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Foreignness as a constraint on learning: The impact of migrants on disaster resilience in small islands

EMMA L. TOMPKINS^{1,*}, LISA-ANN HURLSTON² AND WOUTER POORTINGA³

¹Sustainability Research Institute, School of Earth and Environment, University of Leeds, Leeds, LS2 9JT, UK

²Sustainable Development Unit, Cayman Islands Government Department of Environment, P.O. Box 489, Grand Cayman KY1-1106, Cayman Islands, BWI

³Welsh School of Architecture, Bute Building, King Edward VII Avenue, Cardiff, CF10 3NB, Wales

Knowledge about natural hazard management has increased significantly since Gilbert White's seminal research in 1945, yet people are still badly affected by natural hazards. A key question remains in natural hazards research: why, when all the conditions for effective disaster risk reduction are in place, do some people not take action to reduce their risk of harm? Through a questionnaire-based study we investigated the motivating factors that led residents of the Cayman Islands to prepare for annual tropical cyclones (hurricanes). Factors that increase the likelihood of individuals preparing for hurricanes are: previous experience of major storms, having linking networks and ties, having a child under the age of 15 in the home, and residency status – expatriate residents are less likely to prepare. Factors that appear to prevent adaptive behaviour include: living close to or adjacent to the coast, recent migration to the islands, and living in rented accommodation. The findings of the survey confirm that even within societies that are well prepared for tropical cyclones, there are still sub-groups who do not engage with the preparedness process. In the case of the Cayman Islands, new migrants are the most vulnerable to tropical cyclones as they tend to fall into the demographic groups least likely to prepare for cyclones, live in locations with high levels of exposure to cyclone impacts, and interact mostly with other expatriates with no previous experience of cyclone impacts. As climate change promises to bring an increasing intensity of tropical cyclones, these findings have relevance for all islands which draw on migrant workers to support economic growth.

Keywords: Caribbean; climate change; expatriates; hurricane; learning; migrants; migration; motivation; networks; principal component analysis; tropical cyclone

1. Introduction

Understanding how people prepare for and respond to weather hazards is an area of increasing interest as climate change threatens to alter the severity and predictability of weather events (IPCC, 2007). By identifying those in society who are least likely to take action to protect themselves, their property or their families, appropriate incentives or penalties can be devised to encourage action by these groups. A 1974 survey of households in hurricane-prone areas in the USA showed that only 22 per cent of the 1,400

respondents had voluntarily invested in protective measures (Kunreuther et al., 1978), suggesting that voluntary anticipatory action is not to be expected among the majority of the population in hazard-prone areas. Even after the devastating Hurricane Andrew which severely affected Florida, USA, in 1992, researchers found that only 37 per cent of those who experienced Andrew had subsequently taken additional measures to reduce future losses (Kunreuther, 1996).

It has long been recognized that natural disasters rarely occur as a result of unexpected natural hazards but are more often created as a

■ *Corresponding author. **E-mail:** e.l.tompkins@leeds.ac.uk

result of human activity in hazard-prone areas (see, for example, Burton et al., 1993; Smith, 2001). Hazards turn into disasters when vulnerable populations who are sensitive to impacts, and who have low adaptive capacity, are exposed to hazardous events (Wisner et al., 2004). For example, the unfolding tragedy in New Orleans after Hurricane Katrina in 2005 has been attributed to human behaviour, rather than the tropical cyclone (hurricane¹) itself (Burby, 2006; Congleton, 2006; Cutter and Emrich, 2006). Empirical evidence suggests that exposure to hazards comprises only a small part of vulnerability and that social, cultural and economic factors are more important elements in increasing vulnerability to hazards (Pelling, 1997; Adger and Brooks, 2003; Few, 2003).

Empirical evidence shows that factors reducing vulnerability include investments in adaptive capacity, reinforced by effective learning systems plus strong and supportive local networks (Pelling, 2003). Social networks and ties, trust and norms can provide the glue that holds communities together, thus allowing people to more effectively achieve collective goals (Putnam, 1995) – including disaster preparedness. Interpersonal networks, the news media, culture, and trust in risk information all moderate the way in which disasters happen as they contribute to amplification or attenuation of the risk (Kasperson et al., 1988). Each of these factors leads to more or less engagement by the public with the hazard, and hence contributes to better or worse preparedness (Pidgeon et al., 2003). In addition to this significant body of literature on risk perception, there has been some work investigating the relationship between hurricane preparedness and psychological distress (Sattler et al., 2002) and in identifying the types of personalities most likely to reduce their own exposure to hazards (Barnett and Breakwell, 2001).

Yet despite this extensive research on risk perception, few studies have identified generalizable factors which describe the characteristics of individuals least likely to engage in broader disaster risk reduction for tropical cyclones. One

example is Kunreuther (2006), who suggests that limited voluntary action results from a lack of interest, an underestimation of probability, and a lack of enforcement of building codes.

In this paper we explore the factors contributing to risk mitigating behaviour in the context of tropical cyclones in the Caribbean. We do this through an assessment of hurricane preparedness actions and motivations among a sample of the population of the Cayman Islands (Tompkins, 2005). Every year from June to December, during 'hurricane season', much of the Caribbean region is exposed to tropical cyclones. As with all populations there are some who always prepare for the seasonal hurricane risks, but there are also those who never prepare. We explore the relative importance of previous storm exposure, risk perception, social capital and standard demographic and socio-economic characteristics to ascertain what characterizes resilient and vulnerable households. The findings are of critical importance in revealing where investments in risk mitigation should be targeted to reach those groups who are least likely to prepare.

2. Individual and societal drivers of risk mitigating behaviour

If everyone in the world behaved rationally (i.e. according to rational choice theory as summarized by Scott, 2000), national disaster risk management policy would be simple. Governments would create incentives or penalties to ensure that the costs of mitigating possible risks are less than the costs of experiencing the hazard associated with the risk. However, this model of rational action has been extensively criticized for being too simplistic (e.g. Green and Shapiro, 1994).

Scholars from a range of disciplines now argue that while human behaviour is in part influenced by rationality, it is often more powerfully influenced by other factors. Simon (1957) recognized the importance of access to information and uncertainty. Habits and routines affect behaviour (Tversky and Kahneman, 1974), as do the social and collective decision-making contexts (see for

example Granovetter, 1985), the influence of other people (Tajfel, 1982), social 'norms' and morality (Frank, 1988), and emotional responses (Zey, 1992). Numerous theories of human behaviour have been espoused that take into account some of these other influences. For example, the Theory of Reasoned Action (Fishbein and Ajzen, 1975) suggests that people act according to their *beliefs* about the outcomes of their behaviour and how they value that outcome – this creates their *attitude* towards the action. Behaviour is modulated both by this attitude as well as by perceptions of what others think they should do/how they should behave, i.e. *behavioural norms*. The Theory of Planned Behaviour adds to the model of perceived self-efficacy to take action (Ajzen, 1991). Competing models include Stern's Attitude-Behaviour-Context model which states that behaviour is determined by both internal and external factors, i.e. factors affecting personal attitudes, as well as contextual factors in which decisions are made (Stern et al., 1999).

Each of these strands of research proves that individuals have multiple experiences that influence their response to risk (Slovic, 2000). Hazards researchers have tested these theories in relation to individual and household willingness to engage in the latter stages of disaster risk reduction, i.e. to respond to early warning systems and evacuation orders. Research in this area has focused on the content, source and frequency of early warning messages (Drabek, 1986), and on how risk is perceived. The majority of this risk perception literature points to the importance of past experience of major hazards as a determinant of future action. Dow and Cutter (2000) and Sorensen (2000) argue that past experience of a major tropical cyclone increases the likelihood of household evacuation, whereas experience of 'false alarms' (i.e. evacuation is ordered but the hazard does not affect the area) lessens the likelihood of future evacuation. Barnett and Breakwell (2001) take this idea further and assess whether individuals associate hazards with dread and the extent to which they can control the hazard. They conclude that

those who experience risks most severely are more likely to prepare for similar risks in future. Gender is another factor likely to influence willingness to evacuate. Bateman and Edwards (2002) posit that women are more likely to evacuate than men, partially because of socially constructed gender roles. Other research has shown that having young children in a home is likely to increase the chances of heeding evacuation orders, whereas being part of an ethnic minority group or a poor and excluded group reduces the chance that the information or the officials giving the warning will be trusted or their advice heeded (Drabek, 1999).

This body of research shows why people respond to early warning systems and evacuation orders, yet it does not explain why there is long- or medium-term preparedness for tropical cyclones. Disaster risk reduction is often conceived as a cycle of activity comprising four elements: risk mitigation, preparedness, response and recovery (e.g. Drabek and Hoetmer, 1991). The process starts with long-term risk mitigation. This includes strengthening homes to withstand winds and floods through use of braces to support the gable ends of the roof,² attaching hurricane straps to the roof to prevent the roof from separating from the walls,³ or migrating away from coastal areas and flood-prone canals – see the advice from FEMA and ARC (2007). Medium-term preparedness includes annual testing of the early warning system and disaster risk management drills. The immediate response to the hazard involves the use of early warning systems and the protection of windows and doors with shutters, or evacuation – either flying off the island to a safe location or going to a shelter. Finally, after the disaster, recovery begins – this focuses on sustainable rebuilding (e.g. Quarantelli, 1988).

In the following sections, we investigate the factors that influence individual behaviour in response to hurricanes and the social-psychological dimensions of disaster resilience. Specifically, we focus on individual preparedness, i.e. as it relates to migration away from hazard zones, strengthening homes to withstand impacts, shuttering properties, and evacuation.

3. The Cayman Islands survey

The three Cayman Islands (Grand Cayman, Cayman Brac and Little Cayman) lie in the north-west Caribbean and are seasonally affected by tropical storms between June and December. Storms affect Grand Cayman every 2.2 years and pass directly over Grand Cayman every 9.1 years (NDACG, 2009). Recent major storms affecting the islands are Hurricanes Gilbert (1988), Michelle (2001), Ivan (2004), Gustav (2008) and Paloma (2008). Gilbert and Ivan both passed within 30 miles south of Grand Cayman (and caused the most damage in recent years).

The Cayman Islands' small population of approximately 57,000 (Government of the Cayman Islands, 2009a) has grown largely through in-migration to support the expansion of the tourism and offshore financial sectors. Economic expansion through in-migration has produced significant improvements in income on the islands. The islands transformed from a largely subsistence fishing economy in the 1950s (Nietschmann, 1979) to an international financial centre by the 1980s (Johnson, 2001), with an average per capita income of CI\$40,200 (USD48,240) in 2007. Most migrants to the islands fall into the 25–39 years age group; between 1970 and 2006 the proportion of the population aged between 25 and 39 increased from 18 to 35 per cent (Government of the Cayman Islands, 2007).

Migrants to the Cayman Islands come from all over the world, and work in a range of sectors including: construction (17 per cent of all migrants), tourism (15 per cent), real estate and business (14 per cent), domestic help (12 per cent), wholesale and retail (12 per cent), education and health (8 per cent) and finance (7 per cent). The following countries' migrants accounted for 23,865 (90 per cent) of all migrants to the Cayman Islands in 2008: Jamaica (43 per cent), Philippines (11 per cent), UK (8 per cent), Canada (7 per cent), USA (6 per cent), Honduras (4 per cent), India (3 per cent), Colombia (2 per cent), Guyana (1 per cent), Nicaragua (1 per cent), South Africa (1 per cent), Australia (1 per cent), Dominican

Republic (1 per cent) and Ireland (1 per cent) (Government of the Cayman Islands, 2009b). In 2008, approximately 40 per cent of immigrants originated from countries not prone to tropical cyclones (Government of the Cayman Islands, 2009a) and hence, we assume, have little or no experience of tropical cyclones, or knowledge of how to prepare.

While the number of migrants has risen, the birth rate of native born Caymanians has fallen. The proportion of migrants increased from 15 per cent of the population in 1975 to 47 per cent in 2001. This dropped to 39 per cent as a result of out-migration after Hurricane Ivan in 2004. By 2006 this figure was back up to 42 per cent. (Government of the Cayman Islands, 2008).

Due to the low-lying nature of the Cayman Islands and the proliferation of infrastructure and building in coastal areas, most hurricane damage tends to come from high wind speeds, wind-borne debris, and flooding from both storm surges and high levels of precipitation (Minor and Murphy, 1999). Those residents living on or near the coast are particularly sensitive to the impacts of tropical cyclones, notably the strong winds and the storm surge.

To investigate levels of hurricane preparedness and drivers of action, a questionnaire survey was developed to test the main theories that explain risk mitigating behaviour, namely past exposure to tropical cyclones and levels of social capital, as well as socio-economic and demographic characteristics.

Between January and March 2004, prior to the start of the official hurricane season, 1,000 copies of the questionnaire were mailed out. It was not possible to undertake stratified random sampling; however, we targeted organizations, clubs and groups representative of those working and not working. We sent questionnaires to the main utility company employees, business and trade clubs, social clubs, charitable organizations, the University College of the Cayman Islands, a variety of churches representing different communities, and the main government secondary schools. In addition, an electronic copy of the survey was emailed to all government employees.

We assumed that this mechanism would allow us to reach a wide range of people in different socio-economic groups. We used the media (through television and radio interviews) to advertise the survey and to encourage people in each of the groups we targeted to distribute surveys for friends and family members. A total of 407 responses were returned and considered valid; 38 per cent of the respondents were male and 60 per cent female (see Table 1). The oldest respondent was 85 and the youngest 17; the average age was 39 and the median 38. The average length of residency on the islands was 18 years.

4. Findings from the survey: Driving influences

Of the 407 respondents, 6 per cent (25 respondents) stated that they took absolutely no action to prepare for a tropical storm (see Table 2). The most frequently undertaken preparedness activities involved long-term structural support of homes: 35 per cent (144 respondents) had fitted

TABLE 1 Socio-demographic characteristics of respondents

Characteristic	N	%
<i>Gender</i>		
Male	155	38
Female	245	60
<i>Residency status</i>		
Caymanian ^a	139	34
Cayman Status holder ^b	129	32
Expatriate resident ^c	131	32
<i>Location of home on island</i>		
Coast or canal	126	31
Inland	265	65
<i>Home ownership</i>		
Owners	203	50
Renters	125	31

^aA Caymanian is born in or outside the Islands and at the date of birth has at least one of his/her parents or grandparents who are Caymanian domiciled in the Islands.

^bA Cayman Status holder is granted status legally, e.g. through marriage to a Caymanian, long-term residence, or being born and raised in the Cayman Islands to long-term residents who are not Caymanian.

^cExpatriate residents can live/work on the Cayman Islands on annual work permits for up to 10 years.

TABLE 2 Actions already taken to prepare for hurricanes by type of action

Type of hurricane preparedness activity	Respondents who had taken action prior to hurricane season	Frequency (%)
Braces installed to support roof	144	35.4
Straps to tie roof to walls	140	34.4
Shutters placed over windows or doors	126	31.0
Moved to safer location	80	19.7
Evacuation plan (e.g. airline ticket purchased)	7	1.7
Other	3	0.7
Do nothing at all	25	6.1

N = 407.

gable-end braces in their roofs to support the roof from collapsing under strong winds; 34 per cent (140 respondents) had attached ties to hold their roof onto the walls (to avoid losing their roof in strong winds).

The third most frequently stated activity was short-term preparedness in the form of fitting hurricane shutters to windows and doors to prevent flying debris from penetrating them (31 per cent reported doing this). Although 20 per cent had already moved inland as a precautionary measure, only 2 per cent of respondents had made evacuation plans to fly off the islands.

4.1. Past exposure to tropical cyclones

To evaluate whether past exposure to hurricanes influences preparedness we investigated whether there was a relationship between those who had *actually* experienced the worst storm to hit the Cayman Islands in recent years (Hurricane Gilbert) and levels of preparedness. A dummy variable was created, 'badly affected by Gilbert', which

scored 1 where Gilbert was the worst event experienced, and 0 otherwise. Cross-tabulating 'badly affected by Gilbert' with types of preparedness produced a striking positive correlation. There was a significant relationship between exposure to Hurricane Gilbert and: putting up shutters ($p < 0.05$), installing braces to support the roof ($p < 0.05$), putting ties/straps to attach the walls and roof ($p < 0.01$) and making evacuation plans ($p < 0.05$).

Interestingly, we found that there was no significant difference in levels of preparedness between people who *stated* that they were 'badly affected' by other storms that they self-identified as the 'worst hazard they had experienced'⁴ and people who stated that were 'not affected at all' by other storms (for details of the analysis using principal component analysis with varimax rotation see Tompkins et al., 2009). We conclude that respondents' *perceptions* of severity of storm impacts experienced therefore appear less useful in explaining who prepares than indicators that reflect *scientifically defined* storm severity.

4.2. Levels of social capital

Bridging and bonding networks have been shown to support adaptation to unexpected environmental change (Tompkins and Adger, 2004; Newman and Dale, 2005) and climate change (Pelling and High, 2005). As such, we were interested to identify the influence of social networks on hurricane preparedness. To investigate this further we explored perceptions of the importance of kinship and friendship ties on preparedness behaviour.

Individuals were asked to score their level of agreement (using a Likert scale from 1 to 5, as described in Trochim and Donnelly, 2007) with the statements in Box 1, according to whether they 'strongly disagreed' (1) or 'strongly agreed' (5). The first three statements refer to *bonding capital*, i.e. horizontal linkages or 'networks of dependence', homogeneous groups on whom one relies on a daily basis such as family members. The fourth and fifth statements refer to *bridging/linking capital*, i.e. vertical linkages or

'networks of power'; these are heterogeneous groups which can be drawn upon to increase capacity or one's own access to power.

Box 1 Statements describing attitudes to social networks and ties

Bonding capital

1. People generally have friends with similar income
2. Families are the most important financial and social supports for each other
3. Without supportive friends or family it is very difficult to become successful

Bridging/linking capital

4. It is easy to meet the influential people in my community
5. It is important to meet people who are more influential than yourself or you don't progress in life

To assess the importance of social capital in motivating behaviour we created two new aggregate variables, 'bonding capital' and 'bridging/linking capital'. We hypothesized that respondents who rely on their immediate networks are likely to emulate the behaviour of others in that network, i.e. those with friends who prepare will also prepare, and those with friends who do not, will mirror this and take no action. As expected, we found equal levels of bonding capital among Caymanians and other types of residents but, unlike Pelling (2003), we did not find a relationship between recognizing the importance of bonding capital and hurricane preparedness. This, we assumed, was because some respondents belonged to groups who did not prepare.

Conversely, we hypothesized that those who perceived they had higher bridging/linking capital, i.e. the set of connections we maintain that connect us to more powerful actors, were more likely to be networked into the social fabric of the island, and hence more likely to prepare. As expected, we found that those who valued bridging capital were more likely to put up shutters

($p < 0.05$); attach straps or ties to their roof and walls ($p < 0.05$); and to make evacuation plans ($p < 0.05$). Caymanians were more likely to perceive the importance of bridging capital than Cayman Status holders or expatriate residents ($p < 0.05$). Bridging capital clearly influences the decision to prepare for storms.

4.3. Income

It is often assumed that wealth increases household and individual willingness and ability to undertake hurricane preparedness activities. Using cross-tabulations, we explored the relationship between income and preparedness activity, and found a very mixed picture. We found a positive relationship ($p < 0.05$) between income and putting up shutters and installing braces on roofs. However, there was no relationship between income and installing straps ($p = 0.620$), making evacuation plans ($p = 0.727$) or moving home ($p = 0.236$). This may be because, for those who had been badly affected by past storms, evacuation and moving to a more secure home was prioritized irrespective of income.

4.4. Social, demographic and cultural factors

We hypothesized that those respondents whose children lived with them at home would be more likely to take disaster mitigating action. When we tested this hypothesis, we found that those individuals who had children under 15 living at home were indeed more likely than those without to install shutters ($p < 0.05$) and very much more likely to have moved inland to a safer location ($p < 0.005$).

Our analysis shows that female respondents were less likely than males to ensure that braces had been installed to support their roof ($p < 0.001$), or to check that hurricane straps hold their roof onto their walls ($p < 0.001$). This suggests that males are more likely than females to invest in structural preparedness of their homes.

We also hypothesized that there would be a higher degree of preparedness by those who owned their own home, as structural support or

the addition of shutters can add value to homes. Our sample showed that home owners are significantly more likely ($p < 0.001$) to install shutters than renters. Homeowners are also more likely ($p < 0.01$) than renters to use hurricane straps to attach the roof to walls (an action taken by 54 per cent of homeowners), or install braces to support the roof (also 54 per cent of homeowners).

Our analysis creates a rough profile of a 'disaster risk ignorer' in the Cayman Islands, namely: someone without children under 15; female; a renter; a coastal resident; someone who has not experienced a major hurricane; and someone without bridging/linking capital on the islands. This profile matches the profile of many expatriate residents on the islands. To verify whether expatriates were less likely to prepare than Caymanians or Status holders, we investigated the relationship between residency status and some of these factors.

4.5. Residency status

We found that there is a relationship between home ownership and residency status, i.e. Caymanians are more likely to own their home whereas expatriates (working on temporary contracts) are more likely to rent. We investigated the relationship between residency status and location of home (located on the coast or inland). Using a chi-squared test, we found a statistically highly significant relationship ($\chi^2(2) = 42.658$, $p < 0.001$) between being Caymanian or a Status holder and living away from the coast, and being an expatriate resident and living near the coast (see Table 3).

The following section explores the factors that influence the different types of preparedness in more detail.

5. Explaining risk mitigating behaviour in the Cayman Islands

Probit models were used to test the extent to which each of these independent variables influences preparedness activities. First, we consider

TABLE 3 Relationship between residency status and location of home

Proximity of home to coast or canal	Residency status (%)		
	Caymanian	Cayman Status holder	Expatriate resident
Don't live on coast or near canal (n = 265)	43.6	34.0	23.4
Live on coast or near canal (n = 126)	16.7	28.6	54.8
Total (n = 391)	34.3	32.2	33.5

the factors most likely to lead someone to put shutters on the doors and windows of their home (see Table 4). Significantly, Caymanians are the most likely to install shutters on doors and windows, Caymanian Status holders are less likely to install them ($p < 0.01$) and expatriate residents ($p < 0.001$) are very much less likely than other residency groups to install them. However, coastal residents are more likely than inland residents to protect their windows and doors ($p < 0.05$).

A person's age is a highly significant determinant of action ($p < 0.001$). For every year a person ages, they are 9 per cent more likely to protect their windows and doors from flying debris in storms with shutters. However, for every year living on the island, a person is significantly less likely to use shutters ($p < 0.01$). We assume this may be because new residents who have survived minor storms without damage gain a false sense of security over the years. We speculate that the 'years living on island' result in Table 4 is skewed by the large percentage of expatriates who have been on islands for less than 10 years.⁵

Interestingly, the factors that lead individuals to install braces to support their roofs are different from those that determine the use of straps/ties (holding roofs onto walls) (see Table 5). Male respondents were more than 2 times as likely to have ensured that braces were supporting their roofs than female respondents ($p < 0.01$).

Once again, age plays an important role. For every year older respondents are 3 per cent more

TABLE 4 Factors influencing the installation of shutters on doors and windows in preparation for tropical cyclones

Independent variables	Shutters on doors/windows		
	Odds ratio	95% CI	p
Affected by Hurricane Gilbert (88)	1.06	0.47–2.39	n.s.
Affected by Hurricane Mitch (98)	2.14	0.65–7.05	n.s.
Affected by Hurricane Michelle (01)	2.03	0.87–4.72	n.s.
Gender	0.65	0.35–1.20	n.s.
Age	1.09	1.05–1.12	<0.001
Lives near coast	2.14	1.02–4.51	<0.05
Years living on island	0.94	0.90–0.98	<0.01
Cayman Status holder	0.21	0.07–0.62	<0.01
Expatriate resident	0.04	0.01–0.18	<0.001
Child <15 years living in household	1.40	0.74–2.66	n.s.
Owens house	1.93	0.87–4.30	n.s.
Perception of previous bad impact	0.92	0.75–1.13	n.s.
Bridging social capital	1.08	0.75–1.55	n.s.
Perceived resilience	0.90	0.62–1.31	n.s.
Individualism	0.82	0.53–1.27	n.s.

Adjusted $R^2 = 0.253$.

likely to have installed braces ($p < 0.05$). Proximity to the coast appears to be the most important variable influencing use of straps/ties, although in this case negatively. Those living on the coast are 11 per cent less likely to have installed straps/ties than those living inland ($p < 0.001$). This could be a result of the high level of rental accommodation aimed at expatriate residents in coastal areas.

Finally, we ran a regression analysis to ascertain which variables influence people to move inland away from hurricane impacts (see Table 6). The results were surprising, suggesting that willingness to move inland to avoid high levels of exposure was 95 per cent less likely for those currently living near the coast. From this we can assume that those who live near the coast are very unlikely to move to reduce risk exposure.

TABLE 5 Factors influencing the use of ties and braces in preparation for tropical cyclones

Independent variables	Roof ties/straps for walls			Roof-supporting braces		
	Odds ratio	95% CI	p	Odds ratio	95% CI	p
Affected by Hurricane Gilbert (88)	1.24	0.57–2.70	n.s.	0.92	0.43–2.00	n.s.
Affected by Hurricane Mitch (98)	0.92	0.29–2.84	n.s.	0.44	0.14–1.36	n.s.
Affected by Hurricane Michelle (01)	0.78	0.33–1.87	n.s.	0.69	0.30–1.59	n.s.
<i>Gender</i>	2.11	1.16–3.83	n.s.	2.38	1.31–4.32	<0.01
<i>Age</i>	1.03	1.00–1.05	n.s.	1.03	1.00–1.06	<0.05
Child <15 years living in household	1.15	0.61–2.16	n.s.	0.87	0.47–1.61	n.s.
<i>Lives near coast</i>	0.89	0.43–1.84	<0.001	0.77	0.38–1.58	n.s.
Owens house	1.78	0.80–3.93	n.s.	1.63	0.75–3.55	n.s.
Status holder	1.53	0.57–4.08	n.s.	1.18	0.45–3.05	n.s.
Expatriate resident	0.98	0.26–3.75	n.s.	0.60	0.16–2.26	n.s.
Years living on island	1.01	0.97–1.05	n.s.	1.01	0.97–1.05	n.s.
Perception of previous bad impact	1.04	0.85–1.27	n.s.	1.11	0.91–1.35	n.s.
Bridging social capital	1.11	0.76–1.61	n.s.	1.00	0.70–1.44	n.s.
Perceived resilience	1.32	0.91–1.93	n.s.	1.20	0.83–1.74	n.s.
Individualism	0.89	0.57–1.37	n.s.	0.71	0.45–1.10	n.s.

Ties adjusted $R^2 = 0.199$; braces adjusted $R^2 = 0.204$.

Reflecting again on who lives near the coast (in the survey 17 per cent of coastal dwellers were Caymanian, 29 per cent Cayman Status holders and 55 per cent expatriate residents), this outcome also suggests that residency status plays a key role in determining levels of exposure.

Research on other islands popular with expatriate migrants in search of a better lifestyle shows that incomers tend to migrate towards areas with great views and coastal locations, as evidenced in Corfu (Lazaridis et al., 1999). It is not only new migrants to the islands who value the benefits of coastal locations above the risks; so too do returning residents who may have lived and worked overseas for a significant period and have adopted 'foreign' views about location (Thomas-Hope, 1993). These returning residents may also have lost their association with the islands and their memories of past hurricanes.

Socio-demographic factors are clearly significant in driving preparedness for weather hazards. However, the impact of residency status on preparedness was unexpectedly significant. The specific demographic characteristics of new migrants, i.e. they tend to be between 25 and 39

years of age, they tend to be childless, and they tend not to own their own homes, and they are more likely to live on the coast, all reduce the likelihood of their engaging with disaster risk reducing activities.

We have shown that risk mitigating behaviour is in part determined by who people interact with. Those who are networked into Caymanian society are more likely to prepare. Migration theorists argue that long-term residents are more likely to assimilate into societies than recent migrants (see for example DeWind and Kasinitz, 1997), hence Status holders are more likely than short-term expatriate residents to have become embedded in Caymanian society and to have built networks with long-term residents, or those in the national hurricane preparedness networks. As such Caymanians and Status holders appear to be better prepared for hurricanes than new arrivals.

In contrast with expatriates, Caymanians and Status holders are more likely to have bought their home, and this is more likely to be inland or in an area of relatively low exposure. This is not a surprising finding, but it has implications

TABLE 6 Factors influencing migration inland in preparation for tropical cyclones

Independent variables	Move in anticipation of impacts		
	Odds ratio	95% CI	p
Affected by Hurricane Gilbert (88)	1.18	0.47–2.98	n.s.
Affected by Hurricane Mitch (98)	0.43	0.10–1.88	n.s.
Affected by Hurricane Michelle (01)	2.28	0.77–6.77	n.s.
Gender	0.82	0.39–1.75	n.s.
Age	0.99	0.96–1.03	n.s.
Child <15 years living in household	1.50	0.73–3.07	n.s.
<i>Lives near coast</i>	0.05	0.01–0.24	<0.001
Owens house	1.09	0.43–2.77	n.s.
Status holder	0.59	0.19–1.81	n.s.
Expatriate resident	0.35	0.07–1.72	n.s.
Years living on island	0.99	0.94–1.04	n.s.
Perception of previous bad impact	1.12	0.88–1.43	n.s.
Bridging social capital	0.73	0.48–1.11	n.s.
Perceived resilience	0.82	0.53–1.28	n.s.
Individualism	1.42	0.84–2.42	n.s.

Adjusted $R^2 = 0.342$.

for how the government of the Cayman Islands prepares for storms and invests in hazard communication as expatriates comprise almost 50 per cent of the population.

6. Foreignness and disaster resilience

The issue of foreignness as a determinant of disaster risk preparedness is an unexpected but interesting issue that has arisen in this study. There has been a reasonable amount of research investigating cross-cultural attitudes to risk, although these studies have focused on risk perceptions across a wide range of risks – natural, health and technological – in a number of countries (e.g. Boholm, 1998). Some studies have considered ethnicity; however, these have mostly focused on how ethnic groups value risk (e.g.

Flynn et al., 1994), how ethnicity and risk perception are correlated with poverty (Vaughan and Nordenstam, 1991), and how ethnic groups view information and emergency management institutions (Drabek, 1999). The issue of residency status has not been well investigated. The main studies in this area focus not on residency status but on the influence of place of birth (nativity), specifically the differences in risk perceptions between native-born and foreign-born residents in the USA (Hunter, 2000; Adeola, 2007).

Our findings in the Cayman Islands point to another emerging phenomenon, namely, that young, childless, internationally mobile migrants, in rented accommodation, in coastal locations, may be placing themselves at higher risk from natural hazards than other groups. This group appears more likely than others to deliberately expose themselves to hazards, and to take the least level of precaution to protect themselves or their property. Migrants to the Cayman Islands are not a homogeneous group, yet a characteristic many share is a lack of willingness or a lack of capacity to build resilience to hurricane impacts. We speculate that this characteristic arises as a result of four factors. First, migrants perceive their residency as temporary and hence are less likely to invest in property improvements to safeguard their homes. Second, following John and Dennis (2000), we assume that migrants are likely to send savings home (to save or to support relatives); they do not see spending on risk reduction as a priority. Third, drawing on our analysis, we assume that migrants underestimate the severity of hurricane impacts – the ‘it’s not going to happen to me’ mentality. And fourth, migrants experience negatively reinforcing peer support.

Expected changes in the intensity of hurricanes mean that expatriates’ behaviour could potentially weaken the future economic resilience of the Cayman Islands. Climate change is expected to increase the intensity of hurricanes in the Caribbean basin, bringing with it a range of severe consequences (Knutson and Tuleya, 2004; Anthes et al., 2006). If storms become more intense, there is a danger that those affected by hurricanes will experience higher levels of loss (Munich Re,

2006). Many residents left the Cayman Islands after Hurricane Ivan due to the impact of this very damaging storm (ECLAC, 2005). More intense storms could lead to higher levels of non-returning expatriates, thereby creating higher levels of staff turnover, higher recruitment costs for local firms, and thus potentially reduced productivity (for more on the links between staff turnover and productivity, see Huselid, 1995; Black and Lynch, 1996).

If the Cayman Islands Government continues to pursue economic development that depends on short-term expatriate labour, the number of people who are not aware of, or not willing to, prepare for hurricanes on the islands will rise. This could reduce the islands' disaster resilience through two streams: (i) wider-spread damage leading to slower and more expensive disaster recovery, and (ii) rising insurance costs.

We have shown that expatriates are less likely to invest in structural protection of property. It has been proven that people who take no voluntary action to protect their properties experience greater damage to their properties and possessions in hurricanes (Kunreuther et al., 1978; Drake et al., 2007). When properties are storm damaged, possessions are lost and living conditions can be extremely harsh. For example, many of those living in shelters after Hurricane Katrina suffered physical and emotional stress (Brodie et al., 2006). The larger the proportion of residents badly impacted by storms, the fewer people available to return to work and participate in both economic and physical rebuilding after a storm, thus slowing the island's return to normality after a disastrous hurricane. We conclude that the more action taken by individuals to prepare for hurricanes, the smaller the likelihood of wide-spread economic losses, and the less the government will have to spend on post-disaster recovery.

Hurricane (or catastrophe) insurance in the Caribbean is deemed to be high price with low risk transfer, which is a less than satisfactory situation for homeowners (Pollner, 2001). This insurance is most often purchased by tourism-related properties and other large or medium-sized private businesses (Auffret, 2003). Auffret notes

that many householders and small businesses in the Caribbean do not take out insurance. While insurance premiums in the Cayman Islands are not tied directly to local impacts – reinsurance markets are strongly affected by global disasters – if there are high levels of claims locally, there is a short-term effect on local premiums, as experienced in the Cayman Islands after Hurricane Ivan in 2004. If people do not prepare their homes and consequently experience sizeable losses, the costs of insuring homes across the islands may rise, and may force the government to expend resources on additional forms of risk transfer such as catastrophe bonds.

A combination of both of these factors can potentially reduce long-term disaster resilience in the Cayman Islands. Unless the government can identify means of encouraging preparedness activity among those groups who are least likely to prepare, the social and economic costs of hurricanes in the Caribbean are likely to increase as the intensity of storms increases with climate change.

7. Conclusions for research and policy

Research on disaster preparedness has historically focused on early warning systems: the frequency and content of the message and the reasons why people evacuate. This research has explored why people undertake a range of preparedness activities. In the Cayman Islands' case it is clear that the Cayman Islands Government needs to target hurricane preparedness information at specific groups including women, non-Caymanians, young people, coastal residents, and those in rented accommodation. In order to enhance disaster risk management in the Cayman Islands, new approaches to engaging these groups need to be identified and may include: supporting female-headed households to undertake structural preparedness (e.g. training or grants), alternative communication models to engage young people, targeting landlords and households in rented accommodation at the beginning of every hurricane season, and producing guidance for new migrants to the islands on the risks from tropical

cyclones. Under a changing global climate where tropical cyclones are expected to become more intense, this challenge becomes more urgent.

This research focuses on the agency of individuals to prepare for storms. The political and ideological structures that affect preparedness were not investigated specifically. However, the findings of this paper indicate that the implications of economic development strategies cannot be ignored. Indeed, the Cayman Islands' case highlights an issue that many countries face. By pursuing a policy of economic diversification, the Cayman Islands Government necessarily imported labour. Yet this very policy of creating new economic sectors (financial services and tourism) that rely on migrant workers could affect the Islands' resilience to hurricanes, by expanding the proportion of society that does not engage with risk-reducing activity.

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Notes

1. 'Tropical cyclone' is the correct term for a hurricane. 'Hurricane' is the regional term for tropical cyclones in the Caribbean.

2. Hurricane braces are wooden beams (usually 2 × 4s in the shape of an inverted V or an X) used in gabled roofs, to support the roof.
3. Hurricane straps are metal attachments used to tie the roof securely onto the walls of a house.
4. Respondents cited a number of events including Hurricanes Mitch and Michelle, other Caribbean storms, other storms including the UK strong wind storm in 1987 and various Pacific island storms.
5. In 2003 a new Immigration Act was introduced that set seven years as the maximum length of time a work permit holder could work continuously in the Cayman Islands; however, those work permit holders who in 2003 had worked on the islands for between 8 and 15 years had the right to apply for permanent residence.

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