes limited progress on retrofitting in the Caribbean generally primarily to 'lack of incentives and concerted leadership in the promotion of benefit features and practices'.[86] In the case of Dominica, limited availability of flat land also forces developments into coastal areas and hillsides, again increasing hazard vulnerability of buildings.

[85] This figure was much higher than those estimated for two other island states that were also examined as part of the same study, Saint Lucia and Saint Kitts and Nevis

[86] In the context of Saint Kitts and Nevis, ECLAC/ECCB (1998) reports that the lack of quality control and monitoring in the construction industry was very evident in terms of the number of walls that 'just disintegrated' as a consequence of the high winds experienced during Hurricane Georges, reflecting poor reinforcement and low quality of bricks.

Chapter 14.

Conclusions and Policy Implications

This study has demonstrated how many aspects of the Dominica economy, with perhaps the notable exception of offshore financial services, are vulnerable to tropical storms and hurricanes. It has been relatively easy to highlight their impact on short-term annual fluctuations in macroeconomic and agricultural performance, particularly the devastating impact of Hurricane David. However, it has been far more challenging to assess their impact on longer-term growth and their implications for sustainable development. Such effects would be felt, most fundamentally, via their impact on the pace of capital accumulation, in turn tied to opportunity costs in terms of the use of both public and private investment resources and savings.

In analysing the economic and financial impacts of disasters in Dominica, five key issues have emerged, which are discussed in further detail below:

- the changing nature and uncertainties of natural hazards,
- the dynamic nature of the economy's hazard vulnerability;
- the emphasis which has been placed on rapid post-disaster recovery rather than longer-term vulnerability reduction;
- the tensions associated with decision making in a capital-scarce economy and the related importance of comprehensive economic and financial analysis, and
- inadequacies relating to hazard risk information and broader disaster management.

Many of the findings of the case study are intuitive, even obvious. However, this is the first time that the evidence for Dominica has been brought together, analysed and used to draw policy implications. Such detailed analysis is also of wider importance in testing widespread assertions about the economy-wide significance of natural disasters in hazard prone countries across the world and the problems they pose for long-term development.

A wider purpose of the whole study is to explore the usefulness of economic analysis in informing disaster management policy. Therefore these conclusions also review what has been learnt in this country study. The method of investigation adopted has been primarily empirical. The available evidence on natural hazards and their impacts has been examined through a series of complementary, sometimes highly disaggregated, analyses. Different forms of analysis have been used in an eclectic way – as the available evidence permits – involving visual inspection of time series statistics sometimes combined with more formal regression analysis to quantify apparent relationships. This has been complemented by a separate review of individual natural disasters, based on available written documentation and qualitative evidence from interviews with some of those directly involved at the time, including several still in positions of responsibility in government and civil society in Dominica. An important consideration in this approach has been only to do what can be replicated relatively easily in another developing country.

What conclusions are to be derived from this extended and perhaps sometimes repetitious series of investigations at economy wide, sectoral and sub-sectoral levels? What kind of 'model' is emerging of the way in which natural disasters impact on a small Caribbean island economy? Do findings reconfirm existing approaches to managing and reducing natural hazard vulnerability or are there possible 'gaps'? Does such a detailed investigation help to refine or redefine our appreciation of the ways in which economic analysis can better contribute to understanding and reducing the negative effects of natural hazards?

14.1 Natural Hazard Risks And Uncertainty

Perceptions of natural hazard risk depend in part on recent experience. New experience combined with incomplete, but changing, objective information about complicated processes in determining and expressing levels of risk, imply

that reported levels of hazard risk are constantly being adjusted Thus there is considerable uncertainty relating even to underlying natural hazard risks, both in Dominica and elsewhere.

Tropical storms and hurricanes are the most common natural hazard in the Caribbean, causing enormous physical damage and socio-economic disruption Considerable progress has been made in the formal assessment of risks – from historical data and through increasingly sophisticated modeling. The 'normal' model presupposes that physical damage is expected to be a function of the *intensity* of the storm and its *proximity* to the at-risk place or island. These relationships are also expected to be non-linear, as is implicit in the storm and hurricane categories – for example, this is illustrated by contrasting the effects of Tropical Storm Debbie or Iris with Hurricane Category 1 Marilyn and Category 4 David (Table A2.1). However, as the most recent extreme event that affected Dominica, Hurricane Lenny, shows, these underlying assumptions about storms and their likely physical impacts may need to be re-examined. Dominica and neighboring Guadeloupe and Martinique suffered coastal damage equivalent to what might have been expected from a close encounter with a Category 4 hurricane as this 'unprecedented' storm tracked west to east, some 150 miles to the north of Dominica (Map 3). Yet such a storm was too distant to be included in the hurricane frequency statistical analysis reported in Annex A.3 and created difficulties for meteorologists in predicting from their models how Lenny would develop and in providing hazard warnings. The variable timing of occurrence of a storm creates additional uncertainty. For example, the lateness of Lenny may have implied that its impact on the tourist industry was more severe, allowing little time to rehabilitate facilities before the main winter season began.

Landslides introduce additional uncertainties that physical development planning should take into account. A small economy has no redundancy in its lifeline infrastructure Thus, if even a small section is damaged as a consequence of a landslide, it can have island-wide implications There are considerable pressures to develop the apparently most financially attractive locations of the island without due regard to natural hazards and also to minimize initial investment costs. The Layou River landslide (Map 2) was not anticipated, but fortunately it affected an area in which damage to infrastructure, housing and commercial assets was limited. How should landslide risk assessments be built into physical planning approvals?

The recent *volcanic alert* and similar episodes over the past 30 years have shown how difficult it is to assign probabilities within a typical physical planning horizon of 25-30 years to the likelihood of perhaps a 100 or even a 400 year eruption event, such as those that have occurred since 1971 in St Vincent, Guadeloupe and Montserrat. Should Dominica's government adopt a "precautionary principle" of avoiding public sector and discouraging private sector development in that area of the island where scientists might assign a significant risk of an eruption within the next 100 years? Such a policy could imply no substantial development of public infrastructure and utilities beyond those for distribution to consumers and discourage some forms of private development in Area 1, the region of the island identified in the 1999 preparedness plan (Map 2) as currently thought to be the highest risk zone.

The risk of a severe or even catastrophic *earthquake* is probably very small, but this is currently another area of uncertainty and there is a lack of public information. The more precise assessment of seismic hazard risk is likely to have implications for building codes and construction practices for private and public buildings and other key infrastructure.

Finally, *climatic change* is a further complicating factor that is widely thought to be altering the whole distribution of risks associated with meteorological and sea-related hazards.

14.2 Dynamic Nature of Vulnerability

This study has highlighted the dynamic nature of hazard vulnerability, relating both to changing levels of development and capital investment in the island and also to the structure and composition of economic activity As indicated above, in the longer term scientific research suggests that climatic change may also increase the underlying level of hazard risks themselves, with further implications for the scale and nature of vulnerability

In the past, as a colonial plantation cum subsistence economy, the impact of disasters was heavily dependent on the vulnerability of the prevailing export crop and the associated structure of production and marketing. In the first half of the twentieth century, limes were the dominant crop. Limes are relatively insensitive to high winds, and were grown on plantations owned by UK-based companies who were able to absorb intermittent losses and associated recovery costs from operations within a particular country. This effectively acted as a geographical risk-spreading mechanism. Meanwhile, small-scale farmers produced much of the island's food as 'ground provisions'. From the 1950s, banana production under smallholder cultivation progressively displaced plantation agriculture, increasing the overall hazard vulnerability of the agricultural sector. Bananas are highly sensitive to wind damage and smallholders were also less able to bear heavy losses, implying increased vulnerability in both the type and the structure of production.

Hurricane David demonstrated that vulnerability, but also increased the share of bananas in total agricultural output, as banana cultivation offered a fast, low-investment means of restoring agricultural livelihoods in an assured export market. The compulsory WINCROP banana crop insurance scheme, introduced in 1987-88, also provided partial financial protection. The rapid recovery in export production and earnings after Hurricane Hugo in 1989 demonstrated the resilience of the banana economy.

In the 1990s, banana production declined with falling real prices and the loss of guaranteed preferential access to the European market, again changing the economy's hazard vulnerability. To some extent, the fall in banana production was a positive development, reducing the potential scale of agricultural losses in the event of a disaster. However, a more diversified agricultural sector will also be less secure because the WINCROP scheme only covers bananas and other crops lack an assured domestic or export market. Thus, a future disaster could be associated with a higher rate of default on agricultural loans, increased demand for credit and slower post-disaster recovery

The economy's hazard vulnerability has also changed over the past two decades because of a shift in its broader composition, accelerated by the WTO process. Agriculture's share of GDP halved to only 19% between 1977 and 1997, while manufacturing, tourism and financial services became increasingly significant These latter sectors are less sensitive to all except a catastrophic event, such as Hurricane David, implying a reduction in the island's broader economic vulnerability. If the country's recent expansion into international financial services proves successful then a further decline in broad economic vulnerability can be anticipated in the future.

Development of the island's key infrastructure and the road system provides another example of changing long-term hazard vulnerability, in this case linked to Dominica's level of development rather than structure and composition of economic activity. Until the 1950s, sea transport was the primary form of intra-island movement, implying rapid recovery of the transport network in the aftermath of a storm, assuming that boats suffered little damage. The more recent emergence of road transport as the major form of transport, coupled with the fact that Dominica has a mountainous terrain, forcing much of the road network along the coastline, has effectively exacerbated the impact of storms, both in terms of direct and indirect effects. The scale of physical damage to the transport network is now potentially far more severe and the pace of recovery much slower, with knock-on implications for the movement of goods and people. Increasing vulnerability of this nature can have extreme consequences in a country such as Dominica, with limited capital resources relative to demand and thus a tendency to select least-cost solutions, a vulnerability first exposed by Hurricane David The subsequent slow and uneven progress towards the effective protection of roads and the rest of the islands key infrastructure is shown by the coastal damage caused by Hurricane Lenny (see below).

The changing character of hazard vulnerability of the Dominica economy over time was sharply captured by the fact that a number of those interviewed during the course of this study stated that the impact of Hurricane David was in part so severe because the island had not experienced a hurricane for 40 years and thus that everyone was caught unaware. Yet ,whilst Dominica had not experienced a Category 4 hurricane since 1930, meteorological records show that there had, in fact, been a number of less severe storms (Annex A.2-A.3). Instead, it would appear that the changing nature of, and apparent rise in, the island's hazard vulnerability had not fully impinged on perceptions of risk. Similarly, periods of drought have been increasingly reported in the first months of the year – that is, in the dry

season. This phenomenon probably reflects both wider and more intensive banana cultivation, rather than long-term changes in rainfall.

There is apparently a widespread perception after several disastrous hurricanes, and even disaster elsewhere (e.g. Montserrat), that there is increasing hazard risk. However, that increase in risk is often seen as the consequence of exogenous forces, climatic change or geophysical processes – that is, factors which cannot be controlled or influenced. In reality, as this study has highlighted, the level and nature of hazard vulnerability is also critical. Moreover, a particular level or form of hazard vulnerability is not inevitable. Some sectors and sub-sectors are more hazard vulnerable than others whilst measures can be taken to reduce structural vulnerability. The latter may imply an increase in initial investment costs but can prove cost-effective in the longer term. Thus, detailed and comprehensive medium- and long-term economic and financial analysis and planning should take into account hazard risks. This could reduce substantially the Dominica economy's hazard vulnerability and thus contribute to sustainable growth.

14.3 Economic Policy Choices in Disaster Management

Mitigation versus rapid recovery

In the immediate aftermath of a disaster, there are some inevitable choices for both government and the private sector that need to be made between the pursuit of rapid recovery and a reduction in longer-term hazard vulnerability. In Dominica, effectively by default, the emphasis has been placed more on rapid recovery because the political impetus and associated financial incentives for change have been insufficiently strong. Two examples illustrate this.

First, Dominica's agricultural sector is currently unable to satisfy the relatively assured domestic demand for copra from the island's largest manufacturer, DCP. Coconuts are also relatively insensitive to hurricanes and moisture stress. But it can take four to six years for a new tree to produce commercially whilst newly planted bananas can bear fruit in as little as six months. Thus, in the aftermath of hurricanes, farmers have opted to replant bananas and even switch into bananas, rather than to cultivate less hazard-prone coconut trees.

As a second example, a high proportion of temporary housing sited without planning approval and repairs undertaken in the immediate aftermath of hurricanes has become semi-permanent, in part due to funding constraints. Such practices potentially imply deterioration in the housing stock and increased vulnerability to future hazards.

The opportunities presented during periods of post-disaster rehabilitation to reduce longer-term hazard vulnerability need to be grasped. This is an issue that the government, the people and the donor community should address.

Decision-making in a capital-scarce economy

The study has highlighted the tension caused by the wide range of demands made on public finance, including for funding to reduce physical vulnerability to disasters (in the form of both initial capital investment and maintenance resources). For example, Hurricane Lenny in 1999 exposed the inadequacies of sea defenses and the considerable vulnerability of the road network and other infrastructure along the coast, 20 years after Hurricane David also inflicted severe damage and almost a decade after the first comprehensive sea defense protection plan was completed (Mouchel, 1991). Such tensions are particularly acute in small economies such as Dominica's, with relatively high per capita infrastructure needs, in turn due to diseconomies of small scale and the island's relatively scattered population, combined with a difficult and mountainous terrain. Moreover, the problem has been exacerbated by a lack of long-term planning, quite apart from the incorporation of hazard risk information into this process.

The study points to the need for improved information on the budgetary impact of disasters in order both to facilitate cost-effective allocation of resources and also to emphasize the importance of integrating hazard risk reduction concerns into medium- and long-term economic and financial planning. Improved information on the impact of disasters on individual

investments is also required to facilitate the adoption of appropriate mitigation measures in the design of new projects. Such information would be of benefit to donors as well, who finance a substantial part of public investment in Dominica.

The GoCD (2000) identifies two issues of particular relevance in seeking to establish sustainable growth and alignment with the liberalized global market: first, the strengthening of macroeconomic fundamentals, particularly the structure of the fiscal and external accounts, and, second, the need to expedite the establishment of the infrastructure required to support the expansion of private investment. Such goals are unlikely to be attained without improved hazard risk management. However, an integrated approach to national development planning, including between economic and physical planning operations, has also been announced as one of the government's medium-term objectives. This offers an important opportunity to incorporate natural disaster risk reduction into future planning

Dominica currently has no comprehensive strategy for hazard vulnerability reduction. The damage done by Hurricane Lenny drew attention again to the weaknesses of the island's sea defenses and limited progress made in implementing the sea defenses upgrading plan drawn up in 1990 and revised in 1997 (Mouchel, 1997). Apart from the obvious problem of funding, there appear to be have institutional problems impeding progress. Experience in Dominica after Hurricane David and more recently in the region, during and after hurricanes in 1998 and 1999 (Michael, 2000) and also the Montserrat volcanic emergency (Clay and others, 1999) suggests that a high-level inter-departmental task force would contribute to more effective disaster management both in a crisis and in planning for disaster reduction.

There has been little analysis of the nature of vulnerability of the island's economy, at least in part reflecting a perception that although Dominica is highly hazard prone, there is little that can be done to reduce its vulnerability. The country has yet even to approve a building code, whilst land use is not based on detailed risk mapping. Moreover, the potential power of insurance as a mechanism for promoting reduced infrastructure vulnerability has yet to be harnessed

14.4 Natural Hazard Information and Risk Management

Inevitably, perceptions of risk play a major role in determining economic actions Perceptions, in turn, shift in an environment of changing vulnerability, as already noted. It is critically important to ensure that perceptions of risk closely approximate levels of objective risk. In Dominica, there has been some recent evidence of increased risk aversion, as displayed, for example, by certain banking institutions. However, the levels and forms of hazard risk information available have been inappropriate, hindering both financial service providers and other actors from taking appropriate risk-averting decisions. A case in point is volcanic risk (Box 14.2).

The World Bank's (1998c) disaster management project and previous projects have included a risk-mapping component. However, as of mid-2000, there appeared to have been little progress in implementation, at least in Dominica. The attitude of aid agencies towards risk mapping also varies widely, with some dismissing landslide risk mapping as an 'academic preoccupation.'

Two issues that urgently need to be addressed are how to ensure sufficient investment in hazard risk mapping, monitoring, assessment and dissemination and to ensure that the information is provided in an easily understood and usable form. Ensuring such investment is particularly difficult in a small island economy, due to related economies of scale and because hazard monitoring and assessment are public goods. These issues require sustainable regional solutions, in turn posing questions relating to funding, human resources and political commitment to co-operation.

The Task Forceof the Commonwealth Secretariat/World Bank (2000) on small states draws attention to the role of good quality and widely disseminated public information in providing a more rational basis for business decisions. Information and consultation on its implications is necessary to ensure that civil society, embracing both commercial and non-profit voluntary organizations, plays its part in the evolution of public policy on natural hazards.

14.5 Economic Analysis of Natural Disasters

The cumulative implication of the economy-wide and sectoral analyses undertaken in this study is that Dominica's economy is highly sensitive in the short term to natural disaster shocks. The short-term impacts of these shocks are visible in national income statistics, trade, physical measures of production and social sector indicators. The value of more formal analysis has been to quantify the effects of the most extreme events and to show that some of the possible effects cannot be detected.

The use of regression analysis is relatively straightforward but highly context specific. The variables introduced to "quantify" the effects of natural disaster shocks - hurricane event dummies and producer prices for bananas - provide a significant level of explanation. However, when, as a test of specificity, the same variables were included in an analysis of the performance of the economy of St Lucia, the other large Windward island banana producer, hardly any of the variability in growth rates of the economy or agricultural sector was explained. However, it would be relatively simple to undertake a similar analysis for other eastern Caribbean economies incorporating a more appropriate set of explanatory variables.

Some of the effects of shocks are probably lost in economic assessments by confining the analysis to annual national income statistics that are readily available for almost all countries. This study also found that far better fit equations were obtained using quarterly rather than annual data

The study has not attempted to estimate the longer-term impact of disaster shocks and related uncertainty on economic performance. Such figures could be very useful in impelling governments and donors into action However, they would, at best be very rough approximates.

Estimates of long-term impacts could be derived in a variety of ways but each has its drawbacks First, a simple auto - regressive model of annual rates of growth could be developed, incorporating disaster dummies as an explanatory variable and then using the model to calculate long-term rate of growth that would have been achieved under a no disaster scenario (that is, setting the dummy variables to 0). Such an exercise was undertaken in an earlier study of Fiji (Benson, 1997a), suggesting that in the absence of a succession of natural disasters Fiji could have doubled its average annual real growth rate, achieving an average of 4 8%, rather than 2 4%, per annum. However, precisely because it was so crude, the model may exaggerate the growth effects of disaster reduction

Others have explored the long-term impact of disasters by modeling economic growth as a function of the rate of growth of the capital stock and then considering the implications of disaster-related capital losses (e.g., MacKellar and others, 1999). However, such models presuppose that the principal disaster-related losses occur to productive infrastructure In reality, in the case of Dominica the relative proportion of fixed capital stock in total losses can vary significantly between disasters while non-capital losses also have potential long term implications. Non-capital losses would also need to be taken into account, pointing the direction towards general equilibrium (CGE) modeling.

CGE modeling, in turn, again entails certain difficulties, this time relating precisely to the shift away from simplistic assumptions to an attempt to emulate an economy more fully. The complexity of impact of a disaster, often affecting virtually every aspect of the economy in the case of small nations, creates difficulties in designing appropriate general equilibrium models with valid underlying behavioral assumptions. There are additional difficulties relating to the relatively rapid structural changes which small open economies such as Dominica's commonly experience and which would also need to be taken into account in any model.

14.6 Wider Implications for Small State Economies[87]

"The Caribbean will be expected to successfully carry out over a period of ten years a process of liberalisation which has taken the advanced economies over fifty years to master." (Owen Arthur, Prime Minister of Barbados, quoted in Commonwealth Secretariat/World Bank, 2000)

This study has shown just how quickly the vulnerability of an economy can alter in a small economy. The sources of change are structural, occurring within the economy that is being driven by exogenous forcing mechanisms – technological development, (most uncertain) climatic change and the WTO process. The latter source of change underlines the conclusion of this study that there is nothing inevitable about the extent of vulnerability or that it will simply decline as a consequence of economic development. What then are the likely areas in which there would be substantial value added from improved disaster management, leading to the promotion of sustainable development of Dominica and other small island states?

Vulnerability indicators

Work undertaken by the Commonwealth Secretariat and others has done much to identify subgroups of smaller highly vulnerable states (Commonwealth Secretariat/World Bank, 2000). Various indices have been developed based on a (sometimes weighted) range of components capturing different aspects of vulnerability, including that relating to natural hazards/disasters (see Box 4.1). However, as this study and our earlier research shows, the various groups of small states according to this form of categorization are themselves characterized by considerable diversity. First, their economies are typically dominated by a few activities, reflecting the theory of comparative advantage. Second, much depends on issues of governance and the effects of very specific historical developments – contrast Dominica, Fiji and Montserrat.

Vulnerability indicators themselves are based on statistics over relatively short periods of time. Yet country circumstances change very quickly, implying that the specifics of vulnerability are highly dynamic. Thus, frequently revised data are required if the indicators are intended to reflect the dynamics of the economy. Practically, this lapse of time means that the indicators are insufficiently sensitive to changes and important subtleties of the situation.

In the specific case of natural hazard or disaster related measures of vulnerability, the way vulnerability has been measured has varied between studies, basically reflecting poor data on the impacts of disasters as well as the complexity of factors determining hazard vulnerability. The results indicate the sensitivity of the relative ranking of countries to the indicator chosen and the period of time over which data are taken to calibrate the indicator.

In conclusion, whilst vulnerability indices may be useful for certain purposes, the results should be treated as very approximate and not used in isolation to determine allocations of mitigation resources or the extent of need for improved disaster management.

Disaster mitigation

In considering appropriate forms of disaster mitigation, it is important to look at the physiography of a small state which underlies the economy and society. Such factors differentiate volcanic, mountainous and wet Dominica and Montserrat from Antigua or Fiji in terms of infrastructure at risk to hurricanes or landslides. Predominant forms of economic activity– bananas, coconuts, sugar, tourism and so forth - have also been influenced by historical legacies whilst certain more recent events have also made a heavy footprint. The dynamics of the economy must be considered. The analyses undertaken in this study reconfirm the substantial value added in disaster mitigation investment. More specifically, areas of investment that will generate high social returns and help facilitate long-term sustainable development by buffering medium-term growth from the effects of disaster shocks should be pursued. The facilitation of appropriate investments by the private sector is a particular challenge. However, a first step in this direction could be achieved by encouraging and supporting the

[87] The authors draw in this section on their earlier investigations of two other small island economies, Fiji and Montserrat (Benson, 1997a, Clay and others, 1999)

private sector in enhancing their hazard risk awareness and adopting appropriate risk management tools, both structural and non-structural.

Stable macro-economy

A current extremely difficult issue facing many small states is the adjustment to the WTO regime, with the loss of preferential access to EU markets, in particular, and advantages under the Multi-Fibre Agreement. The recent task force report by the Commonwealth Secretariat and World Bank (2000: para 74) makes the argument that, since it is unknown in a general sense or even more specifically at a country level what new activities are likely to succeed, investing in the quality and robustness of lifeline and social infrastructure makes sense as a financial strategy. The rapidity of this enforced process of adjustment is illustrated by the recent sharp decline in Dominica banana exports, and hazard events show how disruption to economic activity, as in 1995 and 1999, and uncertainty, as in the 1998-9 volcanic alert, carry the additional risk of undermining this process.

Financial risk spreading mechanisms

The insurance industry is relatively well developed in the Caribbean but the role of catastrophe insurance in spreading and reducing risk could be enhanced significantly. The cost of insurance is high and volatile, resulting in significant under-insurance. There has been little use of insurance as a tool for promoting hazard mitigation. Moreover, there are fundamental concerns about the efficiency and underlying strength of the insurance industry, relating to the proliferation of property and casualty insurance players in the Caribbean. Insurance legislation drafted by the ECCB aimed at strengthening the industry should be approved by member country legislative bodies as a matter of urgency.

Uptake of business interruption cover as well as property insurance has been low. Businesses have often made inefficient choices in arranging cover in part because of the limited information available to them and lack of competition as well as high costs. Business community organizations could play a potentially beneficial role in this regard, by acting as a conduit for the dissemination of information and providing training in risk spreading techniques

The only form of agricultural insurance has been provided by WINCROP, covering bananas (see Box 6.1). This scheme has been relatively successful in transferring risks from growers to the insurance market This is because (inter alia).

- there is a well defined client group of growers for export through the DBMC;
- premiums are easy to collect at low cost, via automatic deductions from DBMC payments to growers;
- damage assessment is relatively simple and reliable– a visual sample survey of plants combined with average sales over the past 3 years;
- the scheme is not too ambitious, providing cover of around 20% of damage; and
- the organization, a company owned by marketing boards, makes reinsurance easier.

The scheme has several of the advantages of earlier dedicated export commodity reserve schemes without the disadvantages of inter-year storage or intervention in markets. Even so it is vulnerable to draw down of reserves because risk is not sufficiently spread – including only four islands that can all be affected in one or two years, as in 1994-95. Moreover, something similar is needed for the highly vulnerable agricultural small-scale natural resource sector groups, such as fisheries, vegetable, fruit and ground provision growers and hucksters. Indeed, this need is becoming increasingly urgent with the declining importance of bananas. However, some of the conditions for success are difficult to replicate.

The Small States Task Force is also critical of the role of international and bilateral agencies. There are many agencies working in parallel in the Caribbean region, and they too encounter problems of coherence and overstretch in their relationships with several small states. The establishment of an Eastern Caribbean donor group in Barbados, including the UN agencies and bilateral donors, is therefore potentially an important development It can bring more coherence to support for post-disaster relief and rehabilitation and to planning for disaster reduction. Within such a grouping, possible ways of supporting the strengthening of disaster management in a small state like Dominica include:

- joint donor support for a disaster mitigation program with substantial capital costs instead of parallel projectized funding minimizing duplication of arrangements that increase recipient/lender transaction costs,
- government and donors agreeing a lead donor agency for support and supervision of a project reducing overstretch in contributing agency personnel working with several small states;
- supporting regional solutions whenever possible on a sustained medium - and longer-term rather than short-term basis, delegating responsibility to a lead agency in the region and where appropriate a lead contractor, again minimizing transaction costs and providing continuity in support, and
- exploring ways within existing procedures that minimize micro-management of small project components at a country level.