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The impact of legal vulnerability on environmental inequalities. A case study of coastal populations in Guadeloupe (French Antilles)

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ABSTRACT

This paper draws on sociology, geography and law to analyse the exposure of populations to coastal multihazards in a postcolonial and overseas context. The research is based on a case study conducted in two municipalities in Guadeloupe (French Antilles): Deshaies and Capesterre-Belle-Eau. The corpus of data consists of 52 interviews conducted with inhabitants and institutional actors, as well as a set of spatialized data and a regulatory corpus. The analysis underscores how public policies must contend with a complex territorial reality that is still bound to the postcolonial past and legacy of slavery in Guadeloupe. The potential contradictions between regularization policies, hazard prevention policies and policies to curb insalubrious housing tend to expose the most fragile populations to what we refer to here as legal vulnerability.

1. Introduction

This paper draws on sociology, geography and law to provide an interdisciplinary analysis of how exposure to natural hazards intersects with social vulnerabilities. We examine the exposure of populations to coastal natural hazards in a postcolonial and overseas context. Our research is based on a case study conducted in two municipalities in Guadeloupe (French Antilles): Deshaies and Capesterre-Belle-Eau (CPE), respectively on the west and east coast of the island of Basse-Terre, and both exposed to multiple coastal hazards (Fig. 1).

The question underpinning this article is the following: which factors aggravate the socio-environmental vulnerability of coastal populations despite the implementation of well-intended public policies? Our main focus is on *legal vulnerability, which* tends to further encompass other types of vulnerability. Legal vulnerability may result from historical legacy and/or contemporary processes. It has two dimensions that are interrelated:

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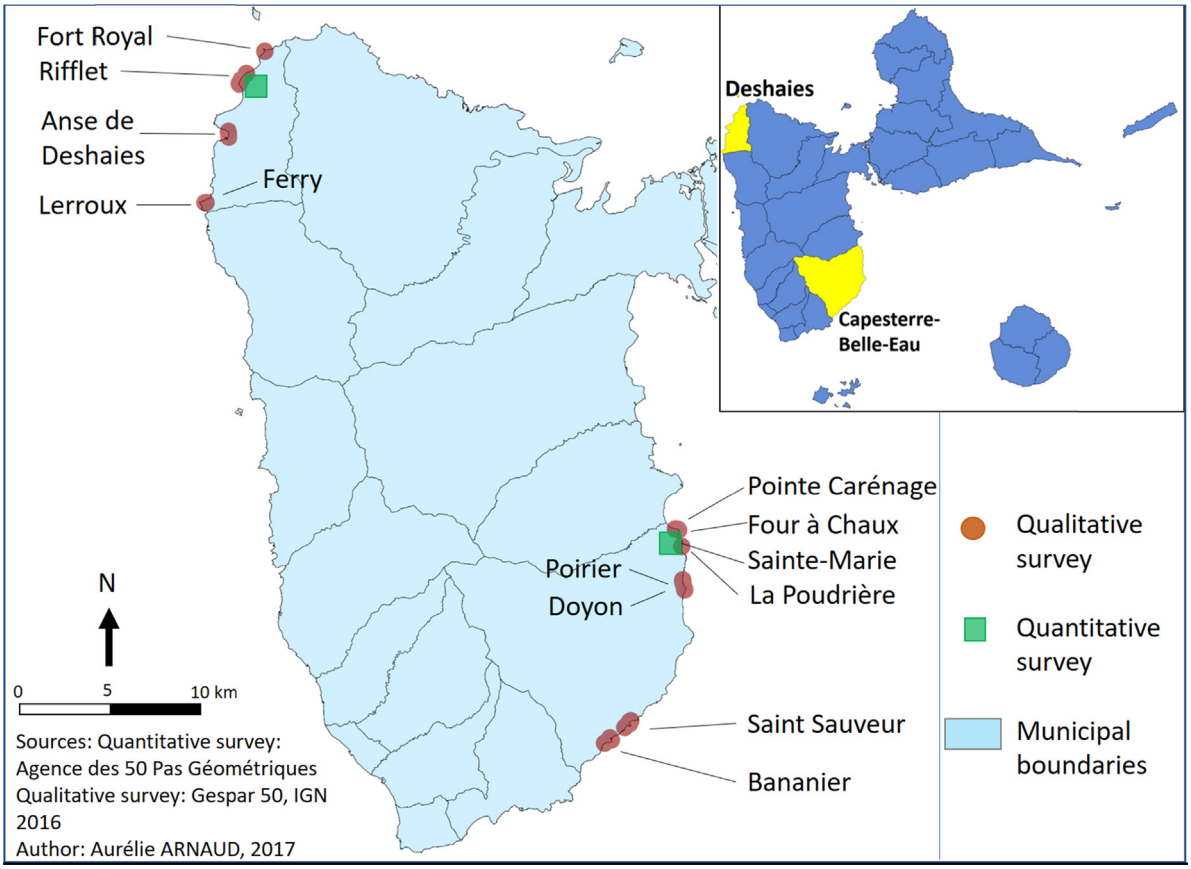

Fig. 1. Map of the fieldwork sites.

- access to legal tools and information, their understanding and handling;
- the legal situation of individuals and their assets (occupation without right or entitlement, involuntary detention of a fraudulent property title, inability to provide proof that would allow a situation to be legalized, presence on the territory without a stay document, undeclared professional activity, etc.).

Our research is conceived within the analytical framework of environmental inequality. The notion of environmental inequality designates situations in which environmental vulnerabilities (exposure to environmental hazards or inaccessibility to environmental amenities) and social vulnerabilities are compounded (Taylor, 2000). Previous research has shown that a large array of interacting economic, social, cultural and ethno-racial factors are bound up in the notion of social vulnerability, and such factors tend to reinforce each other in contexts of environmental inequality (Adeola, 2001; Bullard, 1993). Coastal environmental inequalities occur when the populations most exposed to natural hazards are also the most socially vulnerable (Mavromatidi et al., 2017). Coastal urbanization has dramatically increased around the world, thus exposing more and more populations to natural hazards (IPCC, 2014). Research has further shown that postcolonial contexts tend to be subject to environmental inequalities in general and to coastal environmental inequalities more specifically (Jonah and Kofi Adu-Boahen, 2016; Licuanan et al., 2015).

2. Context

As a colonial settlement, Guadeloupe was organized around plantations, with preference given to the plateaus of Grande Terre and the fertile volcanic land on the periphery of Basse-Terre (Sainton, 2012). In 1674, an edict by King Louis XIV of France declared that the coastal zone of the French Antilles was the property of the State and could not be built-up along a strip that ran 81.20 meters inland. The role of these "50 Steps of the King" [1] was to facilitate military defence, traffic flows and access to the sea for fishing as well as for commercial and artisanal activities (Chadenas et al., 2016; Constant-Pujar, 2011; Dufau, 1990). The latter were grouped together in market towns that long remained active in daytime but were not commonly places of residence (Sainton, 2015).

[1] This legal term was defined in 1681 by the Marine Code under Colbert: "Shall be considered sea shore and beach all that is covered and uncovered during the new and full moons, and the point up to which the high tide of March extends on the shore" (Constant-Pujar, 2011, translated here).

The definitive abolition of slavery (Schoelcher decree of 27 April 1848) was a historic date in several respects, including for land occupation. Ultimately, a non-negligible share of newly freed slaves had no choice but to remain on the plantations in exchange for an unattractive work contract. Others were instead able to settle in towns and villages. Some were able to purchase a plot of land to farm (Buttel, 2007), while others moved onto vacant land, ravines and coastal areas without right or entitlement– including along the "50 Steps of the King" (Brissac, 2011). The arrival of inhabitants in the 50 Steps zone was tolerated by public authorities at the time and even encouraged by plantation owners who, having not received all the compensation promised for the loss of their slaves, were quite unwilling to tolerate the presence of newly freed slaves on their plantations if the latter were no longer working. Successive agricultural crises and subsequent rural exoduses – which culminated in the decline of the sugar industry in the late 20th century – led new and extremely poor populations to occupy coastal areas without right or entitlement (Burner, 2015; Priet, 1997). Policies to regularize illegal occupations on the coast were first initiated in the 19th century. The decree of 21 June 1882 enabled the granting of "permanent and non-transferable" property titles to the occupants of built lots. The decree remained in effect until the mid-20th century, although it did not do much to change the situation. The decree of 30 June 1955 turned the 50 Steps zone into state-owned land, thus allowing the State to formally sell lots to their occupants. Occupants with the most financial and cultural capital benefited more than others from such opportunities for regularization. This last large wave of regularization in the decades preceding the coastal law of 1986 appears to have been particularly advantageous for new beach resorts, mostly concentrated along the coast of Guadeloupe's Grande-Terre.

The coastal law of 1986 sought to end the rapidly expanding urbanization of coastal areas. When it was drafted, the legislator introduced a chapter directly focused on France's overseas areas, thus specifically considering the historical legacy, economic vulnerability and geographical constraints of the country's overseas departments. Marine Public Property in Guadeloupe is as such defined as the land covered by territorial waters in addition to "dry" public property of a depth of 81.20 meters, thus corresponding to the "50 Geometric Steps". The 50 Steps zone is therefore protected through both its inability to be built-up outside of urban areas and by its labelling as inalienable public land. Moreover, the implementing order of 13 October 1989[2] related to the 50 Steps zone authorized the State to give away some already occupied built land under certain conditions. To coordinate these regularization procedures, the "Agence des 50 Pas géométriques" ("50 Geometric Step Agency") was created in 1996.[3]

3. Material and methods

The two areas studied here were selected based on their environmental and social characteristics. Both municipalities are subject to comparable types of hazards. In addition to flooding, mass movements and volcanism,[4] both are exposed to earthquakes; some of them can cause tsunamis and soil liquefaction (Burac, 1999; Mompelat et al., 2011). The rainy season is further subject to storms and even hurricanes that result in at times very strong cyclonic swell (D'Erocle, 1995; Desarthe, 2014; Pagney-Benito-Espinal et al., 2002) and have a marked impact on coastal erosion in some places (BRGM, 2010). The two areas studied differ, however, in terms of their socio-economic makeup, touristic appeal and governance. Indeed, tourism is extremely limited in Capesterre-Belle-Eau and concerns mainly a French Antilles-based clientele. Conversely, although Deshaies is quite far from the large and prestigious resort towns of the archipelago, it nevertheless has a non-negligible tourism-based economy, with a dozen hotels (there are none in Capesterre-Belle-Eau) and 34.5% holiday homes (versus 3% in Capesterre-Belle-Eau). Finally, the municipalities of Deshaies and Capesterre-Belle-Eau differ in their local policy approach to coastal hazard prevention: while one has a proactive approach, the other is mired in inertia (Fig. 1).

The interdisciplinary corpus of data used in our analysis consists of 52 interviews conducted with inhabitants of the areas managed by the "Agence des 50 Pas" agency and institutional actors (Table 1),[5] as well as a set of spatialized data (physical, regulatory and socio-economic data), a regulatory and jurisprudential corpus.

The sample selected for the interviews considered the socio-economic and ethno-phenotypic diversity of inhabitants in the zones studied on the one hand, and the array of competent institutional actors in both the municipalities studied on the other hand. The interview grids combined questions from three disciplines (sociology, geography and law) and the questions were adapted to the type of interviewee (inhabitant or institutional actor). In the context of this article, our analysis will focus more particularly on the following topics:

- For inhabitants: their residential history and the history of their current home, the status of their dwelling and any procedures undertaken to regularize it, their attachment to the location and to their residence itself, and their socio-economic, cultural and family situation;
- For institutional actors: the involvement of their institution in managing the Guadeloupean coast and its position in relation to the other institutions involved, their professional experience regarding the

[2] Code Général de la Propriété des Personnes Publiques, art. R. 5112-2 and subsequent.

[3] Law #96-1241 of 30 December 1996 on the planning, protection and development of such areas.

[4] La Grande Soufrière is an active, 1467 m-high volcano located in the municipality of Capesterre-Belle-Eau. The town of Capesterre-Belle-Eau is directly exposed to lava flow, whereas Deshaies, like the rest of the archipelago, is exposed to volcanic ash fall.

[5] The survey also included 4 interviews with economic actors, but this part of the corpus was not used in the context of this article.

Table 1
Type, number and duration of the interviews conducted with inhabitants and institutional actors.

Municipality	Interviewees		
	Inhabitants (Semi-structured interviews)	Municipal-level institutional actors (In-depth interviews)	Other institutional actors (Government departments, Regional council, Adem, BRGM, etc.) (In-depth interviews)
Capesterre-Belle-Eau	18	2	18
Deshaies	12	2	
Total duration of the interviews	21 hours and 30 minutes	19 hours and 40 minutes	

Guadeloupean coast and their personal opinion regarding management of the Guadeloupean coast.

The interviews were fully recorded[6] and transcribed. They underwent manual thematic division in order to conduct discourse analysis.[7]

To date, the socio-economic data generated by the "Agence des 50 Pas géométriques" are the only statistics specifically available for the coastal zones of the two municipalities.[8] They provide an initial level of instructive information, although it is nevertheless incomplete. The heterogeneity of the data does not allow for a systematic comparison of all districts. In the context of this article, we draw on the first statistically exploitable data obtained through a homogenization process that involved the selection and preparation of variables common to both districts. This data set covers two neighbourhoods, Rifflet in Deshaies and Sainte-Marie in Capesterre-Belle-Eau (Fig. 1). The data aspire to be complete: they pertain to 30 occupied lots (primarily homes) in the Sainte-Marie neighbourhood and 85 in the Rifflet neighbourhood.

Finally, from a legal perspective, our analysis focuses on the application of national legal regimes related to the coast and the management of hazards, and on regulations specific to France's Overseas Departments, based on specific cases of assets present in the "50 Steps" zone in the municipalities of Deshaies and Capesterre.

4. Results

The colonial legacy is still visible in the general layout of land use on Basse-Terre island: wealthy neighbourhoods are mainly located on hills overlooking the sea; middle class districts are mainly in the intermediary zone; and poor districts are concentrated along the seafront (Brissac, 2011). Despite policies to encourage the regularization of buildings without a property title, a clear majority of inhabitants in the 50 Steps zone still illegally inhabit their homes. The "Agence des 50 Pas" estimates that there are 10,000 buildings along the 50 Steps strip. To present, 5800 applications for regularization have been submitted, but only about half have been accepted by the agency. There are several factors behind the complexity of situations in the field and the random nature of property regularizations in the coastal zones managed by the "Agence des 50 Pas" in Guadeloupe.

Economic factors. The illegal occupation of this public land has been tolerated and free of charge for inhabitants, whereas the regularization process and the work necessary to comply with urban and sanitary norms comes with a direct or indirect cost for inhabitants. In the case of regularization, inhabitants must first pay a land surveyor and then purchase the land, granted for a small amount. When neighbourhoods are developed by the "Agence des 50 Pas", inhabitants must pay to ensure the provision of services to their land, meaning they pay to have the house connected to urban networks (running water, sanitation, etc.). Finally, in the case of assignment, by officialising their status, inhabitants become homeowners and are thus required to pay a mortgage, as well as property and council taxes. These procedures as such represent a cost for inhabitants – one that is too much for many poor people in the 50 Geometric Steps zone. In the two neighbourhoods for which we have statistical data, there is a particularly high percentage of poor inhabitants. Forty-seven percent of households in Sainte-Marie and 55% of households in Rifflet have a monthly income of less than EUR 1000. The average monthly income for the municipality of Deshaies as a whole is EUR 1374. It is EUR 1025 in Capesterre-Belle-Eau[9] and EUR 2063 for all of France.[10] Similarly, relocation procedures for those most at risk can represent an economic loss for inhabitants since the indemnification measures available are not adapted to squatters or to erosion (Barnier funds) and are limited to EUR 40,000 for a home or EUR 20,000 for a commercial building under the Letchimy law.[11]

Cultural and institutional factors. Regularization procedures are long and complex. They require inhabitants to fill out detailed forms in French. Creole societies are characterized by their high degree of diglossia and the least educated segments of the population are often less comfortable dealing with documents in French. Efforts to accompany inhabitants and simplify procedures are

[6] Only one of the interviews was not recorded at the request of the interviewee.

[7] The short format of this article made it impossible to include interview excerpts in the presentation of our findings.

[8] Unlike most other French coastal territories, the gridded data provided by the French National Statistics Institute for small spatial scales (grids of 200 m of coast) do not exist for Guadeloupe.

[9] These amounts do not take into account the income of holiday homeowners in these municipalities.

[10] Source: Ministry of the Economy.

[11] Law #2011-725 of 23 June 2011 known as the "Letchimy" law pertaining to specific measures for districts of informal housing and the fight against indecent habitats in French overseas departments and regions, Decree of 18 February 2013 setting the scale for financial aid outlined in articles 1, 2, 3 and 6 in Law #2011-725 of 23 June 2011.

offset by institutional coordination issues. The creation of the "Agence des 50 Pas" added another layer to the complex administrative system. Although created to better address cross-sectional issues, the agency nevertheless added an additional link in the chain of pre-existing overlap and confusion between the different competent institutions. Moreover, the local "*lakatè*" culture often works to further exacerbate cultural vulnerability. "*Lak: acte et tè*" is the Creole word for a property deed. In Guadeloupe, a *lakatè* may be a simple oral agreement or some other type of non-official document. This means that the holder is often – usually unwittingly – not in compliance with French law.

Regulatory and legal factors. Changes to the legal context have further accentuated the complexity of situations in the field. When the "Agence des 50 Pas" was created in 1996, the "Barnier Law" of 1995[12] had just been passed; it unified pre-existing natural disaster management planning tools and imposed a single tool – Natural Hazard Prevention Plans (PPRNs). These plans stipulate the zoning of land that can or cannot be built or that is subject to regulations based on the estimated hazards. The drafting of such plans obviously took time and, in Guadeloupe, the first PPRs were approved starting in 2007–2008. The mapping of hazards was as such a lengthy procedure–and the "Agence des 50 Pas" had already begun its regularization mission based on its own mapping tools.[13] The "Bachelot Law" of 2003[14] further bolstered the process by requiring that information about potential hazards be given to buyers and renters of land subject to a PPR. The law of 2004 on the modernization of emergency management created municipal safety plans through which municipalities must implement measures to alert the population and manage crises. "The "Grenelle 2 Law"[15] of 2010 transposed the 2007 European Directive on flooding[16]; it unified regimes related to freshwater flooding and coastal flooding, and placed environmental concerns at the forefront of hazard management approaches, now required to strive for the "good ecological status of water" outlined in the Framework Directive on water.[17] The MAPTAM Law[18] of 2014 led to a transfer of authority towards the intermunicipal level for water management, aquatic environments and flood prevention. Furthermore, since 2015, land considered subject to "serious and predictable natural hazards that threaten human lives" can no longer be assigned.[19] Given this, starting in 1996 and particularly since 2012[20] and 2015,[21] assignments have gradually begun to be refused in the 50 Geometric Steps sector, which is classified as a high-hazard zone [posing a grave danger for human life and a red zone in the PPRs (Fig. 2)]. The "Agence des 50 Pas" estimates that this affects 2000 cases. It therefore appears that based on the same exposure to hazards, the time at which knowledge of such hazards appeared and the legal context mean that applications for assignment are treated differently based on whether they were submitted before or after the publication of the PPR maps, and before or after 2012 and 2015. And yet, 35% of the zones managed by the "Agence des 50 Pas" in both the municipalities studied are classified as red zones in the PPR (that is, are characterized as very high risk level).

5. Discussion

Coastal management in France is torn between local pressure to defend urban coastal areas from the sea through heavy infrastructure to "reinforce" the coastline, and French legal texts that increasingly seek to:

- strike a balance between urbanization and the protection of natural coastal areas;
- drive hazard prevention strategies.

It was notably winter storm Xynthia (2010), its media coverage and its contentious aftermath that accelerated the movement to think about the strategic retreat and relocation of assets and people threatened by coastal hazards. Xynthia, and the rise in coastal hazards around the world more generally, have contributed to increased concerns among French public authorities (Perherin et al., 2016). During our research, several of the institutional actors interviewed mentioned liability which could indeed potentially affect: for example, the "Agence des 50 Pas" in its role as a consultant; the Prefect in his or her role as a decision-maker[22]; or even elected officials, since mayors are responsible for public safety and drafting municipal safety plans.

While a planned retreat from coastal areas is increasingly considered by experts to be the most sustainable and cost-effective approach, it raises some serious social and political challenges for local governments (Abel et al., 2011; Rocle and Salles, 2017). When it comes to institutional actors, the first line of resistance is often from local municipalities (Mineo-Kleiner and Meur-Férec, 2016), although some have nevertheless recently shown signs of cooperation (Rocle and Salles, 2017). This is true

[12] Law #95-101 of 2 February 1995 on improving environmental protection.
[13] Documents from pre-existing expert reports or those commissioned from consultants.
[14] Law #2003-699 of 30 July 2003 on the prevention of technological and natural hazards and the reparation of damage.
[15] Law #2010-788, 12 July 2010, National Commitment for the Environment.
[16] Directive #2007/60/CE of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.
[17] Directive 2000/60/CE of the European Parliament and of the Council of 23 October 2000 outlining a framework for a political community in the field of water.
[18] Law#2014-58 of 27 January 2014 on the Modernization of Territorial Public Action and the Affirmation of Metropolitan Areas (MAPTAM), modified by the Law on the New Territorial Organization of the Republic (NOTRe) on 7 August 2015.
[19] Law #2015-1268 of 14 October 2015 on the renewal of overseas law, CGPPP art L5112-5.
[20] Letter from the Directorate of Legal Affairs on 17 September 2012, and at the request of the Prefecture of Guadeloupe.
[21] Law #2015-1268 of 14 October 2015 on the renewal of overseas law.
[22] The Prefect ("*Préfet*") is the senior civil servant representing the executive branch of government in each of France's administrative departments ("*départements*").

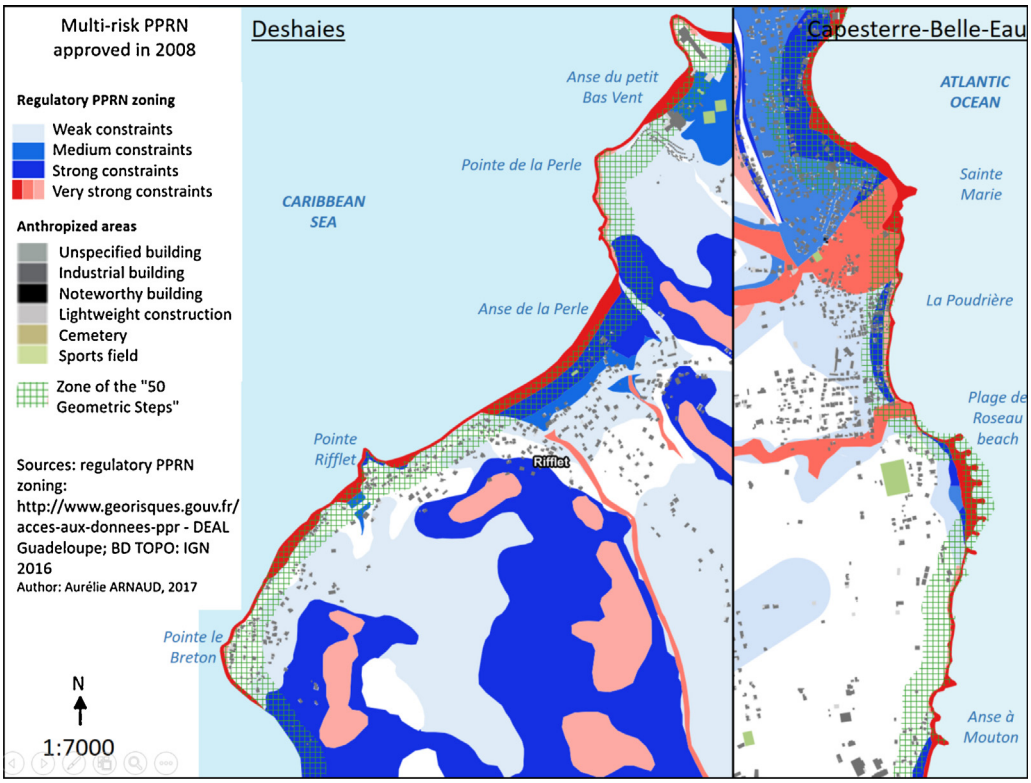

Fig. 2. Excerpt from the Capesterre-Belle-Eau PPRN.

for the municipality of Deshaies, although not for Capesterre-Belle-Eau.

In Capesterre-Belle-Eau, the municipality has focused its efforts on urban planning in the centre of the town, which has a road and coastal promenade protected by a breakwater behind which are several housing complexes. This renovation work was undertaken based on planning in favour of hardening the coastline. Real effort has also been put into social housing. A few other neighbourhoods were also the focus of partial planning efforts, like the pedestrian roadway built in the Poudrière district, part of which has since been destroyed by coastal erosion. Other neighbourhoods remain in their original state and illegal land occupation has often occurred with tacit or explicit consent from elected officials. Inhabitants are as such subject to contradictory discourse in the form of orally granted municipal permission on the one hand and national policies aimed at legalization and relocation on the other hand. The decision-makers, we interviewed from this municipality, expressed growing concern about being held criminally responsible. And yet, a certain inertia nonetheless prevails.

The municipal team in Deshaies has shown an impressive desire to seize on the national legal framework to manage its coast. When cyclone Lenny struck in 1999, a relocation project for inhabitants in the Ferry district was already underway, albeit it faced resistance from local inhabitants. When the district was particularly ravaged by the cyclone, the last bastions of resistance were destroyed alongside many homes. Inhabitants then agreed to be relocated to a new neighbourhood (Leroux), further away from the coast.[23] In Rifflet, revegetation of the sandy zone was undertaken and an access road and car park equipped with ecopassages for turtles were built. In other neighbourhoods, the municipality has opted to allow certain inhabitants or small businesses (town centre) to remain in place.

Such voluntary policies have nevertheless encountered resistance from inhabitants. During our interviews, inhabitants in both municipalities expressed their strong attachment to their place of residence. While similar phenomena have been observed in other parts of France (André et al., 2015; Meur-Ferec et al., 2008), its roots are historical in Guadeloupe. Indeed, the occupation over time of the Guadeloupean coast by poor populations was almost always a choice "by default". The plots of land where newly freed slaves built their Creole huts have nevertheless been the subject of great physical and symbolic appropriation. The Creole gardens surrounding such huts nourish, heal and protect (Benoît, 2002); similarly, the sea and shore provide additional food through fishing[24] and the trapping

[23] Dwellings in this new neighbourhood are smaller and denser than in the neighbourhood that was destroyed. The inhabitants we met stated that this relocation has resulted in a weakening in ties of solidarity compared to the original neighbourhood and to a loss of additional food sources from their former gardens, a phenomenon also observed in other cases (Burner, 2015).

[24] Even though fishing is officially banned in certain parts of Capesterre-Belle-Eau due to the particularly high chlordecone pollution levels from decades of intensive banana farming in the municipality.

of crab. The inhabited coast is a true *lived space* for the people we interviewed, meaning it is "a place visited by everyone [...], with its attractive sites, hubs around which people's lives are constructed: homes, houses, places of work and leisure. It is the concrete location of everyday life" (Di Méo, 1990, translated here). These coastal neighbourhoods are places of sociability and solidarity, where "informal" (or piecemeal for the poorest) economies have developed. That is why the inhabitants interviewed expressed resistance over their possible relocation. The idea of being rehoused in an apartment building with no garden and far from the seaside was hard for them to accept. Statistics from the "Agence des 50 Pas" show that a clear majority of inhabitants might accept relocation if it was in the same neighbourhood (60% for Sainte-Marie and 67% for Rifflet) and in a private home rather than in an apartment complex (60% for Sainte-Marie and 72% pour Rifflet).

The plots of land on which people live are the ties that anchor entire populations to their painful past at the intergenerational and generational scale. For some, the land was passed down through family; for others, it is a place of refuge following a natural, social or familial disaster. Several of the inhabitants we met described their itinerancy as they were repeatedly forced to move, for example after the 1976 volcanic eruption, then by a cyclone and/or other event – Hugo in 1989, Luis and Marilyn in 1995, Lenny in 1999, etc. Examining their discourse makes it possible to identify the extent to which such inhabitants are torn between their attachment to a place and past trauma. Some were marked by the exceptional events of cyclone Hugo, during which coastal swell, flooding and violent winds broke, shattered or destroyed their homes and eroded their land. Fear was patent in their discourse, despite being systematically offset or exceeded by a sense of pride – pride at having survived the catastrophe; pride, in some cases, that their house had resisted the cyclone; exacerbated pride when the home was built by inhabitants themselves; and, lastly, pride in having risen again after the event. The religious fervour common in the French Antilles (Prudhomme, 2009) is also important in shaping the way inhabitants relate to natural hazards. The inhabitants interviewed viewed natural disasters and their survival of them wholly or in part as an act of God.

6. Conclusion

Multihazard coastal situations complexify the process of governing hazards. Seismic phenomena, tsunamis and soil liquefaction are largely unpredictable and require extremely short reaction times (often within seconds), whether in terms of forecasting, alerting or protecting inhabitants. Moreover, in Guadeloupe, the legislator's intentions to repair and prevent hazards must contend with a complex territorial reality that is still unable to escape its postcolonial past and the legacy of slavery. The challenges coordinating and the potential contradictions between regularization policies, hazard-prevention policies and policies to curb insalubrious housing tend to expose the most fragile populations to situations that we suggest calling, in the tradition of Jacqueline Candau and Anne Gassiat (2017), "incapacitating". In other words, rather than alleviating the legal, environmental and social vulnerability of populations, the current institutional confusion has subjected some inhabitants to paradoxical situations that may actually block, delay, or encourage *laisser-faire* attitudes and provisory measures that end up lasting. Seen as such, this legal vulnerability tends to reflect a further accumulation of environmental and social vulnerability. The situation of inhabitants is thus particularly unequal at present and it looks as though it will be difficult to resolve the complexity of the issue. Meanwhile, the term of the "Agence des 50 Pas" is set to expire in 2021.

Environmental hazards are not permanent across time and space, since both hazards and vulnerabilities can evolve. Previous research (D'Ercole and P. Pigeon, 2000; Meur-Ferec et al., 2008) has underscored the anthropogenic origin behind worsening natural hazards. Coastal areas are particularly affected, with the effects of climate change further felt in terms of increasing extreme events and rising sea levels (IPCC, 2014). Other very direct anthropogenic effects are also visible, such as the hardening of shorelines, the exploitation of natural resources and the construction or expansion of harbours (Austin, 2006; Williams et al., 2017). Hazards are no longer merely natural, they are increasingly socio-natural and are thus complexifying the issue of responsibility as we move into the future.

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As we write the final lines in this conclusion, Hurricane Maria has just struck the French Antilles (21 September 2017). The first reports are dire and include submerged coasts and destroyed buildings. Two deaths have been reported in the municipality of Capesterre-Belle-Eau.

References

Abel, N., Gorddard, R., Harman, B., Leitch, A., Langridge, J., Ryan, A., et al., 2011. Sea level rise, coastal development and planned retreat: analytical framework, governance principles and an Australian case study. Environ. Sci. Policy 14 (3), 279–288.

Adeola, F.O., 2001. Environmental Injustice and Human Rights Abuse: the States, MNCs and repression of minority groups in the world system. Human Ecol. Rev. 8 (1), 39–59.

André, C., Sauboua, P., Rey-Valette, H., Schauner, G., 2015. Acceptabilité et mise en œuvre des politiques de relocalisation face aux risques littoraux : perspectives issues d'une recherche en partenariat. Vertigo 15, 1 (On line, URL: http://vertigo.revues.org.lama.univ-amu.fr/16074).

Austin, D.E., 2006. Coastal exploitation, land loss, and hurricanes: a recipe for disaster. Am. Anthropol. 108 (4), 671–691.

Benoît, C., 2002. Corps, jardins, mémoires. In: Anthropologie du corps et de l'espace à la Guadeloupe. Paris, CNRS.

BRGM, 2010. Rapport et dynamique du trait de côte de l'archipel guadeloupéen. Étude de 1956 à 2004. (BRGM/RP-58750-FR. Juillet 2010. 186 p. http://infoterre.brgm.fr/rapports/RP-58750-FR.pdf).

Brissac, D., 2011. L'écologie urbaine dans les îles de la Caraïbe : Le cas de la Guadeloupe. La dynamique des écosystèmes produits par les espaces urbains, la ville et les quartiers en étalement urbain. In: Teisserenc, P., Etien, R., Chicot, P.Y. (Eds.), La recomposition territoriale : un défi pour la Guadeloupe. Presses de l'Université des Antilles et de la Guyane, pp. 205–218.

Bullard, R., 1993. Race and environmental justice in the United States. Yale J. Int. Law 18, 319–335.

Burac, G.C., 1999. Les Antilles terres à risque. Karthala, Paris, France (300p.).

Burner, M., 2015. L'occupation à risque du territoire, traduction contemporaine d'un contexte géo-climatique et historique. In: Huc, J.C., Etna, M. (Eds.), Eclats de temps. Anthologie des évènements climatiques extrêmes de la Guadeloupe. PLB éditions, pp. 332–343.

Buttel, P., 2007. Histoire des Antilles françaises (423 p.). Perrin, Paris, France.

Candau, J., Gassiat, A., 2017. Mise en incapacité professionnelle pour contrôler l'accès à la terre agricole. Enquête à Piton l'Ermitage (La Réunion). In: Proceedings of the Colloque Agriculture, Ruralités et Développement, Université Libre de Bruxelles.

Chadenas, C., Rollo, N., Desse, M., 2016. Les 50 pas géométriques dans les territoires ultramarins. Cah. Nantais 2, 43–52.

Constant-Pujar, A., 2011. Gestion responsable du foncier et développement durable Outre-mer. Contribution à une approche critique de l'espace martiniquais. (Thèse pour le doctorat en sciences juridiques) Université des Antilles et de la Guyane, France.

D'Erocle, R., 1995. Natural hazards in the French West Indies: an overall view. In: Panizza, M., Soldati, M., Barani, D. (Eds.), The Erasmus 93-94 Programm in Geomorphology. Università degli Studi di Modena, pp. 7–24.

D'Ercole, R., Pigeon, P., 2000. L'évaluation du risque à l'échelle internationale : méthodologie et application aux diagnostics préalables aux actions de préparation et de prévention des catastrophes. Cah. Savoisiens Geogr. 1, 29–36 (Université de Savoie).

Desarthe, J., 2014. Ouragans et submersions dans les Antilles françaises (17e–20e s.). Études caribéennes. (On line, 29, URL: http://etudescaribeennes.revues.org/7176).

Di Méo, G., 1990. De l'espace subjectif à l'espace objectif : l'itinéraire du labyrinthe. Espace Geogr. 19–20 (4), 359–373.

Dufau, J., 1990. La loi littoral du 3 janvier 1986 : la zone des 50 pas géométriques dans les D.O.M. AJDA (444 p.).

IPCC, 2014. Fifth Assessment Report, Worpking group 2. Climate Change 2014: Impacts, Adaptation and Vulnerability. .

Jonah, F.E., Kofi Adu-Boahen, K., 2016. Coastal environmental injustice in Ghana: the activities of coastal sediment miners in the Elmina, Cape Coast and Moree area. Geo. J. 81, 185–196.

Licuanan, W.Y., et al., 2015. I-C-SEA Change: A participatory tool for rapid assessment of vulnerability of tropical coastal communities to climate change impacts. Ambio 44, 718–736.

Mavromatidi, A., Briche, E., Claeys, C., 2017. Mapping and analyzing socio-environmental vulnerability to coastal hazards induced by climate change: an application to coastal Mediterranean cities in France. Cities 72, 189–200.

Meur-Ferec, C., Deboudt, P., Morel, V., 2008. Coastal risks in France: an integrated method for evaluating vulnerability. J. Coastal Res. 2, 178–189.

Mineo-Kleiner, L., Meur-Férec, C., 2016. Relocaliser les enjeux exposés aux risques côtiers en France : points de vue des acteurs institutionnels. Vertigo 16, 2 (On line, URL: http://vertigo.revues.org/17656).

Mompelat, J.M., Audru, J.C., Terrier, M., Bertil, D., 2011. Prévention du risque sismique aux Antilles françaises. Geosciences 68–75 (<hal-00663445>).

Pagney-Benito-Espinal, F., Asselin de Beauville, C., Bonneton, A., Pontikis, C., 2002. Crisis management and preventive responses to the last tropical cyclone experiences in the French Antilles. In: Proceedings of the 25th Congress of the American Meteorological Society, San Diego, California, pp. 418–419.

Perherin, C., Meur-Ferec, C., Deniaud, Y., 2016.In: FLOODrisk 2016-3rd European Conference on Flood Risk Management, E3S Web of Conferences, Coastal hazards mapping: which obstacles prevent the stakeholders from reaching a consensus?.

Priet, F., 1997. Le nouveau régime de la zone des cinquante pas géométriques dans les départements d'Outre-mer. Commentaire de la loi n 96-1241 du 30 décembre 1996. RFDA 1166–1186.

Prudhomme, C., 2009. Les religions dans les mondes créoles : entre histoire et anthropologie. Hits. Monde Cult. Relig. 4 (12), 11–26.

Rocle, N., Salles, N., 2017. Pioneers but not guinea pigs: experimenting with climate change adaptation in French coastal areas. Policy Sci. 17 , http://dx.doi.org/10.1007/s11077-017-9279-z.

Sainton, J.P., 2012. Histoire et civilisation de la Caraïbe, Tome 2. Karthala, Paris.

Sainton, J.P., 2015. Histoire et civilisation de la Caraïbe 498 p. Karthala, Paris, France.

Taylor, D., 2000. The rise of the environmental justice paradigm. Injustice Framing and the social construction of environmental discourses. Am. Behav. Sci. 43, 508–588.

Williams, A., Rangel-Buitrago, N.G., Pranzini, E., Anfuso, G., 2017. The management of coastal erosion. Ocean Coastal Manage. 111, 1–17.