

# **The Readiness of the Trinidad and Tobago Cadastral System for Recovery from Disaster**

**Charisse GRIFFITH-CHARLES, Trinidad and Tobago**

**Key words:** Cadastre; Informal settlements; Risk management; Security of tenure

## **SUMMARY**

Cadastral records in developed countries are usually held centrally or regionally in a digital database that is archived offsite. This ensures that the records are recoverable in the event of an impact on the repository. In many low-income and developing countries, however, cadastral records are not of a standardised format but evidence of legal tenure can be gleaned from records held at various locations. Evidence of legitimate tenure can be held locally or at the household level, without duplicates.

The formal cadastral records in Trinidad and Tobago have suffered loss on previous occasions and therefore an assessment of possible risks was done and a post-disaster Business Continuity Plan (BCP) model was developed. In addition, because much of the evidence of land rights is informally held, this evidence was also part of the assessment of disaster impact and part of the larger business continuity model. An assessment was performed to determine where cadastral records exist and where they could be recovered from if a disaster were to arise. It was found that action on the part of various stakeholders can be taken now to avert the eventual magnification of the disaster that will result if the records were to be destroyed. A well-documented plan to deal with different emergency scenarios must also be prepared and disseminated so that all stakeholders would be aware of the procedures for preserving land tenure to be followed in a disaster in this country. Recording of oral, and other informal evidence is strongly recommended for the country using existing tools such as STDM or Open Tenure software.

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## **1. INTRODUCTION**

The cadastral system plays a key role in recovery from disaster. During the emergency response period, cadastral records can assist in providing information on the location of individuals to emergency personnel. In the recovery phase, records can be used to begin to re-establish boundaries and prevent conflict. They can also be used to site camps and emergency shelter where they will not impact on land rights. In the reconstruction phase, records can be used to plan new and improved spatial positioning while taking existing rights into consideration. To be able to perform these functions, the cadastral system should be current, complete and comprehensive as well as backed-up, archived and safely housed. Both the records themselves and the potential for replacement of boundaries on the ground that the records protect are therefore vulnerable to disaster.

However, particularly in developing countries, if formal records do not comprehensively reflect all the existing tenure, then evidence of informal land rights should also be preserved as loss of this evidence in the event of a disaster can result in land-grabbing, conflict, and discrimination. Oral and documentary evidence held at individual, household, and community level can support land rights and therefore needs to be recorded, documented, and archived so that they can be located in the case of disaster. Business Continuity Plans (BCP) can ensure that a cadastral system is prepared to support and re-establish formal and informal rights in the event of a disruption in the system. Most BCPs, however, relate to a physical business enterprise only. For developing countries, the provision of cadastral services should incorporate the communities and individuals who hold and maintain information on land rights.

An assessment is necessary to determine what are the potential risks to the integrity of the cadastral records, both formal and informal, wherever they occur, and what are the actions that may be performed to minimise the risks now and to recover from the impact of disaster should it occur. The Trinidad and Tobago cadastral system presents vulnerabilities to several risks so a comprehensive assessment is required to determine what is the range of risk and, what are the actions required to mitigate those risks and who can be charged with the responsibility of performing those actions. This analysis uses a BCP process to investigate these issues and proposes solutions for mitigating the risks to the cadastral records so that recovery can occur in the event of impacts to the cadastral system.

## **2. BACKGROUND**

Security of land tenure allows land occupants to experience well-being in a society and also supports their livelihood activities. When disaster strikes, land occupants should be able to resume

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that security of tenure as early as possible so that they can resume livelihood activities. This provides for the society's recovery and is a factor in its resilience (FAO 2011; Barnes and Riverstone 2008). In instances where the security of tenure is expressed in a formal document, the land occupant has the additional ability to access credit to fund their own disaster mitigation actions on the land and, after disaster has passed and financial systems have resumed, can again use credit access to fund their own recovery and reconstruction (FAO 2011, Griffith-Charles et al. 2015). The resumption of the security of tenure after the disaster, whether in perception or in a formal document is predicated on the continued existence of evidence of land tenure rights after the disaster. This requires a cadastral system within which; the records can withstand the impact of the disaster, can be reinstated from exact copies of the original, or are recoverable from other comparable evidence.

Land occupants without formal documents held in a state repository use their occupation and the acknowledgement of the community to provide them with security of tenure against counterclaimants to their land. In the event of a disaster where evidence of their occupation is destroyed, and perhaps their immediate neighbours injured or killed, they are reluctant to leave the site and therefore remain in danger. Aid agencies and emergency crews are unsure as to whose land they can use to site camps and shelters without documents indicating rights. When reconstruction begins, there is an opportunity to restructure and relocate infrastructure in an improved way but this cannot happen without knowledge of whose land rights, formal or informal, are being affected. Cadastral records are therefore important before, during, and after disaster.

### **3. BUSINESS CONTINUITY PLANNING**

Business Continuity Planning developed as a way for business enterprises to continue to provide services even the face of unanticipated disruptions (Zsidisin et al. 2005). This planning can take the form of reducing the probability of disruption, using mitigation strategies, or reducing the impact of the disruption on the service activities by providing backup routes to performing services. Disruptions that rarely occur, or are unpredictable, but have high impact can be difficult to manage in planning as mitigation strategies and alternative process planning can be expensive to establish and maintain especially for businesses in low-income and developing countries.

There have been applications of the BCP to geospatial activities, services, and databases. The Geospatial Information Authority of Japan (GSI) developed a Disaster Management Operation Plan that was able to respond to the Great East Japan Earthquake of 2011 by providing emergency services to agencies in need of geospatial information (Nagayama et al 2012). The efforts focused on providing topographic data for assessing physical damage and not on land tenure rights data.

For many developed countries, the institutions responsible for the cadastral system, primarily the cadastral mapping agencies and the legal land registries, follow structured processes to ensure the continuation of the land administration business in the event of disaster. The business of acquiring, maintaining, and disseminating land information conforms to formal models and include business continuity plans (BCPs). The land information is usually contained in orderly digital databases and

consist of comprehensive and complete data on all land parcels in the jurisdiction. This does not mean, however, that digital records are more secure against disaster than analogue records. In fact, Cerullo and Cerullo (2014) indicate that dependence on information technology increases risks to data not only from hardware and software failing, and obsolescence of data formats, but also targeted cyber-attacks. Koch (2004) posits that BCPs should ideally focus on the processes instead of the technology. However, processes are now linked inextricably with technology so alternatives to the processes should be determined to allow for loss of technology in disaster. IT can be addressed only as it is used to support the fundamental processes. A BCP should identify the critical functions, the different types of minor and major risks to these functions, and the risk mitigation strategies for each of the individual risks, minor and major.

Comparisons of developed and developing countries' approaches to business continuity in cadastral and tenure systems in the face of disaster impacts can be examined as in Table 1. Here, the experiences surrounding the cadastral records and land tenure before and after Hurricane Katrina in New Orleans and the tsunami in Aceh as gleaned from Haroen et al (2005) and Reale and Handmer (2011) are compared.

Table 1. Comparison of Aceh's and New Orleans experience with cadastral systems in disaster

Pre-disaster	
Aceh (Tsunami 2004)	New Orleans (Hurricane 2005)
No back-up or archived cadastral data	Backed-up and archived cadastral data off-site
Largely informal tenure	Completely formal tenure
5-10% parcels registered	100% parcels registered
Post-disaster	
300,000 land parcels affected	Available online database on parcel flood status
90,000 certificates of title damaged	Back-up data recovered

Source: Haroen et al. (2005) and Reale and Handmer (2011)

Prior to the Hurricane in New Orleans, the cadastral system contained 100 % of the formal tenure information which was archived offsite in another state. Aceh on the other hand only had 5-10% of its parcels under formal registration. The comparison given here indicates that the developed system of New Orleans supported earlier recovery of the land administration which in turn provided support for return to development. In Aceh's case, much effort, cost, and time were expended subsequent to the disaster for recovery. The citizens of both communities experienced increases in vulnerability as a result of the disaster and the loss of livelihoods (Reale and Handmer 2011). However, available and recoverable cadastral records in New Orleans after Hurricane Katrina allowed the community to feel more secure about their tenure and provided for a greater sense of well-being. In the reconstruction phase of the recovery from the disaster, Aceh recognised the need for incorporating alternative sources of data. The Government looked to recovering cadastral data from NGOs, remaining documents in state offices, and verbal evidence from communities.

The experience of Aceh underscores the need to apply BCPs holistically over all sources of formal and informal land tenure and land rights information, wherever it is held, prior to the disruption. Communities, and individuals must be thought of as being part of the cadastral system in the assessment phase of developing the BCP. This reduces the cost, effort and responsibility of the state and makes the process more feasible for developing countries.

#### **4. METHODOLOGY**

BCP systems for business enterprises are stated to be comprised of standard elements such as risk identification, risk assessment, risk ranking and risk management (Gilbert and Gips 2000; Chapman et al. 2002). A more detailed breakdown of these elements into activities can be listed as (Morton 2002; Zsidisin et al. 2005):

- Provide management guidelines
- Identify serious risks
- Prioritise the operations to be maintained and the procedure to maintain them
- Create and assign staff to disaster teams
- Take a complete inventory of data
- Know where to get help
- Document the plan
- Review the plan with employees
- Maintain and revise the plan periodically

The approach for this study was to apply the BCP process for business enterprises to the particular institution of the cadastral system, specifically in Trinidad and Tobago, where the formal data are incomplete and the informal data are dispersed or undocumented. The BCP assessment of the cadastral records in the cadastral system of Trinidad and Tobago included a determination of the nature of the existing tenure records and where they were held. The primary objectives of the BCP assessment as applied to the cadastral system were:

1. To plan how to reduce cadastral data damage or loss in the event of a disruption
2. To plan how to ensure the continuance of critical functions of cadastral data after a hazard event or disaster or other disruption, that is, provision of land rights information and provision of boundary information
3. To identify key BCP personnel and alternate locations and modes of operation
4. To facilitate decision making for the execution of this plan in the event of disaster or hazard event or disruption.
5. To provide alternative courses of action which will minimize the effects of a threat on data
6. To achieve minimum response times and proper recovery during a hazard event or disaster or disruption.

Interviews with key section personnel at the cadastral mapping institution: the Lands and Surveys Division, the land registry, the utility companies for water, electricity, and telephone, and the planning department were conducted and examinations of records on stored information were performed. Open interviews were therefore held with the draughting office, the vault records section, the IT sections, and the deed and title records sections. An examination of the potential

risks to the records was then undertaken to determine what the effects could be, what the appropriate actions should be and who should undertake the actions. The assessment also included examination of the location of informal tenure information since this affects a large section of the population. The questions posed in the interviews were:

- What type of cadastral data is stored, analogue or digital?
- Are data archived internally to the institution or externally?
- Is data backed up, how and where?
- Have any disruptions ever occurred that posed a threat to the data?
- What impact did previous disruptions cause?
- Post disruption, were any assessments or mitigation strategies put in place?
- Is there any plan in place currently?
- Has this plan had to be executed?
- Have any entities purchased data or have data been shared with any entity?

The interview responses were then used to develop the BCP. Since these BCPs can be copious documents, focus here is on documenting the findings of two aspects of the activities listed in the BCP. These activities were: ‘take a complete inventory of the data’, and ‘identify serious risks’.

## 5. INVENTORY OF CADASTRAL DATA

The graphic component of the cadastre in Trinidad and Tobago is comprised of an index that relates the relative positions of the parcels to the filed survey plans. The index has been digitised but the link to all of the survey plans does not always exist. In fact there are several thousand plans that are held at the institution but are not indicated on the index and can only be located by diligent searches through the files. Figure 1 shows the analogue index and an excerpt from the digital vectorised index.

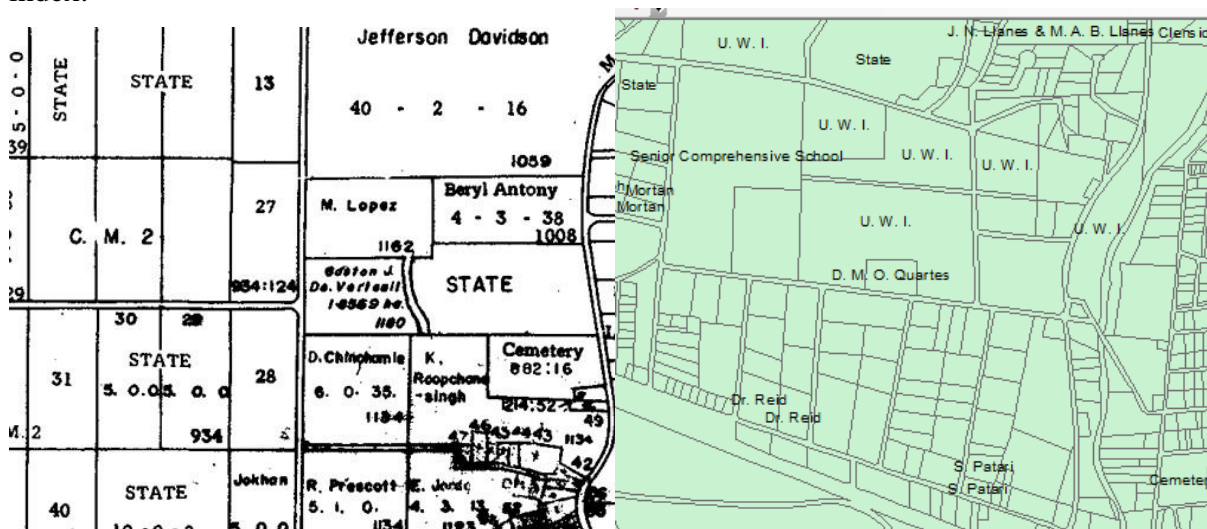
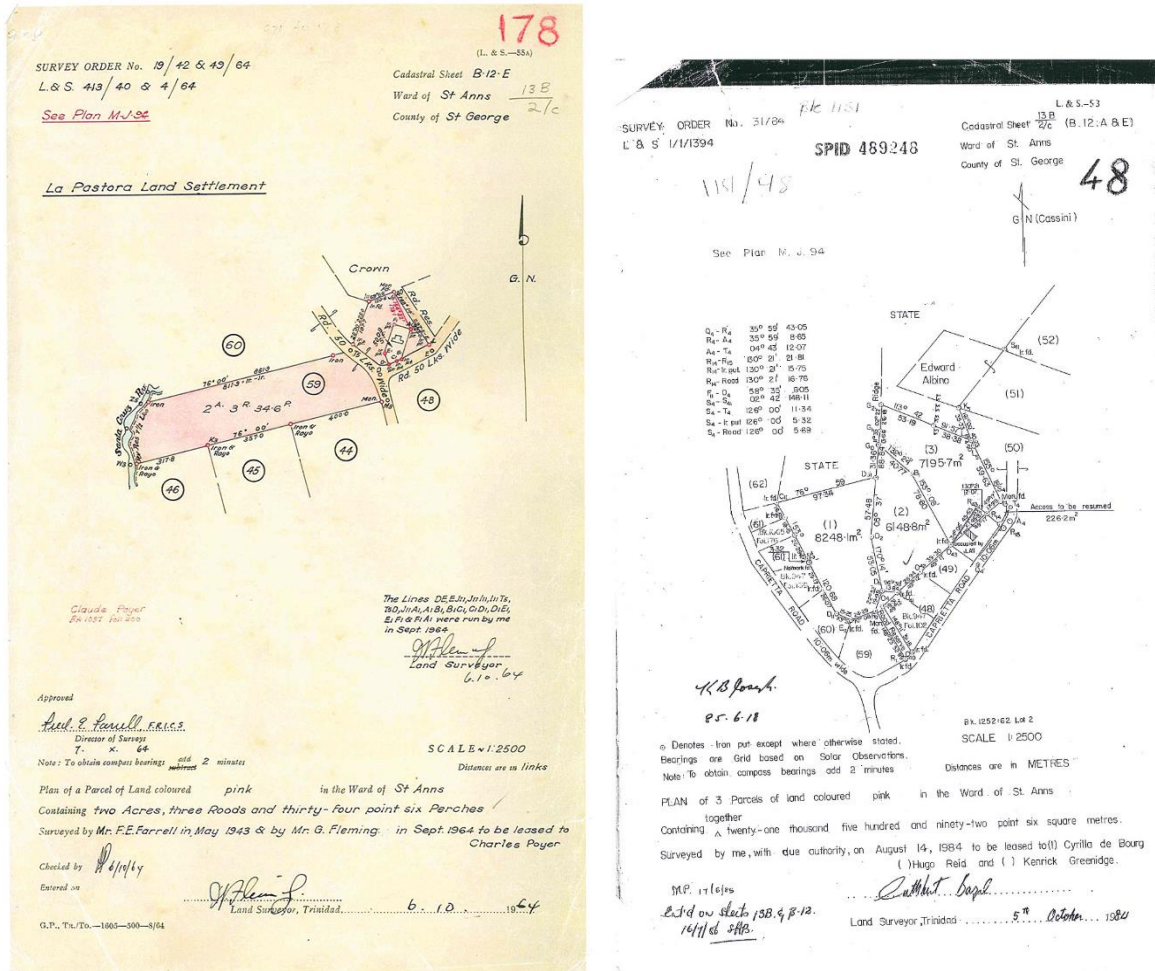


Figure 1. Analogue Index and Vectorised Index

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The cadastral plans are not individually coordinated so in the event of a disaster that removes much of the physical features, even if some plans are available it would be difficult to reinstate the boundaries on the ground. Figure 2 shows examples of these uncoordinated cadastral plans. The parcel locations are therefore placed in relative position on the index. The cadastral index and the filed cadastral plans do not contain all evidence of rights as many parcels are not surveyed or no formal title is held for the parcels. Some parcels, even though not surveyed may be described verbally in a deed. Deeds and titles are stored at the Registrar General's Office but again these records do not provide evidence of tenure on all parcels in the country (Griffith-Charles and Opadeyi 2009; Griffith-Charles 2004).



may be aware of the location of neighbours and the duration of their occupation. This data is usually unrecorded.

From the assessment the list of available formal records include:

- survey plans, cadastral indexes - both in analogue and digital form, each containing incomplete information. The digital archives are held at the same institution.
- legal records of deeds and titles some of which are held in paper documents and some that have been digitised. The digital archives are held at a separate institution within the same city.
- land tax records in paper form which may provide evidence of informal occupation and use

Informal records that evidence informal land rights include:

- Unregistered deeds held by individuals
- Listing of occupation on state land
- Receipts for purchase of squatted state and private land in the informal market
- Receipts for payment of private land rents

The locations at which these formal records are kept and therefore those that are subject to the BCP are:

- The state central repositories of the Lands and Surveys Division and the Registrar General
- The state decentralised revenue departments

The locations at which records evidencing informal land rights are kept include

- Land Settlement Agency
- Community knowledge
- Household documents
- Individual knowledge

## **6. IDENTIFYING SERIOUS RISKS TO INFORMATION**

Risks to the cadastral and other tenure related information are many and such risks may be localised at the building, street, or community level such as fire, flood and small scale conflicts. At the national level, risks are more widespread and may take the form of earthquakes, hurricanes and tsunamis. Table 2 collates the possible risks that can affect the various locations housing cadastral and tenure information in Trinidad and Tobago.

While Trinidad and Tobago is considered to be fortunate as it rarely experiences serious natural hazards, the cadastral records have been affected twice indirectly as a result of conflict. In 1903 a riot protesting a hike in a water tax resulted in a fire that destroyed the house of parliament which also contained much of the cadastral records, both the graphical and the legal documents (Laurence 1969). Again, in 1990, a political coup took place in the same house of parliament and resulted in water damage to some of the cadastral plans after water pipes were broken in the assault on the building (Pantin 2007). Any planned response to the formal records will therefore require localised actions based on the hazard event and the impact.

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As indicated in Table 2, the effects of localised fires, floods and conflicts that impact on the records and on individuals that may have knowledge that is not replicated anywhere would be loss of that knowledge and damage or complete destruction to records. Pre-disaster mitigation responses to this risk would require recording of any knowledge that is not documented, duplication of any information that is singular in nature, and archiving of any duplicated documents and data at a remote location outside of the localised area. Responsibilities can be assigned to specific individuals within the state institutions to manage these mitigation activities, while informal tenure information remains the responsibility of individuals who have such records. Regional initiatives to introduce the use of the STDM software have occurred in St. Vincent in the Grenadines and in Saint Lucia (Griffith-Charles et al. 2013). These initiatives demonstrate that the software can be used within the informal tenure types in the region at low cost.

Similarly, Table 2 indicates the risks that can have national impact on Trinidad and Tobago and on the formal cadastral records and informal tenure evidence. The risks identified include earthquakes, hurricanes and the rare possibility of a tsunami. The effects on the records are the same as for the risks at the localised level but more widespread damage may be anticipated. The mitigation responses are again the same except for national level damage archiving of data should be done to servers external to the country. The responsibilities are also the individual's, the communities', and the state's. In this instance, however, it is recommended that regional level archiving of data as well as international can be done.

Table 2. Risks, effects, responses and responsibility assessment

RISK	EFFECTS	RESPONSE	RESPONSIBILITY
<b>LOCAL –</b> <ul style="list-style-type: none"> <li>• Fire</li> <li>• Flood</li> <li>• Conflict</li> <li>• Computer viruses</li> <li>• Cyber attacks</li> <li>• Theft</li> <li>• Unauthorised changes to records</li> <li>• Death of rights holder</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of knowledge</li> <li>• Damage to records</li> <li>• Loss of records</li> </ul>	<ul style="list-style-type: none"> <li>• Record, Duplicate, and archive, personally held knowledge,</li> <li>• Store records, - within building, and/or close by, - (This is a small volume requirement)</li> </ul>	<ul style="list-style-type: none"> <li>• Individual</li> <li>• Community</li> <li>• State</li> </ul>
<b>NATIONAL –</b> <ul style="list-style-type: none"> <li>• Earthquake</li> <li>• Hurricane</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of knowledge</li> <li>• Damage to</li> </ul>	<ul style="list-style-type: none"> <li>• Record, Duplicate, and archive, personally held knowledge,</li> </ul>	<ul style="list-style-type: none"> <li>• Individual</li> <li>• Community</li> <li>• State</li> </ul>

<ul style="list-style-type: none"> <li>• Tsunami</li> <li>• Computer viruses</li> <li>• Cyber attacks</li> <li>• Death of rights holder</li> </ul>	<ul style="list-style-type: none"> <li>• records</li> <li>• Loss of records</li> </ul>	<ul style="list-style-type: none"> <li>• Store records, - off site, out of country – (this is a large volume requirement)</li> </ul>	<ul style="list-style-type: none"> <li>• Region</li> <li>• International</li> </ul>
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## 7. BCP

The BCP itself can be a detailed and complex document giving specific strategies for digital and analogue recovery, potential locations for recovery activities, assignment of roles and responsibilities, and scenarios for action in each type of disaster. While the BCP can be provided and mandated for state personnel, it is anticipated that communities can be encouraged to set up parallel committees to protect and recover their information. An outline generic process (Oregon State 2008) adapted to the cadastral system can be as follows as an example:

Response Procedure to disaster incident:

1. The Site Emergency Coordinator (SEC) Incident Commander activates and initiates the emergency operation plan until threat is subdued and situation is under control
2. Thorough facility assessment done by Safety Officer and Facilities Manager to render it safe or unsafe.
3. If rendered safe, Safety Officer and the Facilities Manager report to the Directors and Executives of the company/facility.
4. If rendered unsafe, report is given and arrangements made to evacuate to the predetermined cold site.
5. Director and Executives determine if a BCP is necessary.
6. If yes, BCP Incident Commander takes charge from the SEC.
7. The BCP Incident Commander assembles teams both from the internal departments and other local supporting agencies to the strategic location/facility.
8. In a case where the disaster is nationwide, commander may resort to consulting and working collaboratively with regional and international managers as well, who store local cadastral data in their systems.
9. Alternate team members are contacted if necessary, for example if a team member is unavailable.
10. Assessment is done of the extent of damage to data.
11. Recovery of data initiated.

## 8. CONCLUSION

Situations such as that of the cadastral system of Trinidad and Tobago where much of the tenure information is informal, require a plan that provides for the likelihood of disaster impact. BCPs for the formal sector can be developed based on formal business procedures that exist, which can be modified for cadastral systems. Since the country has had some relatively minor experiences with

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disaster that has impacted cadastral data, it should serve as a warning for potential impact of larger proportions. For the informal data, public awareness needs to be engaged so that individuals and communities are encouraged to bear some of the responsibilities, costs and effort of documenting and archiving vital land tenure data that will support their well-being in the event of disaster. The state can monitor and oversee the documenting and archiving of household information on land rights as this is less costly in the short term than a systematic adjudication and titling process or a comprehensive data acquisition process. Mitigation activities should begin now instead of waiting until more detrimental incidents occur. This process can be adopted by many low-income countries who require a cost effective and feasible procedure for documenting the undocumented land tenure rights that exist in their jurisdiction.

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## **BIOGRAPHICAL NOTES**

Dr Charisse Griffith-Charles Cert. Ed. (UBC), MPhil. (UWI), PhD (UF), FRICS is currently lecturer in Cadastral Systems, and Land Administration in the Department of Geomatics Engineering and Land Management at the University of the West Indies, St. Augustine, Trinidad and Tobago, where her research interests are in land registration systems, land administration, and communal tenure especially 'family land'. She is a Fellow of the RICS, Atlantic Regional President of CASLE, and member of the Institute of Surveyors of Trinidad and Tobago (ISTT), which is a member of the FIG. Dr Griffith-Charles has served as consultant and conducted research on, inter alia, projects to revise land survey legislation in Trinidad and Tobago, assess the impact and sustainability of land titling in St. Lucia, address tenure issues in regularizing informal occupants of land, and to assess the socio-economic impact of land adjudication and registration in Trinidad and Tobago, apply the STDM to the eastern Caribbean countries, and document land policy in the Caribbean. Her publications focus on land registration systems, land administration, cadastral systems, and land tenure.

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