

Reconstructing early modern disaster management in Puerto Rico:
development and planning examined through the lens of Hurricanes San
Ciriaco (1899), San Felipe (1928) and Santa Clara (1956)

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ABSTRACT

Reconstructing early modern disaster management in Puerto Rico: development and planning examined through the lens of Hurricanes San Ciriaco (1899), San Felipe (1928) and Santa Clara (1956)

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This is the first longitudinal, retrospective, qualitative, descriptive and multi-case study of hurricanes in Puerto Rico, from 1899 to 1956, researching for planning purposes the key lessons from the disaster management changes that happened during the transition of Puerto Rico from a Spanish colony to a Commonwealth of the United States. The selected time period is crucial to grasp the foundations of modern disaster management, development and planning processes. Disasters are potent lenses through which inspect realpolitik in historical and current times, and grasp legacies that persist today, germane planning tasks. Moreover, Puerto Rico is an exemplary case; it has been an experimental laboratory for policies later promoted by the US abroad, and it embodies key common conditions to develop my research interface between urban planning and design, meteorology, hydrology, sociology, political science, culture and social history.

After introducing the dissertation, I present a literature review of the emergence of the secular characterization of disasters and a recent paradigm shift for understanding what a disaster is, its causes and how to respond. Next, I summarize the multidisciplinary research and policy knowledge concerning Puerto Rican hurricanes. Subsequently, I explain my methodological sequential data analysis, beginning with three case studies, followed by cross-case comparisons and assessments, ending in answer, recommendations and conclusions. I implemented a version of Grounded Theory, combining deductive and inductive thinking, with a phenomenologist

standpoint that valued people's experiences and interpretations of the world. I aimed to denaturalize so-called 'natural disasters', exposing with a political economy lens the political character of public decision-making before, during and after a disaster; and grasp how politics impacted the society under study. My research methods were archival research in the field and online, visual sociology and case study. Based on information-oriented sampling, I chose the destructive hurricanes San Ciriaco (1899), San Felipe (1928) and Santa Clara (1956), which occurred at critical historical junctures. I examined three themes: characterization, causation, and relief. Those themes divided into six sub-questions and thirty-eight variables, summarized later.

Answer: Disaster management vastly improved mirroring shifting ideas of God, nature, knowledge and humanity; always influenced by the dependent position of the island. Historically, citizens tried to handle hurricanes through mythological beliefs, empirical observations, rituals and material practices; some of which endured colonization and modernization into the mid 20th century. Disaster management emerged haphazardly; at first it was ineffective and improvised relief, without much preventive or reconstructive policy-making. The official perception of hurricanes changed from being essentially uncontrollable religious or natural events, to natural events that could be tamed with technology, physical changes and policies. Yet, it was a more nuanced confluence of environmental, economic, social, cultural, and political factors that enabled storms to become destructive disasters affecting the Puerto Rican economy, environment and society. The social groups that experienced higher resilience or vulnerability during a disaster respectively corresponded to the groups that were best and least served during relief and who could or could not produce public transcripts and policies. Such division resulted from entrenched social and political arrangements, including citizens' rights,

colonial administrative policies, social hierarchy that merged local and external power dynamics, and notions of habitus¹. Eventually, the growing understanding of citizens' rights was critical to reduce hurricane casualties and the worst forms of vulnerability through New Deal and Commonwealth developmental projects. By also including contentious aims though, they created other forms of underdevelopment and dependency from the US; whilst technology and modernity paradigms bolstered new risks that would become rather costly. Simultaneously, disaster management became a federal responsibility, which reached Puerto Rico; but it was the unplanned intersection of a hodge-podge of disciplines, approaches and institutions, centered on physical interventions and neglecting the role of culture and the political economy of disasters with negative lasting impacts. Although improvised, contradictory and controversial; the main factors enabling the rise of disaster management were increased governmental leadership, knowledge construction, public awareness, planning and investment in hard and soft infrastructure, and relief provision.

My dissertation contributes to Puerto Rican Studies and to emerging planning discussions about the Circum-Caribbean. Also, it contributes to disaster management, an area of academic and practice-oriented literature relevant for planning, fastly growing given the rising frequency and intensity of multiple disasters; and which is usually focused on contemporary events, prospective forecasting and proposal-making. Contrastingly, my dissertation's strengths reside in being a critical and exhaustive historical study of hurricanes that proposes an option to the customary deleterious disciplinary fragmentation of disaster studies and management, and to the emphasis on physical change that remain standards in most countries.

¹ Understood as durable structures or frameworks of thought which motivated individuals and groups to pursue and justify specific paths of action (Bourdieu, 1977).

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5. List of Acronyms

ARUV	Administration of Housing and Urban Renewal
CORCO	Commonwealth Oil Refining Company
CRUV	Corporation of Housing and Urban Renewal
DIVEDCO	Community Education Division
ENSO	El Niño Southern Oscillation
ERA	Emergency Relief Administration

ERCA	Emergency Relief and Construction Act
HUD	U.S. Department of Housing and Urban Development
ICP	Institute of Puerto Rican Culture
NHC	National Hurricane Center
NOAA	National Oceanic and Atmospheric Administration
PNP	National Progressist Party
PNPR	Nationalist Party of Puerto Rico
PPD	Democratic Popular Party
PRERA	Puerto Rican Emergency Relief Administration
PRIDCO	Puerto Rican Industrial Development Company
PRHRC	Puerto Rican Hurricane Relief Commission
PRHRLS	Puerto Rican Hurricane Relief Loan Section
PRRA	Puerto Rican Reconstruction Administration
SJ	San Juan
SPH	Standard Project Hurricane
SSHS	Saffir-Simpson Hurricane Scale
SSHWS	Saffir-Simpson Hurricane Wind Scale
WMO	World Meteorological Organization

6. Acknowledgments

I had the luck of writing this dissertation twice.

Like all students, I wrote and rewrote and rewrote until I felt I had a very good draft to submit in 2012, which I stored daily in 3 different places. Under tough conditions, I worked hard, perhaps too hard; but I wanted and needed to finish properly in due time as my funding and motivation were dwindling. Well, in the early hours of the day in which I had planned to submit it officially to my adviser via email, a thief broke in my parents' house in El Salvador and stole my computer and external harddrive. Soon I learned that the third backup, the dropbox account my adviser kindly set up for me, failed. According to the company, my location in an unstable internet connection caused a malfunctioning; my files were not lost. They never existed.

This bizarre episode happened within a larger episode that could rank as incredible in the much famed Latin American magical realism literature; in fact, I should write it just to share how in my part of the world reality supersedes fiction. The whole thing was too absurd even to me; as a result I was speechless, hungerless and sleepless. What had been my life purpose just vanished, and although inside of me all hell broke loose, I could not shed a tear, scream, less so communicate it to my adviser or anyone else in my department. I would have doubted it also, particularly because I had already spent 8 years stumbling to get there. In sum, the theft got me in a downward spiral of despair, frustration, resentment, anger and disease. It has taken almost three years, many countries, many therapies and, most of all, the support of many dear ones and strangers to overcome it. I hope that I can do justice in acknowledging their part in the following lines; and I ask to be forgiven in case that memory fails me during these rushed final moments.

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After what felt like an eternal stagnant time in El Salvador filled with doubts, unemployment and hardship; Forrest Hylton and Tabitha Decker gave me the chance to be a traveling faculty of the “Cities in the 21st Century” International Honors Program/Study Abroad, in the fall of 2013. Due to that job, I travelled to amazing destinations –New Orleans, Sao Paulo, Cape Town and Hanoi-, shared knowledge with my 32 undergraduate students, three travelling colleagues and others I met in each country; and I remembered why I once cared so much about cities and learning, and why finishing my dissertation (again) was worth it. Next, I hit the road without a plan, just with the intentions of keeping my motivation alive and finding my better self that had been so lost. Vietnam, Cambodia, India, Singapore, Malaysia, Indonesia, Korea and Japan kept me fascinated for a year and a half, in which good ideas and solid drafts started to see the light. As importantly if not more, my self-love, intuition, creativity, wellness, femininity and constant laughter started to thaw and blossom.

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7. Dedication

I dedicate my work to all the Puerto Ricans who, like my country fellows from El Salvador and far too many places in the world, do not have the right to be safe from disasters.

I also dedicate it to those who lost their lives, their dear ones, their health, their livelihoods and their joy due to preventable crisis and still wait for acknowledgement, remembrance and justice.

Chapter I. Introduction

“The Huracán is the most horrendous phenomenon of all that are visible on this island, and I even believe that in all America. It is a furious wind accompanied by rain, lightening, thunderstorms and most times by earth tremors, all terrible and devastating circumstances that can be gathered to ruin a country in a few hours: the whirlpools that the air forms and the torrential rains that inundate towns and countryside, accompanied by lightening, seem to be announcing the last convulsions of the universe”

-Notes from “Geographic, civil and natural history of the island of Saint John the Baptist of Puerto Rico”, the earliest and outstanding Puerto Rican historical account covering from 1493 to 1783, first published in 1788 (Abbad y Lasierra, 1866, p. 120).

This dissertation is the first longitudinal, retrospective, qualitative, descriptive and multi-case study of hurricanes in Puerto Rico -from 1899 to 1956- focused on the contemporary transformation of disaster management; analyzing hurricanes San Ciriaco (1899), San Felipe (1928) and Santa Clara (1956).

Disasters in Puerto Rico are a germane urban planning topic that merits rigorous examination, as the island is located in a highly hazard-prone region due to the confluence of various tectonic plates, extensive local fault systems, and exposure to diverse meteorological processes. Thus, depending on location and with varying regularity, Puerto Ricans may suffer human, economic,

social, cultural and environmental losses from hurricanes², storms, cold fronts, four types of floods -riverine, urban, flash and coastal-, landslides, earthquakes, seismic induced tsunamis, subsidence and surface collapse, wildfires, heat waves, droughts, and accentuated bipolar climatic system -intensive rainy and dry seasons- (Palm & Hodgson, 1993). That catalog of destructive events expands with human-triggered combustions, chemical pollution (Agencia Estatal de Manejo de Emergencias y Administración de Desastres, 2008), famines, epidemics, plagues, and decades of U.S. multi-site military weapon testing³. In other words, the development of Puerto Rico is tied to disaster management, an area of studies rich of overlapping interests needing multidisciplinary approaches, as this dissertation will demonstrate.

1.1 Historical and current relevance of hurricanes in Puerto Rico

Hurricanes have been the most prominent type of disaster on the island due to their higher recurrence and harmfulness; thus, around them more diverse representations, rituals, superstitions and observations developed, including knowledge that has been validated by practice and science centuries later (Auld/Powhatan, 2007; R. J. Grace, 1956; Schwartz, 2005).

The earliest tangible and intangible evidence of how humans understood and coped with

² Hurricanes are Western Hemisphere tropical storms that form in the Atlantic Ocean and northern Pacific Ocean, east of the International Date Line, and exceed the intensities of tropical depressions and tropical storms. They are called typhoons in the Western Pacific, cyclones in the Indian Ocean and Willy-Willy in Australia.

³ The latter left a legacy that includes impoverished communities at high risk, environmental degradation and unnumbered undetonated active devices with uncertain location.

destructive crises on the archipelago dates back to pre-Columbian times. Indigenous peoples of the Circum-Caribbean shared an understanding of disasters vinculated to supernatural deities who commanded nature. For instance, Carib, Arawak, and Taíno islanders adored and gave offerings to a mighty Goddess or God commander of hurricanes, who was known by several names and could be related to chaos, weather and wind (Gutiérrez Calvache, Fernández Ortega, & González Tendero, n.d.; Mulcahy, 2006). For some groups, the powerful deity created the Antilles and remained entitled to destroy them. Pre-Columbian indigenous in parts of the Caribbean properly identified signs of impending storms according to Fray Iñigo Abbad y Lasierra (Abbad y Lasierra, 1866), who was a Spanish Benedictine monk, traveler in the Americas, and fine pioneering author of Puerto Rican and Caribbean history. In other words, mythological beliefs and superstitions about storms coexisted with useful experiential knowledge.

Spanish Catholic colonizers also viewed hurricanes as an otherworldly affair, though vinculated to a different God that essentially chastised sinful behavior (Abbad y Lasierra, 1866; Alvarez-Curbelo, 1997; Centeno Añeses, 2000; Perpiñá y Pibernat, 1899). Moreover, indigenous forecasting was typically understood as despicable sorcery or satanic pact; thus, after Christopher Columbus's first expedition to the Americas in 1492, Spaniard newcomers neglected indigenous understandings of hurricanes –whether useful or not-. Instead, they introduced a myriad of

practices to ward off storms and survive them (Molina Casanova, 1988; Neely, 2006), some of which were engrained traditions until the mid 20th century. Registers of Puerto Rican disasters exist since the early colonial time (Abbad y Lasierra, 1866; Fowles, 1910; Van Middeldyk, 1903); yet, they varied in accuracy, area of study, consistency, and objectivity vis-à-vis religiosity. Until the late 18th century, a religious characterization of hurricanes prevailed on the Spanish territories, and biased relief and reconstruction. Hurricanes were seen as the most destructive catastrophe in the continent, comparable to a rapid Apocalypse (Abbad y Lasierra, 1866).

Connections between religion and disasters extended beyond the Hispanic colonies, as the characterization of hurricanes and the few embryonic mechanisms of prevention and mitigation were officially influenced by the Christian creeds brought by European colonizers (Coll y Toste, 1976; DIVEDCO, 1965; Molina Casanova, 1988; Neely, 2006; Ortíz Díaz, 2000; Schwartz, 2005); and also by beliefs held by surviving indigenous, enslaved Africans and later indentured foreign workers, although their influence was mostly informal. Diverse palimpsests of new and old religious beliefs, superstitions and empirical knowledge shaped the everyday life and policy-making spheres in the fragmented colonies. Although they are seldom addressed, in each country they differently filtered into today's characterizations of disasters and may interfere with or help effective public policy and collective action, which is why I review them.

Colonial records expose that hurricanes changed more than ecosystems and the built environment. They reshaped local social relations and even outcomes of international rivalries within the Caribbean and with the European metropolises (Schwartz, 2005). For instance, local authorities and powerful citizens used devastating storms as means to elevate protests to central administrators and overseas rulers, in order to renegotiate authority (Schwartz, 2005), funding, taxation and other critical issues. Disaster preparedness, relief and reconstruction –the latter possibly the most attended sphere of the disaster cycle until recently- reveal ideals of social order expressed in spatial relations. As my research shows, the selection of entitled and excluded stakeholders to elaborate post-disaster public transcripts⁴ closely relates with underlying social structures and interactions of human life that prefigured vulnerability⁵ or resilience to each hurricane; such as economic growth and profit distribution, urbanization trends, social hierarchies, cultural processes and political stability. Relief decisions to guarantee survival, re-establish some sort of stability and launch recovery lacking time, information and resources ultimately speak of citizenship, rights and obligations, as I also demonstrate. Likewise, the nature of emerging conflicts, mechanisms used to negotiate or suppress them, changes in policy trends and power relations expose the backbone of public life. In sum, disasters are potent lenses

⁴ I am using the notion of socially accepted versions of events represented in the public sphere through official documents, legal constructs, media messages, popular music and other means- modified from (Bryant & Bailey, 1997).

⁵ Vulnerability is the joint between susceptibility of communities at risks vis-à-vis their economic, spatial, social and cultural capacities to cope with threats -modified from (Hilhorst & Bankoff, 2004)-. Resilience is the opposite.

through which inspect realpolitik in historical and modern times, and understand legacies that affect the present, both pertinent tasks for planners.

Hurricanes remain emblematic of disaster management and provide a rich background for research. They are pulsating in the everyday life sphere through spontaneous cultural manifestations such as music, paintings, novels, proverbs and superstitions; which I review along the substantial production of related planning documents, scholarly writings and policy decisions. Hurricanes are an essential part of the shared social fabric of Puerto Ricans; they have received attention and funding historically, as they have been central for active and reactive development processes. Furthermore, they remain strategic in the light of worse disasters due to the complex interaction between context transformations and climate change; the latter possibly the most cited example of human-induced environmental impacts on physical and biological processes (Bryant & Bailey, 1997) and contentious as it is tainted by ideological alignments, economic interests⁶, and even contradictory scientific findings. On the one hand, recent worldwide extreme climate records, temperature, precipitation and storms (Blakely & Carbonell, 2012) have highlighted the topic and sparked beliefs about stronger and more frequent

⁶ Discussions oscillate between sheer denial even in light of valid evidence or blind beliefs without substantiation. At stake are the economic and political consequences of addressing mitigation –reduction of Greenhouse Gas (GHG) emissions- over adaptation –tackling inevitable climate-impact risks- (Blakely & Carbonell, 2012). Most emitters do not bear the climate change costs of GHG emissions, they do not have to compensate those affected by climate change; thus, they lack economic incentives to reduce emissions. Without policy interventions, human-induced climate change is an externality unaddressed by institutions and markets (Stern, 2007).

meteorological events due to climate change⁷. Also, recent estimates of a global-average migration of tropical cyclone activity away from the tropics could indicate hurricane impacts in areas formerly intact, thus unprepared, and radical associated droughts and rains (Kossin, A. Emanuel, & Vecchi, 2014). On the other hand, climate change trends could have less direct short term impact on meteorological hazards than the steady variability of climate systems and other non-climatic risks (Jha, Bloch, & Lamond, 2012). Decadal cycles of increased hurricane activity have been associated with particular combinations of physical conditions⁸ and El Niño Southern Oscillation⁹, not necessarily with climate change. For instance, longitudinal data points to the beginning a more active hurricane regime since 1995¹⁰, which implies higher human and material losses in the Circum-Caribbean and Central America; but it is similar to one last observed between 1940s-1960s. Thus, some scholars and policy-makers claim that the correlation between climate change and worse events may be true, but it is not proven yet with available means and data sets (Goldenberg, Landsea, Mestas-Nunez, & Gray, 2001; Pielke Jr. et al., 2003). Ultimately, even low magnitude storms could unleash large impacts because of

⁷ For example, hurricane Mitch (1998) and other recent catastrophes were attributed to global warming by the U.S. Agency for International Development, the International Federation of Red Cross and Red Crescent Societies and influential developmental scholars (Pielke Jr., Rubiera, Landsea, Fernández, & Klein, 2003).

⁸ Including oceanic temperatures and atmospheric circulation patterns.

⁹ Commonly known as ENSO, which fluctuates between two extremes, El Niño -warmer Pacific Ocean water- and La Niña -colder Pacific Ocean water also called El Viejo, anti-El Niño, or simply a 'cold event'.

¹⁰ In 1998, hurricanes Bonnie (Category 3), Georges (Category 4), and Mitch (Category 5) happened when La Niña was taking its place after a 'Very Strong' Niño¹⁰, which lasted from April 1997 to May 1998, and was the worse of the 20th century.

enhanced vulnerability of human settlements (Pielke Jr. et al., 2003), which highlights the urgency to address social, cultural and political processes that yield relatively fast benefits. In addition, assuming certainty about climate change demands to build into near-term investments and plans an appropriate contemplation of future processes and worst-case scenarios (Jha et al., 2012). Both options are critical for Puerto Rico; people and investments concentrate along the coast, implying the need to rethink worse exposure to hurricanes, storm surges, tsunamis, floods, sea level rise, changing ocean currents, warming of the sea surface and air temperature, irreversible salt-water intrusion in aquifers supplying potable water, droughts, wildfires, and heat waves. It also implies the urgency to anticipate possible effects such as economic stagnation, food and energy insecurity, water scarcity, death of species, plagues, public health emergencies and civil turmoil.

Hurricanes remain equally relevant for planning decisions in the light of less discussed yet potentially exacerbated damages of complex emergencies, if combined with vast spreads of toxic pollution from weapon testing sites used by the U.S. Navy until the early 2000s, pharmaceutical plants built in recent decades, heavy industry brown fields dating from the 1950s and 1960s, and rusty abandoned sugar mills and associated outdated infrastructure built in the early 20th century for example. Toxic contamination could be caused by direct human interventions -accidents, mismanagement and sabotage-, environmental triggers -seismic activity or extreme weather

events-, and their combination; as the 2011 Fukushima Daishii disaster showed. Those crises can be worsened by territorial changes of the 20th century reviewed in my dissertation, including purposive urbanization of risk-prone areas, food-dependency, and construction of dams, canals and levies calculated for low impact disasters, not for exceptional cyclical ones or those foreseen in climate change scenarios. Other risk-enhancing factors are poor evacuation protocols, unprepared aftermath response and the combination of disasters in a short time span, as the atrocious complex emergency of 1867¹¹ examined in Chapter V. Thus, disasters that could be prevented or minimized will bring destruction, set back development and increase dependency on the U.S., potentially at times of shrinking federal economic support and economic decline.

I.2 Dissertation position in relation to the literature of hurricanes on the island

There is a robust production of academic and policy-documents addressing Puerto Rican hurricanes. In the last three decades approximately, it expanded in quantity, complexity and diversity; yet, its dispersion remains a fundamental problem. I could not find websites or physical archives systematically storing multidisciplinary documents for public consultation. Surprisingly also, given the amount of existing work, my search online and in Puerto Rican archives yielded that there is no annotated bibliography or critical literature review for

¹¹ After months of droughts; a hurricane, earthquake and tsunami took place less than a month apart.

understanding the construction of scientific and formal knowledge concerning hurricanes. Chapter III is the first effort that takes stock of such knowledge and concludes that devastating hurricanes have catalyzed information production, ignoring minor events. The most recurring unit of analysis is the island level, disregarding that hurricanes are a common link to understand the Circum-Caribbean region and diverse areas within Puerto Rico. Another drive has been the martial use of meteorology. In addition, physicalist, materially oriented sciences and technocratic approaches prevail; whilst humanities and social sciences are underdeveloped; which characterizes mainstream disaster studies¹² and management¹³ in the U.S. and other countries. This tendency points to a widespread understanding of hurricanes as problems to solve through scientific, technical interventions in the physical environment; which has filtrated into what urban planners typically undertook when intervening in disasters. Contrastingly, since the late 1960s, there is a growing understanding of disasters as socially and culturally constructed processes that have material basis, which has advanced disaster management and the planning profession, and which my research echoes. The literature addressing hurricanes on the island - as in other territories- hardly builds connections between disciplines, when holistic interdisciplinary thinking is needed to complement specialized approaches. Even within the same discipline,

¹² The field of disaster studies emerged in the 1970s, and is known by different names, including disaster research, disaster risk studies, disaster and emergency studies, or disasters and trauma studies; which reflects changing emphasis and lack of agreement on a particular name. It started by reuniting shared needs in the scientific disciplines that studied disasters separately –such as meteorology or seismology- and subsequently promoted interdisciplinary.

¹³ Likewise, the related practice of disaster management is known by different names such as disaster preparedness and response, emergency management, disaster response, or disaster risk reduction.

methodologies, focuses and units of analysis vary, which is both an epistemological strength and weakness. Diversity is enriching but undermines longitudinal, retrospective and comparative studies. The latter kind of studies focused on similarities and differences when facing the same peril -as my research does- denaturalize so-called ‘natural disasters’ by exposing human agency and political economy, which could ultimately improve policy-making.

Puerto Rican hurricanes need further examination by governmental institutions, especially and most strikingly by urban planners, who would benefit from a historical perspective and multi-disciplinarity to manage disasters in a culturally sensitive way; joined by anthropologists, ethnographers, preservationists, art historians and other professionals hardly engaged. For the most part, plans and studies focus on specific, contemporary examples; such emphasis disregards the relevance of comparative and retrospective examinations, and the need to grasp complex, long-term processes. Since the 1950s, procedural documents address how to act before, during and after a hurricane –often made by academics or public servants in the military and Civil Defense-. Although they could be criticized at many levels -cohesiveness and effectiveness for instance-; they have a valuable intention to plan and react, and they portray how disaster management evolved. However, a vital task tends to be missing, the elaboration of “thick descriptions” (Geertz, 1963, 1973) that surpass the presentation of facts -and also procedures for this case-; to expand in details perhaps seemingly unconnected at first sight, but that when

interpreted together can reveal conceptual structures and meanings, intricately layered and intercrossed. As a result, those engaged with disasters –in academia and practice- have shunned the duties of understanding how modern disaster management took off from the turn of the 20th century until the mid-1950s, and of examining the main contemporary economic, spatial and social processes that would bolster disaster resilience and yet create new forms of vulnerability simultaneously. That knowledge gap blurs the foundations of current disaster management practices; and how and why influential contextual transformations happened. Besides, since the past shapes the present, historical mistakes might be repeated or successful yet limitedly acknowledged practices can be discarded, without much reflection. Overall, a long term view is a critical contribution to scholars, policy and decision-makers.

I.3 Dissertation framework

As discussed in Chapter II, my theoretical point of departure is the rejection of the initial and still used secular characterization of disasters as extremes of nature capable of disrupting suddenly a well-organized life (Cannon, 1994; Varley, 1994), and mainly worsened by imperfect knowledge, ignorance and individual responsibility; which could narrowly direct to moralizing (Varley, 1994) or physicalist interventions (Hewitt, 1983; Hilhorst & Bankoff, 2004). Also, I reject the positivist beliefs in technological and scientific rationality (Fischer, 1996) that shaped

disciplines studying and managing disasters, including meteorology. Instead, my research adheres to what I interpret is a paradigm shift that started in the late 1960s. It gained strength since the 1990s with the institutionalization of disaster management launched through the ‘UN International Decade for Natural Disaster Reduction’ (1990-2000)¹⁴ and subsequent international¹⁵ and city level¹⁶ initiatives to integrate vulnerability reduction into mainstream development processes, and even push “toward an international treaty that recognizes safety from preventable disasters to be a human right, and thus a responsibility of governments” (Ben Wisner, 2001, p.1). Essentially, the paradigm shift characterizes disasters as processes resulting from the interaction between social dynamics and environmental circumstances. The result is the denaturalization of so-called ‘natural disasters’ using a political economy lens to expose the political character of public decision-making before, during and after a disaster, and grasp how

¹⁴ It advanced debates mostly through forums, publications, projects and policy guidelines; it focused on the behavior of nature and implicitly backed technical interventions on ‘untamed natural forces’. It gathered a large network of professionals and expanded awareness; although implementation was slow (Ben Wisner, 2001).

¹⁵ The 1996 ‘UN-Habitat Agenda: Disasters Prevention, Mitigation and Preparedness, and Post-disasters Capabilities’ outlined measures to reduce urban vulnerability; whilst the ‘World Bank Disaster Management Facilities’ was founded in 1998 to mitigate ‘natural’ disasters. Both separated city and disaster management; had a mismatch between policy and practice, scarce resources and political support to direct development priorities (Sanderson, 2000). The Local Agenda 21 and Millennium Development Goals indirectly connected with disaster risk and vulnerability reduction via sustainable development and socio-economic development. The International Strategy for Disaster Reduction framework (UN/ISDR, 2004) conceptually connected risk reduction to sustainable development; yet, it missed defining overlaps and contradictions (Birkmann, 2006). The Kyoto Protocol went into effect in 2005 to lower GHG emissions; and although some of the worst emitting nations have not abided, it has increased research, awareness and dissemination of processes including hazards. The ‘Hyogo Framework for Action 2005–2015’ (UN, 2005) urged to build knowledge about hazards, multi-causal vulnerabilities, and changes of both to shape policies, plans and programs targeting resilience (Birkmann, 2006).

¹⁶ For example, before 2005, over 1,000 U.S. Mayors signed the Conference of Mayors Climate Protection Agreement; others joined the ICLEI Cities for Climate Protection (renamed Local Governments for Sustainability), the Clinton Climate Initiative and the C40 Cities Climate Leadership Group (Blakely & Carbonell, 2012).

politics impacted the society under study. Political economy emphasis comes from the realization that "there is little long-term value in confining attention mainly or exclusively to hazards in isolation from vulnerability and its causes. Crisis will recur unless the underlying causes are tackled. This perspective does not reduce the importance of technical or planning measures to reduce physical risk, it simply insists on concerns for the deeper level" (Blaikie, Cannon, Davis, & Wisner, 1994, p.30). Consequently, disaster management becomes a public policy responsibility that should circumvent conventional dichotomous choices, implying binary and mutually exclusive technical versus social options in which the first ones have usually prevailed (Pielke Jr. et al., 2003). Instead, I see synchronizing social and technical agendas as a possibility to surpass previous mistakes, in order to prevent and reduce disasters and ultimately promote social justice. The goal of disaster management would be to facilitate people's practices -including their interactions with the environment- through social, political, cultural, material, and scientific interventions that diminish multi-causal hazards in the short and long-term whilst achieving social equity.

The research question is: *in terms of informing policies, what are the key lessons from the disaster management changes that happened during the transition of Puerto Rico from a Spanish colony to a Commonwealth of the United States?* In order to answer the question, the heuristic proposition of this dissertation is to carry out sequential data analysis (Yin, 2003), beginning

with three separate case studies. The case studies follow the questions that guide ‘Chapter II. Literature Review: What is a disaster? What caused it? How to tackle it?’ In practice, they narrow down to three themes *characterization, causation, and relief*. As explained in Chapter IV, the themes are divided into sub-questions and variables that structure the case studies in the same order to facilitate comparisons, requiring attention to keep track of temporality. Sequential data analysis continues in Chapter VII with comparative assessments, summarized in Annex 1. The final chapter presents the answer, recommendations and conclusions.

The cases presented in chronological order are hurricanes San Ciriaco (1899), San Felipe (1928) and Santa Clara (1956). Their names corresponding to Catholic saints indicate the persistent weight of religion, and they are the most significant cases of the selected time period due to two reasons. First, they represent extreme hydro-meteorological events. They were Cape Verdean hurricanes, called that way because they form off the coast of Western Africa, close to Cape Verde. Those are the strongest storms that threaten the Circum-Caribbean because they may gain a sizeable amount of energy whilst traversing the Atlantic Ocean during summertime, when essentially the combination of soaring heat, humidity, marine currents and atmospheric patterns can turn them into devastating hazards¹⁷. Moreover, those hurricanes made landfall and completely traversed Puerto Rico in a similar northwest bound track, which has two implications

¹⁷ In contrast, storms and hurricanes formed off nearby the Circum-Caribbean region and the Pacific tend to be less destructive because they cannot accumulate enough energy in a shorter distance.

for increasing damages. They concentrated the strongest winds in opposing directions right around the place where the vortex meets the earth; thus, they delivered more force on land than hurricanes passing further north or south, in the Atlantic Ocean or Caribbean Sea respectively. Also, their analogous track implies that they iteratively distressed almost the same ecosystems and human settlements. Hence, in the physical sense they are deviant, extreme, or atypical cases; which usually activate more actors and response mechanisms than typical cases, and detonate the production of information (Flyvbjerg, 2006). The second reason for the selected cases to be more significant is that they happened at the crux of particularly unstable and revealing historical junctures, when influential long-term decisions and social dynamics were negotiated. San Ciriaco (1899) corresponds to the shift from Spanish to American domination; it was instrumental to weaken the option of independence and laid the ground for another form of underdevelopment. San Felipe (1928) corresponds to the immediate preamble of the first economic and civil breakdown in modern times; it extended the foundations of more underdevelopment and fueled independence demands. Santa Clara (1956) corresponds to the beginnings of the Commonwealth; it unveiled iterative dependency and underdevelopment dangerous to admit in the new political formula. Besides, it prompted the only Commonwealth's cultural proposition to address hurricanes¹⁸, widely used in the next years. The latter was a valuable effort that deserves careful examination to grasp its strengths, vacuums and

¹⁸ A film, two posters, a booklet and a bulletin.

inconsistencies. In a nutshell, other storms and hurricanes happened during the studied period - and I present them-; yet, San Ciriaco, San Felipe and Santa Clara reunite stronger characteristics to yield the greatest possible amount of pertinent information, with enough variations and replications to reach saturation, and expose the processes under study.

I.4. Chapter Summaries

Chapter N.II. Literature Review: What is a disaster? What caused it? How to tackle it?

This chapter departs from the view that disaster management is shaped by how we answer “What is a disaster? What causes it? How to tackle it?” Those interrelated questions serve to structure my case studies around three corresponding themes *characterization, causation, and relief*. Thus, in order to situate the research, I reviewed those questions in the literature, from the moment in which the modern secular characterization of disasters took shape until it became the field known as disaster studies, in tandem with the practice of disaster management. Therefore, this chapter II.1) Recapitulates the emergence of the modern secular characterization of disasters; II.2) Examines what I interpret as a recent paradigm shift for the understanding of disasters based on separate but sometimes cross-pollinating transformations in II.2.a) natural sciences, II.2.b) social sciences, II.2.c) experiential grassroots accounts and arts, II.2.d) novel complex emergencies,

and II.2.e) the practice of disaster management. II.3) Conclusions summarize main findings and inform the research design.

Chapter III. Review of the Puerto Rican hurricanes literature until 2012

This chapter is the first effort that takes stock of the multidisciplinary knowledge and policy issues concerning Puerto Rican hurricanes. When conducting this research, it was difficult to make sense of the vast existing body of work, which left me with more questions than answers. I organized it separated by disciplines until 2012 with two purposes, one was to frame my research design, case studies and contributions; and the other is to fill a knowledge gap in itself. The chapter discusses III.1) Introduction of the questions to be addressed; III.2) Thematic structure definition for a hurricane literature review found in a seminal paper; III.3) Review of the literature on Puerto Rican hurricanes until 2012 combining disciplinary themes and chronological order; III.4) Answers and recommendations.

Chapter IV. Research Design

IV.1) The Research Definition is based on a political economy lens; the Research Strategy is a version of Grounded Theory (Glaser & Strauss, 1967) using both deductive and inductive thinking, with a phenomenologist standpoint and emphasis on qualitative work; and the Methodology combines archival research in the field and online, visual sociology and case study.

IV.2) Case Study Selection is based on strategic criteria and information-oriented sampling. Case Study Analysis is done in three sequential steps. The first step is descriptive case analysis organized around the themes *characterization*, *causation*, and *relief*, divided into six sub-questions, which in turn are unpacked into thirty-eight variables. The second step is cross-case comparative assessments and tables. The third step is conclusions and recommendations.

Chapter V. Hurricane San Ciriaco (1898): colonial underdevelopment and dependency reconfirmed

San Ciriaco is the deadliest hurricane registered in Puerto Rico and it marks the transition from Spanish to American control. Months before San Ciriaco, Americans invaded Puerto Rico during the Spanish-American War; the island became a non-incorporated U.S. territory under military domination, which influenced the ways in which the hurricane was addressed and remembered.

Characterization summarizes V.1) the most relevant data, historical context in which the hurricane took place, main information producers, excluded information producers, and prevailing biases about the disaster. V.2) The chapter characterizes knowledge production around San Ciriaco in multidisciplinary, artistic, regional, local, multi-hazard, and multi-storm terms. Compared to previous disasters, San Ciriaco can be examined in diverse original documents. Americans had started an unprecedented documentation process of the new possession, which became useful to assess hurricane damages and monitor relief. This time

period has been studied extensively because of its decisive transitional nature; San Ciriaco has received academic attention as part of other topics or by itself.

Causation is examined in a sequential and complementary manner to cover the quadricentennial Spanish colonial era: V.3) the ways in which economic growth and urbanization caused vulnerability or resilience; and V.4) the ways in which socio-cultural hierarchies, collective memory and knowledge production also caused vulnerability or resilience. In sum, social hierarchy and disaster vulnerability were correlated despite limited technical knowledge, awareness and means of communication. Purposive lack of preventive planning and investment, and permanent precariousness engrained in the Spanish legacy created selective vulnerability before the hurricane hit.

Relief reviews V.5) how the Spanish regime mishandled relief during the 1867 crisis, when a hurricane, earthquake and tsunami took place less than a month apart. This case is the baseline to evaluate the transformation of disaster management. V.6) how the U.S. military government responded to San Ciriaco -the first organized yet questionable disaster relief example on the island- until the establishment of the Foraker Act in 1900, which officialized the U.S. dependent relationship of Puerto Rico.

V.7) Conclusions present the top findings and introduce the next chapter.

Chapter VI. Hurricane San Felipe (1928): Imperialism by neglect

San Felipe is also known as San Felipe II or Okeechobee, and it remains the strongest hurricane recorded in Puerto Rico. It happened during a period of U.S. detachment from development in Puerto Rico concurrent with extractive policies, called ‘imperialism by neglect’, which increased poverty, vulnerability and turmoil.

Characterization summarizes VI.1) most relevant data, historical context in which the hurricane took place, main information producers, excluded information producers, and prevailing biases about the disaster. VI.2) The chapter characterizes the production of knowledge around San Felipe in multidisciplinary, artistic, regional, local, multi-hazard, and multi-storm terms. This time period has been studied because it precedes the most violent years on the island during modern times. San Felipe is less studied than San Ciriaco as part of other topics or in itself.

Causation examines in a sequential and complementary manner, focused on almost three decades of overtly exploitative U.S. dominion: VI.3) the ways in which economic growth and urbanization caused vulnerability or resilience; and VI.4) the ways in which socio-cultural hierarchies, collective memory and knowledge production also caused vulnerability or resilience. Social hierarchy and disaster vulnerability remained correlated, lack of U.S. administration preventive planning and investment enhanced selective vulnerability.

Relief analyzes VI.5) The Red Cross relief provision for the 1927 Mississippi floods in the absence of a federal institution, which became an improvised and arguable template for San

Felipe. VI.6) San Felipe relief is reviewed until 1932, when hurricane San Ciprián had a poor federal response, and worsened economic and social mayhem.

VI.7) Conclusions present the top findings and introduce the next chapter.

Chapter VII. Hurricane Santa Clara (1956): the New Deal legacies and the Commonwealth, between avocado forecasting or storm bombing

Santa Clara, also known as Betsy, was a mild and fast hurricane that caused 9-16 casualties when practices to manage hurricanes included popular forecasting based on avocado crops and futile techno-military storm bombing. It happened after the New Deal developmental agenda and political repression undermined the pro-independence sector and enabled the status change of Puerto Rico to a U.S. Commonwealth (1952), which meant self-governing powers bound by U.S. federal jurisdiction.

Characterization summarizes VII.1) most relevant data, historical context in which the hurricane took place, main information producers, excluded information producers, and prevailing biases about the disaster. Original writings reflect the views of influential men although not necessarily in top positions of power, such as U.S. and Puerto Rican politicians, elite members, intellectuals; but also middle-income journalists, artists, and scientists, who had gained access to growing education and media outlets. VII.2) The production of knowledge around Santa Clara in multidisciplinary, artistic, regional, local, multi-hazard, and multi-storm terms. Again, this

critical time period has been studied due to its political nature; but compared to San Ciriaco and even San Felipe, Santa Clara has been essentially disregarded as part of other topics or itself.

Causation covers in a sequential and complementary manner almost two decades of: VII.3) the ways in which economic growth and urbanization caused vulnerability or resilience; and VII.4) the ways in which socio-cultural hierarchies, collective memory and knowledge production also caused vulnerability or resilience. The New Deal launched plans and actions to tackle socioeconomic and built environment deficits; preserving the U.S. interests and other questionable aims by force if needed. Modern disaster management emerged as a professionalized, identifiable field of practice. The planning profession was under redefinition and growth, its actions -and lack of- related to disaster management without official integration. Social hierarchy and disaster vulnerability correlation prevailed less blatantly, as social hierarchies were reaccommodating with mixed spatial consequences.

Relief reviews VII.5) the reshaping of U.S. federal disaster management influenced by the New Deal, WWII, the Cold War, and the 1954-1955 hurricane seasons; which had key consequences for the island. VII.6) Santa Clara's relief stage covers until 1958, when the Commonwealth created exceptional cultural productions to raise hurricane awareness and safety.

VII.7) Conclusions present the top findings and issues that unfolded in the next years.

Chapter VIII. Case Study Comparisons, Recommendations and Conclusions

VIII.1) Data from the three sequential descriptive case analyses is comparatively assessed in correspondence with the three themes, six sub-questions and thirty-eight answering variables established in the methodology.

VIII.2) Recommendations are presented.

VIII.3) The research question is answered with concluding remarks.

Annex 1. Cross-case comparison tables

A synthesis of the three cases.

I.5. Dissertation relevance

My dissertation is a critical and comprehensive historical study of hurricanes, which proposes an alternative to overcome the usual deleterious disciplinary fragmentation of disaster studies and management, and the conventional emphasis on physical change that plagued Puerto Rico in the first half of the 20th century, both of which remain standard in most countries. In other words, my dissertation provides an unusual contribution to disaster management, an area of academic and practice-oriented literature extremely relevant for urban planning, fastly growing given the rising frequency and intensity of multiple disasters; and which is usually focused on contemporary

events (e.g., hurricanes Katrina 2005 and Sandy 2012, Haiti earthquake of 2010, Fukushima 2011), prospective forecasting and proposal-making (climate-change related literature).

I showed that throughout Puerto Rican history, citizens tried to handle disasters through mythological beliefs, empirical observations, rituals and material practices; some of which subsisted until the 20th century despite colonization and modernization. I summarized how the origins of disaster management on the island are extremely haphazard, and imbricated in colonial administrative policies, notions of habitus¹⁹ and of citizens' rights that have taken centuries to question and overcome. First, disaster management was limited to tremendously ineffective and improvised relief, without preventive or reconstructive policy-making. Meteorological knowledge and media communications took off gradually. During the New Deal, multiple institutional changes contradictorily promoted development, whilst disaster management became a federal responsibility which quickly showed on the island. Even then, it was the unplanned and uncoordinated intersection of a hodge-podge of disciplines, approaches and institutions; which conventionally emphasized physical interventions, neglecting the role of culture and the political economy of disasters with negative lasting consequences.

¹⁹ Understood as durable structures or frameworks of thought which motivated individuals and groups to pursue and justify specific paths of action (Bourdieu, 1977).

I proposed a particular interface between urban planning, meteorology, hydrology, urban design, sociology, political science, social history and culture. I show why it is relevant to understand grass-root processes aiming to manage disasters; if they are helpful, harmless or detrimental; and why they should be negotiated to enhance safety through current practices. Practitioners and scholars need to gain a richer understanding of social and cultural processes related to hazards as shaping and being shaped by popular and specialized practices of disaster management. Specifically, planners must engage in learning from people and sharing how cultural choices impact environmental processes and vice versa. The role of studying and managing culture has traditionally been outside of planning and fallen to preservation -as in the Instituto de Cultura Puertorriqueña-, yet that discipline conventionally disregards disasters. Thus, planning and preservation need to collaborate more fully in shaping disaster studies and management. Significantly, urban planning remained part of the solution but also of the problem, to a great extent following conventional tenants of the planning profession in the US. For instance, since the New Deal, it put forth a model of rational top-down planning shaped by powerful interests which disregarded participation, and promoted urban renewal and development schemes that built housing on beach fronts, desiccated mangroves, flood plains, and other disaster-buffering areas; within a modernization context that exploited resources unlimitedly and altered ecological relations purposively, in due course increasing risks and economic losses from flooding.

My dissertation also contributes to the body of literature of Puerto Rican Studies, which has unfolded in parallel to the presence of Puerto Ricans in the U.S. and to the development of local cultural institutions. It also adds to the planning discussions of the Circum-Caribbean, a relatively new epistemic community that searches to overcome the historical fragmentation of this region; and to similar discussions in other risk-prone areas. Puerto Rico presents distinctive characteristics, but it is also an exemplary case. It has been an experimental laboratory for policies and projects later promoted by the US abroad; which merits examination. Also, it embodies conditions increasingly common. For instance, Small Insular Developing States (SIDS) in the Caribbean and the Pacific are severely threatened by ecosystemic changes, as investment and citizens concentrate in the critical range of two to four meters above sea level (IPCC, 2014); and many other countries would also experience increased disasters along urbanized coasts and coastal plains. Moreover, the disconnection observed in Puerto Rico between disasters, urban planning, physical sciences, the humanities, social sciences and the arts is remarkably shared by peoples in other disaster-prone regions experiencing diverse modes of governance and cultural identities. Paraphrasing W.E.B Du Bois' 1906 seminal writing, that the African-American's "*problem in America is but a local phase of a world problem*"; the Puerto Rican case can be seen as a Caribbean phase of a world problem, which can shed similarities and differences. Therefore, this case can advance theoretical and practical ways of thinking about disasters and urban planning.

I.6 References

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Chapter N.II. Literature Review: What is a disaster? What causes it? How to tackle it?

II.1 Emergence of the secular characterization of disasters

Ancient civilizations in countries such as India, Greece, Iran, China, Mexico, and Peru studied the weather systematically. Yet, their pre-modern characterization of meteorological disasters framed them as events caused by otherworldly mythological beings or the forces of nature. In the Circum-Caribbean region, indigenous groups and European colonizers essentially believed that they were at the mercy of different deities, severely limited to counteract disasters. During the 18th century and primarily in Europe, modern meteorology emerged through significant technical and theoretical breakthroughs following Enlightenment ideals, which would transform the mainstream characterization of hurricanes and other disasters into a secular affair. Records and studies of weather-related events became more systematic emphasizing chronological lists – which in turn heavily relied on notions of separated and exceptional elements-; their characteristics that could be observable and measurable with increasingly sophisticated technology; and aggregate although random destruction data. In the Hispanic Caribbean, meteorology took off after the second half of the 19th century (Blaikie et al., 1994; Lines Escardo, 1998; Poey, 1862; Viñes, 1877), due to the value of exports and of the region as a stage of colonial power struggles. Historic meteorological records and studies contain valuable information; yet, their structuring principles and questions usually disregard how social processes enabled hazards to become disasters, or the intricate and fluctuating connections

between storms, politics and social life (Schwartz, 2005). They tend to be "thin descriptions", factual accounts without interpretation that are insufficient and even misleading sometimes (Geertz 1973). Meteorology emerged separate from its social, cultural and political meanings; as seismology, volcanology and other disciplines later comprised in disaster studies. It was a technical task that needed the allegedly value-neutral 'rationality' of science to address nature; which meant particularly biased rationales. In tandem, disaster management emerged based on a technocratic belief that applications of engineering and geophysical knowledge could handle what were seen as physical threats posed by nature (Hewitt, 1983; Hilhorst & Bankoff, 2004).

Recent works have incorporated self-reflexivity on disaster-related scientific disciplines. For meteorology, that includes the historical impact of technology on forecasting, the bureaucratization of prediction through newly established weather services, and the emergence and politicization of relief organizations (Schwartz, 2005). However, the early emphasis on the quantitative climatic and geologic aspects of disasters gained currency to view them as extremes of nature; and such choice had arguable long-term ontological and epistemological consequences. Since the 19th century, quantitative emphasis guided attempts to establish minute mathematical approximations for defining disasters -essentially to calculate geophysical, hydro-meteorological data in a specific location-, explain material processes behind and react to them-. Such trend resulted in propositions such as the commonly known as Richter scale²⁰ and its

²⁰ Initially known as the Local Magnitude Scale, it was created in 1935 by Charles Richter and Beno Gutenberg as a logarithmic open-ended scale to measure with a seismograph the vibrational energy released by shocks locally. Each single number increase indicated a 10-fold energy release. (Wijkman & Timberlake, 1984). The same authors created the Modified Richter Scale, to correct unreliable measurements taken at a distance. Next successor was the Moment Magnitude Scale (MMS), developed in the 1970s by the U.S. Geological Survey; it retains Richter's continuum of magnitude values but the formulae differ. Contrastingly, the Modified Mercalli Intensity Scale quantifies the intensity of a shock, not only its physical magnitude. Experts assess impacts on the Earth's surface, buildings, and people, in a scale from I to XII; and although less used, for some scholars is a more comprehensive evaluation. (Bommer, 1996).

successors for seismic activity; or the Standard Hurricane Project²¹ and the Saffir-Simpson Scale²² for hurricanes, which I discuss in detail as I used them. Scientifically endorsed scales and postulates became academic canons to portray and compare disasters during the 20th century. They have entered conventional media and popular use and shaped policy-making and urban growth via mechanisms such as legislation, zoning, disaster-resistant construction codes, formal and informal land markets, and insurance contracts.

Behind those scientific constructs remained an uncontested paradigm until the late 1960s. Academics and policy-makers generally understood disasters as ‘natural’ events suddenly disrupting a somehow steady, ‘normal’, well-organized life (Cannon, 1994; Varley, 1994). Essentially, two approaches prevailed. One was unapologetically naturalist, sometimes called physicalist, which directly attributed disasters to the violent forces of nature (Blaikie et al., 1994). The other approach sustained an understated ‘environmental determinism’. Our imperfect judiciousness and misunderstandings of nature fatally molded our interactions with it; we reoccupied dangerous areas and rebuilt fragile settlements due to a ‘bounded rationality’ (Blaikie et al., 1994). When dominating views ascribed to imperfect knowledge, ignorance and individual liability as causes of crises, disaster responses could center on moralizing people (Varley, 1994), calling for inapt psychological propensities, irresponsibility and discriminatory versions of the ‘blame the victim’ approach.

21 Following devastating mid-1950s hurricanes, the U.S. Army Corps of Engineers and the Weather Bureau developed it to characterize storms and influence policies.

22 In 1973, Herbert Saffir and Robert Simpson classified hurricanes in five categories of growing intensity to estimate potential property damage. The officially called Saffir–Simpson Hurricane Scale (SSHS) integrated sustained wind speed with approximations of storm surge, flooding and other variables.

II.2 Paradigm shift for understanding what a disaster is, its causes and how to respond

Since the late 1960s, the mainstream secular characterization of disasters based on science has faced increasing contestation from diverse standpoints, opening the space for progressive disaster studies and management, in addition to making planners rethink their role in relation to disasters. I interpret that there is an emerging paradigmatic change to understand what a disaster is, its causes and how to tackle it. It is prompted by transformations meaningful for my research that are happening separately or interdependently in II.2.a) natural sciences, II.2.b) social sciences, II.2.c) experiential grassroots accounts and arts, II.2.d) novel complex emergencies, and II.2.e) disaster management practice.

II.2.a) Natural sciences

Based on methodological and ontological arguments, the characterization of disasters through scientific conventions has been questioned. Methodologically, challenges emerged as technology advanced and when long-term consequences exposed failures. In other words, a valid critique concerns the rigor in methods and data quality for establishing scientific measures, or scales, which in turn are crucial to minimize or worsen damages. One example is the Standard Project Hurricane (SPH), which since 1959 influenced for decades hurricane-related planning and construction in the U.S. section of the Gulf of Mexico. Regrettably, the SPH was methodologically flawed (ASCE Hurricane Katrina External Review Panel, 2005). The database omitted worst cases to define a representative storm, resulting in flooding protection systems unprepared for extreme recurrent events. Besides, the cost-benefit ratio calculations excluded the greater economic and social costs of failure in urban areas compared to rural ones. Against admonitions by the National Oceanic and Atmospheric Administration (NOAA), infrastructure

designed according to the SPH was not retrofitted as in the hurricane flooding protection system of New Orleans (Louisiana); its levees collapsed during hurricane Katrina (2005). Another example is precisely the successor of the SPH, the Saffir-Simpson Hurricane Scale (SSHS). Citing scientific inaccuracies, in 2010 the U.S. National Hurricane Center (NHC) instituted the Saffir-Simpson Hurricane Wind Scale (SSHWS); which focuses on sustained wind speed and excludes flood ranges, storm surge estimations, and other storm-related information. SSHS projected storm surge values were often miscalculated as they resulted from combined factors disregarded by the scale²³ (National Hurricane Center, 2009). For each category, the SSHWS also exemplified potential damages to buildings, infrastructure and vegetation in the U.S., rising by about a factor of four for each category increase. In 2012, the NHC slightly modified wind speed range for Categories 3, 4, and 5 to correct a decadal miscalculation when rounding knots to miles and kilometers (The Weather Channel, post 2012). Classification of previous storms remains unaltered. Scientific criticism of both Saffir-Simpson scales emerged as soon as practice revealed their flaws, and there is a range of proposed options that are continuous -like the Richter scale-²⁴. Yet, even the methodological definition of variables remains contentious. One basic example is wind speed, for which the top disagreement lays on the choice of averaging time period with at least five options (3-sec, 1-min, 2-min, 3-min, 10-min). The World Meteorological Organization (WMO)²⁵ recognized that measuring exact wind speed, particularly under tropical cyclone conditions, remained a hard task with potentially doubtful results due to available data and inconsistent theories. Since 2008, the WMO definition of wind speed is

²³ Including storm size, forward speed, bathymetry and coastline characteristics in the landfall location.

²⁴ For instance, the Hurricane Intensity Index focuses on the dynamic pressure due to storm winds, and the Hurricane Hazard Index integrates surface wind speeds, radius of maximum storm winds and translational speed.

²⁵ A specialized United Nations agency created in 1950, it has a membership of 191 states and territories.

average wind measured at 10 meter height during 10 minutes; WMO regional associations and national weather agencies follow it to standardize information and policies (Harper, Kepert, & Ginger, 2009; World Meteorological Organization & Economic and Social Commission for Asia and the Pacific, 2011). Instead, the U.S. National Weather Service, the Joint Typhoon Warning Center and the Central Pacific Hurricane Center defined wind speed as average wind measured at 33 feet (10.1 meter) height during one minute (National Weather Service, 2013). In brief, scales illustrate that scientific knowledge is useful yet contentious and imprecise.

Moreover, in ontological terms, the mainstream scientific understanding of disasters is questioned for validating science at the expense of neglecting other forms of knowledge equally valuable, such as social constructivist perspectives, grassroots experiential accounts, and cultural and art-related manifestations. A central debate is the mistrust in the impartiality of science. Emphasis on ‘politically correct’ or ‘value-neutral’ scientific characterizations of hazards can nullify conflictive meanings and serve power elites to limit debates, clouding social inequality issues (Blaikie et al., 1994; M. J. Cohen, 2000). It has taken a long time to challenge biases behind technological choices and scientific information, the practical insufficiency and ethical fallacy of implementing such interventions separate from structural societal factors that create differentiated vulnerability to hazards, and without knowledge of how differently interventions would impact diverse social groups (Cannon, 1994). The most radical social constructivist perspectives tend to challenge science and even castoff mathematical models that void disasters and environmental discussions from their social and political components through probability estimates, abstruse data and simplified interpretations (M. J. Cohen, 2000). In return, scientists criticise social constructivism for lack of a unified clear vision, poor skills to grasp the

materiality of the biophysical environment and validate insights, and overdependence on cultural symbolism (M. J. Cohen, 2000).

Another debate is the definition of disasters. Until the 1960s, disasters were geophysical extremes of nature, including seismic and climatologic processes such as volcanic activity, earthquake, tsunami, hurricane, cyclone, typhoon, monsoon, tornado, soil liquefaction, landslide, flood, snow blizzard, avalanche, sand storm, wildfire, heat wave and drought. Research and policy-making addressed them with increasing disciplinary separation that blurred the complex connections among them, preceding social and political background, and impacts. A groundbreaking dynamic led by natural scientists happened in 1969, when the Natural Hazard Research Group (University of Colorado) set parameters to define a disaster in terms of human casualties, injuries and economic losses²⁶, which my research incorporates. It separated seismic and climatologic events from effects on human life; the former were no longer the disaster, but catalysts²⁷ (Birkmann, 2006; Wijkman & Timberlake, 1984). As implied in the name of the group and their background though, they still casted disasters as natural, not as events embedded in social structures; and as phenomena, isolated occurrences instead of processes.

Parameters of human and economic losses are valuable; they have become worldwide standards and enable quick comparisons along with scientific scales. For example, the initial contact of lay citizens with the severity of an earthquake is constructed through the media "typically in terms of preliminary Richter-scale readings plus early estimates of the number of dead and injured...News

²⁶ More than 100 people dead or injured; over \$1 million in damage. (Wijkman & Timberlake, 1984).

²⁷ Also called hazards, trigger events, forcing mechanisms, driving forces, perturbations, stressors, physical exposures or environmental threats.

reports of disaster become the sampling frame. They identify the existence of the event" (Stallings, 1998, p. 132-133). Likewise, Saffir-Simpson category and parameters of human and economic losses characterize hurricanes. The latter parameters also feed larger indicators that influence policy frameworks and projects. For instance, the Disaster Risk Index (UNDP, 2004b) divides number of people killed by number of people exposed to evaluate the relative vulnerability of a country; which influences international aid, development loans and urban planning decisions.

Yet, numeric parameters of human and economic losses have received multiple criticisms because they limit the characterization of disasters, needing complementary information as my dissertation provides. Parameters focused on large-scale impacts distort our understanding of disasters as interconnected multi-scalar processes, grounded on the everyday life. Most official registers only take account of events where 10 or more people die, 100 or more are severely injured, or where the aggregate economic damage is enough for international agencies to be called in (Bull-Kamanga et al., 2003). Thus, many 'small and medium'²⁸ disasters do not qualify for calling in external help or for entering most national and international records; yet, they deserve attention for reasons that motivated me to summarize them briefly in my case studies. Cumulatively, their total impact²⁹ may be higher than from a large disaster, as shown in Latin America and Africa (Bull-Kamanga et al., 2003). In areas of high urbanization and social inequality, those events are on the rise -in number, territorial spread and negative effects-; and they may become larger (Lavell, 1994a). According to another view that contradicts popular

²⁸ Where 3-9 persons are killed, 10-99 seriously injured, or radical damage happens to people's homes or production systems (Bull-Kamanga et al., 2003).

²⁹ The parameters used to evaluate impact were number of people killed, injured and impoverished.

wisdom, megacities may be better prepared to face disasters than rural communities, small villages and cities that lack resources and capacities (Cross, 2001); or than suburban and sprawl areas, where poor coverage due to low density could be a suitable proxy of insecurity (B. Wisner, Blaikie, Cannon, & Davis, 2004). In the latter cases, minor figures underestimate a crisis. At any rate, usual parameters hardly straddle urban-rural, dense-sprawled divides; or consider overlapping local, national and supranational boundaries. A pragmatic and ethic argument is that ‘small’ disasters and quotidian hazards deserve attention because they strengthen capacities to face larger events; the same groups, areas, economic structures and systems of civil and political organization tend to be exposed (Lavell, 1994a).

Parameters of human and economic losses can be misleading also if applied in a contextless manner, which is an argument strengthening a shift towards political economy and human agency that I endorse-. For instance, the losses of wealthier people frequently tend to be greater in absolute terms but lesser in relative terms than the losses of low-income citizens (Blaikie et al., 1994). The latter frequently gather all their assets³⁰ at the site of the disaster, which multiplies their losses; they rarely have cash reserves; their creditworthiness in the formal sector is minimal or none, subjecting them to predatory lending; and their healthcare and health conditions are usually precarious and mostly worsen during a shock. Their personal networks of support may result affected and unable to help extended family members and friends suddenly homeless, unemployed, dispossessed, sick, injured, emotionally traumatized and mourning. Also, loss of intangible assets such as solidarity, trust and peace may happen, causing grave and permanent disruptions of societal functioning (Bogardi & Birkmann, 2004); including increased criminality,

³⁰ Such as dwelling, clothing, food, tools and materials for artisanal production, subsistence animal husbandry, seeds and agricultural implements.

violence and instability. Those are severe obstacles to overcome a crisis, yet, they are invisible in combined standard data. Moreover, economic figures about losses may disregard the formal built environment and businesses. They even more rarely incorporate destruction of precarious housing and informal economies; when they do, they commonly fail to reveal the severity of the tragedy for the affected poor and how the disaster created more poverty (Bull-Kamanga et al., 2003). Also, parameters of casualties, injuries and economic losses may blur degrees of societal collapse and response capacity³¹ and environmental impacts due to their anthropocentric nature³².

II.2.b) Social sciences

In the 1970s, social scientists undertook the challenge to denaturalize ‘natural’ disasters (O’Keefe, Westgate, & Wisner, 1976), which my dissertation follows. Those social scientists used empirical data to support two arguments. First, during the 20th century, the frequency of extreme geophysical events did not increase significantly; yet, human and material losses grew. Second, similar events had different context-dependent outcomes; for instance, higher human losses usually happened in underdeveloped countries. Henceforth, disasters were defined as processes dependent upon social hierarchies, everyday interactions to habitats and broad historical conditions that enhance or mitigate these matters (Hewitt, 1983); not merely the result

³¹ Contrastingly, less used qualitative characterizations include when basic social functions are halted or destroyed (Oliver-Smith, 1996); all major public and private facilities need vast substitution or repair to restore primary social and economic services (Torry, 1979); external aid is needed for recovery (Blaikie et al., 1994); or ruin is so hefty survivors have nowhere to turn for help (Tobin & Montz, 1997).

³² One contention is if human vulnerability can be characterized without including the ‘surrounding’ eco-sphere vulnerability (Turner et al., 2003). The other issue is that environmental vulnerability and degradation deserve their own characterization, based on intra-species justice arguments (Birkmann, 2006) or an ecocentric view that puts the earth first (Parton, 1993).

of hydro-meteorological or geophysical events. Such radical contribution questioned disasters as natural incidents that suddenly interrupt ‘normal’ everyday life. Disaster causes were found in the order of ‘normality’, in the prefiguring underlying structures and interactions of economic, social, cultural and political life (Hewitt, 1983).

Another exceedingly relevant change during the 1970s was the introduction of the notion of ‘vulnerability’ to disasters, used in my case studies. It has at least two traced origins. One explanation is that it comes from Risk-Hazard models, which interpreted risk as the combined result of exposure to the hazardous event and the sensitivity of the entity exposed, applied for environmental and climate impact assessments (Burton, Kates, & White, 1978). In the other explanation, the concept evolved out of social sciences to counterbalance hazard-oriented characterizations of disasters dominated by natural sciences (Schneiderbauer & Ehrlich, 2004). Next, the concept of vulnerability addressed why some individuals and specific groups underwent more the effects of hazards than others. The discussion focused on how social systems shape risks and opportunities in nature, how they put varying demands on nature and how nature affected them differently. Instead of sweeping, indiscriminate opportunities and risks, the idea was that socio-economic hierarchies create uneven access to opportunities and imbalanced exposures to risks (Cannon, 1994). Vulnerability discussions demanded an understanding of power relations through access to and control over location³³, exploitation of environmental resources for economic growth³⁴, prioritization of projects and problems³⁵ and

³³ Generally correlated to the spatial and social distribution of hazardous activities and events. For instance, superior land used for commercial ranching and agriculture pushes excluded citizens to areas prone to droughts, floods or landslides; low income citizens may be living in buildings that governments and property owners fail to reinforce against hazards (Cannon 1994).

³⁴ Such as water, minerals, forests, pasture, arable land, marine resources, wildlife with partial or total exclusion of some actors; this in turn usually increases their vulnerability.

discursive means³⁶ (Bryant & Bailey, 1997); which are connected to planning as my research shows. Moreover, discussions of power relations sought to expose nuanced contradictions of the social fabric. For instance, groups controlling some ‘bundles’ of resources or entitlements could be susceptible to one type of hazard more than another, without direct correspondence to relative wealth (Blaikie et al., 1994) or social position, and also varying across scales and time. From the spatial standpoint, that meant that powerful groups could be diminishing others’ vulnerability and increasing theirs through exclusionary land markets and legislation that monopolize attractive risk-prone areas, such as beachfronts or steep slopes with outstanding views. Impoverished citizens in upper watershed areas could be causing vulnerability to themselves or groups of all incomes through hazard-prone survival practices that increase landslides and floods; such as intensive cattle grazing, wood extraction, slash-and-burn agriculture and precarious urbanization. Impoverished citizens may survive the seismic collapse of their one-storey, light and flimsy dwellings unlike higher-income residents of sturdier, taller buildings; but not hurricanes. In other words, although generally the poor suffer the most in a disaster (Bryant & Bailey, 1997; Cuny, 1987; Varley, 1994); simply equating vulnerability to poverty -measured by income and assets- or access to and control over particular variables was insufficient to propose specific and successful counterbalancing strategies. Instead, vulnerability was conceptualized as a multifaceted characteristic resulting from combined factors of social difference (Cannon, 1994) with changing and sometimes even contradictory relevance; including

³⁵ The capacity to direct financial, technical, administrative and other resources by directing attention to particular project possibilities, for practical political aims and organizational ends (Forester, 1989).

³⁶ Including the content of the 'public transcript' and the mechanisms to build and spread it. Initially, the notion of *public transcript* addressed overt interactions between dominators and subaltern groups, whilst *hidden transcript* concerned underground narratives that critique power and need careful attention (J. C. Scott, 1990). A subsequent notion of public transcript will be used in this research, understood as socially accepted versions of events represented in the public sphere through official documents, legal constructs, media messages, popular music and other means (Bryant & Bailey, 1997).

class, ethnicity, race, gender, sexual orientation, age, disability, citizenship, religion, ideological affiliation and caste. Such understanding helped to decode everyday life processes of the economic, social, political, and cultural stratification of people into a detailed documentation of the most exposed citizens in risky environments (Varley, 1994), in order to find entry points for analysis and action throughout the disaster cycle. Borrowing from safety engineering and risk analysis studies of severity and frequency exposure to risks (Cyr, 2005), the generic formula “Risk (of a Disaster) = Hazard + Vulnerability” (Blaikie et al., 1994) characterized disasters as the interaction between a hazard and the degree of vulnerability experienced by citizens in a particular space and time period. Structural holistic changes were needed to reduce vulnerability, including improvements in capacities to anticipate, cope with, resist, recover from the event (Blaikie et al., 1994), influence post-disaster processes, and produce and disseminate 'public transcripts'. Overall, this view questioned customary narrow focuses on minimizing hazards via technical and material interventions, assuming indiscriminate impacts, or faulting imperfect knowledge and individual responsibility. Thus, vulnerability debates went to the core of power relations associated with decision-making and power theory notions from political science and public administration (Cyr, 2005). Socially stratified vulnerability could be seen as a collective decision –of the most dominant societal factions, politicians and technocrats- about the degrees of insecurity considered acceptable for different persons; in other words, different rights within a society. Vulnerability reduction of one group usually affected the interest of another group, rendering this approach contentious –too political or ideological- for governments or ‘neutral’ international entities (Mitlin, Satterthwaite, & Stephens, 1996; Varley, 1994). The term vulnerability entered academic and policy-making discourses highlighting the political economy of disasters, although definitions kept emerging. The Pressure and Release model (Blaikie et al.,

1994) explained disasters as the intersection between physical exposure and vulnerability of the exposed unit, including root causes, dynamic pressures and unsafe conditions³⁷. In another proposition (Cannon, 1994), vulnerability was based on individual and group preparedness, degree of resilience and resistance of the particular livelihood³⁸ system of an individual or group, and health of individuals and operation of social measures, including preventive medicine. Vulnerability also means the intersection between susceptibility of people and communities at risks vis-à-vis their economic, social, and cultural capacities to cope with potential threats (Hilhorst & Bankoff, 2004)³⁹. Another issue is the separation between social vulnerability, meaning human susceptibility and the preconditions for survival and adaptation; and biophysical vulnerability, a notion from environmental change research meaning the degrees to which a system is vulnerable to climate change impacts and its (un)capacity to adjust (Change, 2005). In 2006, the academic literature had more than 25 definitions (Birkmann, 2006), pointing to ambiguities to apprehend and implement it, as the following table summarizes.

³⁷ Root causes referred to limited access to power structures and resources, political and economic systems. Dynamic pressures comprised lack of training, investment and freedom of press; rapid urbanization, deforestation and fast population changes. Unsafe conditions meant physical environment, local economy, social relations and public actions.

³⁸ Livelihood is defined as "the command an individual, family, or other social group has over an income and/or bundles of resources that can be used or exchanged to satisfy its needs. This may involve information, cultural knowledge, social networks, legal rights as well as tools, land or other physical resources" (Blaikie et al., 1994) p. 9.

³⁹ I use that definition adding spatial capacities.

Table N.1. Disciplinary views of Vulnerability and Recommendations

Discipline	View(s) of Vulnerability	Recommendation(s)
Geography	Vulnerability is determined by the use of hazard-prone areas	Land-use planning that takes into account hazards to reduce risk
Meteorology	Vulnerability is due to a lack of advanced warning of severe weather	Acquisition, creation and effective use of warning systems
Engineering	Vulnerability occurs when structures and infrastructure cannot withstand the forces of hazards	Design and construction of buildings and infrastructure that promotes disaster resistance
Anthropology	Vulnerability emanates from constraining values, attitudes and practices	Alter attitudes to discourage risk-taking practices and susceptibility
Economics	Vulnerability is related to poverty and results in an inability to prevent, prepare for or recover from a disaster	Improve the distribution of wealth and purchase insurance to minimize losses and promote resilience
Sociology	Vulnerability is a product of inaccurate assumptions about disaster behavior and is related to race, gender, age, disability, etc.	Understand behavioral patterns in disasters and pay attention to needs of special populations
Psychology	Vulnerability is a function of overlooking or minimizing risk and not being able to cope emotionally with stress and/or loss	Help people to recognize risk and provide crisis counseling to enable resilience
Epidemiology	Vulnerability is susceptibility to disease or injury and is related to malnutrition and other health factors	Improve provision of public health/emergency medical care before, during and after disasters
Environmental Science	Vulnerability is proneness to environmental degradation, which may change weather patterns and produce long-term disasters	Conserve natural resources, protect green space areas, and ensure that debris management is performed in an environmentally conscious manner
Political Science	Vulnerability is produced by the political structure and incorrect decision making	Alter structure of political system and educate politicians and legislators about disasters
Public Administration	Vulnerability results from misguided laws, the failure to implement policies effectively, and an inability to enforce regulations	Strengthen response and recovery capabilities through preparedness measures, improved policy implementation and increased code enforcement
Law	Vulnerability results from negligence, which is a failure to act as reason or legal statutes dictate	Understand the law, alter statutes, and ensure compliance to widely accepted ethical practices in emergency management
Journalism	Vulnerability is a result of insufficient public awareness about hazards and how to respond to disasters	Dispel myths about disasters, foster increased media capabilities, and educate the public about hazards
Emergency Management	Vulnerability is the lack of capacity to perform important functions before and after disaster strikes (e.g., evacuation, search and rescue, public information,	Foster public awareness about disasters and build capacities through hazard and vulnerability analyses, resource acquisition, planning, training and

	etc.)	exercises
Homeland Security	Vulnerability is due to cultural misunderstandings, permeable borders and fragile infrastructure, and weak disaster management institutions	Correct domestic and foreign policy mistakes, enhance counter-terrorism measures, protect borders and infrastructure, and improve WMD capabilities

(McEntire, 2007, p.10).

A related concept used in my research is ‘resilience’, sometimes equated to robustness or coping capacity, and opposed to vulnerability (Adger, Hughes, Folke, Carpenter, & Rockström, 2005). Resilience was a term launched during the 1950s in psychology, first to explain tolerance abilities of children, and later to encompass psychological or psycho-physiological skills that enabled people to stay mentally and psychologically healthy while enduring and overcoming negative life circumstances (Ripp & Lukat, 2013). Multiple disciplines⁴⁰ borrowed the term for diverse uses, particularly under the recent influence of ecological theories and experiences (Birkmann, 2006). The term has gained international currency concerning disasters, without agreement of what it means or how to attain it. The crux of the debate is whether it is the capacity of individuals, social groups, institutions, ecological and human-made systems to compensate properties that withstood damages –restoring their lost functionality-, or the capacity to respond flexibly to threats and thus deflect prospective hazards. In other words, the contention lies in whether it relates to abilities for absorbing disturbances or shocks; thus, it is tied to resistance. Alternatively, whether it relates to the regenerative capabilities of the examined entity, including learning from and adjusting to abrupt shocks or gradual changes while maintaining main functions; thus it is connected to coping and adaptation. The common focus is a system’s ability to keep its essential functions and structures during crises (Birkmann, 2006), and ultimately enable positive transformations.

⁴⁰ Including disasters, urban studies, human ecology, taxonomy, studies on developing economies, micro- sociology, ethnology and political sociology.

II.2.c) Experiential grassroots, cultural and artistic expressions

Until the 1980s, dominant ‘public transcripts, academic and policy-making literatures endorsed the voiceless and invisible presence of lay and disadvantaged citizens at risk. The neglect of grassroots’ characterization devalues their testimonies, understandings of the root causes of disasters and needs during relief and reconstruction. If the voices and actions of disempowered communities and individuals at risk are incorporated, the tendency has been to portray them “as doing so in ignorance, or out of mere perceptions of the hazard since technical expertise, not common sense or being there decides knowledge. Solutions are found to lie in technical counterforce. They need professionals and mission-oriented agencies to confront and tame nature" (Hewitt, 1998, p.79). In response, for progressive disasters scholars and practitioners incorporating experiential grassroots expressions –including non-verbal testimonies- became an overdue moral, humanitarian and practical debt (Hardie-Forsyth, 1999; Hewitt, 1998; López-Marrero & Tschakert, 2011; Malchiodi, 2008); distant from the appropriation of survivors’ images and testimonies by governments, media, private firms and NGOs to advance their goals, which can result in ‘disaster tourism’ and ‘disaster pornography’ (Hewitt, 1998). My work searches to incorporate the former approach, also used in planning, to overcome the dichotomies experts vis-à-vis lay citizens, top-down vis-à-vis bottom up, and powerful vis-à-vis disempowered through practices that value grassroot experiences, extract context-sensitive lessons and facilitate policies (Lavell, 1994b).

Similarly, a myriad of disaster-related cultural and artistic expressions have been overlooked and delegitimized in the theoretical and policy-making literatures. The root cause is possibly that mainstream development policy-making and prevailing economic paradigms have often

excluded culture and art from among the top priorities (Geertz, 1963, 1973; UNDP, 2004a) or have commodified it (Evans, 2005; García, 2004; Miles, 2005; Miles; & R., 2005; A. J. Scott, 1997; A.J. Scott, 2000). Therefore, the roles of culture in preventing and overcoming crises have been limitedly explored, which means critical knowledge voids in “innovation and persistence in memory, cultural history, worldview, symbolism, social structures flexibility, religion, and the cautionary nature of folklore and folk tales” (A. Oliver-Smith & Hoffman, 2002, p.9). Recently, anthropologists, ethnographers and related professionals have reanalyzed Western-centric archetypical cultural constructions that separate humans vis-à-vis environment and disasters, interphases between material and cultural conditions that shape disasters (A. Oliver-Smith & Hoffman, 2002), cultural processes among communities located in risk-prone environments (Torrence & Grattan, 2002), and recent migratory and acculturation processes that fragmented intergenerational transmission of cultural memories, such as disaster warning signs (Torrence & Grattan, 2002). There are even less traces of learning from literary writings that record disaster-related experiential knowledge, societal conflicts, environmental and spatial changes, economic processes, religious beliefs, superstitions, and potential areas of intervention. Yet, the arts are understudied sources which in many aspects are closer to the everyday life than technical writings, and frame relevant issues for disaster studies and management. That is why I included artistic manifestations concerning hurricanes, which have entered seldom scrutinized 'public transcripts' and popular consciousness. Other manifestations that I could not include due to unavailability are art therapy to increase crises resilience⁴¹, disasters as pedagogic exhibits⁴², and debates linking cultural heritage to a culture of disaster prevention and preparedness⁴³.

⁴¹ Art and play expose experiences of trauma, depictions, fictions and neuropsychological characteristics. Creative expressions –particularly non-verbal modalities- express the unspeakable, when silence is self-imposed or imposed by others (Malchiodi, 2008). Sensory manifestations document acts of human degradation that may take place during crises, relevant for policy-makers⁴¹. Also, they circumvent ‘talk’ that tends to be temporarily unavailable in

II.2.d) Complex emergencies

The disaster debate has broadened since the 1970s from separate sudden or slow onset hazards with environmental triggers to comprise their overlaps, civil strife, accidents, famines, epidemics, biological hazards and technological collapses. A typology of disasters based on crises defined four types: ecosystemic, socio-technical, business-economic failures, and sociopathic attacks (Quarantelli, 1998). Such change reflects a different age of risks heralded by three complex emergencies in the U.S., soon followed by three even worse emergencies outside the U.S. mainland; and recognized by social theory. Their lessons are key for planners and motivated me to include complex historical emergencies due to the junction of climatic and seismic events.

Love Canal (1978), Three Mile Island (1979) and Times Beach (1982) changed public awareness, control and legislation in the U.S. Explosion and leakage of buried municipal and industrial chemicals affected Love Canal (New York). Preceding residents' complains about

sections of the brain -Broca's area- affected during traumatic circumstances; and ease recovery as mechanisms to regain symbolic mastery over disruptive events (Malchiodi, 2008). Academic research examples –mostly centered on children- include the therapeutic powers of play, work, and creative arts to overcome crises (Frost, 2005); arts-based learning to build post-trauma resilience (Smilana, 2009); and the arts and literature as answers to the impacts of disasters, war, and terrorism (Gangia & Barowskyb, 2009). Non-academic examples for a wide audience that examine beyond children's issues are a website by the International Art Therapy Organization, which includes diverse post-disaster rehabilitation processes using creativity, arts and performances (International Art Therapy Organization, 2009); and art therapy articles (Gordon, 2010; Malchiodi, 2008).

⁴² For instance, a 2012 Miami-based hurricane exhibit included artifacts recuperated from Hurricane Andrew (1992), a full-scale P-3 hurricane hunter aircraft to simulate a mission, game designing, constructing and testing a model house against hurricane-force winds; with the aim of building citizens awareness to prepare and protect themselves before, during and after hurricanes (Rojas Torres, 2012).

⁴³ Relief and poverty reduction institutions, NGOs and other stakeholders lack studies documenting the long-term economic and social advantages of investing in traditional built environments and technologies, learning lessons from popular and vernacular cultures, and incorporating other forms of cultural heritage in disaster prevention and response. In turn, lack of reliable data to estimate investment returns undermines support to related interventions (Calame & Sechler, 2004; Ripp & Lukat).

pollution and degraded living conditions were ignored for years, as the case was tainted by inadequate prevention and responses from officials, denial of private stakeholders, and lack of accountability mechanisms that guaranteed social justice (E. C. Beck, 1979). The explosion severity and public outrage gave way to the 1980 Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund, which established emblematic compensations and requirements regarding a national inventory of contaminated sites (E. C. Beck, 1979; Blum, 2008). The Three Mile Island nuclear power station (Pennsylvania) partial meltdown was brought under control, without long-term health impacts on nearby residents. Yet, initial poor official communications, anxious evacuation of thousands of citizens, escalated cleanup costs, and later disclosure of critical details prompted legislation and controls for the industry, and anti-nuclear awareness and environmental activism possibly decisive to stop nuclear projects in the country (P. A. David, Maude-Griffin, & Rothwell, 1996; Hopkins, 2001). Also, the case inspired the pivotal work of sociologist Charles Perrow criticizing the role of industrialization in creating risks, which resonated with contemporary environmental activism⁴⁴. In Times Beach (Missouri), a paving project made headlines as the largest civilian exposure to toxic dioxin in the country. Alarmed residents were evacuated when a flood worsened living conditions, the federal and Missouri governments acquired homes and businesses after contentious legal battles, and undertook expensive tidying (Hites, 2011; Humphreys, 1989).

⁴⁴ According to his 'normal accidents' thesis, ever increasing and unmanageable catastrophes were an inseparable component of the intricate human-technical processes of industrial societies (Perrow, 1984). Organizations generally established the framework of debates concerning risk acceptability and made choices about risks; which in turn had unpredictable cascading implications. Despite efforts to forestall accidents -regulation, control, design, training and warning-, human agency limitations prevailed, as futile regulation, disregarded warnings, incompetent response, and human errors. Thus, the impossibility to turn safe complex systems with catastrophic potential should deter us from creating them (Perrow, 2011).

Bhopal (1984), Chernobyl (1986) and Exxon Valdez (1989) expanded disaster characterization. Pesticide leaking from a plant in Bhopal (India) became the world's largest industrial disaster. The Chernobyl Nuclear Power Plant (Ukraine) atmospheric release of radioactive material became the worst nuclear plant accident, only rivaled by the 2011 Fukushima Daiichi Nuclear Power Station catastrophe (Japan). The Exxon supertanker oil-spilling in the south central coast of Alaska, close to the municipality of Valdez, was the largest and most ecologically damaging release of oil in North American history, only rivaled by the 2010 Deepwater Horizon/British Petroleum crisis in the Gulf of Mexico. The cases share large scale, complexity, initial inadequate official measures and censorship that worsened the crisis and made authorities and investors unreliable. Subsequent discoveries include known previous technical mismanagement, for-profit maintenance neglect, lack of mechanisms to compensate great human, economic and environmental costs still being accounted for (Chernobyl Forum Expert Group Environment, 2006; Eckerman, 2006; Gill, Picou, & Ritchie, 2012; Paine et al., 1996; Palinkas, Downs, Petterson, & Russel, 1993; Rodin, Downs, Petterson, & Russell, 1992 ; Sriramachari, 2004). Contemporary social theory breakthroughs emerged in the publication of "Risk Society" by Ulrich Beck (1986 in German, 1992 in English), which coincided in time and some fundamental ideas with "The Constitution of Society" (Giddens, 1984). For Beck modernization's purpose changed from distributing wealth and dominating external threats to managing risks resulting from industrial society (U. Beck, 1992). For Giddens, sociologists and social scientist had hardly developed systematic appraisals of ecological concerns⁴⁵; yet, the crisis of modernity would force the transgression of epistemological and ontological boundaries (Giddens, 1990) in a new state called reflexive modernization. Both authors analyzed the growing and contentious role of

⁴⁵ Although pioneering sociological writings addressed mutually influencing human-environment interactions emerged since the late 1970s (Catton & Dunlap, 1978; Dunlap & Catton Jr, 1994).

expertise; emergence of enhanced reflexivity; lay citizens' mistrust of officials, experts and industries; concerns about low probability/high consequence events and increasing individualization (M. J. Cohen, 2000). Human agency marked the production and mitigation of modern risks⁴⁶, and modernization would change through social pressure for risk reduction, industrial regulation and relinquishment of growth plans.

An epistemological debate oscillates between the difficulties of providing effective analysis and interventions if compounding all disasters and the need to visualize even more complex emergencies due to previously unforeseen confluences (Perrow, 2011; Quarantelli, 1998). Fukushima exemplifies an extreme, potentially lethal worldwide radioactive disaster due to environmentally triggered events -an earthquake and associated tsunami-, overlapped with design and structural failures, seawater penetration and electrical blackout (Perrow, 2011). Ultimately, Fukushima reiterated the need to see disasters as part of a nature-culture dyad, in which professionals must take a broad integrative perspective to understand their causal mechanisms and possible responses.

II.2.e) Redefinition of the disaster management practice

Early practices of disaster management used top-down elitist models of rational planning and decision-making to technologically discipline nature and tame disasters (Fischer, 1996) and to reestablish social order by force if needed, overshadowing social developmental issues -as my dissertation confirms-. Since the 19th century (Neely, 2006), armed forces have often undertaken

⁴⁶ Such as changes in the food chain due to contamination and pesticide concentration, newly discovered diseases, biotechnological modification of species or high technology criminality. In my case study, examples are technologically enabled urbanization of risk-prone areas and extensive hydrological changes.

prevention plans, relief and reconstruction "assuming that only a military-style organization can function properly in a disaster area, but also because it underpins the notion of the state reimposing order on a devastated community" (K. Smith, 1992, p.42), sometimes at the expense of endorsing preceding injustices or setting up new ones. Moreover, military attempts to modify climate through technological interventions dates from the early 20th century (Fleming, 2009; Gilbert, 1998; Mooney, 2007; Sloterdijk, 2009); and since the 1950s it was implemented in Puerto Rico and the U.S. at undisclosed costs. Despite wasted resources and ongoing social construction of disasters, militaristic technocratic climate change remains in the agenda⁴⁷.

The 20th century is full of examples in which politicians, media, practitioners and academics have framed disaster management is as a binary and mutually exclusive technical versus social choice, with predilection for the first option. Moreover, for profit lobbyists have promoted experimental costly technology disregarding vernacular, time-tested, low-cost technologies; and processes that address social change and touch powerful interests. Thus, the field has favored allegedly adequate technical changes, following conventional tenets of efficiency and modernization via expensive engineering-led innovations (Pielke Jr. et al., 2003). Progressive approaches propose a strategic interplay of structural and non-structural measures, respectively called 'hard' and 'soft' interventions (Pielke Jr. et al., 2003). The former indicates technical and material interventions; the latter calls for social innovation including education, social policies and economic incentives towards a lifestyle of sustainable interdependencies that includes disaster management. My case studies tracked both.

⁴⁷ In one research proposition, U.S. aerospace forces could 'own the weather' by 2025, a revolutionary capability as controversial as atomic bombing given its high-risks, but supposed to be exceedingly worthwhile. Weather-modification would cover fully the battle space; from derailing adversary operations or backing those of allies via small-scale tailoring of weather patterns to absolute supremacy of counter space and global communications (House et al., 1996).

Also, progressive disaster management has moved away from the narrow leadership and management of specialized professionals and agencies (Bull-Kamanga et al., 2003), to incorporate disciplines that were tangential, new or acted separately, including planning. Often unacknowledged by ‘disaster experts’, lacking an educational curriculum that incorporated disasters, and internal debates about the multidisciplinary and politicized underpinnings of planning; urban specialists acted separately and limitedly on key processes related to risk accumulation. Land use planning and emergency management illustrate this point, examined in my dissertation. Avoiding high-risk areas has been traditionally the most direct tool in land use planning (K. Smith, 1992), requiring steps such as risk zoning and legislation, intervention in exclusionary land markets, dissemination of disaster memories -which planners rarely address-, and contentious⁴⁸ relocation of settlements on hazard-prone areas. "Risk zoning, urban development ordinances, or other technical instruments rapidly become a useless (and at times costly) exercise if not attuned to real social conditions and to the real possibilities of control" (Lavell, 1994b, p.60). Also, emergency management must integrate planning explicitly. At best, conventional urban specialists acted limitedly during relief, a critical stage of improvised and accelerated decision-making that may crudely reveal persistent underlying assumptions, incipient long-term policies and political life trends. For instance, unplanned warning and evacuation may cause panic, crime, looting, widespread traffic jams, petrol scarcity, severe economic loss, shortages in metropolitan or national public services, public health risks for those displaced (Blaikie et al., 1994) and expose more citizens to psychological traumas, injuries and death. Neglect of warning and evacuation is a political decision with contentious underpinnings that merits inquiry from the planning standpoint, particularly in places with historical hazard

⁴⁸ Including high costs, opposition from powerful stakeholders or exposed communities who fear societal disruption, insufficient compensation mechanisms and undisclosed motivations to force them relocate.

recurrence or new hazards. Another critical choice is to invest in local relief capacity; its weakness empowers distant administrations, foreign aid institutions, charities and outsiders. Crises worsens if those stakeholders are unaccountable for implementing contextless responses and treating disaster survivors as victims incapable of participating in the decision-making of their present and future, who may even 'need' to be disciplined with patriarchal or militaristic approaches. Moreover, uncoordinated responses by diverse entities can lead to vital vacuums, duplication of efforts, manipulation for personal or political purposes, overburden of survivors, generation of false expectations or skepticism, weakening of local entities which precisely needed strengthening (Maskrey, 1994), and ultimately reinforce injustice, underdevelopment and dependency (Cuny, 1987; Maskrey, 1994; B. Wisner et al., 2004). Relief "is likely to be most efficient when there is a clearly prioritized identification of tasks to be done and it is also established beforehand who is responsible for each job" (K. Smith, 1992, p.126). Ultimately, this reinforces the call to integrate disaster management and planning in order to achieve vulnerability reduction, which increasing numbers of scholars and practitioners raised since the 1980s (Paul Susman, P. O'Keefe, & Ben Wisner, 1983; Varley, 1994). "To isolate disasters and make them a 'special problem' is in itself an invitation to disasters" (Lavell, 1994a, p.62). Another argument to integrate disasters in urban development processes was based on cost-effective analysis (Alcira Kreimer & Mohan Munasinghe, 1992).

II.3. Conclusions

Since the late 1960s and with more strength since the 1990s, there has been a paradigm shift moving away from positivist beliefs in technological and scientific rationality, and from the

initial secular characterization of disasters as geophysical extremes of nature that suddenly disrupt 'normal' life. Coming from multiple standpoints, lay citizens, activists, scholars and policy-makers advanced fundamental questions concerning disasters. Their central contributions include the failures of science and technology to characterize and handle disasters, alternative knowledge that addresses power relations, valorization of grassroots accounts and the arts, threats of industrialization and modernity, contested roles of institutions and citizens in crises prevention and response, rise of novel complex emergencies, and redefinition of disaster management practice.

The resulting paradigm to understand and handle disasters can be framed as a politicized and human-centered approach, an alternative 'co-evolutionary' construct, which intends to circumvent dichotomous choices by synchronizing social and technical changes. Distilled to policy-making, the aim would be to facilitate changes of people's practices, including their interaction with the environment, through social, cultural, material, infrastructural or technical interventions, in order to promote social justice through successful interventions. From all these layers of knowledge, this research will undertake the following questions: What is a disaster? What caused it? How to tackle it? In practice, they narrow down to three themes further developed in the Research Design Chapter and examined in the case studies: *Characterization, Causation and Relief*.

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Chapter N.III Review of the Puerto Rican hurricanes literature until 2012

III.1. Introduction of the questions to be addressed

When conducting my research⁴⁹, it was hard to grasp the body of work concerning hurricanes on the island. I organized it until 2012 to frame my research design, case studies and contributions, and fill a knowledge gap. Although I kept disciplinary separation, the following questions serve to extract what is relevant for my dissertation:

- 1) *Is there a robust production of literature and policy-documents for Puerto Rican hurricanes*
- 2) *Which have been the main catalyst for advancing hurricane knowledge and policy production?*

⁴⁹ Most of the local search was conducted at the Universidad the Puerto Rico (UPR), Río Piedras campus in San Juan. The UPR system of 42 libraries works as a national public with unique centennial documents; but it suffers of classification inconsistencies. Several collections reaching until the 1980s use non-digitalized typed cards exclusive to each library. The same topic can be classified under different headlines, and may not be listed in both official languages. When date is missing, the library notation is a question mark – for example 19? means it was published in the 20th century-. Master's Thesis or Doctoral Dissertations may be catalogued inconsistently and other materials are uncatalogued. The latter problem is shared by the archives of Fundación Luis Muñoz Marín, Puerto Rico's Public Broadcasting Station (WIPR-TV), Archivo General de Puerto Rico, the Puerto Rican Planning Board and the Instituto de Cultura Puertorriqueña (ICP), which I consulted in lesser degree. Most of those institutions have had reductions of funding, personnel and hours of consultation during the last decade. Hence, this review could be lacking relevant publications. I conducted an online search during four years. Using a snowball sampling-like technique, I followed references in publications; and I also made random searches in scholarly journals and search engines. When only references were available, not the documents, I still mentioned them to construct a comprehensive overview and facilitate the search for scholars and policy-makers. At Columbia University, I consulted Avery, Butler and Lehman libraries to a much lesser degree.

- 3) *Which are the most and least developed disciplines?*
- 4) *Are there common threads for all the disciplines?*
- 5) *Which are the main units of analysis?*
- 6) *Who have been the main producers of research and policy documents?*

III.2. Thematic structure definition

The historical article Hurricanes and the Shaping of Circum-Caribbean Societies (Schwartz, 2005) succinctly advances a holistic, multidisciplinary review of the regional literature useful to this chapter. For the author, underneath disciplines lays a revealing and changing myriad of paradigms about society, environment and science. His proposition of four disciplinary themes to group the literature, with examples, is accompanied by an incisive synopsis of each theme's developmental background:

- i) Sociological studies firstly structured around coping and risk management, social and psychological responses of individuals to disasters, and self-vulnerability enhancing choices. This literature was mostly written with a sociological or psychological background, based on qualitative information gathered through interviews and direct observation; and it lacked longitudinal perspective and connections with political and economic dynamics.
- ii) Policy guidelines produced mainly by governmental institutions, NGOs, scholars and donors. This literature emerged with a technical and pragmatic emphasis on problem-

solving, focused on disaster stages, and usually with feeble sensitivity to contextual characteristics including historical and cultural specificities.

iii) Climatological studies to record events scientifically and improve prediction. This literature has grown linked to technology; yet, traditionally lacked self-reflective criticism of the political, social and cultural foundations of science and the manipulations of science. Recent topics include forecasting bureaucratization through governmental institutions and the historical impact of technology.

iv) Historical studies which at their origins could be described as classical hurricane historiography, chronologically listing data such as casualties, economic losses and physical trajectories. This literature overlooked the social construction of disasters and the shaping of societies by disasters. While many historians have seen storms as a danger to Circum-Caribbean peoples, their ‘naturalness’ blurred their understanding as endogenous to historical process. Recently, hurricanes have become a legitimate topic of inquiry, complementing usual Caribbean meta-narratives including slavery, plantation economies, imperialism and race.

Schwartz’s structure is a useful point of departure, but the Puerto Rican hurricanes literature is broader in disciplinary terms and would benefit from a fine tuned temporal and contextual follow-up of the disciplines and approaches within disciplines. Thus, this chapter reviews a) Meteorology, b) Biology, c) Physical sciences, d) Epidemiology, e) Social sciences, f) Economics, g) Law, h) History, i) Post-hurricane evaluations by policy-makers, j) Prevention

policy-making, k) Insurance, l) Housing, and m) Literary writings. Within each discipline, publications are examined in chronological order to track the development of paradigms, knowledge and policies. Each discipline is concluded with a succinct critique.

III.3. Review of the literature on Puerto Rican hurricanes until 2012 combining disciplinary themes and chronological order

III.3.a) Meteorology

Since the early Spanish colony, sources recorded climate data and storm impacts in Puerto Rico with degrees of religiosity, accuracy, consistency and scalar coverage. Yet, Caribbean meteorology emerged in advanced academic Cuban institutions, with intellectuals such as Andrés Poey and priest Benito Viñes at the forefront (Schwartz, 2005), whilst in Puerto Rico the discipline remained inexistent. At the turn of the 19th century, the U.S. Army Signals Corp produced regional information for domestic purposes, protection of ships and cargo, and to extend the U.S. power (Arsenault, 2005). Data was collected from merchant and marine ships and complemented with personal observations, quotes from civilians, officials, travelers and local observatories. All informants were male.

Systematic literature focused on Puerto Rican weather started to be produced by U.S. Army Signals Corp meteorologists in 1899. Following the U.S. invasion, the newly established San Juan Weather Bureau tracked storm for protection and military purposes (Neely, 2006). San Ciriaco devastation confirmed the tactical necessity of methodical research, hurricane data were

mapped and served political and fundraising aims in Washington (Davis 1902), including decisions about denying independence to the island. Pioneering meteorologist in Puerto Rico were men from the U.S. (Alexander, 1902; E. B. Garriott, 1899; E.B. Garriott, 1899), and they amassed technical information sent from ships or gathered locally through barometric, wind speed and rain gauges readings. They produced scientific reports, tables and sometimes maps and drawings; they concomitantly produced typical listings of casualties and damages. This profile of information and meteorologists (Fassig, 1928; Hartwell, 1931; Weightman, Mitchell, & Hartwell, 1932) continued for almost four decades, integrating technological advances that improved data collection during San Felipe (1928), San Zenón (1930), San Nicolás (1931) and San Ciprián (1932). Ongoing martial emphasis included military personnel, location of weather monitoring station within armed forces bases, applied use of war technology, secrecy on information, and bellicose motivations for research, policies and projects.

Since the 1940s, the meteorological literature grew fastly incorporating experiments that took place in Puerto Rico, without the locals having access to or decision-making power over the new knowledge. For instance, after an improvised flight that departed from the island to penetrate a storm, the U.S. War Department created in 1944 the first Weather Reconnaissance Squadron, a military team with an instrument equipped aircraft originally dedicated to military missions. Soon scientists on board collected regional meteorological data, establishing longitudinal records and producing theoretical works. After WWII, reduced security constraints on military technology enabled the practical use of radars (Maynard, 1945). Furthermore, when the race with the Soviet Union started, president Eisenhower followed his weather advisor -Harold T. Orville-, who believed controlling the weather meant planetary control (Fleming, 2009). Since the mid-

1950s until the 1980s, the military aimed to engineer storms, hurricanes and clouds as weapons for an all-weather air force (Mooney, 2007). U.S. conducted aerial bombing experiments over Puerto Rico, the Atlantic Ocean and the U.S. to modify hurricanes and storms. Meteorological literature produced for those military objectives and projects was often classified as confidential. Records in the UPR libraries are a few black and white photographs of U.S. Air Force squadrons; original documents are unavailable. Online searches of writings evaluating its linkages then and now to Puerto Rico yield meager results. At that time, mostly strictly technical writings circulated and they increased after the 1954/1955 disastrous Atlantic hurricane seasons and the Weather Bureau launching of the National Hurricane Research Project in 1955 (Mooney, 2007). In turn, some of those changes reflected post Santa Clara, including regional meteorological research for the hurricane season (Dunn, Davies, & Moore, 1956), local meteorological conditions and radarscope readings of the hurricane (J. A. Colón, 1959), and detailed studies about the hurricane eye (R. J. Grace, 1956). Similarly, after Hurricane Donna hit Puerto Rico in 1960, research included the habitual hurricane season meteorological research (Dunn, 1961), and in-depth studies on weather and circulation (Tisdale, 1960), the filling of Donna over Puerto Rican land (B. I. Miller, 1964), and a summary of empirical studies of the horizontal motion of small radar precipitation echoes caused by Donna and other tropical storms affecting Puerto Rico and surrounding territories (Senn & Stevens, 1965). A study of Donna's surface winds unusually took place four decades later, reinterpreting 1960 data with new methods (Dunion, Landsea, Houston, & Powell, 2003).

Afterwards, the island went through a fairly quiet storm period⁵⁰ until the late 1980s. The literature focused on the worse events, such as Hurricane David (1979) and tropical storm Isabel (1985), examples are the general summary of David's corresponding hurricane season (Heber, 1980), uses of weather satellite imagery in teaching the characteristics of tropical cyclones (Bencloski, 1981), a comparative weather report on hurricanes David and Frederic in Puerto Rico and the U.S. Virgin Islands (National Oceanic and Atmospheric Administration, 1980), a Ph.D. dissertation examining Puerto Rican tropical cyclone structure and intensity change (Nuñez, 1981), and the Atlantic hurricane season that included storm Isabel (Case, 1986).

In 1989, Puerto Rico was harshly hit by Hurricane Hugo which reflected on the meteorological literature (Brennan, 1991; National Weather Service, 1989; F.N. Scatena & Larsen, 1991). Publications following the landfall of hurricane Georges, in 1998, research includes the aircraft mission summary of climatological data (Aberson, Gamache, Leighton, Black, & Popstefanija, 1998), preliminary storm report (Bennett & Mojica, 1998), complete storm report (NOAA/AOML, 1998), preliminary meteorological report from the National Hurricane Center (Guiney, 1999) and observed boundary layer wind structure and balance in the hurricane core (Kepert, 2006).

Parallel efforts to understand climate and hurricane zonation include a commercial hurricane zoning map (Shell Oil Company Incorporated, 19?), a climate study for Puerto Rico and the U.S. Virgin Islands (Calvesbert, 1970), a climate zonation based on principal components analysis

⁵⁰ During those years, there were hurricanes and storms of moderate to low wind strength, yet their corresponding flooding impacts were severe. For instance, after hurricane David (1979), newly created FEMA declared Puerto Rico a disaster area due to agricultural and property flooding damages. The 1985 storm Isabel triggered what was considered the worst landslide disaster in North American history, killing 123-300 people in Ponce only. President Ronald Reagan declared the island a Federal Disaster Area.

and an artificial neural network (Malgrem & Amos, 1999), and a climate map of Puerto Rico, Vieques and Culebra (Daly, Helmer, & Quinones, 2003).

In conclusion, the meteorological literature is increasing in numbers, length and technical complexity; with significant production after major events. Gaps include self-reflective criticism of the political, social and cultural foundations of climatological science and the manipulations of scientific knowledge (Schwartz, 2005). Other missing topics include secularization and bureaucratization through the weather bureau and related institutions, disciplinary impacts of local research, historical effects of technology, state of the profession at the local level, present and future priorities, tensions between U.S. and Puerto Rican institutions and experts, tensions between the dominant figure of the expert vis-à-vis general public, connections and mismatches with policy-making, and preventable information breaks that occur during major events.

III.3.b) Biology

The contributions from the biological sciences emerged in the early 20th century and have vastly increased in quantity, quality and complexity. They first focused on the impacts of San Felipe on diverse trees and forests (C. G. Bates, 1930; C. Z. Bates, 1929), Santa Clara on forests (Wadsworth & Englerth, 1959), and Edith (1963) on marine life in the southwest coral reef La Parguera (Glynn, Almodóvar, & G., 1964). Around the 1980s, biology graduate students and researchers produced highly specialized studies with reduced policy implications. The first examples found came from marine biology; an M.Sc. thesis about the effects of hurricane David (1979) on the benthic macro algae La Parguera (Matta, 1981) was followed by evaluations of David's impacts on the shallow water Gorgonian corals of Puerto Rico (Yoshioka & Yoshioka,

1987, 1989). A contemporary piece focused on hurricane damage and recovery in the montane forests of the Luquillo Experimental Forest (Weaver, 1986), a protected area in northeastern Puerto Rico used for tropical forestry research during nearly a century. In 1988, the National Science Foundation (NSF) launched the Luquillo Long-Term Ecological Research Program (LUQ-LTER⁵¹) to study natural disturbances -i.e. hurricanes, floods, landslides, and droughts- and ecosystem responses to them. A year later, Hugo prompted an extremely sizeable production of biological knowledge, including an introduction to hurricane biological impacts in the Caribbean emphasizing Puerto Rico (L. R. Walker, Lodge, Brokaw, & Waide, 1991); and the multiple hurricane impacts on Luquillo comprising animal populations responses (R. B. Waide, 1991), shrimp abundances in a montane stream (Covich, Crawl, Johnson, Varza, & Certain, 1991), bird populations (Robert B. Waide, 1991), forest frogs (Woolbright, 1991), tree damage and recovery (L. R. Walker, 1991), light availability changes (D. S. Fernández & Fetcher, 1991), seedling populations (Guzmán-Grajales, 1992; Guzman-Grajales & Walker, 1991), secondary forests and plantations (Rodríguez Pedraza, 1993), termites (McMahan & Blanton, 1993), biomass and nutrient content of three experimental watersheds (F. N. Scatena, Silver, Siccama, Johnson, & Sanchez, 1993), bats (Gannon & Willig, 1994), vegetation dynamics of disturbance and recovery (Everham, 1996), litter dynamics along stream, riparian and upslope areas (Vogt et al., 1996), leaf litter spider species (Vargas Carcaña, 1997), and five-year effects on a flood plain Palm Forest (Frangi & Lugo, 1998), implications for parrots of pre- and post-hurricane fruit availability (Wunderle, 1999). Comparative studies addressing Hugo include damage to trees related to maximum gust speeds measured or estimated in 18 urban and rural

⁵¹ Luquillo was recently included in the NSF Critical Zone Observatory Network, and the aim is to study how processes and water balances differ in landscapes with contrasting bedrock but similar climatic and environmental histories (Brantley et al., 2006).

sites in Puerto Rico and the Lesser Antilles (John K. Francis & Gillespie, 1993), responses of tree species to hurricane winds in subtropical wet forests in Puerto Rico (Zimmerman et al., 1994), the first five years reorganization of above ground biomass and nutrient use in three tropical forests in the U.S. Virgin Islands (F. N. Scatena, Moya, Estrada, & China, 1996), and a longitudinal study of hurricane disturbance regimes in the Luquillo Experimental Forest landscape reproducing wind damage and meteorological impact from historical records (Boose, Serrano, & Foster, 2004).

Likewise, after hurricane Georges, biologist gathered information about its effects on frog populations of the Cordillera Central (Jarrod & Vilella, 1999), several species of urban trees in San Juan (John K. Francis, 2000), seed and seedling bank dynamics in secondary forests (Lomascolo & Aide, 2001), the *Artibeus jamaicensis* bat (Rodriguez-Durán & Vázquez, 2001), forest floor decomposition in several forests (Ostertag, Scatena, & Silver, 2003), vegetation changes in Luquillo Experimental Forest, the Guánica Dry Forest and five cities using NOAA's Advanced Very High Resolution Radiometer (Ayala-Silva & Twumasi, 2004), diversity and abundance of *Anura Leptodactylidae* forest frogs before and after Georges in the Cordillera Central (Vilella & Fogarty, 2005), resident avifauna of Maricao State Forest (Tossas, 2006), structural response of Guánica dry forests to hurricane winds (Van Bloem, Lugo, & Murphy, 2006).

In conclusion, this extensive literature shares some of the weaknesses concerning the meteorological literature. For instance, there is no self-reflective criticism of the political, social and cultural foundations of science and the manipulations of scientific knowledge, disciplinary

impacts of local research, historical effects of technology, local state of the profession, present and future priorities, tensions between U.S. and Puerto Rican institutions and experts, tensions between experts vis-à-vis general public. Most publications are conducted in isolated forests due to disciplinary and funding biases that dismiss urban or agricultural environments. Finally, it is hard to advance ecosystemic views, multidisciplinary, and policy repercussions.

III.3.c) Physical sciences

Physical sciences publications emerged relatively late, in the 1970s; and most aim to be applied research, although their usefulness remains unexamined. Instability of natural and human-made slopes has been addressed given the landslides triggered by hurricanes and heavy rains, but also by seisms (DeGraff, Bryce, Jibson, Mora, & Rogers, 1989; Pando, Ruiz, & Larsen, 2004). A miscellaneous investigating series that included a map of landslides and areas of susceptibility to land sliding in Puerto Rico (Monroe, 1979) was soon followed by emergency-driven research. As mentioned, tropical storm Isabel unleashed lethal landslides in southern Puerto Rico during 1985. The worse one remains the most disastrous landslide in U.S. history, killing between 127-300 low-income residents only in Mameyes (Ponce) and generating demands for landslide knowledge and policy changes, including zoning. Examples are preliminary Irene storm response activities and recommendations of the U.S. Geological Service landslide hazard research team (Campbell, Herd, & Alonso, 1985), evaluation of Irene storm landslide hazards (R. W. Jibson, 1986), geological research about debris flows in southern Puerto Rico associated to climatic events (Randall W. Jibson, 1989), guidelines for determining landslide risks post-Hugo based on slope hazard evaluation (USGS, 1991), hurricane Hugo triggered landslides in eastern Puerto Rico (Matthew C. Larsen & Torres-Sánchez, 1992), rainfall intensity-duration threshold for

landslides in a humid-tropical environment (M. Larsen & Andrew, 1993), geographic relations of landslide distribution and assessment of landslide hazards in the Cibuco, Blanco and Coamo river basins (M.C. Larsen & Torres-Sánchez, 1995), stability analysis of western slopes (Divarkala & Macari, 1998), frequency and distribution of recent landslides in three mountain tropical regions (M.C. Larsen & Torres-Sánchez, 1998), map showing landslide susceptibility in Comerío (M.C. Larsen & Parks, 1998), an overview of rainfall-induced landslides that included the main issues, a literature summary and a proposal of rainfall intensity landslide threshold based on data from 1959 to 2003 to implement as a warning criterion (Pando et al., 2004), susceptibility to rainfall-triggered landslides in Ponce (Matthew C. Larsen, Santiago, Jibson, & Questell, 2004) and rainfall-induced landslide susceptibility island zonation (Lepore, Kamal, Shanahan, & Bras, Published online 25 February 2011). Also, publications of the last decade have addressed the need for landslide mitigation policies, learning from the assessment of the U.S. National Landslide Mitigation Strategy (National Research Council, 2004); comparative landslide mitigation examples from Venezuela, Puerto Rico and the Dominican Republic (M. C. Larsen & Wiczorek, 2004), and a project to forecast the hurricane-flood-landslide continuum effects at landfall in Haiti, the Dominican Republic and Puerto Rico (Negri, Golden, & Updike, 2004).

Also in the 1980s, marine scientists gathered knowledge on coastal storm risks. First was a methodology for predicting Caribbean wave heights in storms (Lizano Rodríguez, 1988). After Hugo, a hurricane storm tide atlas was published for the affected eastern municipalities of Yabucoa, Humacao, Fajardo, Naguabo, Ceiba, Luquillo and Río Grande (Post, 1994), an evaluation of the Puerto Rican experience concerning the use of NOAA's computerized storm

surge model SLOSH⁵² to manage coastal hazards (Mercado, 1994), Hugo's effects on storm-tide elevations on the U.S. Virgin Islands and Puerto Rico (Torres-Sierra, 1996), an evaluation of the U.S. Army Corps of Engineer's deep water wave prediction techniques during hurricane Georges (Hsu, Martin Jr., & Blanchard, 2000), storm impacts on eastern Puerto Rico coastal resources and environments with a baseline to compare the impact of future storms, in addition to coastal geologic hazards, their identification and recommendations (Bush, Richmond, & Neal, 2001); and a long-term reconstruction of relative flooding intensities causing hurricane-induced deposits in a Vieques coastal lagoon (Woodruff, Donnelly, Mohrig, & Geyer, 2008).

In sum, geomorphology, coastal geology and hydromorphology are the most developed physical sciences literature addressing hurricanes and related disasters; all increased in numbers and complexity during the last decades, as the previously examined disciplines. Critical missing issues include the predominance of the figure of experts, without participatory assessments and approaches that help to build linkages to risk-enhancing everyday life practices and top-down policies, minimizing communication breakdowns.

III.3.d) Epidemiology

The Puerto Rican epidemiologic literature on the public health consequences of hurricanes is relatively reduced, yet it started early with a 1900 brief report after San Ciriaco by Dr. W.W. King, General Surgeon of the U.S. Marine-Hospital Services (King, 2006 (1900)). He provided an urban background to explain the crisis in Ponce -the most devastated city-, and summed up storm-related mortality, injuries, and infectious diseases with a racist bias. Post Santa Clara, researchers examined a typhoid fever outbreak in Ponce due to the sudden arrival of rural and

⁵² Sea, Lake and Overland Surges from historical, hypothetical, or predicted hurricanes.

suburban refugees and the pollution of drinking water networks (Masi, Timothee, & Armijo, 1958). Subsequently, researchers have assessed the health impacts of the 1985 storm Isabel Flood Disaster (V. J. Dietz, Rigau-Perez, Sanderson, Diaz, & Gunn, 1990), hurricane Hugo-related deaths in South Carolina and Puerto Rico (Philen et al., 1992), an increase of leptospirosis in dengue-negative patients after hurricane Hortense in 1996 (Sanders et al., 1999), deaths associated with hurricane Georges in 1998 (Alvarez & Deseda, 1998), and dengue risk in relief workers after Georges (O'Leary et al., 2002).

Different avenues of research emerged recently, signaling a more comprehensive view of hurricane-related epidemiology. Psychology and psychiatry contributions include an evaluation of children between 5-13 years of age who became refugees after hurricane Hugo (Santos Rivera, 1992), a conduct pattern comparative study of children affected and unaffected by Hugo (Arroyo de Jesus, 1993), Georges' post-disaster stress in children and teenagers living in shelters, and proposed activities to ease the counseling process and transition to family-living conditions (Prewitt Diaz, 1999); whilst another paper focused on the risk of post-hurricane psychiatric disorders among a random sample of the child and adolescent population, providing research and clinical implications (Felix et al., 2011). On a different vein, a book chapter retrospectively examined prevailing public health mentalities during San Ciriaco from a historical perspective (Pabón Battle, 2000), and a self-instructional module by the Puerto Rican Health Department and the UPR Center for Public Health Preparation targeted the preparation of public health professionals for emergencies and disasters (Rivera Gutiérrez, n.d after 2008).

Despite those recent changes, relevant knowledge gaps include health-care infrastructure destruction, public health services disruption, homelessness and displacement, social dislocation, loss of livelihood and jobs, economic crisis, and transformation of ecosystems, as discussed in the seminal paper ‘Epidemiology of Tropical Cyclones: The Dynamics of Disaster, Disease, and Development’ (Shultz, Russell, & Espinel, 2005). Moreover, the legal underpinnings of public health responses remain unaddressed, for the detriment of emergency management and public health officials evaluating the adequacy of laws for preparedness and response activities, and establishing informational, educational, and training resources (Weiss, McKie, & Goodman, 2007). Finally, identification of vulnerable groups beyond children and teenagers, conflicts with health insurance providers, long-term post-hurricane health care costs, and a public health evaluation of urban expansions at risk would contribute to disaster management, planning, and development policy making.

III.3.e) Social sciences

Related writing from social sciences emerged late compared to most of the disciplines examined above or the literature abroad; and some examples overlap with epidemiology -post-disaster stress-. The first available work is a Social Work Ph.D. dissertation on adult social support networks developed to overcome Hugo, at the island level (Bravo Vick, 1989). A subsequent paper examined attitudes, experience, and behaviors of homeowners in relation to hurricanes and other natural hazards in Puerto Rico (Palm & Hodgson, 1993). Hurricane Georges prompted an array of diversely focused and comparative research. A Social Work M.Sc. dissertation compared disaster community responses to Georges, including recovery management mechanisms, and formal and informal support systems. The case studies were the precarious and

flooding vulnerable area Península de Cantera, surrounded by an estuary in San Juan; and the semi-rural community of Viví Arriba, in the coffee highlands of Utuado (Rivera Grajales & González Rivera, 1999). A cross-national study examined preparedness, resource loss, and psychological distress of college students following Georges in the U.S. Virgin Islands, Puerto Rico, Dominican Republic, and the United States (Sattler et al., 2002); and another paper compared the social uses of media during Georges in eight communities of Mayagüez, western Puerto Rico (Perez-Lugo, 2004). A decade later, a study focused on the influence of political, cultural, economic and social factors on residents' capacities to respond to natural phenomena; evaluating impacts and strategies (Maldonado Muñoz, 2009). The research compared Miñi-Miñi and Piñones, two coastal areas within Loíza, a highly impoverished and risk-prone municipality of the San Juan Metropolitan area. Moreover, the research compared hurricanes Hugo, Hortense and Georges. In between, a rare retrospective paper on education and intergenerational mobility, by economists, used census data to study how islanders on the margin of school entry during Santa Clara and residing in the most affected areas attained much lower levels of education as adults than their counterparts in less affected areas (Bluedorn & Cascio, 2005).

In sum, most of this recent literature remains highly empirical, framed by an emphasis on short-term coping with post-disaster situations which gives it rhetorical power, instead of longitudinal assessments or an emphasis on preventive approaches. Increasingly, comparative studies and concepts indicate updated notions of disasters as socially embedded. However those analyses remain detached from macro issues, such as the island status and underdevelopment, from micro everyday cultural practices that increase or diminish risks, and the planning profession. Thus, the lack of works from disciplines such as political science and anthropology reflects a gap.

III.3.f) Economics

The available economics literature is extremely limited, although data about economic losses is usually produced after every disaster and published as part of technical research papers, official documents and mass media works. A book chapter reviewed the extent and economic significance of landslides in Puerto Rico, including cases associated to weather events (DeGraff et al., 1989). Following Hurricane Marilyn (1995), brief and standardized economic recovery plans were simultaneously prepared by UPR scholars at the Economic Development University Center, for the coastal municipalities of Loíza, Culebra, Carolina, Ceiba, Naguabo, and the highland municipality of Juncos (José I. Alameda-Lozada, 1997; José I. Alameda-Lozada, 1997; Centro de Desarrollo Económico UPR, 1997; R. Irizarry, 1997; R. L. Irizarry, 1997; Valle Caballero, 1997). The economic impacts of Hortense and Georges were summarized in two reports by the Puerto Rican Planning Board and endorsed by the Office of the Governor (Gobierno de Puerto Rico, Oficina del Gobernador, & Junta de Planificación, 1997, 1999). Both documents provide a snapshot of indicators, instead of processes; and indicators changed weakening comparisons. The second one provides a basic methodological explanation and attempts to include environmental damages with costs. For both, the Planning Board offered to update evolving conditions, which were unavailable.

Essentially, there is a feeble understanding of the dynamic economic impacts of hurricanes in Puerto Rico over time; which is an overarching trend for U.S. disaster management (Deryugina, 2011). The seminal piece “Hurricanes and Economic Research: An Introduction to the Hurricane Katrina Symposium” (Ewing, Brown Kruse, & Sutter, 2007) summarizes the main avenues of research in the U.S., basically divided in the ways in which the economic activity of regions is

disrupted by hurricanes and other catastrophes, and how to frame and promote recovery and resilience. Amongst the relevant issues raised by the economics literature unaddressed in the Puerto Rican case are the polemic question if hurricanes and related disasters promote long-run growth when there is an increase of external and internal resources that unleash redevelopment processes (Skidmore & Toya, 2002), the macro-economic impacts of hurricanes (Strobl, 2008), their effects on local labor markets (Belasen & Polacheck, 2008), the economic value of hurricane forecasts and warning system and of improving forecast quality (L. David, S., & Lazo, 2007), the design of fund transfer programs for general economic downturns -including welfare and food stamps- used as hurricane buffers even when there is no direct aid (Deryugina, 2011), and the recovery and resilience evaluation of an economy including fiscal costs hidden behind wealth or disaster-specific response policies (Deryugina, 2011).

III.3.g) Law

There is one outdated compilation of laws that lists Caribbean hurricanes (Seijo, 1965). Thus, there is a substantial void of knowledge concerning the role of law for enforcing disaster prevention and mitigation policies in Puerto Rico. For instance, one relevant yet missing analysis is how the human rights of a number of populations may be affected during the different phases of the disaster lifecycle; and how governments undertake or reject the responsibility of guaranteeing those rights and enforcing subsequent legal punishments and policy changes (National Bar Association-International Law Section & Program in International Human Rights Law of Indiana University School of Law-Indianapolis, 2008; The Inter-American Commission of Human Rights, 2006). During the emergency phase for instance, survivors can be left vulnerable to multiple human rights violations, including lack of effective information and

transportation, sexual and gender-based violence, denial of humanitarian assistance, discrimination in aid distribution, forced recruitment of children, loss of documentation, unsafe and involuntary return or resettlement, and property dispossession. Moreover, human rights violations may concern more than those hit by the disaster, including reconstruction and cleanup workers, journalists, medical staff and volunteers. A related topic is how citizens react to the lack of governmental enforcement of human rights, present in unscrupulous zoning and construction practices, or insurance defaults. Finally, the overlap between epidemiology and law concerning disasters is a missing link, as discussed above.

III.3.h) History

After Poey's mid-19th century groundbreaking and meticulous bibliography and chronology of Caribbean hurricanes; similar works were published until recently and constitute the backbone of historical information online and in press, with varying degrees of depth, rigor and scale (Alcalá, 1967; Lastra Aracil, 1983; Millás, 1968; Miner Solá, 1996; Mújica-Baker, n.d. after 1998; Ramírez de Arellano, 1933; Salivia, 1972; Seijo, 1965; Ivan Ray Tannehill, 1956). The best of those sources provide valuable information and point to avenues of research. Yet, a key absence in those writings are the social dynamics that sustained the construction of disasters throughout history and the ways in which Puerto Rican society has been reshaped by disasters (Schwartz, 2005).

The first in-depth historical analysis of how a hurricane influenced Puerto Rican society and politics is relatively recent (Schwartz, 1992). It addresses hurricane San Ciriaco and ten years later Puerto Rican scholars responded with a multidisciplinary although incipient discussion

(Rosario Rivera, 2000b), which includes a photographic and statistic overview of the damages (Rosario Rivera, 2000a), the position of the military government (Santiago Caraballo, 2000) and the catholic church (Ortíz Díaz, 2000), traces of San Ciriaco in early 20th century literature (Centeno Añeses, 2000), a health perspective mentioned above (Pabón Battle, 2000), and post-hurricane migration (I. Fernández, 2000). In much less detail, San Felipe (1928) is addressed in the paper examined above to structure the literature review (Schwartz, 2005). Those writings highlight a change to see hurricanes as a valid lens to grasp history, power relations and human-nature interactions; also taking place in fields like anthropology, sociology, ethnography, and planning. Yet, this approach needs more development for Puerto Rican hurricanes⁵³.

III.3.i) Post-hurricane evaluations by policy-makers

Post-hurricane evaluations precede the prevention policy-making literature for three decades, a trend signaling the reactive origins of disaster management. The oldest available post-hurricane evaluations by policy-makers or people influential to policy-making date from the late 19th century and can be characterized as descriptions, mostly enquiries without a professional methodology. The divergent interpretations on what caused the disaster include the forces of nature, the wrath of God, the sins of Puerto Ricans, weak construction techniques and ignorance (Abbad y Lasierra, 1866; Córdova, 1831a, 1831b; Fontán y Mera, 1868); usually with little reflexivity on governmental responsibilities or social inequality. Yet, an outstanding evaluation of the 1867 crisis by an appointed royal commission criticized lack of governmental investment

⁵³ An extremely relevant contribution used in my work, although it is outside the temporal frame set for this literature review is the book “Sea of Storms: A History of Hurricanes in the Greater Caribbean from Columbus to Katrina” (Schwartz, 2015)

for causing the crisis and suggested public works to gain the good will of Puerto Ricans and maintain control over the colony (Schwartz, 1992).

After San Ciriaco, descriptions and evaluations were written by Spanish or Creole men in positions of power, such as the Spanish Dean of the San Juan Dioceses (Perpiñá y Pibernat, 1899), a Spanish ex-military official (Aráez y Ferrando, 1905) and a wealthy Creole pro-independence (Coll y Toste, 1976). The parallel report by U.S. Governor General Davis (Davis, 1902) marks an official transition towards secular scientific assessments and policies by Americans. Those works share an upper class perspective, whilst the absent voices of socially disadvantaged groups reveal their marginalization from telling and memorializing their experiences, and influencing public decisions.

In the following decades, three post-disaster assessment and intervention documents indicate the preeminence of non-government organizations, short-lived or permanent, including the Puerto Rican Central Committee of Support for the 1902 Mont Pelée eruption in Martinique (Comité Central de Socorros a Martinica, 1903); the Red Cross which delivered short-term San Felipe relief in Puerto Rico, the Virgin Islands and Florida (American Red Cross, 1929); and the Redemptorists under the Southern Cross group, which described Catholic losses also caused by San Felipe in Puerto Rico, St. Thomas, St. Croix; and their short-lived relief interventions (Redemptorists under the Southern Cross, 1928). I did not find a specific institution addressing disasters during the New Deal, although many tackled projects reducing disasters. Moreover, only minor weather-related events happened, and they were included in larger policy-making reports (Information Research Section PRRA, 1938). During the early Commonwealth years, the

Office of Civil Defense addressed several devastating events, such as Santa Clara (1956) and Donna (1960). Yet, for Santa Clara, I found one document making evaluations, the Governor's yearly report to Congress (Luis Muñoz Marín, 1957), which underplayed the crisis. Thus, critical documents inconvenient to circulate may be unclassified, lost or destroyed.

Around the 1980s, post-hurricane evaluations increased in quantity, frequency and diversity. The Isabel storm floods and landslides of 1985 prompted federal agencies to make a comprehensive evaluation (Federal Interagency flood hazard mitigation team response report for Puerto Rico, 1985). Following Hugo, multi-factorial assessments included impacts on historic resources (Bierce, 1989); a National Disaster Survey Report (US. Dept. of Commerce, 1990); comparison of intergovernmental disasters performances for Hugo in the Caribbean, South and North Carolina, and the Loma Prieta earthquake in San Francisco (Schneider, 1990); evaluation of its effects on water supplies in the U.S. Virgin Islands and Puerto Rico (Morris & Krishna, 1991); difficulties in technological transfers of U.S. disaster mitigation programs, comparing the successful Weather Service Forecasting Office and the computer model used to evacuate and shelter populations (SLOSH), the contentious coastal management program, and the problems experienced with sheltering, long-term emergency housing, and lifeline protection (Aguirre & Bush, 1992), and a relatively comprehensive evaluation concerning North Carolina and Puerto Rico, which included meteorology, hydrology, emergency planning and response, surface winds and property losses, lifelines, coastal processes, conclusions and recommendations (Commission on Engineering and Technical Systems, 1994).

Following Georges in 1998, evaluations included a report on how public agencies and a composting company processing woody debris overcame challenges such as contamination and equipment wear (Myers, 1998), and the administrative report by the Red Cross (Cruz Roja Americana Puerto Rico, 1999).

In sum, since the 1990s, comparative evaluations have increased, still focused at the island level. Technocratic and top-down approaches prevail, with little reflexivity of their validity. Another constant issue is the lack of coordination in terms of institutions, territories, disciplines and even approaches within disciplines. Although much can be learned from such diversity; it is difficult to advance longitudinal assessments. This literature needs in-depth critical analysis. Also, the immediate relief stage has received less attention than the preceding and subsequent stages.

III.3.j) Prevention policy-making

This literature has followed particularly destructive storms to shape long-term processes. As mentioned, New Deal institutions implemented disaster related projects; however, I could not find a specific entity in charge, which could be a reason for the lack of documents explicitly studying or preparing for disasters. During the early Commonwealth years, fastly produced documents highlight detailed island-wide planning of roles and procedures to follow, with growing leadership of the Commonwealth government. Several documents refer to the Cold War logic and express fears of nuclear destruction on the island⁵⁴. For example, a Vigilante's Manual outlines the organization of the Civil Defense volunteer base, regional coverage, hypothetical chains of command, detailed tasks to undertake and equipment to be used in case of hurricanes,

⁵⁴ Preparations in case of nuclear, radiological, biological and chemical attacks are a lasting concern on the island. For example, a private university just published related guidelines in its comprehensive security manual for the Metropolitan Campus. (Universidad Interamericana de Puerto Rico Recinto Metropolitano, 2012)

floods, storm surges, fire and radioactive bombs (Oficina de la Defensa Civil, 1954). The Commonwealth and Civil Defense created an Operational Survival Plan mapping evacuation scenarios throughout the island in case of nuclear fallouts, calculating population to be displaced from the main cities, specifying travel times and roads to the main shelters (Commonwealth of Puerto Rico & Civil Defense, 1958). Around the same time, the Civil Defense Office prepared a basic citizens manual of guidelines to implement in case of hurricanes, floods and storm surges (Oficina de la Defensa Civil, 19?). After Santa Clara (1956), prevention guidelines targeted massive audiences through a series of educational materials, including a booklet, bulletin, documentary and posters to reach even illiterate citizens (DIVEDCO, 1965; Doniger, 1958). Those documents emphasize “self-help” and the landfall phase. After Donna (1960), there was a written clarification of the roles to be undertaken by the Office of Civil Defense and the American Red Cross in disaster operations (Oficina de la Defensa Civil, 1960).

Concomitant literature concerning anthropocentric climate control policies to modulate storms through military bombing is unavailable. At the UPR libraries, a few 1960s black and white photographs of the ‘Stormfury Project’, show air force squadrons getting ready for their missions. Also unavailable are subsequent reflections about costs, achievements and failures of this approach, why Puerto Ricans could not engage the decision-making whilst they were actively working on local interventions, and the implications of diverting finite resources away from building and implementing knowledge about the social construction of disasters.

Few proactive prevention documents were published between 1960s-1980s, as there were few hurricanes, and they had a planning emphasis, including an island search and rescue plan

(Agencia Estatal de Defensa Civil, 1977), a document on coastal flood hazards and responses (Puerto Rico Dept. of Natural Resources, 1980), and an M.Sc. planning thesis concerning a plan to coordinate natural disaster mitigation (Cortés Burgos, 1987).

Post-Hugo prevention publications turned to multi-scalar decentralization, stakeholders acted without coordination yet incorporated new concepts such as strategic planning and vulnerability. For instance, the San Juan Metropolitan Area Hurricane Evacuation Study carried out by U.S. FEMA includes vulnerability analyses in the coastal municipalities of Loíza, Carolina, San Juan, Cataño, Toa Baja, and Dorado; but also inland, such as Guaynabo (FEMA, 1990). A mitigation plan for Natural Risks was done by the Puerto Rican Commonwealth and the Department of Natural Resources (Estado Libre Asociado de Puerto Rico & Departamento de Recursos Naturales, 1991). The former institution also published an executive order to establish the coordination of executive functions for emergency and disasters (Estado Libre Asociado de Puerto Rico, 1993). However, none of those documents is available online, thus I cannot comment their content.

Another hurricane evacuation study is focused on the southern coast of the island, indicating the higher vulnerability to inland storm tide penetration along the southeast and south coasts for Category 3- 5 storms (Departamento de Recursos Naturales, Agencia Estatal de Defensa Civil, & Servicio Nacional de Meteorología, 1993). An ambitious organizational analysis of disaster preparation and mitigation for the city of Mayagüez was proposed using surveys, quantitative data and network analysis to evaluate institutions involved locally (Rodríguez Rivera, Cólón Rivera, Gutiérrez Sánchez, & Rodríguez Rivera, 1993). A year later, the project yielded initial

results (H. Rodríguez & Troche, 1994). Seemingly around that time, the Planning Board sponsored an undergraduate study about floodplain population estimates and population density GIS maps for Bayamón, Cataño, and Guaynabo. It aimed to extrapolate population estimates for the rest of the island and improve efficiency in the allocation of resources for flood prevention and mitigation (Heckley, Mues, Reis, & Taylor, n.a).

Before Georges (1998), the Puerto Rican counterpart of FEMA had circulated succinct guidelines, focused on family self-preparedness addressing food, water, documents, tools, first aid kit, clothes, hygiene and personal care items; planning a division of tasks -including evacuating children and people with special needs- and proper return to households (Agencia Estatal para el Manejo de Emergencias y Administración de Desastres, n.d. already in use in 1998). Following Georges, a Presidential long-term recovery action plan for the island was prepared (Federal Emergency Management Agency, 1999) and although is unavailable online or printed, the index points to a physicalist yet ample vision of changes. For instance, the plan lists mitigation through building codes, planning and coordination, and floodplain management; private and public housing repairs, shelter needs, technical training and assistance; agriculture interventions -including financial assistance, insurance expansion and anti-erosion and flooding measures-; non-agricultural community development planning interventions -new investment and small business encouragement, bolstering flood insurance, fiscal and unemployment assistance-; transportation interventions -including roads, bridges and harbor repairs-, and power for the urban train; and works in the energy sector that comprise reparation of generators, transmission and distribution lines, and a prospective vision for the electrical system. A year

later, the U.S. Coast Guard prepared a plan to protect its units and port stakeholders from heavy weather in Puerto Rico and respond to damages (U. S. Coast Guard Marine Safety Office, 2000).

Next works include a strategic plan for hurricane vulnerability reduction in the island of Vieques, written as an UPR planning M.Sc. thesis (Echevarría Rosas, 2006); the identification of population vulnerable to hydrological hazards in San Juan (Azar & Rain, 2007); and an island-wide plan of emergency operations (Agencia Estatal de Manejo de Emergencias y Administración de Desastres, 2008). The latter is a long and unevenly finished document with official support, indicating institutional responsibilities for emergencies. Framed by the U.S. National Incident Management System, municipal, regional, island and federal institutions are listed for preparation, response and recuperation; along with procedures, tasks, and federal disaster aid programs.

Finally, two radically different papers address flood risks at local scales. The first assesses flood risks in the metropolitan coastal municipalities of Carolina and Loíza to provide information to Civil Protection institutions (Seguinot Barbosa, Batista, & Sánchez Celada, 2008). After a spatial-temporal evaluation of hazards, vulnerability and floods risks in both municipalities based on cartographic analysis, researchers identify priority areas of special attention and investment before and after a major disaster. However, they warn that those areas may not coincide with real areas of high risk based on socio-economic factors. Such approach exemplifies mainstream research projects operating on technical assumptions without reaching out for people involved, which undermines the research. The second paper advances a grassroots approach for two flood-prone communities in the east (López-Marrero & Tschakert, 2011). Community members and

emergency managers were guided to use participatory methods and techniques –including conceptual mapping, participatory mapping, and listing and ranking- to identify vulnerabilities in their respective areas, Maternillo and Mansión del Sapo. They concluded that enhancing resilience in those communities demands support for social learning developing upon existing knowledge, using a varied set of flood management options, and supporting collaborations and linkages between emergency managers and community members to motivate collective flood management, overcoming obstacles such as distrust.

In sum, this literature shares commonalities with the post-hurricane evaluation writings, such as not being subject to in-depth critical analysis. Mostly technocratic and top-down approaches have been implemented, lacking reflexivity. Lack of coordination provided valuable diverse contributions yet blocks longitudinal and integrated policy assessments.

III.3.k) Insurance

The first insurance document set minimum insurance rates applicable to Puerto Rico for fire, hurricane, riot and civil commotion (Puerto Rico Board of Fire Underwriters, 1937). During a vast turmoil on the island following San Felipe (1928) and San Ciprián (1932), the Great Depression and the sugar economy collapse; this document exposes the early role private insurance companies had on the island to influence public policies concerning disaster prevention; particularly zoning, building codes and technology. Two research pieces cover Georges losses, one briefly (Lohse, 1998), the other one in-depth by comparing in five jurisdictions -Puerto Rico, California, Florida, North Carolina, and the U.S. Virgin Islands- cost and availability of home insurance, hazard mitigation efforts, regulatory actions, and state

government insurance mechanisms; and evaluating policies to improve insurance supply and risk management (M. F. Grace & Klein, 2002).

In sum, the few insurance documents found are too limited to be considered the only existing literature; although I conducted iterative searches to provide a broader and better sample. Such difficulties point to a potential problem to be experienced by other scholars and policy-makers. Many questions should be addressed to improve hurricane management. For instance, insurance can be afforded usually by a limited population segment in developing economies. "The vast majority of the exposed risk from earthquakes is presently uninsured, even in those countries where government-supported schemes have been introduced. Most policies are on commercial and industrial property rather than residential property" (K. Smith, 1992) p.117. Besides, in the light of increasingly frequent and more destructive events, instability in the insurance sector may include inability to resource payouts, withdraw from highly urbanized areas at risk or increase premiums dramatically. What could be the options on the island? Could hurricane insurance target beyond conventional improvements in building design and construction – so-called “building back better”, to encompass a wider range of individual and collective disaster management actions? In other countries, insurance has led to disincentives for governments to fully enforce preventive policies, and it has caused lack of preparedness and complacency among residents at risk (Lamond et al. 2009 in (Abhas K, Bloch, & Lamond, 2012)). If there are similar dynamics on the island, what interventions could take place? Usually, lower income groups lack insurance, resulting in great difficulties during disasters and recovery. Which are the specific trends in different parts of Puerto Rico? Could micro-insurance schemes be implemented, with government intervention or collective pooling, to provide financial resources at critical times?

III.3.1) Housing

Available housing and hurricanes literature is very feeble. Governmental and private investment on social housing in the 1950s and 1960s remarkably reduced extreme vulnerability, but remains contentious among scholars. Yet, I could not find contemporary documents addressing housing and hurricanes, possibly due to classification or misplacement errors, or reflecting the epistemological separation of housing and disaster management. Post-Hugo, federal prevention documents targeted hurricane-resistant building guidelines (FEMA, 1989), an academic paper reviewed the performance of structures (Marshall, 1990), whilst another examined the wind uplift capacity of steel corrugated roof deck systems (Figuroa Diaz, 1996). Post-Georges, federal construction guidelines addressed one and two family dwellings in hurricane and seismic zones, according to Puerto Rican planning regulations and building codes (FEMA, 1999); and a UPR workshop designed permanent housing for homeless evacuees (E. Quiles Rodríguez, 1998). Next, UPR-Mayagüez researchers associated with counterparts in the U.S. or abroad examined the performance of typical roof structures usually vulnerable to wind, and other building parts. The results provide an engineering basis for establishing minimum construction standards mainly concerning residential roof structures in the CARICOM islands, and to a lesser extent, industrial roofs. Some examples include a methodology to analyze structural vulnerability to hurricane winds (Hurtado Astaiza, 1992), estimation of windstorm vulnerability of individual building types of Puerto Rico, hurricane hazards and consequent property losses in the region through mathematical modeling (Khanduri & Morrow, 2003), performance of wood-zinc roof systems (Avilés, 2006), development of hurricane based fragility curves for wood-zinc houses (R. G. González, 2007), fatigue strength of wood-zinc roof systems under hurricanes winds (Aviles,

Saffar, Ramos, & Garcia-Herrera, 2007), fragility wind curves for industrial metallic buildings (García-Palencia, Saffar, & Godoy, 2008).

My findings are limited, possibly because when it comes to disasters housing remains seen as a technical problem, concerning construction materials and techniques. Such approach is limited, particularly if narrowed to research and education carried out at higher education levels - excluding ample sectors of the population- and disregarding vernacular knowledge. Also, it prompts questions about the application of constructive knowledge, diffusion for different audiences, and enforcing mechanisms to promote updating and avoid manipulation or corruption. Ultimately, it blurs an understanding of housing as a social habitat that -in addition to physical hazards- must confront larger issues of affordability, location, tenure, and stigmatization to reduce vulnerability.

III.3.m) Literary writings

Since the 19th century, writers have reflected on hurricanes with poignancy and depth. The oldest work preserved is the novel 'Huracán. Leyenda Puertorriqueña' (Hurricane. Puerto Rican Legend) based on the folktale of Roberto Cofresí (del Toro Soler, 1897). The latter was a southern pirate active during the turn of the 18th century, who defied Spanish vigilance and storms to become a beloved emancipatory figure, a hurricane himself. In 1896, this novel received a literary award from the Ponce Press, which represented pro-independence intellectuals backing narratives of success against the two most feared blockages for the independence Puerto Rico, Spain and 'the forces of nature'. Writings by Cayetano Coll y Toste, a wealthy pro-independence Creole and influential intellectual of Ponce during the late 19th century, exemplify

contemporary ideas. He wrote two short stories concerning hurricanes, ‘The legend of the Virgin of Guadalupe’ (DIVEDCO, 1965) and ‘The San Ciriaco Hurricane’ (Coll y Toste, 1976). In the former, only divine intervention framed by Catholic beliefs helped the protagonists overcome a hurricane, which allegedly took place in 1568, when destructive hurricanes discouraged the early Spanish settlers. The story circulated widely in a book about Puerto Rican legends and, during the mid-1950s, the Commonwealth incorporated it into massive disaster prevention education materials. The latter piece described the vast post-San Ciriaco destruction in Ponce. Another short piece with a testimonial quality evaluating San Ciriaco’s devastation was written by Ramón Aráez y Ferrando, a former Spanish military official (Aráez y Ferrando, 1905), and it was incorporated in the Commonwealth materials (DIVEDCO, 1965). Post-San Ciriaco, male writers from an upper and middle class background captured in novels the profound ongoing societal changes, according to the article ‘Traces of San Ciriaco in early 20th Century Literature’ (Centeno Añeses, 2000). Centeno summarizes that José Elias Levy addressed loss of rural livelihoods, increased urban unemployment, precarious housing, child mortality, bankruptcy, suicide and the first large migration wave towards Hawaii in his novels ‘Estercolero’ (1901) and ‘Mancha de Lodo’ (1903), which respectively mean Dunghill and Stain of Mud. Matías López García published in 1905 the novel ‘Gestación’ (Gestation) depicting unemployment, loss of rural assets, starvation and social polarization to understand the gestation of a new order benefiting Americans. In the 1909 novel ‘El hijo de Carmen o Aventuras de un Obrero’ (Carmen’s son or Adventures of a worker), Eladio Ayala Moura described the hurricane landfall in Ponce and ensuing rough life. Ramón Julia Marín captured the desolation of inland tobacco workers in his 1911 novel, ‘Tierra Adentro’ (Inner Land). A year later, his novel ‘La Gleba’ (The Glebe) described the return to semi feudal conditions of servitude experienced by broke small

coffee farmers vis-à-vis the expansion of American political power, land ownership and sugar cane. Remarkably, Centeno's paper is the only literary overview of hurricanes and, although it lacks in-depth analysis, it presents key themes and how they intertwined with history.

For San Felipe, contemporary writings were unavailable; yet, it remained central to musical, pictorial and literary works decades later. The novel 'La Víspera del Hombre' (The Eve of Man) by René Márques won the first prize in a contest organized by the Ateneo Puertorriqueño, in 1958. It initially unfolds in the highlands months before San Felipe, and it uses the subsequent crisis as a background to present a love and humanitarian tragedy affecting Puerto Rico (Márques, 1959). This piece received extensive positive reviews by the jury, and became standard text for secondary and high-school students. Santa Clara landfall in southwest Puerto Rico was narrated as the short testimony of a middle-low class teenager, who self-published it almost 50 years later, having lived abroad (Fernández Gordián, 2003). Unlike writings of the day, Fernández provided a vivid grass-root account that reflected structural changes such as urbanization, migration, political leadership, technological changes, popular beliefs, social hierarchies and institutional vacuums. 'Después del Huracán' (After the Hurricane), was a story by Edgardo Sanabria Santaliz combining realistic experiences and imaginary situations, marking for the first time the use of a hurricane to frame in Puerto Rico what is known as 'Real Maravilloso' (or Magical realism). It was published in Spanish with nine Puerto Rican authors (Edgardo Sanabria Santaliz, 1983), then in English as a journal article and as part of a collection of short stories by Hispanic Caribbean authors (Edgardo Sanabria Santaliz, 1995). In the 90s, following Hugo, books for children and youngsters addressing hurricanes entered mainstream publications. 'Sueño en El Yunque' (Dream in El Yunque Forest) was a short illustrated children

book that addressed Hugo's impact in the northeast of Puerto Rico (Rodriguez Martínó, Hernández, & Lugo, 1993). It incorporated scientific advice about the Luquillo Experimental Forest, heavily damaged. Yet, the story also used magical elements, including the myth of Yuquiyú, the Taíno indigenous mountain spirit residing in El Yunque, able to save the island from storms. The short fictional story 'Noche de Paz' (Night of Peace) for youngsters, first published in the April 1995 edition of Cricket Magazine, used a young boy's view of a family experiencing their home destruction by a hurricane (London, 1998). This account written was by a foreigner and the hurricane is not specified. In the children book 'El último Coquí' (The last Coquí), the main character Coquiki hears he is the only surviving Coquí –endemic frog emblematic for the island- after a devastating hurricane, and he searches the island for his peers (N. A. Pérez, 2002).

In 2007, the Texan-based Puerto Rican dance company Angelito Borincano launched the musical 'Sembrando Herencia' (Planting Inheritance), in which hurricanes San Ciriaco and Santa Clara have key historical roles. The former is deemed important because of the coffee industry crisis explicitly, and because of the political changes implicitly. The latter is deemed relevant because of its relationship with the 1950s Great Migration of islanders to the US. Light-skinned highlanders, Jíbaros, are given a Boricua angel after San Ciriaco (Angelito Borincano, 2007). The angel witnesses rough living conditions on the highlands, travels with humans to New York City during the mid 20th century exodus -and back- searching for a heroic act that will earn him deluxe wings. According to the official website, the troupe aimed to bring awareness of often-forgotten elements from Puerto Rico's rich heritage among diasporic Puerto Ricans and other Latinos; the success of the bilingual musical turned into a yearly show traveling mostly in the

US. Finally, a musical recording classified as testimonial, singing and guitar playing, and called ‘The identity of words, an approach to testimonial literature’ mentions hurricanes as a source of deep local sorrow and display of courage and strength (Ralph Rivera & Rodríguez, n.a.).

To conclude, more work is needed to learn from literature writings that record experiential knowledge, societal dramas, environmental and spatial transformation, economic processes, religious beliefs, superstitions, and potential areas of intervention. The cited writings may be a limited sample, they are understudied sources often closer to the everyday life than technical writings. Little is known of how storm narratives entered popular consciousness and how they could strengthen disaster management.

III.4. Answers and Recommendations

1) Is there a robust production of literature and policy-documents for Puerto Rican hurricanes?

Yes, the field expanded in the last decades exponentially in quantity, complexity and diversity, yet, its dispersion remains a fundamental problem. I could not find websites or archives systematically storing multidisciplinary documents for public consultation. Thus, a recommendation is to start a shared collection available for review in physical and online forms. UPR would be the ideal institution to undertake the task, with cooperation from FEMA, Civil Defense, Weather Service, and other entities.

2) *Which have been the main catalyst for advancing hurricane knowledge and policy production?*

Devastating hurricanes have been the top catalysts for advancing knowledge and policy production. Thus, research and policy decisions are usually based on the most extreme and isolated cases. Minor events such as mild storms and floods, and even daily practices are not examined. Such absence blurs how those circumstances enhance or diminish large-scale disasters, and it also blurs the understanding of disasters as long-term, interconnected processes. Thus, multi-storm studies, minor incident studies, and studies of the everyday life vis-à-vis disasters would be relevant areas of research and analysis. Potentially concurrent although less frequent events have not been catalysts for integrated multi-risk knowledge and policy production. For instance, earthquakes and tsunamis have a lower return period compared to yearly hurricane seasons. Disasters have been studied separately, in disciplinary terms; they are not systematically studied in confluence, though Puerto Rico has experienced concurrent disasters with crushing consequences. Moreover, new complex emergencies could derive from multi-risk circumstances, such as extreme weather events affecting brown fields, pharmaceutical industries, or Navy bombing sites in Vieques -where active mines remain underground-. Thus, multi-risk analysis and policy-making need further development. Another catalyst has been the martial use of meteorology in Puerto Rico; it began as a tactical endeavor before the island became U.S. territory, and it has kept transforming. This martial emphasis, its benefits and drawbacks need to be discussed, including its environmental impacts, financial costs, why Puerto Ricans were separate from decision-making, implications of diverting finite resources away from addressing the social construction of disasters, and what permeated into current disaster management that reduces effectiveness and fairness.

3) *Which are the most and least developed disciplines?*

Physicalist, materially oriented sciences and technocratic approaches prevail, humanities and social sciences are weak; which points to a prevailing understanding of hurricanes as problems solvable through scientific, technical interventions in the physical environment, in opposition to an understanding of disasters as socially and culturally constructed processes that have material basis. For example, meteorological studies consolidated almost a century before social sciences studies; there are extensive contributions from biology and geology, some from epidemiology, and few from law and economics; whilst I did not find studies from anthropology, ethnography, archaeology and political science studies. For more than a century, understudied literary writings have captured significant processes; yet, they remain under examined. In contrast, technocratic studies and policies for hydrological modifications have received funding since the 1930s. In sum, without implying abandonment of traditional studies, the recommendation is to have multidisciplinary discussions on the need to set strategic priorities for disciplines and approaches that help to construct a more holistic, balanced understanding of disasters.

4) *Are there common threads for all the disciplines?*

Generally, there is no self-reflective criticism of the political, social and cultural foundations of science and the manipulations of scientific knowledge and policy-making. Other absent debates are the state of each discipline at the island and local levels, disciplinary impacts of local research into mainstream production of documents and policies, historical effects of technology, present and future priorities. It is hard to build inter-disciplinary connections, which hurricanes need. Even within the same discipline, methodologies, focuses and units of analysis vary, which is both an epistemological strength and a weakness. Such diversity is enriching but also hinders

longitudinal, retrospective and comparative studies; which if focused on the economic, socio-cultural and spatial similarities and differences when facing the same peril help to denaturalize so-called ‘natural disasters’ and improve development policy-making. Even recently, most disciplines show top-down productions of knowledge and policies by experts, based on their technical expertise. Grass-roots perspectives are rarely captured, missing lived expertise of disasters. Also, the unquestioned figure of the expert leads to limited critical evaluations of which are the repercussions of knowledge and policy-making when disasters strike, what worked or not on the ground, and how unresolved tensions between experts vis-à-vis general public have undermined disaster management.

5) *Which are the main units of analysis?*

The most recurring unit of analysis is the island level, equivalent to the nation state. During the recent decades, several local scales are studied, even micro-territories; this move is part of a rescaling process taking place in multiple disciplines, which has brought relevant contributions for Puerto Rico. Simultaneously, the notion of the Circum-Caribbean as a unit of analysis has not been used, although recent research projects compared U.S. states or neighboring countries. Thus, even if hurricanes are a common link to understand the Circum-Caribbean region, studies reinforce colonial and geographical insularity, instead of searching for commonalities and divergences that would advance knowledge and policy-making. In sum, the choice of unit of analysis is an analytical matter that needs further consideration, having to do with changing emphasis on the local, national and global. Moreover, disasters should become a relevant topic for purposive intellectual crosspollination with countries in the region, in order to generate shared echoes from the substantial hurricane literatures and policies under production.

6) *Who have been the main producers of research and policy documents?*

The first systematic producers of research and policy documents were male U.S. military meteorologists during the turn of the 20th century, then civilian male U.S. meteorologist. Such tendency is a consequence of the U.S. dependent political status of the island since 1899, which has resulted in direct connections with U.S. institutions –including academia and armed forces-. It also reveals a persistent gender gap. Based on references, a few male Puerto Rican authors joined in the late 1950s and increased later; whilst women joined around the 1990s. There is no data on the authors' ethnicity and class, but affirmative action for educating and hiring experts is a recent requirement to offset entrenched exclusionary biases, which could have shaped the researchers and policy makers' epistemological and ontological frameworks. In fact, a substantial amount of policy documents share an upper class perspective, whilst the absent voices of socially disadvantaged groups reveal their long-term marginalization from memorializing their experiences and knowledge, and shaping public decisions. Researchers and policy-makers must recognize implicit biases in the co-production of knowledge and integrate the knowledge from affected but usually disenfranchised groups. Since the 1980s, masters and Ph.D. students, and academics of the University of Puerto Rico have built multidisciplinary in-depth work about hurricanes; more than members of other local universities. Yet, when checking on the references of American documents, particularly policy-documents, they seem to be disengaged with the locally produced knowledge. It would be fruitful to explore how this issue can be addressed, including more availability of locally produced works, in Spanish and English. Another issue is the potential tensions between U.S. and Puerto Rican institutions and experts, which could undermine disaster management. At one level, tensions may reside in the different cultural and institutional backgrounds and even language barriers, which should be openly

discussed when establishing projects. At a more fundamental level, there seem to be disciplinary and funding biases that shape priorities above the local scale, with contentious consequences. For instance, the NSF launched an extensive biology research project in the late 1980s, incorporating local scientists. It has yielded relevant findings about the protected tropical rainforest of Luquillo, the only one of its kind in U.S. territory. This seems to be a case of scientifically-driven research that values environmental vulnerability and degradation per se, aside from their anthropocentric value, although it is unclear whether the underpinning assumption is based on intra-species justice arguments (Birkmann, 2006) or an ecocentric view that puts the earth first (Parton, 1993). Although relevant, it does not contemplate an understanding of how the ecosystem vulnerability (Turner et al., 2003) relates to human vulnerability. From the project description and main findings, it is hard to advance ecosystemic views and make policy recommendations. Moreover, this ecosystem is not representative of the island, where interactions between humans and environments have created a multiplicity of ecosystems understudied from the biological viewpoint. In other words, it is focused on ‘pristine’ nature, an extremely rare case in contrast to ‘second’ nature or areas with extensive anthropogenic transformations, where most population and investments are at risk, and which is essentially disregarded by biologists. Thus, it is valid to discuss the priority such kind of research, the possibilities to complement it with policy-driven results, and with transformed ecosystems that show other forms of fragility.

To conclude, those knowledge vacuums are significant obstacles to gather and interpret data consistently, understand causal relationships, infer and compare spatial dynamics, build solid assumptions useful to improvise during emergencies and plan long-term disaster management,

and build consensus so that policies become enacted. Therefore, those vacuums in knowledge reveal a danger for the future of the island, and my research is an opportunity to design and build useful complementary knowledge.

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Chapter N.IV. Research Design

IV.1. Research definition, strategy and methodology

My research defines disasters as socially and culturally constructed processes that have physical basis. I aim to denaturalize so-called ‘natural disasters’ using a political economy lens to expose the political nature of public decision-making related to disasters and grasp how politics impacted Puerto Rican society. In other words, the political economy lens unveils the muddled process of implicit or explicit struggles to gain or maintain power and authority (Lindblom, 1977) and shape particular outcomes, in a societal setting with conflicting interests, extreme pressures, reduced resources and time. The societal setting may be understood as a country or other form of territorial jurisdiction, social groups, firms, or other organizations (Hanappi, n.a.).

As research strategy, I implemented a modified Grounded Theory Approach (Glaser & Strauss, 1967), using both deductive and inductive thinking. In other words, my approach did not depart from a hypothesis or a fixed theoretical framework to apply to the phenomenon under observation. Instead, I started with preliminary guiding research questions, themes, methodological approaches, tentative cases and literature review; which were adjusted throughout data collection and interpretation phases. I examined iteratively the phenomenon of study through a flexible methodology, collected diverse empirical data, identified core questions, redeveloped tentative linkages between questions and data, summarized and substantiated findings in order to understand processes instead of verifying or invalidating preconceived

‘truths’. Also, as a study of a qualitative nature, my research extracted some of the basic qualities of an intricate social phenomenon by asking “how” and “why”. Hurricanes involve complex webs of causes, effects, and dynamics. Qualitative research captures the essential characteristics of complex webs to explain what a phenomenon is like in practice, how it works, and how it is affected by other patterns or phenomena (Dougherty, 2005). Another epistemological assumption of this dissertation is that the phenomenon under study required a contextual immersion; living on the island would not only be useful for local archival research but it would help to acquaint myself with Puerto Rican culture; which, in turn, could inform the historical background of the research. In parallel, the research design had a phenomenological standpoint, also called interpretivist approach (Yanow, 2014), valuing people's experiences and interpretations of the world regardless of their position as experts or non-experts. People transform the meaning of the phenomenon under study through mutual interactions, which involves taken-for-granted understandings and practices (Dougherty, 2005) not explicitly captured by technical knowledge. Accordingly, I juxtaposed technical and non-technical works. Since this research is structured in distinctive historical periods, sources and data changed and required triangulation of methods to achieve validity. Thus, I combined in situ and online archival research, visual sociology and case study analysis.

IV.1.1 Archival research

Archival research suited my purposes as it comprises diverse activities to study mostly textual materials produced by and about organizations, and complements other research methods. Conventionally, archival research implies reviewing documents of a historical nature, allowing access to information that may not be available in other ways, as in the case of my selected

hurricanes. Yet, archival research can be used in non-historical studies of contemporary, non-textual and even digital materials, such as musical scores and recordings, videos, web pages, electronic databases, emails and tweets (Ventresca & Mohr, 2005), part of which I also conducted. My archival research online and in-situ took place in U.S.⁵⁵ and Puerto Rican libraries⁵⁶ during four years. I contrasted technical and non-technical works to juxtapose diverse information sources, modes of data and viewpoints. The technical works include scholarly publications, medical records, policy documents, thesis, websites, exceptionally relevant unpublished materials (i.e. research papers, PowerPoint presentations, annual reports, notes, and manuscripts), graphic and audiovisual materials. The non-technical works include piecemeal available sources closer to the everyday life sphere such as literary works, songs, newspapers, cartoons, and graphic and audiovisual materials.

IV.1.2. Visual sociology

Visual sociology is a recent and miscellaneous field that unfolds around studies of the visual and visual studies (International Sociological Association Visual Sociology Thematic Group TG05, 2012). I examined visual data produced as part of a culture, in order to analyze evidence and processes or present results (Becker, 1986; Suchar, 1997). My aim was to develop a dual interactive process. One process was between images and text, in which images could answer questions (Suchar, 1997) or provide nuanced layers of knowledge that no written answer can

⁵⁵ Columbia University Libraries consulted: Avery, Butler and Lehman.

⁵⁶ Universidad de Puerto Rico (UPR) libraries consulted: the School of Architecture, Graduate School of Planning, Lázaro Collection, Puerto Rican Collection, Audiovisuals Collection, and Public Administration. The archives of Fundación Luis Muñoz Marín, Puerto Rico's Public Broadcasting Station (WIPR-TV), Archivo General de Puerto Rico, the Puerto Rican Planning Board and the Instituto de Cultura Puertorriqueña (ICP) were also consulted for this research, in lesser degree than UPR.

offer. The other process was between the finished research and readers, who could find new meanings, questions or answers pertaining the images. My sampling had to be vast, multi-sourced, and revealing of sufficient aspects of an extended story, in order to support a connected, convincing and coherent argument (Becker, 2002). I selected photographs mostly concerning persons, places or objects; with limited use of conceptual creations or abstract entities –in this case artistic works and caricatures-. My objective was to provide what is called an “existence proof”, not a “compelling proof”, meaning that the topic under discussion is possible (Becker, 2002, p.5). I examined technical and non-technical visual works, such as documentaries, photographs, websites, maps, graphs, tables, cartoons, postcards, posters, paintings, sketches and engravings. The only modification I did was cropping images.

IV.1.3. Case Study

I used the case study approach because it is advantageous for detailed and contextual research. When exploring “why” or “how” questions, I found a case study approach to be useful because it allowed me to emphasize profundity and background; it is suited to explore root causes, histories and open-ended processes (Yin, 1984), and to produce generalizations beyond the case(s) studied (Flyvbjerg, 2006). I also found it valuable as an empirical inquiry to investigate a phenomenon within its real-life context (Lofland, 1971), when context and phenomenon have unclear limits, when multi-sourced evidence is used (Yin, 2003), and when diverse data collection methods are implemented to help validate findings (Eisenhardt, 1989; Miles & Huberman, 1984). I produced descriptive case studies (Thomas, 2011), in order to integrate a myriad of stakeholders, institutions, decisions, policies, projects, events, time periods and other related systems.

IV.2. Case Study Selection and Analysis

The first selection to narrow down the cases was the potential region of study, the Hispanic Caribbean islands, based on the following criteria: geographical similarity and proximity, long-term exposure to the same recurrent type of disaster, cultural resemblance, use of a known language, engagement of organizations and leaders with disaster management, planning, and development policy-making. After preliminary comparative research in Cuba, the Dominican Republic and Puerto Rico; I chose the latter based on the multiplicity of disasters to study, the cooperation of local institutions –particularly the University of Puerto Rico- and the advantages of conducting specialized archival research combined with personal safety.

Among the disasters that affect Puerto Rico, hurricanes were more suitable due to higher recurrence, destructiveness, historical relevance, information availability and lack of previous in-depth comparative studies as the one I proposed. Based on information availability, the island level was the optimal unit of analysis, although Circum-Caribbean and local processes are also summarized. Given the lack of comparative longitudinal hurricane studies, the first half of the 20th century emerged as key to clarify the initial steps taken to create disaster management; and how the main contemporary economic, spatial and societal changes shaped disaster reduction and enhancement. Also, it was more suitable to conduct multiple case studies than a single case. It is valid to conduct research on a single case, particularly when it represents a unique condition. However, multiple cases enable comparisons of commonalities and divergences that shape processes or patterns, which in turn can substantiate conclusions and policy-recommendations. When seen collectively, replications and extensions among individual cases enable context-dependent knowledge (Flyvbjerg, 2006) or grounded-theory to emerge (Eisenhardt, 1989).

Throughout the cases, I identify themes, sub-questions and variables corresponding to processes. Scholars and policy-makers could use and improve both the analytical framework developed for this research, and the findings.

I chose extreme case studies based on information-oriented selection, not random selection. The statistical sampling logic is not applicable to information-oriented selection; there is no formula that defines how many cases must be used. Instead, the researcher's criterion decides how many cases are needed to reach the point of saturation (Yin, 2003) and answer the questions. Extreme, deviant or atypical cases activate more mechanisms and actors than typical ones (Flyvbjerg, 2006), yielding great amount of information relevant for this study. For the selected time-period, San Ciriaco (1899), San Felipe (1928) and Santa Clara (1956) represent extreme hydro-meteorological events due to their physical characteristics, and their enhanced destructiveness by following a similar northwest path. Average cases, which in this situation would be minor events –i.e. mild storms and associated floods- are briefly reviewed in each chapter, along with potentially concurrent although less frequent extreme seismic events –earthquakes and tsunamis-. The aim is to provide a basic counterpoint to the prevailing emphasis to study and address only extreme hydro-meteorological events separately from minor storms and other hazards; regardless of ethical, practical and epistemological considerations. Also, San Ciriaco, San Felipe and Santa Clara correspond respectively to the shift from Spanish to American domination, the preamble to the most violent years in modern times, and the early Commonwealth setup. Their historical contexts were volatile and expose relevant decisions and social dynamics. The cases reveal the process under study, with enough replications and variations to reach saturation.

As advanced in ‘Chapter II. Literature Review: What is a disaster? What caused it? How to tackle it?’, the themes *characterization*, *causation*, and *relief* structure the case studies; divided into six sub-questions, which in turn are unpacked into thirty-eight variables. Following my aim to de-naturalize “natural” disasters, I examined throughout the case studies coincidences and dissimilarities in social dynamics, not just physical and technical processes, to highlight political economy and human agency.

IV.2.1 Theme 1. Characterization

I chose the term *characterization* over definition, description, diagnosis and measuring in order to comprise a broad explanation of how a hurricane was captured in narratives, reports and studies in the immediate aftermath and until 2012, eventually shaping the ‘public transcript’. *Characterization* is divided in two sub-questions concerning immediate hurricane profile and subsequent knowledge production.

Sub-question 1.1 How are hurricanes San Ciriaco, San Felipe and Santa Clara characterized?

For the immediate hurricane profile, I looked for the following variables: *Basic data*; *Context*, *Information producers*; *Excluded information producers*; and *Main biases*. Basic data about disasters means both scientific information and conventionally endorsed parameters of impacts. The former capture the physical magnitude of the hurricane, including the category it reached according scientific convention popularly known as the Saffir-Simpson scale⁵⁷. Estimates of human casualties, injured citizens and economic losses are presented as conventionally endorsed parameters of impacts. Both forms of data are useful to create a shared understanding of

⁵⁷ The term is used in this dissertation interchangeably with the term Saffir-Simpson Hurricane Scale.

hurricanes; yet, as I showed in Chapter II, they have been criticized for valid methodological and ontological reasons; in response I added qualitative data. Next, I summarized the basic context characteristics of each hurricane. Also, I highlighted the producers of information and excluded producers of information concerning hurricane narratives, and summarized the dominant biases in the depictions of each hurricane. I aimed to present an overview of who had power over the initial creation of the ‘public transcript’, which usually influences subsequent plans and decision-making processes.

Sub-question 1.2. What characterizes the production of knowledge around hurricanes San Ciriaco, San Felipe and Santa Clara in multidisciplinary, artistic, regional, local, multi-hazard, and multi-storm terms?

I examined the ways in which hurricanes were treated as a knowledge topic until 2012 in *Multidisciplinary Studies; Arts; Circum-Caribbean studies; Local studies; Multi-hazard studies; Multi-storm studies*; as relevant information concerning the subsequent creation of the ‘public transcript’. I searched for prevailing emphasis in academic disciplines to characterize hurricanes -as meteorological, engineering, political, economic, environmental, cultural or social issues-. I finally compared when these forms of knowledge were produced, by whom, in which language and their circulation. Next, I examined depictions of the hurricanes in literary works, plastic arts, audio, audiovisual, dance and other cultural-related manifestations. I finally compared when and who authored artistic productions, in which language and their circulation; in order to advance how artists contributed to the ‘public transcript’. Although I focused on the island level as the main scale, I summarized which Circum-Caribbean territories experienced each hurricane, and if there were contemporary or subsequent efforts to study similarly affected macro and micro-

territories within the island. Next, I investigated if for each hurricane studied there were preceding or concurrent seismic disasters -earthquakes and tsunamis-; and I addressed if they were used as catalysts for integrated multi-risk knowledge and policy production. Finally, I presented a consolidated summary of storms and hurricanes preceding each case study, and I discussed if they were used as catalysts for integrated multi-storm knowledge and policy production.

IV.2. Theme 2. Causation

I studied the underlying structures and interactions of human life that prefigured vulnerability or resilience to each hurricane. The society and built environment exposed to risks are woven into complex, open-ended, interrelated systems that increase or reduce the impact of a hazard on different social sectors and spatial units. Based on the literature review, I grouped in two the main systems to study from a planning perspective. The first concerns the interplay between economy, urbanization and disasters; the second addresses the interplay between socio-cultural hierarchies, collective memory and knowledge production, and disasters.

Sub-question 2.1. How did economic growth and urbanization cause vulnerability or resilience to San Ciriaco, San Felipe and Santa Clara?

I synthesized the following variables: *Growth engine; Territorial patterns; Planning and investment; Infrastructure; Urbanization of risk-prone areas; Urban growth patterns; Housing and land tenure provision; Architectural, planning and policy records.* In other words, I reviewed first the main drivers for economic growth and who benefited most from access to and control over them. Departing from changing patterns of colonialist exploitation of environmental

resources and people, my examination reaches until the mid 20th century establishment of modern engines of growth. I also examined how the changing structure of economic growth related to multi-scalar patterns of spatial occupation and risk exposure for different stakeholders, translated to policy decisions related to the planning profession. In sum, I studied patterns of territorial occupation, broadly divided between coastal or mountainous zones where hazards differ. I summarized planning policies and large-scale investment priorities concerned with prioritized infrastructure and public works, in terms of location and assumptions behind. I reviewed the process of urbanization of risk-prone areas, with particular emphasis on formal purposive growth processes enabled by technological changes such as transformations of hydro-meteorological systems, coastal and flood-prone urbanization. I examined the patterns of urban growth to unveil how inequitable access to and control over location and technology influenced the spatial distribution of hazardous activities, risks and exposed groups. I discussed the provision of housing and land tenure through policies and projects to assess public interventions to control exclusionary land and housing markets and diminish hazards. Finally, I summarized the types of built environment emphasized in architectural, planning and policy records until now, as part of public narratives that strengthen or weaken fair remembrance of how differently urban life and disasters were experienced.

Sub-question 2.2. How did socio-cultural hierarchies, collective memory and knowledge production cause vulnerability or resilience to San Ciriaco, San Felipe and Santa Clara?

I synthesized the following variables: *Social hierarchy*; *Justification (for hierarchy)*; *Public education and identitarian constructions*; *Beliefs and superstitions*; *Scientific knowledge*. I examined the vectors of social hierarchy and how social hierarchy was used to naturalize unjust

distribution of rights and obligations, both aspects central to the application of political economy to disasters. I undertook a task rarely addressed by planning professionals, I reviewed if and how public education, identitarian constructions, grassroots systems of beliefs and superstitions made sense out of disasters; in tandem with the production of scientific knowledge.

IV.3 Theme 3. Relief

I examined short-term⁵⁸ aftermath responses of the main stakeholders involved⁵⁹. The literature has traditionally placed emphasis on long-term reconstruction dynamics and recently on the preceding processes that turned a hazard into a disaster. The immediate relief stage has received less attention; yet, it is a particular window to improvised and accelerated decision-making, which can crudely expose abrupt actions, persistent underlying assumptions and incipient long-term policies and political life trends. Depending on the crisis and local response capacity, external stakeholders may exert great power without liability for their inappropriate actions. I examined relief in two parts, a preceding influential disaster or process and then the case study under scrutiny.

Sub-question 3.1. How did a previous relief experience or process create influential conditions for the relief stage of San Ciriaco, San Felipe and Santa Clara?

I reviewed a previous and significant disaster relief experience or process as a baseline to compare parties involved in relief provision, underlying assumptions of the roles of governments

⁵⁸ One year after San Ciriaco, when the Foraker Act was passed; four years after San Felipe, when hurricane San Ciprián devastated the island again; two years after Santa Clara, when the Commonwealth finished a set of exceptional cultural productions.

⁵⁹ The U.S. Army for San Ciriaco, the Red Cross for San Felipe, and the Commonwealth for Santa Clara.

and citizens, most relevant biases developed during relief provision, controversies and responses, policy-changes, and political consequences including the use of the disaster as an opportunity or challenge for leaders. The studied variables are: *Disaster; Relief provider; Underlying paradigms; Biases in relief distribution; Controversies; Policy-changes; Political consequences.*

Sub-question 3.2. Which were the defining elements for hurricane relief and incipient policy trends concerning San Ciriaco, San Felipe and Santa Clara?

I similarly studied: *Main challenges; Relief provider; Underlying paradigms; Biases in relief distribution; Controversies; Policy-changes; Political consequences.*

After descriptive case analysis, some of the techniques used to further analyze data are cross-case synthesis, time series analysis, pattern matching, logic models, and explanation building. I chose cross-case synthesis, presenting in tables aggregate data followed by argumentative interpretations, which helps to test internal validity (Yin, 2003). ‘Table N.1. Summary of Case Analysis’ presented below facilitates in the Annex a quick comparison of cases.

Table N. 2. Summary of Case Analysis

Characterization	Hurricane profile	
	Basic data	Casualties, hurricane strength and destruction
	Context	Historical crossroad
	Information producers	Identify according to social vectors of difference
	Excluded information producers	Identify according to social vectors of difference
	Main biases	Dominant views of the event
	Knowledge production	
	Multi-disciplinary	Studies in scientific disciplines
	Arts	Artistic works
	Circum-Caribbean	Studies of regional impacts
	Local	Studies of impacts on different island sites
	Multi-hazard	Studies of seisms, tsunamis
	Multi-storm	Studies of hurricanes and storms
Causation	Economic growth and urbanization vis-à-vis risks	
	Growth engines	Economic base
	Territorial patterns	Coastal versus mountainous urbanization
	Planning and investment	Assessment of priorities and motivations
	Infrastructure	Main projects and motivations
	Urbanization of risk-prone areas	Formal growth through technological changes
	Urban growth patterns	Concentration, polarization, suburbanization
	Housing and land tenure provision	Policies and projects
	Arch., planning and policy records	Type of built environment emphasized
	Socio-cultural hierarchies, memories and knowledge of disasters	
	Social hierarchies	Main groups and vectors of difference
	Justification	Rationales used to establish hierarchies
	Public education, identity construction	Education, culture and hurricane awareness
Beliefs and superstitions	Grass roots explanations	
Scientific knowledge	Technical explanations	
Relief	Previous disaster	
	Disaster	Critical event(s) that influenced the case study
	Relief provider	Institutions and leaders engaged
	Underlying paradigms	Roles of government and citizens
	Biases in relief distribution	Effective discrimination
	Controversies	Leading conflicts and solutions
	Policy-changes	Main transformations for disaster management
	Political consequences	Main implications for political life
	Case study	
	Main challenges	Top political tests
	Relief provider	Institutions and leaders engaged
	Underlying paradigms	Roles of government and citizens
	Biases in relief distribution	Effective discrimination
Controversies	Leading conflicts and solutions	
Policy-changes	Transformations for disaster management	
Political consequences	Political life, development and autonomy	

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Chapter N.V San Ciriaco 1899: colonial underdevelopment and dependency reconfirmed

V.1. A tale of destructive landfall: Characterization of San Ciriaco

“There only remains of this Antillean isle, once so celebrated for its beauty and fecundity, heaps of rubble spread everywhere, which represent a history full of tears, death, and misfortune for its inhabitants” (Partido Conservador, 1899, p. n.a.).

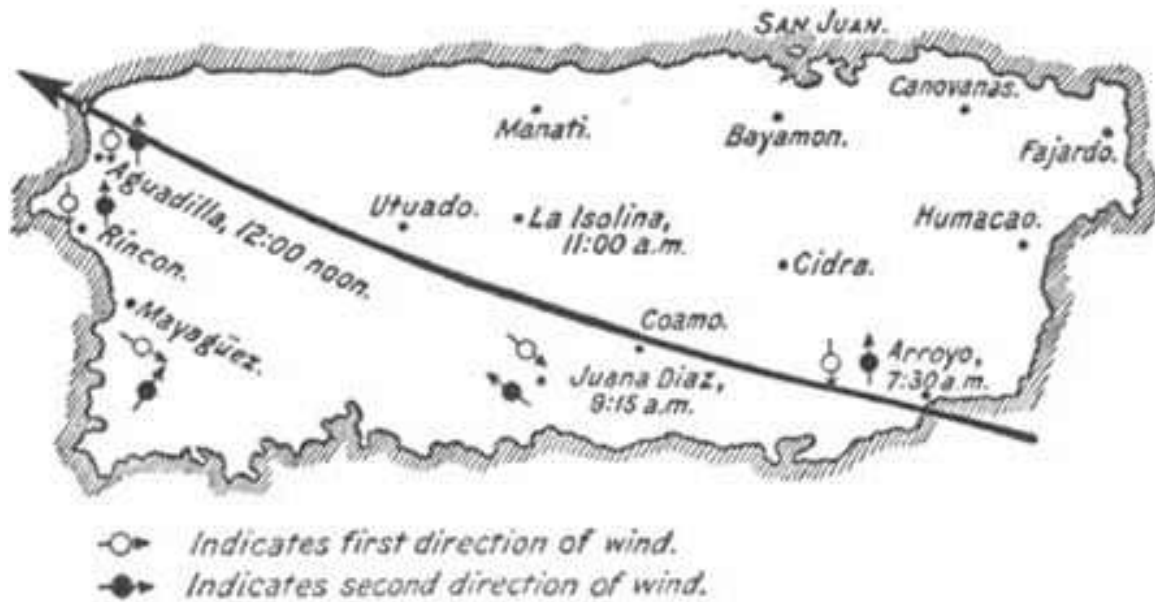
With those bitter lines conveying the catastrophic passing of San Ciriaco, Puerto Rican merchant representatives departed from their usual rhetoric of pride and success luring investors. San Ciriaco was a Cape Verdean hurricane, the strongest storms that threaten the Circum-Caribbean. San Ciriaco traversed the Atlantic towards the Antilles, moved up towards the United States and then dissipated in the North Atlantic. According to a Catholic tradition, San Ciriaco was named after Saint Cyriacus, the corresponding saint to the day of its landfall, August 8th, 1899. Early that morning, the hurricane made landfall on southeast of Puerto Rico, near Arroyo; it traversed the island diagonally to the northwest, exiting nearby Aguadilla slightly after noon. Hurricanes that make landfall and cross the island are more destructive than those passing north or south in the Ocean, concentrating the strongest winds in opposing directions around the vortex, known as the eye. San Ciriaco reached a diameter of almost 60 miles and wind velocities approximations vary from 85 to 145 mph, so current estimates place it in Category 4 of the Saffir-Simpson scale (Puerto Rican Hurricane Center, 2011). Associated rains were copious and lasting, worsening the aftermath. It is not the strongest hurricane recorded on the island; yet, it is the deadliest, 3,100-

3,400 casualties. Moreover, its impacts were cataclysmic on export crops, food security, public health, and the built environment –particularly scarce infrastructure and widespread precarious housing-. Casualties and destruction reveal the precarious state of contemporary disaster management, planning and development processes.

San Ciriaco happened at a historical and unstable point, vital to grasp the foundations of modern Puerto Rico; the U.S. had taken over the island from Spain months before. Four centuries of colonial detachment from the development of Puerto Rico, in tandem with extractive policies enforced by Spaniards and elite Creoles had created inequality, poverty, vulnerability and turmoil. San Ciriaco exposed the fault lines of this asymmetrical legacy; overlapped with the early U.S. interventions. Americans had just started an unprecedented documentation process and it was used to assess damages and monitor relief, which influenced how the crisis was addressed and memorialized. During the Spanish-American War (1898), President William McKinley⁶⁰ (1897-1901) was said to fear hurricanes more than the Spanish Navy (Neely, 2006). After the war, the Army Signals Corp launched meteorology on the island with a military emphasis. Under the U.S. National Weather Service, the new *Negociado del Tiempo* -Weather Bureau- in San Juan collected detailed information about San Ciriaco used in political, military, fund-raising and scientific discussions.

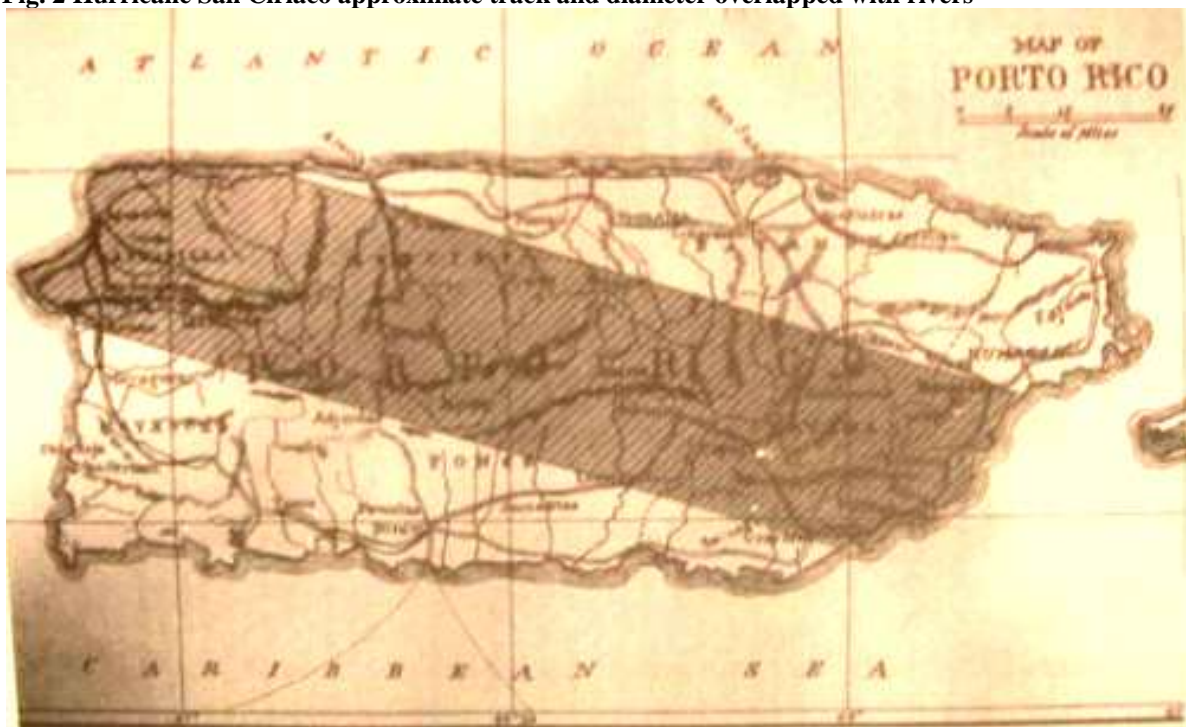
⁶⁰ The 1896 Cedar Key storm that ravaged from Florida to Pennsylvania impressed him as a presidential candidate. Later, he urged Congress to pass legislation for a hurricane warning system to protect American military and merchant vessels. Thus, a Weather Forecasting Bureau was established in Jamaica, with stations in Cuba, Saint Kitts Dominican Republic, Barbados, Trinidad, and Curacao; and later in Puerto Rico and Dominica (Arsenault, 2005).

Fig. 1 Hurricane San Ciriaco path, timing and wind directions over Puerto Rico



For the first time on the island, hurricane path, timing and wind directions were mapped and used officially. Image: (Davis, 1902, p.612).

Fig. 2 Hurricane San Ciriaco approximate track and diameter overlapped with rivers



The shadowed area corresponds to most of the blasted coffee and tobacco planted highlands; flashfloods struck the lowlands along rivers and creeks, where most urban settlements and sugar plantations were located. Image: Military Government of Puerto Rico 1900 in (Military Government of Puerto Rico in Rosario Rivera, 2000a, p.23).

During 48 hours, an average of 10 inches of rain felt island-wide, equaling two months of rain. Some places experienced worse conditions, for example in Humacao, east coast, 23 inches of rain felt in 24 hours (E. B Garriott, 1899). Floods, landslides and coastal surges were brutal. Near Humacao, a 15 feet height storm surge entered one mile inland, wiping out homes and families (Rosado Bauza, 1997). Sábalo and Guanajibo, slums near a mangrove in Mayagüez, became reduced to fuel piles ready to feed steam engines, according to Ramón Aráez y Ferrando, a former Spanish military official (DIVEDCO, 1965). Windy rains for a month increased the trauma according to the mayor of Caguas, in the central highlands:

“Everyone expected another hurricane⁶¹]. Because of this, men, women, and children went into the streets praying with candles lit. Seen at a distance, they seemed to be skeletons leaving the grave. This view demanded respect and it caused pain and affliction to see those poor people walking and skipping among the debris” (Schwartz, 1992, p.310).

A week later, almost 250,000 persons lacked shelter and food, whilst next year mortality rates increased from 30% to 41% (Schwartz, 1992). Property, infrastructure, livestock and crop losses totaled almost US\$ 20 million; an amount that excludes losses in precarious settlements. The first librarian of the new San Juan Public Library summed such ruin:

“one sees giant trees torn up by the roots and man’s proud construction of stone and iron broken and scattered like children’s toy” (Van Middeldyk, 1903Ch. XLI p.n.a.).

Utuado and Adjuntas, small neighboring coffee highland towns, were most battered. Hunger, death, and suffering became dreadful according to the U.S. military Governor of Puerto Rico, Brigadier General and engineer George Whitefield Davis, suddenly in charge of relief provision. In the highlands, the path and strength of the hurricane overlapped with entrenched poverty and almost a decade of maintenance disinvestment in the coffee plantations, as their profitability had

⁶¹ This fear was well-founded. On August 22, a storm hit San Juan and left the port unusable for a week. (E. B Garriott, 1899).

fallen. Uprooted vegetation meant less rebuilding materials and food insecurity. Months later, reports mentioned people dying along the highland roads due to disease, starvation and unemployment (Schwartz, 1992).

Yet, the worst immediate tragedy took place in the southern municipality of Ponce⁶² given its scale, primacy and location. Ponce was the second most important city in Puerto Rico because it was the top export hub of coffee and sugar. With a population larger than San Juan, it was seat of wealthy autonomists and intellectuals which aimed to transform their town into the island capital, and Puerto Rico into an independent country. This situation drastically changed. Hurricane winds and rain ravaged sugar mills and crops along the flatlands, particularly in the Portugués river delta; and hit hard the surrounding coffee highlands. In town, the Portugués river overflow caused most of the 500 registered deaths by drowning, but unaccounted corpses went missing at sea; and it destroyed homes, public buildings, bridges and peri-urban crops. Trolley, railroad, telegraph, telephone, water, sewage and electricity were disrupted. In the novel ‘Carmen’s Son or Adventures of a Worker⁶³’, Eladio Ayala Moura described the landfall and aftermath:

“The wind lashed furiously and most women on their knees raised a prayer to the Almighty begging for mercy, because they understood that was a punishment of the Supreme Being...Panic was indescribable, misery spread everywhere as a final consequence of the catastrophe...Hundreds of corpses were all over town, and there were streets like Coto that could not be traversed, because of the many houses that the big flash flood [correntón] had agglomerated in the middle of the street” (Centeno Añeses, 2000, 91-92).

In the nearby port Playa de Ponce, the storm surge wrecked businesses, ships, cargo, and port facilities. Emergency responses and long-term recovery slowed down in part due to

⁶² Ponce would be located immediately left of Juana Díaz in the first map above.

⁶³ ‘El hijo de Carmen o Aventuras de un obrero’.

infrastructure collapse. Next year, Ponce had ‘an epidemic death rate without the epidemic’ according to Dr. W.W. King of the U.S. Marine-Hospital Services:

“It is not the province of this report to discuss the hurricane disaster, business stagnation, relief measures, or other causes, why they were in such circumstances, suffice to say that many thousands during the past year have been living on a very meager diet and many have starved outright. Bananas and plantains, two of their great food staples, were almost entirely destroyed by the hurricane. They ate whatever could be got. Sugar cane, mangoes, and other fruit (often unripe), rice, beans, codfish, and various native tubers, all cooked together in strong grease until it would need the stomach of the proverbial goat to properly digest it. Much of the codfish, generally of the poorest quality, is eaten raw. A poor quality of rum is drunk in large quantities, though drunkenness is rare. This insufficiency of food was the final straw...[I diagnosed] irritative diarrheas resulting from eating indigestible and decomposing food. During July, 1900, there were distributed by the city authorities rations of codfish actually putrid and stinking. It was finally condemned and destroyed by the superior board of health...To sum up the chief predisposing causes, we have a class of people of no great endurance, badly infected with ankylostoma, living in unhygienic surroundings, always on the verge of sickness, so that it needed but a final straw”(King, 2006 (1900), p.40).

Fig. 3 Playa de Ponce devastated by San Ciriaco



Unknown street showing damages to businesses, institutions and infrastructure. Image: (Mercado Avila, 1997, p.35).

Fig. 4 Playa de Ponce rebuilt



Main street 6 years later. Image: (Gilot, 1905).

Fig. 5 Flooded sugar factory roofs, surrounding city and valley, Arecibo



Fig. 6 Life saving port station destroyed, Arecibo



Fig.7 Floods in the railroad station and Guayabal quarter, Arecibo



Wind bent and destroyed large metal pieces. Sturdy constructions of masonry and brick withstood wind damages, but were affected by humidity. Images: (Alonso, 18-?, pp.103, 128 and 130 respectively).

Fig. 8 A man horseback riding traverses flooded downtown Arecibo



In parts of the northwest coast, where San Ciriaco left, the confluence of rain, flash flooding and sea surges surpassed 4 feet. Most buildings were one storey; thus, trapped inhabitants could not climb up to save themselves and their possessions. Image: (Alonso, 18-?, p.149).

Fig. 9 Destruction after San Ciriaco



Wind collapsed roofs and structures of middle and low-income housing made out of wood, tin and discarded materials. This image (Davis, 1902, p.612) served to negotiate the future of the island in Washington.

Fig. 10 Ravaged Caguas, in the central highlands between Ponce and San Juan



Uprooted vegetation in the central square. Image: (Puerto Rican Hurricane Center, 2011).

Fig. 11 A large devastated section of Arroyo, where San Ciriaco made landfall



Ruined wood structures photographed from Mr. McCormick's rooftop. Image: (Rosario Rivera, 2000a, p.40).

The few available immediate accounts were written by the prominent Spanish Dean of the San Juan Dioceses (Perpiñá y Pibernat, 1899), a wealthy ex-military Spanish official (Aráez y Ferrando, 1905), a wealthy Creole pro-independence (Coll y Toste, 1976), and U.S. Governor Davis (Davis, 1902). The latter compiled a document that marks an official transition towards disaster secularization and vast assessments by Americans, including the integration of climatic records, images and maps, economic losses, and policy-recommendations. Noticeably, those writings and the following were done by wealthy, light-skinned, adult men in positions of power, such as top politicians, public officials, military, merchants, planters, religious authorities, doctors, scientists and intellectuals. The voices of marginalized citizens due to gender, class, race and age were silenced from entering their experiences in the public record, and from shaping policies according to their needs. An upper class, top-down view of the event prevailed.

V.2 San Ciriaco characterized in multidisciplinary, artistic, Circum-Caribbean, local, multi-hazard, multi-storm terms

In terms of a multidisciplinary production of knowledge, San Ciriaco is an incipiently developed opportunity; it has received academic attention as part of other topics or by itself. The initial studies were in meteorology (E.B Garriott, 1899) and epidemiology (King, 2006 (1900)). Nearly a century later, San Ciriaco was subject of the first in-depth historical analysis of how a hurricane influenced Puerto Rican society and politics, and vice versa (Schwartz, 1992). Almost ten years later and inspired by that seminal paper, an edited book by Puerto Rican scholars (Rosario Rivera, 2000b) continued a historical, multifocal discussion of San Ciriaco; including a photographic and statistic overview of the damages (Rosario Rivera, 2000a), the position of the

U.S. military government (Santiago Caraballo, 2000) and the catholic church (Ortíz Díaz, 2000), traces in early 20th century literature (Centeno Añeses, 2000), a health perspective (Pabón Battle, 2000), and post-hurricane emigration (I. Fernández, 2000). Those writings epitomize a move towards the study of storms as a lens to grasp power relations and human-nature interactions (Schwartz, 2005). They could be qualified as nascent in terms of depth; other than historian Stuart Schwartz studying San Felipe (Schwartz, 2005), no other Puerto Rican hurricane has been similarly examined, and the absence of engaged planners is remarkable.

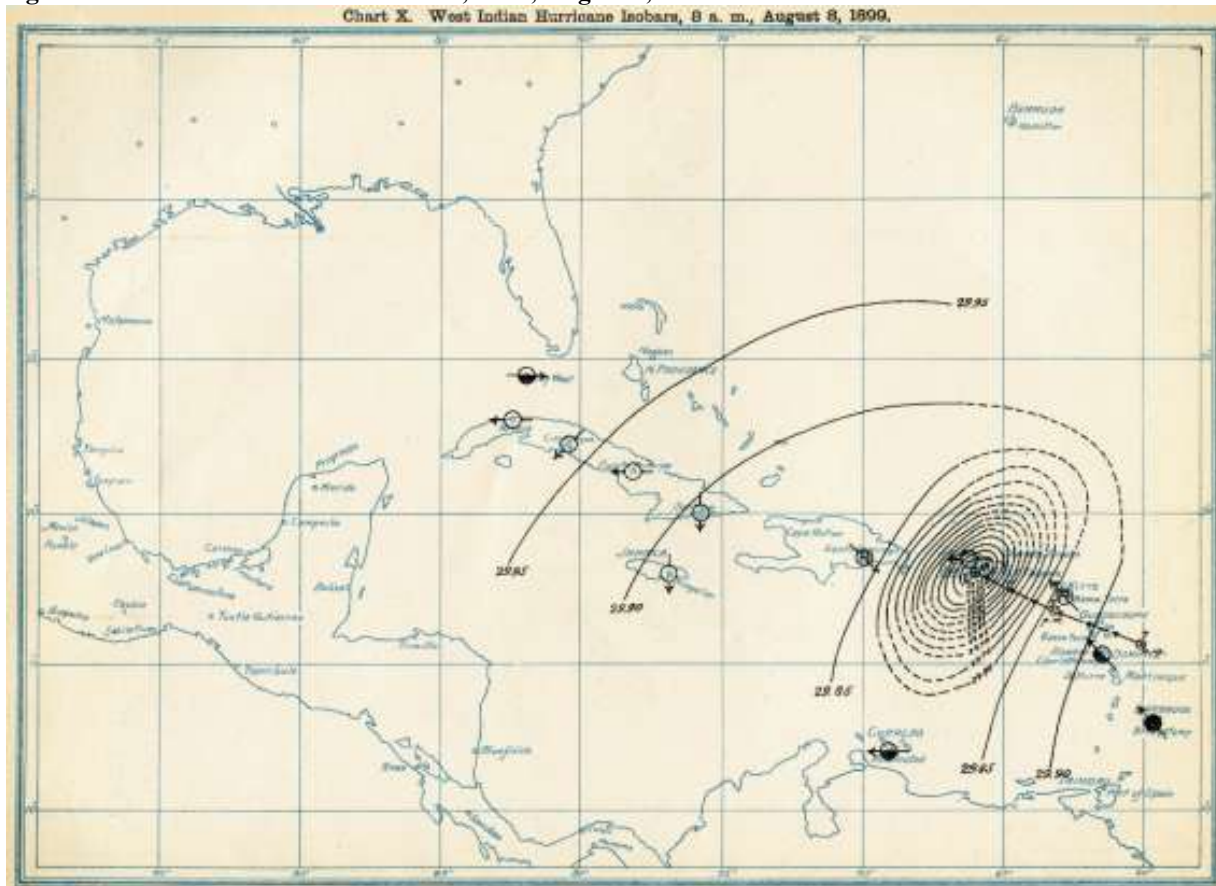
In the arts there are several traces of San Ciriaco. Male middle-class workers, artists and journalists left their literary imprint along male intellectuals and members of the landed elite experiencing accelerated economic demise, according to the article 'Traces of San Ciriaco in early 20th Century Literature' (Centeno Añeses, 2000). For instance, José Elías Levy addressed topics such as loss of rural livelihoods, increased urban unemployment, precarious housing, child mortality, bankruptcy, suicide and the first emigration wave towards Hawaii in his novels '*Estercolero*' (1901) and '*Mancha de Lodo*' (1903), whose titles already paint harsh conditions (Dunghill and Stain of Mud, respectively). Matías López García published in 1905 the novel '*Gestación*' (Gestation); in it he depicts loss of rural assets, unemployment, starvation and social polarization to understand the period of gestation of a new order, in which Americans benefited ruthlessly. In the 1909 novel '*El hijo de Carmen o Aventuras de un Obrero*' (Carmen's son or Adventures of a worker), Eladio Ayala Moura described the hurricane landfall in Ponce and ensuing rough life. Ramón Julia Marín captured the desolation of inland tobacco workers in his 1911 novel '*Tierra Adentro*' (Inner Land). A year later, his novel '*La Gleba*' (The Glebe) depicted the return to semi-feudal conditions of servitude experienced by broke coffee farmers

vis-à-vis the expansion of U.S. power. In 2007, a Texan-based Puerto Rican dance company launched the musical *'Sembrando Herencia'* (Planting Inheritance), in which San Ciriaco and Santa Clara have key historical roles (Angelito Borincano, 2007). The former was considered important because of the coffee industry crisis and political changes.

San Ciriaco affected several territories in the Circum-Caribbean. It remains the longest-lived Atlantic storm tracked in history, it left a vast destruction; yet, it is under-examined comparatively. On August 7, it moved through the northern Lesser Antilles, passed over Guadeloupe and near to Saint Kitts. A day later, it made landfall in Puerto Rico. Then, San Ciriaco lowered to Category 3 and affected the north of the Dominican Republic, Haiti, and the Bahamas. When it made landfall near Hatteras, on the Outer Banks of North Carolina, it could have reached Category 5, the worst in the Saffir-Simpson scale (Walsh, Corbett, & Siepert, 2012). Fishing villages and islands were ruined, survivors relocated inland permanently. Over a dozen ships were lost out at sea; fishnets, docks and other assets were destroyed. Inland corn, tobacco and other crops and foodstuff were lost and farmers went broke; the experience was horrid:

"Language is inadequate to express the conditions which prevailed. The howling wind, the rushing and roaring tide, and the awful sea which swept over the beach and thundered like a thousand pieces of artillery made a picture which was at once appalling and terrible and the like of which Dante's Inferno could scarcely equal" (Doshier n.a. in Walsh et al., 2012).

Fig. 12 “West Indian Hurricane Isobars, 8 am, August 8, 1899”



This manual map of San Ciriaco is an early U.S. effort to provide a regional scientific image of a hurricane, focusing on the new possession. Image: (U.S. Army Signal Corps, 1899).

Next, San Ciriaco drifted erratically in the sea, becoming an extra-tropical cyclone, tropical storm and hurricane again when it hit the Azores, on September 3rd. A day later, it dissipated in the Atlantic; but on the 9th, remnants were felt in France. As part of North Carolina storms, historians have studied San Ciriaco (Barnes, 1995; Hairr, 2008; Walsh et al., 2012). Despite regional damages, there are no contemporary or retrospective Circum-Caribbean comparative studies. I only found the usual data of storm level, imprecise losses and images when looking for scholarship that transcended the paradigmatic vision of the region as a shattered cosmos due to geography, colonial legacies and ideological animosities. Also, local studies within Puerto Rico are missing.

The possibility of learning from San Ciriaco in multi-hazard terms remains unexplored. An expanded temporal frame would enable to study a relatively recent worst case scenario of almost contemporary multi-hazard exposure. In 1867, hurricane San Narciso damages were preceded by a drought and aggravated 20 days later by a devastating earthquake⁶⁴, a large tsunami and aftershocks, as will be reviewed in section V.5. When San Ciriaco made landfall, physical and social consequences of this crisis were present in the collective memory and material environment of Puerto Ricans (Schwartz, 1992). Yet, this complex emergency remains understudied by disciplines such as history, economics, planning, preservation and disaster management, which reduces even further the possibilities of learning from it.

The opportunity of learning from San Ciriaco in multi-storm terms has not been developed either. The worse 19th century hurricanes for Puerto Rico were Santa Ana in 1825, San Narciso in 1867, and San Felipe in 1876. I only found the mainstream listing of events, physical characteristics and generic losses.

⁶⁴The worst seismic activity recorded has taken place in 1520, 1615, 1670, 1751, 1776, 1787, 1867, 1918, 1943 and 1946. The 1670 earthquake affected the southwest, near San Germán; and the 1787 earthquake hit the entire island, damaging El Rosario and La Concepción monasteries; churches at Bayamón, Toa Baja, Arecibo and Mayagüez, and the castles of San Felipe del Morro and San Cristóbal (Reid & Taber, 1919b; United States Geographical Survey, 2012).

Box N.1 Summary of 19th century storms in Puerto Rico: 1804-1837

1804, September 4th; Hurricane Santa Rosalía passed north of the island causing trivial damages, then it hit Charleston, South Carolina.

1806, September 11th, Hurricane San Vicente affected severely Dominica and left 131 deaths, then passed south of Puerto Rico battering Ponce.

1807, August 17-19; Hurricane San Jacinto hit the Leeward Islands, the Virgin Islands, Puerto Rico and the Dominican Republic. It traversed Puerto Rico from southeast to northwest during 50 hours, causing large floods, life and crop losses.

1813, July 23rd; Tropical Storm San Liborio hit the southwest, affecting mainly coffee crops.

1813, August 21st; Tropical Storm Santa Juana hit Dominica before passing close to southern Puerto Rico and damaging crops, it slammed South Carolina next.

1814, July 23rd; Tropical Storm San Liborio a year after, a storm hit hard the south and was felt in San Juan. It destroyed crops surviving a 7 month drought.

1816, September 18-20; Hurricane San José de Cupertino passed over Martinique and then close or over the south coast of Puerto Rico, affecting crops.

1818, September 22nd, Tropical Storm San Mauricio caused minor damages in the south, particularly in Guayama.

1819, September 21st-22nd, Hurricane San Mateo caused 101 deaths in the Virgin Islands; it sank ships, and vastly destroyed houses and crops in Puerto Rico.

1824, September 9-10; Hurricane San Pedro passed near the south coast affecting the area from Juana Díaz to Cabo Rojo.

1827, August 17th; Tropical Storm San Jacinto moved from southeast to north affecting crops. Ships were sunk in harbors surrounding the island.

1835, August 13th; Hurricane San Hipólito crossed from southeast to north lasting around 6 to 7 hours over land. It affected mainly the east and north of the island, then passed north of Hispaniola, over Cuba and hit Galveston, Texas.

1837, August 2nd-3rd; Hurricane Nuestra Señora de los Angeles severely traversed the island from southeast to north during 10 to 12 hours. It is the first storm to have a barometric reading in Puerto Rico, a minimal pressure of 948 millibars in San Juan were 11 people died and ships sunk.

Box N.2 Summary of 19th century storms in Puerto Rico: 1851-1891

1851, August 18th; Hurricane San Agapito passed near the southwest but affected the entire island, damaging agriculture, with winds that could have reached 100 mph. The storm entered Apalachicola city, Florida, four days later.

1852, September 5th; Hurricane San Lorenzo hit southwest Puerto Rico with winds averaging 70 mph to 80 mph. Extensive damages to Guayanilla and Mayagüez.

1867, October 29th; Hurricane San Narciso hit St. Thomas with estimated winds of 120 mph, the first scientifically recorded wind speed. It made landfall in Puerto Rico with diminished winds. It passed over Caguas, hit Ponce and left the island in the west, causing 211 deaths due to flooding and 600 deaths by drowning. In the San Juan bay 50 ships sunk. Despite extremely low pressure readings (1002 millibars in San Juan and 995 millibars in Arroyo); it caused human losses and vast damages to properties and agriculture.

1871, August 21st; Hurricane Santa Juana passed over the Virgin Islands, St. Thomas and then north of San Juan. Its low pressure reading in Puerto Rico was comparable to San Narciso (29.53 in/hg or 1000 millibars). Yet, it did not traverse the island, only 27 deaths were reported and damage was relatively minimal. For the first time, a storm warning was transmitted to San Juan because the telegraph and ultramarine cables were installed in the Caribbean.

1876, September 13th; Hurricane San Felipe I took 10 hours to traverse Puerto Rico from east to west. The storm made landfall with estimated sustained winds of 100 mph, lowering to 60 mph in San Juan. Pressure reports varied from 991 millibars to 988 millibars and rain totaled of 4.71 inches; 19 deaths. For the first time in Puerto Rico, rain measures and daily weather observations were recorded.

1878, November 28th; Tropical Storm San Rufo passed over the south coast with estimated sustained winds of 70 mph. The storm affected lightly the east and south. In San Juan winds reached 20mph and pressure 1004 mb. Limited damage reported.

1888, September 1st-2nd; Hurricane San Gil passed 100 to 150 nautical miles north of Puerto Rico as a category 1 hurricane. Foods caused over 100 deaths.

1889, September 3rd-4th; Hurricane San Martín passed near St. Thomas, then passed at a distance of around 40 nm from the northeast end of Puerto Rico and at around 90 nm northeast of San Juan. Winds of 48 mph and a pressure of 996 mb were measured in San Juan. Mainly damages to banana crops were reported.

1891, August 19th-20th; Hurricane San Magín hit Martinique, with more than 700 casualties reported, then it passed close to the southwest end of Puerto Rico with a west-northwest bound direction. Estimated sustained winds reached 100-105 mph, vast flooding was reported, for example, Carolina city was under 6 to 8 feet of water.

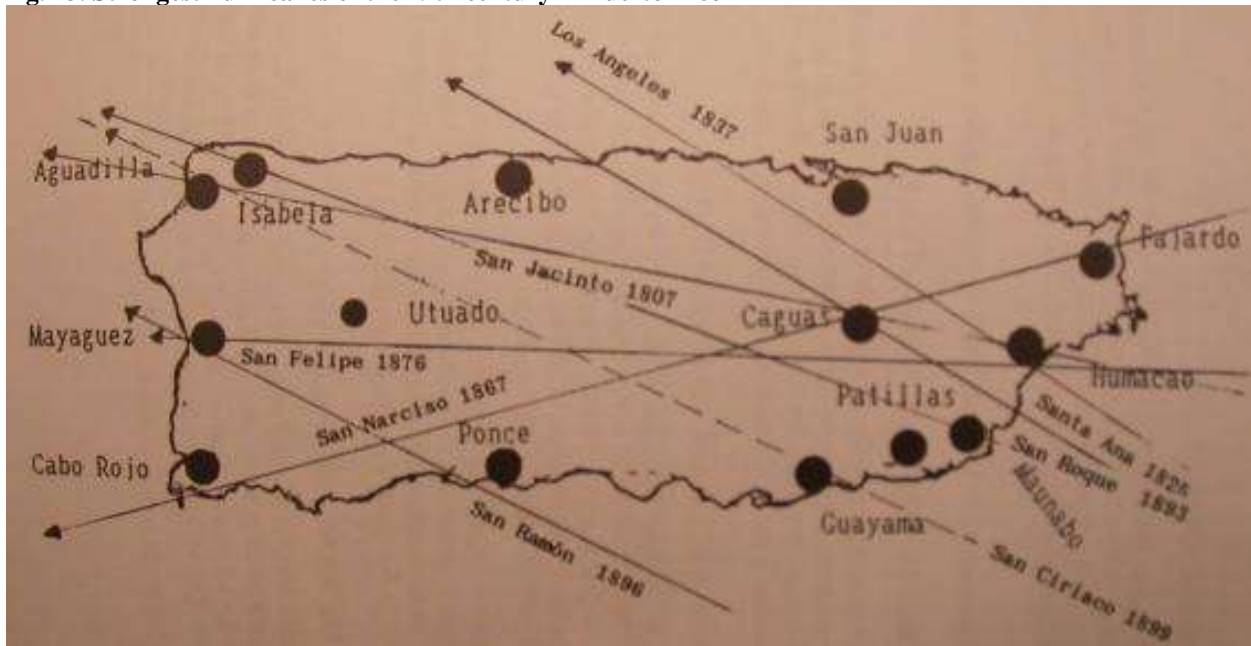
Box N.3 Summary of 19th century storms in Puerto Rico: 1893-1896

1893, August 16th-17th; Hurricane San Roque entered Puerto Rico by Patillas at 7-8 pm and left by Isabela at 3am. The storm winds reached 115 mph approximately at time of landfall. San Juan got 987 mb pressure readings and winds of 55 mph with rains totaling 2.36 inches. Railroad damages were reported. For the first time, flags in governmental offices were deployed as storm warning signals.

1896, August 31st-September 1st; Hurricane San Ramón crossed the southwest area of Puerto Rico. Nearby Ponce, winds reached 100 mph at landfall.

(Miner Solá, 1996; Puerto Rican Hurricane Center, 2011; Salivia, 1972; Ivan Ray Tannehill,

Fig. 13. Strongest hurricanes of the 19th century in Puerto Rico



The fairly consistent path of hurricanes meant iterative destruction cycles. Image: (Miner Solá, 1996, p.45).

V.3 Economic growth and urbanization vis-à-vis disasters

Differentiated vulnerability or resilience to San Ciriaco was influenced by the specific overlap of economy, urbanization and disasters generated after quadri-centennial Spanish colonialism.

Flooding caused most immediate casualties and damages because settlements were mainly located in coastal flatlands or valleys. Yet, widespread wind and rain destruction confirmed the accumulated feebleness of the export crop economy, built environment and society.

Spaniards arrived to Puerto Rico in 1492, and the profitability of easy maritime access made coastal urbanization their main settlement pattern. First, gold extraction took place along the northern coast riverbanks, where the main deposits were located (R. Picó, 1974). In addition, the east-west Central Range and the Range of Cayey limited access to the steep interior. Thus, for fast shipping of riches to Spain, it was convenient to settle in plains close to water provision from creeks and rivers; particularly on the north coast.

Fig. 14 The Island of Saint John of Puerto Rico, circa 1639



Although technically inaccurate, this map (Vingboons, 1639) registers the early pattern urbanization in accessible lowlands and coastal plains, which increased particular multi-hazard exposure. It also depicts the obstacle to colonization and surveillance posed by the Central Range and the Range of Cayey.

Yet, coastal urbanization increased exposure to floods, hurricanes, tsunamis and other hazards; and soon hurricanes ravaged the countryside and new settlements. On September 8th, 1530,

Governor Francisco Manuel de Lando reported to the King of Spain:

"During the last six weeks there have been three storms of wind and rain on this island (July 26, August 23 and 31). They have destroyed all the plantations, drowned many cattle, and caused much hunger and misery in the land. In this city the half of the houses were entirely destroyed, and of the other half the least injured is without a roof. In the country and in the mines nothing has remained standing. Everybody is ruined and thinking of going away" (Lando 1530 in Van Middeldyk, 1903, p.n.a.).

Those severe hurricanes undermined the prospects of settling on the island, as stated in the 1773 notes of Fray Iñigo Abbad y Lasierra, traveler and priest, who magnificently wrote Puerto Rico's first general history:

"inhabitants were evicted from their houses, their haciendas destroyed, they were deprived of their harvest, lost their cattle and goods, without the hope to recuperate them after withstanding the hardest efforts to acquire and keep them. If they turned their eyes to the mines, they saw them all underwater due to the river floods, their works lost and they were without the means or money to repair them. If they searched in their hacienda for produce to subsist, they only found sad residues of general rubbish, which could last for a very short time. In sum, they were surrounded by anguish and misery everywhere, without any hope to overcome it (Abbad y Lasierra, 1866, p.120).

Simultaneously, mining became too difficult and costly to maintain after the 1540s, whilst news about endless riches in México and Perú prompted colonizers to emigrate:

"the governor imposed the death penalty upon any one who should attempt to leave, but, notwithstanding threats and punishments, the inhabitants nearly all succeeded in getting away from the island" (Fowles, 1910, p.12).

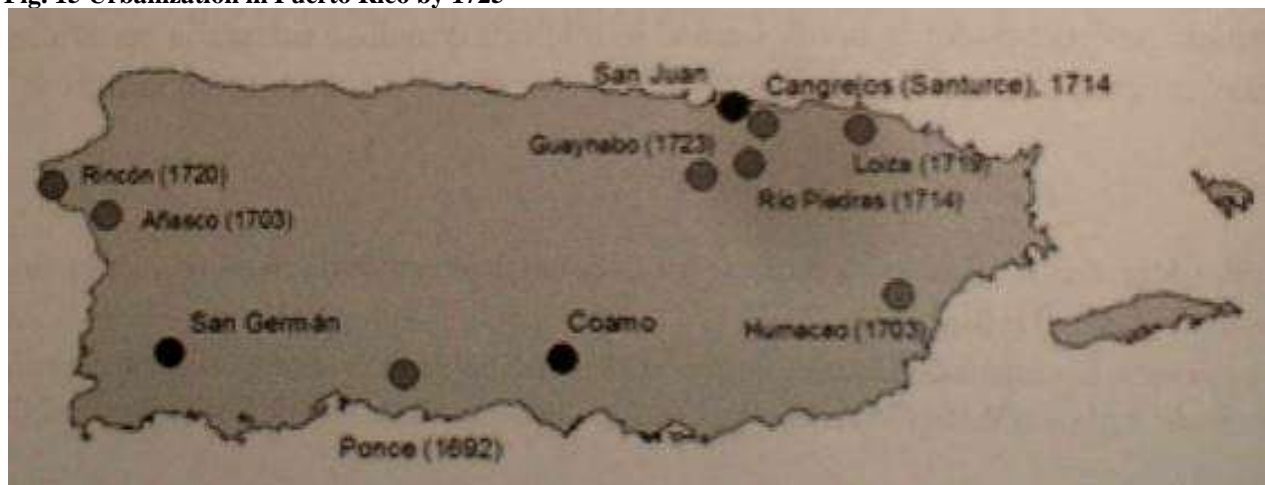
Puerto Rico became a failed economic endeavor and, in the following centuries, scarce records and investment reflect disengagement between Spain and the fate of the islanders.

The oldest Spanish settlements in Puerto Rico –Caparra and its successor, nearby San Juan- exemplify the coastal urbanization pattern. Moreover, they embody how the founding of colonial cities started as an ad-hoc procedure in the entire continent. When colonization grew more complex and larger, the need for planning standardized urbanization became evident. By trial and error, a series of urban legislation commonly referred to as ‘*Leyes de Indias*’ -Laws of the Indies- was passed in the late 17th century with varying degrees of circulation and execution. In Puerto Rico, the Laws of the Indies had limited implementation though (Sepúlveda Rivera, 2004), mainly in central elitist areas. Overall, local development was undermined by exploitative policies, meager reinvestment, a strict trade monopoly dictated by the Merchants of Seville, mining collapse and recurrence of disasters that weakened the already ragged patterns of urban growth. By the mid-16th century, Puerto Rico turned into an unprofitable colonial venture. It was isolated from commercial routes, with minimal population growth, mainly dedicated to subsistence agriculture (Abbad y Lasierra, 1866; López de Haro & Huerga, 1644; Matos Rodríguez, 1999). The remaining advantage of the island was the strategic location of San Juan, which became port and military garrison for vessels traveling between Spain, the Hispanic Colonies and Africa. From 1584 to 1809, intermitting large funding from México called *El Situado Mexicano* covered administrative costs in San Juan and built forts in Cuba, Puerto Rico, Florida and Hispaniola (González Vales, 2007). Public expenses went to build a pricey network of fortifications in San Juan and maintain the military to defend the city and treasure loaded fleet from foreign powers and pirates. That investment policy cemented a martial logic of organization and dominance; and backed underdevelopment by diverting external funding and local tributes from serving lay citizens, which cemented disaster vulnerability. In the mid-17th century, vast poverty was reported based on moving descriptions and indicators such as use of cheap coins and

meager money accumulation (López de Haro & Huerga, 1644). Even the capital and most developed city, San Juan, was poor and small compared to Havana, Bridgeport, Kingston, Port-au-Prince and more so vis-à-vis the large mainland capitals, Lima and México (Matos Rodríguez, 1999). During the 17th and most of the 18th century, territorial development, planning and urbanization remained minimal due to economic depression, scarce investment by the Spanish crown, a primitive agriculture that required permanent field surveillance, and disasters. Slave trade and immigration were stalled because they were tied to the stagnant economy; mainly regional contraband flourished⁶⁵. The major settlements were like Ponce:

“a strange town, of melancholic character, because the homes are without inhabitants, those always live in the haciendas o grangerías [farms] and just go to the towns during festivities, when they hear Mass. Concluded Mass, they return to their haciendas leaving the towns with only the Priest and some poor landless neighbor” (Córdova, 1831a, p.110).

Fig. 15 Urbanization in Puerto Rico by 1725



- Existing settlements before 1650
- Settlements founded between 1650-1725
- Coastal urbanization consolidated during economic hardship (La Gaceta 1868 in A. G. Quintero Rivera, 2003, p.43).

In the late 18th century, an intensive export-led economy grew linked to global changes, including the opening of markets to the Spanish colonies and new countries after the

⁶⁵ Cattle ranching in 'haciendas' by 'hacendados' was a relevant activity for local consumption.

independence of Haiti (1804). Slaves and a free but landless population increased along the expansion of sugar and coffee plantations⁶⁶. Meanwhile, wealthy Spanish and Creole businessmen and planters invested in their urban and rural built environment. Increased governmental planning and investment focused on export-oriented infrastructure, with the underlying assumption of protecting commodities -crops- not citizens. Examples were a tiny and partial railroad grid (Santamaría García, 1994), bridges, ports, roads, and lighthouses that yielded high returns to the Crown, investors and influential merchants and planters; but did not target the development and resilience of lay citizens. Private and public investment consolidated what can be described as “uneven geographical development” (N. Smith, 1984), with abysmal contrasts between what upper income groups enjoyed vis-à-vis the absolute destitution of the vast majority, increasing their vulnerability to disasters and everyday life hazards. The San Juan-Ponce *Carretera Militar* (military motorway) was a rare case of territorial connectivity done fairly fast (1880-1888), exemplifying the logic of governmental planning and investment. Given the scarcity of transportation infrastructure, the motorway facilitated control to the authorities, trade to merchants and planters, and mobility to landless workers looking for cheap seasonal work or emigration to coastal towns and Hispanic countries. A U.S. correspondent, unclear about the motorway funding, reported its usefulness:

“While the construction of the thoroughfare contemplated no philanthropic purpose and was perhaps, financially, an expensive gift to the inhabitants, it will, in the future, be of incalculable commercial value, for it gives to the country the only road within the confines of the island which is really passable at all seasons of the year—except short stretches of a proposed road to encircle the island” (Dinwiddie, 1898, 32).

Most investment concentrated in the sugar-producing lowlands because of the preceding coastal urbanization pattern, accessibility, and diverse needs of sugar versus coffee crops. The highlands

⁶⁶ Tobacco farming and cattle ranching were less relevant economic activities.

were suitable for coffee shrubs, which unlike perennial cane grasses last years and require many workers during a brief yearly harvest period. Thus, highland towns grew slower, despite coffee booms. Private and public investment in coastal towns consolidated fast inequitable urban growth. Ponce, renamed ‘Pearl of the South’, exemplifies a polarization between a small, planned, wealthy center and a large, poor, informal counterpart. This urban growth process was endorsed by municipal, insular and Crown authorities funding amenities and infrastructure in the center, which increased the elite’s assets, quality of life and safety. Small public urban networks developed in Ponce earlier and quicker than in most towns: kerosene lightning (1864), the Aqueduct Alfonso 13th (1873), hydrogen public illumination (1874), submarine cable (1895), telephone (1897), electrical trolley (1898), sewage (1898) (Gandía Córdova, 1899; Pubill, 1900).

There is no data of purposive agricultural and urban growth on desiccated flood-prone areas, as contemporary technology did not enhance large hydraulic transformations. Formal beach urbanization was trivial, but few export or military constructions. Exclusionary land markets prompted low-income groups to occupy risk-prone areas such as hills, mangroves or creeks (A. G. Quintero Rivera, 2003). They mostly caused reversible ecosystemic changes due to the fragility of their constructions.

After the 1820 fire in Ponce, an urban core called *Zona de Piedra* (Stone Zone) emerged and flourished with streets realigned and broadened by the Catalan Vidal D’Ors, humbly following Gaudí’s plan for Barcelona. By the late 19th century, new buildings showed a preference for eclectic styles, such as Catalan Modernist, Neoclassical, Victorian, Neo-Egyptian and Beaux-

Arts (Vásquez Zapata, 2000), and reflected the integration of the most successful immigrants⁶⁷. Novel aesthetic proposals were enabled by vanguard techniques and construction materials –i.e. reinforced concrete, iron and corrugated tin-. Interior decorations included imported stained glass panels, mosaic tile floors, jalousies, balconies, ornate moldings and cornices. In turn, new technologies usually reduced fire, hurricane, flooding and pests hazards. Housing was built individually or in small groups. Citing infrastructure, services and mansions; Creoles argued the superiority of Ponce over San Juan (Neumann Gandía, 1987). For example, famed local journalist Ramón Marín vehemently argued that hundreds of houses, regardless of their materials, often adjusted to the demands of a ‘cultivated population’ and were:

“modern constructions, many attractingly and elegantly decorated internally and externally; some beautified with precious gardens, and almost all of them with spacious patios, in which there was no lack of stables, garages and dwells with pumping bombs, steam several of them, which elevate water to the higher family rooms” (Marín, 1877, p. 202).

Fig.16 “Porto Rico Business Section in Ponce”



“This view is a typical scene on one of the main business streets and gives an idea of the characteristic style of buildings. The city has wide, clean streets and attractive houses, besides an old church erected more than three hundred years ago” (Raphael Tuck and sons after 1899). This postcard generalized central Ponce.

Fig.17 Las Delicias Square recently inaugurated



Opened in 1881 and renovated in 1889, Las Delicias Square and Boulevard modestly imitated expansions in Madrid, Barcelona, Buenos Aires and Havana. It was an exclusive leisure and consumption area, and with the cathedral to its side it was used as an iconic image for postcards. Image: (Gilot, n.d.).

⁶⁷ For example, the Buena Vista Hacienda was founded in 1851 by the Venezuelan Vives family to cultivate coffee, fruits and maize with the top technology available (Santana, 2000). The sugar mill Central Merceditas was inaugurated in 1861 by the Catalán Serrallés family (Cabrero Salcedo, 1991); decades later, it became the largest mechanized mill on the island.

Fig.18 Las Delicias Square and Boulevard



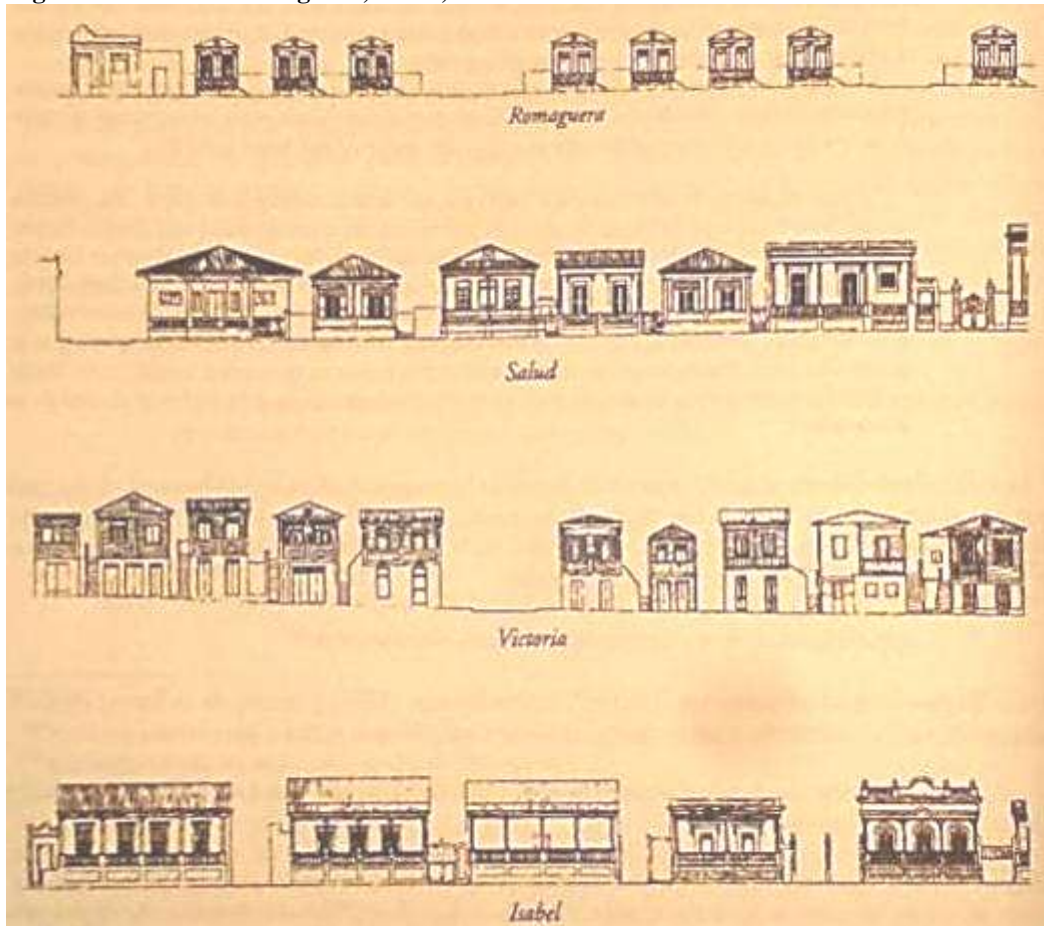
Human powered tram construction circa 1898. Main institutions and prominent citizens were adjacent. Image: (A. G. Quintero Rivera, 2003, p.6).

Fig.19 Ponce Market



“This is the most noted market in the island” (José De Olivares and Joseph Wheeler 1898 in A. G. Quintero Rivera, 2003, p.49).

Fig.20 Elevation of Romaguera, Salud, Victoria and Isabel streets 1890s



Increasing investment in construction materials, techniques and architectural complexity correspond to class and central location. Image: (A. G. Quintero Rivera, 2003, p.94) .

Meanwhile, provision of public housing and land tenure were unknown; sub-standard housing, uneven services, and rundown infrastructure prevailed island wide (J. Lizardi, 2013; J. L. P. Lizardi, 2008). Thus, most citizens experienced extreme precariousness during the everyday life and multi-hazard vulnerability. Some U.S. newcomers reported awful conditions, as they were free of the locals' vested interests in promoting Ponce as the new capital. Poor surface drainage collected unhealthy rain ponds for days; the Portugués River overflowed, damaged lives and properties, and left harmful filth and mud deposits. Exclusive unfiltered water provision came from a small reservoir of the Portugués River; yet, it was polluted in the dry season because water could not settle in the reservoir before passing on into the mains. It was even worse after a storm or in the rainy season. Citizens without water provision gathered it from any river spot. Filtering water, boiling it, or combining both disinfecting methods was unfamiliar or unaffordable for most people. Two small sewers only served hospitals, the jail and a few private houses. A handful recent and fancy houses had flush closets and covered cesspools. Others had open cesspools inside the house flanking the kitchen or in the backyards; they were seldom cleaned resulting in diseases and a stench that reached the streets (Fowles, 1910; King, 2006 (1900); Verrill, 1914).

Moreover, precarious housing, *bohíos*, was made out of any cheap material available:

“The frame work of these dwellings is square timber when it can be obtained, but more often poles answer the purpose. The siding is varied according to the ability of the owner to secure materials. Occasionally it is all made of new lumber. Oftener it is made up of old boards that have been picked up, store boxes that have been taken apart, tin cans that have been straightened out, advertising signs of either tin or wood, and, in many cases, the bark of the palm tree or the leaves of the sugar cane are used. For a roof, discarded pieces of corrugated iron or tin or boards are made to do service, but frequently thatch is used. When the ground is marshy, the buildings are elevated on posts and a floor is built as rapidly as boards enough can be secured for that purpose” (Fowles, 1910, p. 29).

Bohíos had no flush closet or cesspools and the overcrowding of urban slums, *arrabales*, worsened hygienic conditions. Furthermore, *arrabales* and isolated rural *bohíos* were usually located in cheap or free but risk-prone areas, which complicated emergency maneuvers, overpriced *a posteriori* service provision, and increased vulnerability to landslides, flooding, hurricanes, fire and pests such as mosquitoes, hookworm, moth, termites and flies. For Gov. Fernando de Norzagaray y Escudero (1852-1855), the San Juan *bohíos* were a pile of fuel ready to ignite soon, not houses in which to live really (E. R. Quiles Rodríguez, 2003); similar to precarious housing throughout the island.

Fig.21 Caserío Cantera in Ponce before San Ciriaco



The broken topography of areas available for precarious housing and their usual proximity to risks –including river banks, swamps and mangroves- magnified flash floods and landslides during San Ciriaco, such as Cantera slum. Image: (A. G. Quintero Rivera, 2003, p.12). In it, “all the houses in a radio of more than 200 meters disappeared, displaying a spectacle of dragged houses with more than twenty people out of which many died” (Aráerz Fernando 1903 in Rosario Rivera, 2000a, p. 10).

Fig.22 "One of the happy homes of Ponce, Porto Rico"



For the photographer (Zahner, c.1899), the family represents a typical joyful way of life regardless their unsafe home made with palm leaves and discarded materials, and their precarious clothing.

Fig.23 "Primitive Shipping - unloading Lighters at Playa - Seaport of Ponce"



Public investment in gainful port facilities did not contemplate the welfare of dock workers and longshoremen. Image: (Strothmeyer & Wyman, c.1899).

To conclude this section, I reviewed the built environment emphasized in architectural, planning and policy records until now, as part of public narratives that strengthen or weaken fair remembrance of how differently urban life and disasters were experienced. The case of Ponce is emblematic again, only its central area has been documented in the inventories made by the National Park Service (1976), the Architects Association (1984), the municipality of Ponce and the Spanish International Cooperation Agency (1988); and in academic publications e.g. (Cabanyas, 1986; Rigau, 1992b; Vivoni Farage & Alvarez-Curbelo, 1997; Vivoni Farage & Curbelo Alvarez, 1998). Such one-sided approach undermines a multi-layered and pro-equity learning process about everyday life and crises⁶⁸.

⁶⁸ An exception is the award-winning publication focused on precarious habitat from 1508 to 1900, (E. R. Quiles Rodríguez, 2003).

V.4 Socio-cultural hierarchies, memory and knowledge of disasters

Differentiated vulnerability or resilience to San Ciriaco was also shaped by the contemporary juxtaposition of socio-cultural hierarchies, memory and knowledge of disasters. In turn, socio-cultural hierarchies were rooted in a cultural domination process that sustained the Spanish conquest and colonization of the continent, shortly overlapped with assumptions brought by Americans. Cultural domination was a key initial Ibero-American transnational practice that framed policy-making until it became engrained in everyday life, shaping notions of *habitus* (Bourdieu, 1977). In other words, cultural domination shaped durable structures or frameworks of thought, which influenced individuals and groups to pursue and justify particular paths of action. In this case, a dominant path of action was to use nation of origin, race, class, gender, language and religion to set up an exploitative hierarchy. In turn, that hierarchy shaped rights, resources and obligations. It also shaped notions of imagined communities (Anderson, 2006), which could be endorsed or destroyed. Both aspects influenced disasters.

Discrimination based on nation of origin and race resulted in hispanophilia -a preference for Spain, Spaniards, and Spanish culture- and blanqueamiento -whitening-, two of the highest identity and power markers in Puerto Rico, as in the rest of Latin America (Fuente, 2001; Wade, 1997). Peninsulares -European-born Spaniards-, also called *hombres de la otra banda* -men from the other side- were atop the conquering chain of command, controlling key colonial positions, access to profitable lands and production; and discriminating against criollos -Creoles, their fellows born in the Americas- and more so against people of color. In other words, blanqueamiento was an interrelated marker exerted by peninsulares and criollos against people of

color. They forced to work mostly indigenous peoples but also Blacks, who arrived to Puerto Rico in small numbers as slaves and free men with the first conquerors. Peninsulares and criollos imposed enslaving and exterminating practices through the *encomienda* system, harsher than medieval serfdom, which broke social tissues and justified denial of legal entitlements to indigenous peoples, such as land tenure, access to and control over means of production, and education. In other words, *encomienda* endorsed large scale, lasting vulnerability. Besides, Peninsulares accidentally spread diseases or implemented crushing reactions to revolts, debilitating and annihilating indigenous group⁶⁹. By 1517, the indigenous Caribbean populations were collapsing. Fray Bartolomé de las Casas -Spanish Dominican priest, settler, writer and key source for the early Spanish colony- defended the rights of indigenous peoples in the Salamanca Courts, supported the introduction of African slaves to solve free labor depletion, and succeeded in the passage of the 1542 *Leyes Nuevas* (New Laws) to achieve both. Yet, he later regretted this initiative. Protective measures for the indigenous were rarely implemented, and exploitation of Africans and Afro-descendants became equally brutal, overexposing both to crises -including hurricanes, which he thought were the worst storms of all the world's seas (Schwartz, 2015)-.

Slave trade correlated to the economy, thus, it bloomed in the 18th century when the intensive plantation economy took off. Moreover, in 1766, San Juan became a slave distribution center due to the strategic location of the island. Like in the other Hispanic colonies, population started to increase significantly because of higher birth rates and immigration (Matos Rodríguez, 1999).

⁶⁹ Puerto Rican *Táinos* developed counter-strategies like suicide, migrating to other islands, and hiding in the broken mountainous interior -later called *las Indieras*, Indian lands-. Crossbreeding also took place because most officials, settlers, prisoners and slaves were men.

Slaves⁷⁰ constituted the largest number of immigrants and the fastest growing population segment only due to their record arrival numbers⁷¹. From 1815 onwards, legislation known as *Cédula de Gracias* -Royal Decree of Graces- introduced further ethnic nuances and structural changes in the colonies, with repercussions on the built environment and vulnerability to disasters that lasted until the 20th century. Specifically, it modified trade, property and immigration policies to reinvigorate loyalty to Spain, bolster commerce, agriculture and revenue extraction, and stop emancipation of Blacks as had happened in the Haitian Revolution (1791–1804) and regional revolts. The decree enabled direct trade with nations other than Spain. Filling the Haitian vacuum, Puerto Rican coastal sugar cane exports soared, and the U.S. became a buyer eventually; later, coffee exports rocketed. Also, the decree changed land tenure policies, as White immigrants received land denied to enslaved and free Blacks, and seized from White/*Mestizo* Jíbaro small-scale farmers and *hacendados* underperforming in the new economy. The results were land concentration, and continued ethnic and class inequalities because some immigrants gained a comfortable socio-economic position and even joined the elites; whilst the landless population increased and kept experiencing exclusion, and detrimental working and living conditions (Ismael García-Colón, 2006; Francisco A. Scarano, 1984; Schwartz, 1992) that overexposed them to everyday life hazards and extreme events. Lastly, the decree expanded

⁷⁰Enslaved Blacks were mainly of Bantu and Aka origins, although Yoruba, Luba, Bini, Kimbundu and Ewe-Fon groups are also registered. (Mills-Bocachica, 2003)

⁷¹ Their survival and reproductive rates were low due to overwork; deleterious conditions concerning food, clothing, shelter and medical care; and an imbalance between the sexes, with fewer women than men. There were also prisoners brought to work in military constructions, freed Black Caribbean refugees, French planters escaping or expelled from Saint Domingue –later Haiti- and Louisiana, Spaniards escaping from independence turmoil in Hispaniola -later Dominican Republic-, Canary islanders and Irish migrants searching for work (F. Picó, 2006; E. R. Quiles Rodríguez, 2003).

immigration to increase the power of Whites⁷². Until then, the Puerto Rican African Diaspora was the largest population segment (Barreto, 2001; Matos Rodríguez, 1999). Yet, a distinctively racialized geography consolidated in the island due to accessibility, production, tenure, and internal migration policies. In the less populated mountainous interior, most inhabitants were *Mestizo* or White farmers; although escaped *cimarrones* (Maroons) intermingled. Instead of bringing enslaved or free Blacks from the lowlands using terrible roads when export crops demanded temporary workers, impoverished or landless White, *Mestizo* highlanders and some European immigrants⁷³ were employed. In the more accessible lowlands and coastal plains, a pluri-ethnic society grew faster.

By the 19th century, discrimination patterns had filtrated into nascent notions of proper local identity. Although *hispanophilia* and *whitening* are emphasized in this chapter; gender, creed and language were also used to discriminate⁷⁴. Nation of origin still divided the light-skinned elite and it was discursively distorted to match race. Royal officials and wealthy Spanish families

⁷² Light-skinned immigrants included Catalans, Corsicans, Mallorcans, Italians, French, British, Irish, Germans, Dutch, Danish, Lebanese (including Protestants and converted Jews -to a limited extent-), and also Spaniards and Creoles fleeing from independence struggles in the Caribbean Basin, namely from Venezuela, Colombia, the Dominican Republic and Cuba. (F. Picó, 2006).

⁷³ Canary islanders were often cited as cheap *jornaleros* (rural workers) that could substitute slaves when the trade became complicated. (Matos Rodríguez, 1999).

⁷⁴ A patriarchal mind frame restricted the rights of women of all classes and ethnicities, with degrees of difference. (A. Colón, Mergal, Torres, & Serra Deliz, 1986; Findlay, 1999). An example of creed discrimination was the relative tolerance to Europeans and islanders practicing Protestantism since the mid-1800s; whilst Afro-descendants could be punished with torture and death if found practicing their religions. In terms of language, Spanish pro-assimilation policies and everyday life practices pushed the linguistic integration of immigrants as compulsory. (Barreto, 2001). Consequently, even if Puerto Rico was a multicultural colony, Spanish linguistic homogeneity was the officially promoted norm; a few other European languages –namely English, German, French and Italian- were endorsed for business purposes or highbrow cultural manifestations.

argued their superiority over increasingly powerful light-skinned Creoles⁷⁵. Simultaneously, post 1815 light-skinned immigrants challenged and transformed the traditional Creole landowner elite of *hacendados* o *estancieros* (cattle haciendas owners). Independence ideals emerged along a glorified islander identity (Brau, 1966). Like 18th century nationalist movements forging nation-states in Europe, urban Creole intellectuals selectively idealized rural folk traits, pristine nature, ancient local myths and folklore for their interests. The emerging identitarian rationale could not unify contending Creole factions; its dependency on divisive vectors undermined the chance to cement a shared pro-independence project (Barreto, 2001). Yet, it served to naturalize pre-existing social exclusion (Francisco A. Scarano, 1996), which enhanced selective disaster vulnerability. In other words, wealthy creoles established ‘invented traditions’ (Hobsbawm, 1983) and versions of history that contradicted the past for their benefit. They voiced embryonic notions of nationalist identity in which being an islander was a necessary but also insufficient qualifier to be memorialized, ascend socially or gain access to and control over the economy, politics and ultimately a safer way of life. An incongruous figure of the rural plebeian, *Jibaro*, emerged in literary writings since the 1810s (Francisco A. Scarano, 1996). In the most idealized versions, the imaginary founding culture remained in isolated mountainous areas –where supposedly only light-skinned *jibaros* lived-; although the island conquest and colonization unfolded in the lowlands and coast. It was white affluent *hacendados* -ancestors of elite Creoles- who somehow embodied that founding culture of the *jibaros* though. Thus, the Creole rationalization was to portray poor *jibaros* -like other people of color- as lazy, ignorant, violent and needy of the moral example, control and leadership of the well-off descendants of *hacendados*, the ‘true’ locals destined to rule. Based on racial discrimination, identity narratives

⁷⁵ Racial purity, morality, physiology, lazy attitudes towards work and even long-term exposure to a hot climate created an inferior light-skinned ‘Puerto Rican race’ (Córdova, 1831a).

by Creoles disregarded that initially Taínos and later some *mestizos* and Maroons inhabited the highlands also, negating to people of color a role in the foundational myth. Moreover, Spanish officials and Creoles justified harsh living conditions for Afro-descendants due to fears of racially oriented uprisings. Spain officially abolished its slave trade in 1817, but in the Spanish Caribbean it was known that the Crown would not reduce the slave supply to its colonies (Matos Rodríguez, 1999). In Puerto Rico, the severe *Reglamento de Esclavos* -Rules for Slaves- was enacted by Gov. Miguel Luciano de la Torre y Pando during 1826 (Córdova, 1831a), reinforcing inequity and racism. Around the 1840s, international pressure and reduced profitability decreased the slave trade, but racial exploitation continued. In 1848, Gov. Juan Prim de Prats y González enacted the iniquitous *Código Negro* or *Bando Contra la Raza Negra* -Black Code or Orders against the Black Race-. The code severed the civil rights of Blacks even if they were freed, they could not leave their working haciendas; if they were carrying unauthorized weapons immediate death penalty could apply; cultural manifestations such as music, dancing and religious practices were physically punished –death included-. Slavery ended in 1873, later than in most former Hispanic colonies due to the Crown and elite’s resistance.

As a result of such embedded discrimination, it was possible to justify and even naturalize to have a large ‘surplus’ population enduring precarious living and working conditions, job and food insecurity, lack of education and high health risks and, consequently, vulnerable to disasters. For instance, public investment in profitable port facilities had no redistributive effects; dock workers and longshoremen kept facing unstable jobs, low salaries, long hours and dangers which could lead to disease, injuries, permanent disabilities and death (Brau, 1966; Á. G. Quintero Rivera, 1988). The emerging labor movement, particularly sugar workers, organized

strikes since the 1890s. Yet, working and living conditions in sugar and coffee estates were likened to those during slavery (Fowles, 1910). Low wages were commonly paid with tokens and vouchers valid in the plantation store only, enabling abuses. In addition, global downturns of crop prices reflected in critical job insecurity for the poor. For instance, although the quality of Puerto Rican coffee made it a favorite import of the Vatican; Central American and Brazilian exports gained market share based on cheaper wages since the early 1890s. Consequently, in Puerto Rico plantation maintenance diminished, planters advocated even lower wages, and the growing precariousness of highlanders propelled their exodus towards new slums in urban areas or abroad⁷⁶. Food insecurity was another pressing problem by the end of the 19th century, as the crop export and livestock economy turned Puerto Rico into a food importing island. Around that time, almost a quarter of the island surface, 500,000 acres was cultivated; but only 100,000 acres produced foodstuff (Buitrago, 1976); which was insufficient for local demands, transported with difficulties or rotted on the way. Thus, the poor subsisted on a limited, unreliable and expensive diet. Public education levels were extremely low⁷⁷, illiteracy remained a key barrier for social mobility; Spanish was the official language of public education and there was limited teaching of local history as the curriculum was pro-Spanish (Brau, 1966). Finally, the following diseases were widespread amongst the poor: smallpox, enteritis – e.g. dysentery, diarrhea, and typhoid fever-, lethal infantile tetanus from unhygienic midwife practices, inanition, tuberculosis, dengue fever, malaria, anemia, hookworm-anemia, precarious dental health, venereal diseases, and addiction to tobacco and alcohol - sometimes to minimize hunger- (Fowles, 1910). Malaria exemplified the link between vulnerability, poverty, precarious health and infrastructure. Lack of

⁷⁶ Since the early 1870s, destitute peasants emigrated to Cuba, Santo Domingo, Panamá and Venezuela to work as cheap labor (Martinez, 1984).

⁷⁷ An example of unequal access to formal culture is the neoclassical high-brow theater La Perla in Ponce, which received public funding when basic literacy levels were dismal.

potable water infrastructure was patched with domestic open storage -such as cisterns and barrels-, which in turn provided habitats for disease-carrying mosquitoes. Without a disaster, malaria ranked third in the mortality table; it was most prevalent in the lowlands and one-fourth of its inhabitants were estimated to have it (Espinosa, 2000). Poor islanders were often accused by Spaniards and Creoles -and later by Americans- of being lazy, predisposed to nap and elude efforts without any connection to their ill-prone, structural living and working conditions. In sum, pro-independence creoles promoted local culture and identity claims that endorsed exclusionary and vulnerability-enhancing conditions, and excluded the construction of hurricane memories and awareness.

San Ciriaco happened months after the U.S. took over Puerto Rico from Spain, thus, it was a very short but revealing time period to foresee social hierarchy trends. U.S. military, reporters, missionaries, administrators, researchers, investors and lay citizens were building a data base through censuses, maps, diaries, letters, reports, photographs, drawings, postcards, cartoons and even silent black and white films. An imagined community of exotic inferior others was being sculpted and would influence regulatory frameworks, investment, planning and disaster relief:

“When the Americans took possession of the island, Porto Rico was, like all true Spanish-American countries, quaint, quiet, picturesque, and with an indefinable charm or “atmosphere” impossible to picture or describe. For 400 years the people had lived in more or less the same manner, their homes were of Spanish or Moorish style, their lives were simple, their wants few, business worries, financial reverses or competition troubled them not. No one gave a thought of tomorrow, and bullfights, cockfights, dances, and the lottery were the amusements of the populace”- Alpheus Hyatt Verrill, zoologist, explorer, inventor, illustrator and respected author of travel books (Verrill, 1914, p.12).

“We have accepted these people as our share of the burden that the strong must bear for the weak; we will keep them alive; we will lead them slowly, gently toward the light, and finally in half a hundred years they will catch the first glimmering ray which will show them what our standards are and what we wish theirs to be”- Major John Van Hoff, San Ciriaco Relief Director and President of the San Juan Charity Board (in Schwartz, 1992, p. , p.322).

“They [Porto Ricans] sin, but they sin only as animals, without shame, because there is no sense of doing wrong... They are innocently happy in the unconsciousness of the obligations of morality. They eat, drink, sleep, and smoke, and do the least in the way of work they can. They have no ideas of duty, and therefore are not made uneasy by neglecting it” (Gov. Davis 1902 in Findlay, 1999, p.n.a.).

New rulers also questioned the higher standing of Creole elites, they had to:

“be considered in an entirely different sense from European and North American whites. They represent a genus of their own, the Porto Rican whites” -Spokesperson of the Young People’s Missionary Movement of the United States and Canada (Fowles, 1910, p.22).

Yet, poor Puerto Ricans of color got the worst brunt of discrimination, even from doctors:

“These lower classes are a mixture of Spanish, Indian and negro blood, the latter predominant. Many are pure negroes. Generations of an unfed, unsanitary, and immoral life have produced a race short statured, flat chested, and physically weak, as a general rule. Like children, they have never been accustomed to think or do for themselves and have little stamina, becoming in the face of disease or misfortune passive and apathetic” –W.W. King, Assistant Surgeon of the U.S. Marine-Hospital Services making a post-San Ciriaco medical assessment (King, 2006 (1900), p.39).

Constructive descriptions about underprivileged Puerto Ricans are rare. Yet, a Princeton University student, drafted in the Spanish-American War, depicted a positive viewpoint that would have been valuable if translated into policy-making:

“While in Porto Rico I had a very fair opportunity to see a little of the country, and also of the people, and I was very favorably impressed with what I saw. We must not forget that for 400 years the island has been under Spanish rule, and that the chance for internal improvement has been very small. The people are very intelligent, and seem very ready and willing to learn. We had working under us some 150 natives, and I was surprised at the amount of work one would do and at the spirit with which he would do it. Another thing which surprised me very much was the cleanliness of the people. I had been lead to believe that the reverse was true. It was the rule and not the exception for our natives to come to work every morning in clean white shirts and clean blue overalls. I may say that I never had such washing done as I had down there. Chemicals are unknown, and the dirt is removed in the primitive way — beating with a paddle”. W. Brokaw Bamford, Sergt. 1st U. S. Volunteer Engineers Co.l. Third Battalion Peekskill N.Y. to Ponce, Yauco and Guánica (Bamford 1900 in Libbey, 1899, p. n.a.).

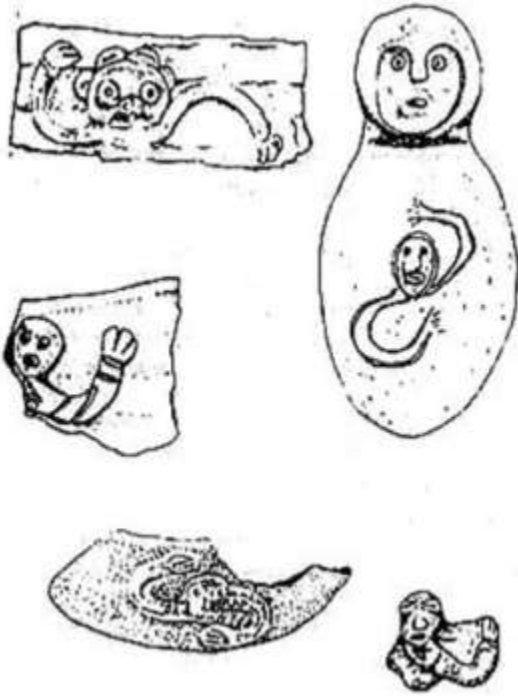
Moreover, newcomers endorsed the opposite view of *hispanophilia*, the islanders' Spanish blood and legacy was a disqualifier for self-rule. They had only been exposed to Spanish superstition, corruption and tyranny -a bag of undesirable characteristics of the Spanish Empire, latter termed *Black Legend*-; thus, they were unable to shape their own destiny without years of education and guidance (R. Fernández, 1996). Other relevant hierarchies were creed and language. U.S. missionaries were encouraged to disseminate their evangelic faith, substituting what was seen as retrograde Catholicism allied to Spain (R. Fernández, 1996). A pro-US curriculum and the use of English as official medium of instruction were non-negotiable (Barreto, 2001). In terms of gender, most fundamental patriarchal assumptions and rights were maintained, though less blatantly (Findlay, 1999). In sum, the new regime imposed its version of hierarchy also based on country of origin, class, race, religion, language and gender. On the ground, policy views essentially oscillated between benevolent or protectionist paternalism overlapped with the new hierarchy, which called for educating the ignorant and abandoned populace in the 'right American way'; or derogatory and supremacist assertions, which justified disciplining people prone to vagrancy.

Other relevant social factors for disaster vulnerability were changes in the memorialization and knowledge of disasters. Since the early colony, multiple sources commented on climate data and storm impacts in Puerto Rico; with varying degrees of religiosity, accuracy, consistency and scalar coverage. Yet, cultural domination gave to Spaniards and Creoles the power to determine what is called the politics of remembrance and forgetting (Appadurai, 1996). They promoted a historical inability of subalterns to speak (Spivak, 1988), to be acknowledged and empowered in the public sphere. As part of purposeful rejection, cultural traditions and experiences pertaining

to marginalized people were systematically excluded from memorialization in discourses, representations and spatial interventions. A grave example was the destruction of indigenous grassroots knowledge to forecast the weather⁷⁸. Hurricanes and storms were a common link among indigenous Caribbeans, who associated disasters with supernatural deities, as other cultures throughout history. Hurricanes were most prominent because of their frequency and destructiveness. Taínos, Arawak and Caribs worshiped and gave offerings to a mighty deity in control of hurricanes, which could be associated with chaos, weather and wind. Some groups even held that god as creator of the Antilles, another interpretation was that winds separated the islands and kept shaping their contours (Schwartz, 2015). The god was known as *Ouragan*, *Hurakan*, *Harakan*, *Furacan*, *Furican*, *Haurachan*, *Herycano*, *Hurachano*, *Hurricano*, *Kulakani*, *Jurakan* or *Jun Raqan*; and the origins of the name remain uncertain. For Mayans, *Hurakán* was a leading deity, along with *Cabrakán* –earthquake- and *Chirakán* –volcano- (Mulcahy, 2006). In Cuban and Dominican Republic Pre-Columbian mythology, an irate Cemí or goddess called *Guabancex* was the ‘Rider of the Winds’; she unleashed destruction along her twin male accomplices *Guataubá* -the announcing thunder - and *Coatrisque* -the ensuing flood- (Gutiérrez Calvache et al., n.d.). Archaeologists have found Cuban petro glyphs and ceramics representing hurricanes with a central rounded and angry head, like the vortex; and twisting outstretched “S” shaped arms protruding from its shoulders or temples, like opposing wind rotation. Such simplified imagery resembles what Sir William Reid confirmed in his 1838 seminal meteorological work ‘The Law of Storms’, to satellite and radar snapshots (Auld/Powhatan, 2007; Schwartz, 2005), and to the current international symbol for hurricanes.

⁷⁸ This research did not find works that clarified extensively how Pre-Columbian Puerto Rican peoples adapted to disasters. Examples of this kind of research concerning Andean pre-Columbian population focused on five aspects: 1) controlling multiple ecological levels; 2) establishing disperse settlements; 3) using techniques and materials suitable to their risky environment; 4) preparation; and 5) ideology and modes of explanation. (Anthony Oliver-Smith, 1994).

Fig.24 Cuban petro glyphs of Guabancex



(Guarch & Querejeta, 1992).

Fig.25 Guabancex riding over hurricane Katrina



(Auld/Powhatan, 2007).

Táinos preferred root crops such as malanga, yautía or yucca due to their resistance to storm damage; in some islands they marked the passing of time through ceremonial dances *-arritos-*, singing about the worst hurricanes and the feats of their ancestors; and, later, their low built thatched roof huts seemed to withstand better wind forces than Spanish-built houses (Schwartz, 2015). Puerto Rican Táinos believed that *Hurakán*, the evil outsider, had its local good counterpart, *Yuquiyú*, who protected the island using as a blockade his home, the sacred mountain of *El Yunque*. Later, broken topography and dense vegetation turned *El Yunque* into a refuge for indigenous and maroons escaping Spanish colonizers. In modern times, it became a National Park and a cherished identitarian symbol, sometimes seen as a mystic place with a reputation as an ancestral hurricane barrier. The implicit assumption that elevated topography acted as a hurricane obstacle was scientifically confirmed with novel technology during

hurricane Santa Clara (1956)⁷⁹. After hurricane Hugo hit the northeast coast (1989), the notion of El Yunque as a storm barrier reemerged informally and in a book for children (Rodriguez Martinó et al., 1993). Also, indigenous in Puerto Rico and Caribbean region knew the signs of impending storms:

“The Indians of this island predicted this sad catastrophe and they took it for granted whenever they observed the air perturbed, a red sun, a deaf noise underground, the stars halos darkened by a vapor that apparently enlarged them, the northeast horizons closed, a strong odor coming from the sea, the way in which the sea got up in the middle of tranquility, changing the wind from east to west suddenly. The experience of those fearful events had taught them to observe mutations in the stars and elements, and prognosticate such fatal phenomena”(Abbad y Lasierra, 1866, p. 430).

Modern meteorologists would confirm a similar description of arriving hurricanes:

“The physical features of hurricanes are well understood. The approach of a hurricane is usually indicated by a long swell on the ocean, propagated to great distances, and forewarning the observer by two or three days. A faint rise in the barometer occurs before the gradual fall, which becomes very pronounced at the center. Fine wisps of cirrus-clouds are first seen, which surround the center to a distance of 200 miles; the air is calm and sultry, but this is gradually supplanted by a gentle breeze, and later the wind increases to a gale, the clouds become matted, the sea rough, rain falls, and the winds are gusty and dangerous as the vortex comes on. Then comes the indescribable tempest, dealing destruction, impressing the imagination with the wild exhibition of the forces of nature, the flashes of lightning, the torrents of rain, the cold air, all the elements in an uproar, which indicate the close approach of the center. In the midst of this turmoil there is a sudden pause, the winds almost cease, the sky clears, the waves, however, rage in great turbulence. This is the eye of the storm, the core of the vortex, and it is, perhaps, 20 miles in diameter, or one-thirtieth of the whole hurricane. The respite is brief, and is soon followed by the abrupt renewal of the violent wind and rain, but now coming from the opposite direction, and the storm passes off with the several features following each other in the reverse order” (Monte, n.d., p. 38).

Hurricanes were a new ontological problem for European settlers. They did not match classic or biblical understandings of the universe, leading to disagreements between theologians, natural philosophers and popular interpretations; for instance, until the 18th century, they were associated

⁷⁹ The eye of that hurricane weakened as the Central Mountain Range slowed the lower part of the system and the upper part continued its forward displacement, altogether wind velocity decreased; when leaving the mountains though, the eye recuperated its structure and widened (R. J. Grace, 1956).

with earthquakes due to changes in the terrain or currents beneath the earth, based on Aristotelian meteorology (Schwartz, 2015). Moreover, during the 16th century, divination and prognostication were perilous endeavors; assumptions based on stars, planets and celestial activity to assist human decision-making got in the way of God's will or was directly related to diabolic powers. A papal bull of 1586 discredited and condemned magicians, palm readers, conjurers, seers, diviners and the like; although a relative tolerance applied to practical matters such as medicine, navigation or agriculture (Schwartz, 2015).

The connections between hurricanes and religion were not completely straightforward; even in the 16th century, some observers believed that storms were natural phenomena and not specifically Godly punishments (Schwartz, 2015). However, a religious characterization prevailed. The typical explication of the early Spaniards colonizers was that the indigenous skill to forecast hurricanes showed witchcraft or, even worse, a pact with Satan that ought to be chastised. As early as 1550, not long after three hurricanes diluted the prospects of settling in Puerto Rico, the Governor ordered an Indian punished for sorcery because he had calculated the arrival of storms (Schwartz, 2005). Similar destruction of indigenous know-how leading to increased hurricane vulnerability were noted in Saint Christopher and Yucatan (Campos Goenaga, 2008; Schwartz, 2005). Under Catholicism, it became traditional to begin the rainy season with the prayer '*Ad repellendas tempestates*', 'For the repelling of Tempests' (Neely, 2006, p. 3), celebrate processions begging for God's protection, and invoke God, the Virgin Mary and saints during a crisis. The Roman Catholic calendar provided storm names matching saint and day of landfall. Churches and chapels were improvised storm refuges and relief distribution centers (Molina Casanova, 1988), given their sturdiness compared to most housing,

the prominent role of religion and the lack of public secular shelters. Priests brought to the Americas the idea that the Holy Sacrament and relics could overpower storms. For instance, in 1645, the Synod of San Juan realized that the Blessed Sacrament had been removed from its monstrance and put outside the church to ward off storms (Schwartz, 2015); despite his prohibition, this action would be repeated during extreme emergencies. On Palm Sunday, palm fronds were blessed in church and then placed in porches and windows of homes to repel storms, or even burned so that the fumes would break up the skies; this tradition lasted in Puerto Rico and Cuba until the beginning of the early 20th century (Schwartz, 2015). Rural colonizer –often illiterate- transplanted their world views also to forecast storms, including observations of changes in animal behavior, vegetation, weather and celestial bodies. Given the lack of alternative explanations, some of those ideas and practices metamorphosed and found their way to influence mainstream society until the 1950s, as chapter VII will examine.

Moreover, there were manifold discursive manipulations by religious authorities and parishioners to explain disasters as God’s punishment for the sins of impious or degenerate people. On the island, the later usually meant impoverished highland *jíbaros*, among whom inbreeding was frequent due to geographical isolation. It also meant Africans and their descendants, practicing forbidden religions and traditions seen as satanic. When San Ciriaco hit, a new group people deserved God’s rage; the immoral and ungrateful traitors of Spain supporting the U.S., according to the influential pro-Spanish Dean of the Diocese of Puerto Rico, Don Juan Perpiña y Pábernat:

“Nobody unaffected by the most repugnant Atheism, Materialism and Naturalism could deny to us that God has sent us the terrible lash on the 8th, as a punishment for our defections...and do not say that this Island does not carry sins that could have attracted such grave and deep

affliction. We believe that it carries large sins, and very large ones since the day of nationality change” (Perpiña y Pábernat 1899 in Ortíz Díaz, 2000, p.85).

In sum, Spanish beliefs and interpretations were superimposed over indigenous superstitions and empirical knowledge in the name of religion and civilization. Contrastingly, there are no records of Americans associating religion, sins and hurricanes. Since their arrival had taken place a few months before, their impact on the memorialization and knowledge of disasters is not chronicled, possibly because it was negligible compared to urgent priorities of the new regime setup.

Meanwhile, meteorology as a modern field emerged in the 18th century; the increasing relevance of Caribbean exports and colonial struggles eventually motivated a pragmatic investment in scientific knowledge to prevent and mitigate losses, and dominate the region. The precursors of Caribbean climatological studies were located in Cuba, because of the earlier development of academic institutions⁸⁰. In 1847, Desiderio Herrera Cabrera published ‘Memory of the Hurricanes on the island of Cuba’ (Lines Escardo, 1998); while the Cuban intellectual Andrés Poey y Aguirre was compiling in Paris the first, lengthy and meticulous bibliography and chronology of Caribbean hurricanes (Poey, 1862). Back in Havana, Poey embarked on a frustrating quest for local data and public subsidies to establish an observatory; which he ended up self-funding briefly in his house. In 1856, the Spanish government appointed him to found the *Observatorio Físico-Meteorico* (Physical-Meteoric Observatory) of Havana; yet, the same government ceased him a few years later, and he moved abroad which slowed the development of meteorology on the island. Overall, the emerging discipline began to list chronologically the path and strength of hurricanes versus their timing; damages to life and property, technological

⁸⁰ For instance, the University of Havana was founded in 1728 and the Royal Academy of Medical, Physical and Natural Sciences of Havana was founded in 1860. Contrastingly, the Universidad de Puerto Rico, the first university on the island, was founded in 1903.

changes for storm measurement; without implications for disaster management or planning. Those records became the preferred format to remember hurricanes; they provide rustic, imprecise yet valuable glimpses to the extreme exposure of the Circum-Caribbean region. Yet, those records disregarded root causes of vulnerability or resilience, most affected or unscathed groups, tensions during relief and reconstruction. A grave flaw of this recordkeeping is that it built generic memories of hurricane impacts, when in fact different groups had diverse levels of resilience or vulnerability. Citizens appeared as a block, which hid injustice and distorted the information that leaders and policy-makers used; ultimately, generic accounts blurred the need for structural changes.

The influence of Catholicism was present even in early meteorology, with the observatory established in 1857 at the Jesuit *Real Colegio de Belén*, Havana. In 1860, the *Observatorio Físico-Meteorológico* was moved to the Royal Economic Society and later relocated to the Universidad de La Habana (Lines Escardo, 1998). In 1870, the Catalan Jesuit priest and meteorologist Benito Viñes Martorell (1837-1893) took over the decaying Belén Meteorological Observatory. Following the contemporary scientific emphasis on data that could be quantified or observed, he developed influential theories known as ‘The Laws of Viñes’ and other publications (Benito Viñes Martorell, 1877; Benito Viñes Martorell, 1877; Viñes Martorell, 1877-78, 1886, 1894). By 1873, he had established the first hurricane warning system in the world, integrating data sent by hundreds of volunteer observers on ships and on the ground, and announcing storms to neighboring islands via telegraph and to isolated Cuban villages via a “pony express” service (Arsenault, 2005). In 1875, Viñes’ accurate and free of charge forecast of an impending storm circulated in the local press, solidifying his public reputation and connections with scientists

worldwide; and the U.S. government contracted to receive his daily cable reports to improve its precarious meteorological service. Viñes became a world authority on weather forecasting and his theories remained intact until WWII, when new technology enabled their refinement. His presentations at the Royal Academy of Medical, Physical and Natural Sciences of Havana included regional cutting-edge data, field observations and prognostics. Viñes first visited Puerto Rico months after hurricane San Felipe I, which made landfall on Sept. 13, 1876. He disembarked in Mayagüez, where the hurricane had left; and he went on to study the vortex track (Lines Escardo, 1998). Next, he gave lectures, conducted detailed field research and worked on establishing an observatory in San Juan. His second and last visit was in 1882; he supervised the installation of the *Observatorio del Colegio de los Jesuitas*⁸¹ and trained assistants in the use of state of the art instruments. His goals were to refine data collection to forecast storms, distribute it locally to diminish losses and send it by cable to his observatory in Havana to build comparative regional knowledge. Yet, his observatory lasted four years only; Jesuits were expelled from Puerto Rico for political reasons and his instruments were shipped to a Jesuit school in Quito, Ecuador (López de Santa Anna, 1958). By 1899, his warning system remained mainly funded by private sources, such as insurance companies, merchant associations and shipping concerns; which reveals multinational governmental disengagement to protect citizens from storms (Arsenault, 2005). A day before San Ciriaco made landfall, marine flag signals for ships were ordered at Aguadilla, Arecibo, Arroyo, Fajardo, Humacao, Mayagüez, Ponce and San Juan (E.B Garriott, 1899). Those belated and meager precautions reconfirm the raw state of meteorology and warning, key components of disaster management, leaving Puerto Rico unprepared for a devastating storm.

⁸¹ Currently the Health Department, next to Sagrado Corazón church in Santurce.

V.5 The 1867 San Narciso hurricane-seismic crisis: flawed relief, Spanish decline

Disaster management emergence and the value of San Ciriaco relief implemented by Americans are best understood vis-à-vis a baseline, the San Narciso hurricane-seismic crisis; which is the worst preceding emergency handled by Spanish colonial administrators; poorly recorded and understudied, but revealing. It took place in 1867, after a drought that affected crops, several storms (NOAA/AOML, n.a.), the devastating landfall of hurricane San Narciso⁸² on Oct. 29th, a terrible earthquake⁸³ and a large tsunami⁸⁴ 20 days later, and aftershocks that lasted roughly six months and worsened landslides and destruction. Interim Governor Lieutenant General José M. Marchesi y Oleaga wrote to the *Ministerio de Ultramar* (Ministry of Overseas):

“Your Excellence Sr.: A terrible incident is filling with horror and desolation the unlucky inhabitants of this Island, barely recovered from the painful impression caused by the last hurricane. The [earthquake] shock was so energetic and terrible that the building of the Royal Fortress [La Fortaleza] in which I live, and that is perhaps the most solid in town, moved like a boat agitated by a thick sea, crashing furniture among themselves and balancing the walls with incredible violence. Immediately I threw myself into the street and I traversed the entire town, the most heartbreaking spectacle was offered to my sight. Men and women were on the streets and squares down on their knees begging with screams for divine clemency, while the earth, without ceasing its tremors agitated buildings, which threatened every instant to bury us under their ruins” (Marchesi y Oleaga 1867, slide a).

The epicenter was located between Puerto Rico and St. Croix, U.S. Virgin Islands; thus, eastern Puerto Rico was most affected. However, reports from San Juan mentioned residents leaving town due to the extensive destruction of homes, infrastructure, official and religious buildings. In the south, the churches of Coamo, Gurabo and Juncos were rendered unusable; the church of Guayama was wrecked and its roof collapsed. Crevices opened in the countryside and nearly all

⁸²Circa 211 flooding and 600 drowning casualties, 50 ships sunk in San Juan Bay only.

⁸³ Its approximate magnitude was 7.5 on the Richter scale.

⁸⁴ It ran inland almost 490 feet in the coast of Yabucoa.

plantation smoke stacks were ruined (P. G. Miller, 1922; United States Geological Service, n.a.). Most of the buildings reported as damaged were made out of masonry or brick, expensive materials resistant to storms and hurricanes, unlike formal but flexible wood-framed housing or precarious *bohíos*. Yet, sturdy buildings could not withstand elastic demands posed by seisms, resulting in life-threatening collapses and weakening of scarce public institutions, infrastructure and services. I could not find parameters of human and economic losses but, in sum, a complex emergency took place; the unlikely worst case scenario of multi-hazard exposure happened in less than a month. People and the built environment were unprepared to deal almost simultaneously with recurring threats posing equal and diverse challenges, magnified by their overlap.

In the 16th Century, the Spanish crown provided tax relief and other privileges in response to disasters, although relief was conceived of as a responsibility of the Church and charity (Schwartz, 2015). By the 18th century, municipalities were the first line of relief providers in the Spanish Caribbean colonies (Johnson, 2005), given the asymmetry and disconnection between local institutions and either the distant administrators in Madrid or the alien insular governments. In the late 19th century, handling disasters was a training-ground for local politicians; it promoted action and autonomy although plagued by structural biases and mainly centered on *a posteriori* patchy practices. The crises had become vehicles of municipal communication with the higher powers, including the metropolis, to negotiate support and power correlations (Schwartz, 2005). Effective or not, the municipalities were in place and the Spanish government was supposed to undertake at least reactive measures to assist them during critical situations. Second in the line of relief were Catholic authorities, who imposed their biases of what caused disasters and who

deserved help. Third were sporadic charity actions by wealthy citizens, whom by discursively naturalizing injustice often felt no duty to engage, and less so promote redistributive policies. In other words, the main assumptions of the roles of governments and citizens were that the island government and particularly the Spanish Crown should not intervene in what were understood as local natural crisis or God's wrath towards sinful people. Municipalities had to undertake relief and reconstruction to compensate for governmental disengagement; whilst religious entities and charitable citizens could engage and impose their prejudices without oversee or accountability. Citizens had no right to relief provision, decisive for survival.

The 1867 crisis revealed the Spanish colonial disconnection from local needs and lack of sensitivity during an extreme catastrophe. It also exposed that its extractive model enabled multi-hazard vulnerability of the poor, who constituted the majority; and endangered even the prosperity of organized Creoles, which in political terms was more evidently menacing to the Crown. Some of them launched liberal reforms, pro-independence debates and associations since the 1820s; despite threats of repression, jail, exile or death. After losing several territories in the Americas, during 1865, the Crown established in Madrid a *Junta Informativa de Reformas de Ultramar* (Overseas Informative Reform Board) to collect and vote complaints from colonial representatives, as a mechanism to mitigate increasing discontent. Yet, the majority of men on the Board were Spanish-born delegates, who boycotted most measures suggested by colonial delegates, including Puerto Rican Creoles (Moscoso, 2003). Back on the island, delegates discussed their failed efforts with their peers, which ignited a call for armed rebellion led by Dr. Ramón Emeterio Betances and Segundo Ruiz Belvis. In 1867, the Crown representatives did not enact the promised and more autonomic "*Leyes Especiales*" (Special Laws), taxes increased and

the militias continued their repressive policing. To make matters worse, in June, the Governor ordered the arrest of prominent liberals under the excuse of a soldier mutiny. Although they were subsequently released by popular demand, the incident left a bitter imprint.

Just a few months later, the disasters left many Creole planters and merchants broke, frustrated and unable to pay their municipal taxes. Consequently, most municipalities were unable to pay their contributions to the island's treasury and launch successful post-disaster actions, which worsened human suffering and economic misfortune. A new and disaster-inexperienced Governor arrived in December, General Julián Juan Pavía Lacy. Adding insult to injury, Pavía demanded overdue municipal payments due to increasing expenses, which stirred protests; even some Spanish officials described Puerto Rico as an agonizing territory (Schwartz, 1992). He also demanded taxes and payments for the right to import goods for consumption. Both ideas were eliminated later; yet, tension remained on the air. I found no data concerning disaster relief, possibly because it was not systematized or records have been lost.

Lack of planning and investment was evident even for a royal commission soon established to investigate the calamity. According to them, only about 3 percent of government expenditures in the preceding decade financed public works or infrastructure that would have minimized calamities. Miguel de Campo, a Spanish official, argued that lack of public utility works reinforced the Creoles' perception of the administration as immoral, hostile and foreign. Such negative perception strengthened the Creoles' reluctance to pay taxes for purposes unrelated to their needs (Schwartz, 1992). Also, it weakened their feeble loyalty, given the Spaniards imposition of social and cultural discrimination, and limits to their economic and ruling

ambitions. Ample grass-roots dissatisfaction was emerging also. Thousands of unemployed rural and urban workers could die of starvation, engage so-called subversives of the public order, or challenge norms and legislation that guarded private property and the better-off (Schwartz, 1992). In that light, deplorable post-disaster conditions were a catalyzer to fight colonialism; it was time to save the regime and its prestige. For José Lianhes, an official writing to the Board of Public Works, policy changes should comprise extensive reconstruction of bridges, docks, roads and public services to:

“demonstrate clearly to the country the interest which the government takes in it, leaving as permanent proof works that contribute to the wealth and well-being of its inhabitants” (Schwartz, 1992, p. 318).

In September of 1868, before reconstruction policies were decided and implemented, the failed insurrection of the *Grito de Lares* (The Cry of Lares⁸⁵) was launched in the highlands. The disaster crisis has been interpreted as an extra motivation to coalesce around a pro-independence armed struggle (Schwartz, 1992). Such claim needs further research, which could finally emerge after more than a century in which the chief historical narratives followed the seminal although subjective work of contemporary Spanish journalist José Pérez Morís⁸⁶.

After the *Grito de Lares*, the Spanish regime alternated political concessions and repression, and implemented new projects with a high degree of variability; all of which are difficult to correlate exactly to the disasters crisis, local political upheaval, changes in Spain or even the mood of the Governor in turn. For example, early in 1869, Governor José Laureano Sanz y Posse (1868-

⁸⁵Also called the Lares revolt, Lares uprising, Lares rebellion or Lares Revolution.

⁸⁶ The latter underreported the insurrection, popular support and subsequent skirmishes in places such as Utuado, Adjuntas, Las Marías, Bayamón, Ciales, Toa Baja and Vieques (Moscoso, 2003).

1870) dictated a General Amnesty which saved the lives of *Grito de Lares* prisoners, granted their liberation and right to exile⁸⁷. Also, the island obtained more political autonomy; Puerto Ricans regained the right to elect representatives to the Spanish Courts, and political parties were allowed, which resulted in the formal establishment of the *Partido Conservador* and *Partido Liberal-Reformista* (Conservative and Liberal-Reformist parties respectively). Free press and the right to meetings were granted, under light censorship. The Civil Guard was created whilst the feared militias were abolished in 1874. Infrastructure repairs and reconstruction included new metal bridges over the Portugués River in Ponce, the Yagüez River in Mayagüez, the Cagüitas River in Caguas; rebuilding city halls in several municipalities, and investment in the telegraph and mail systems (Fundación Puertorriqueña de las Humanidades, 2010). Yet, on his second term, Gov. Sanz y Posse (1874- 1875) eliminated the first article of the Spanish Constitution, which granted the individual rights of subjects; banned political associations, and reinforced tight censorship. He continued constructing highways and bridges, and rebuilding earthquake-struck churches. Under the brief rule of Gov. Romualdo Palacios González (1887), a commission proposed to cease the sugar export rights of Creoles, and declare exclusive shipping rights between Spain and the overseas colonies. Moreover, his persecution of the Autonomist Party members was so extreme that 1887 was known as ‘the terrible year’. Next Governor, Juan Contreras Martínez (1887-1888), reestablished guarantees of personal rights, put in effect the Regular Courts and relocated the Civil Guard (Fundación Puertorriqueña de las Humanidades, 2010). The following Governor though, Pedro Ruiz Dana (1888-1890), increased censorship through the *Ley de Imprenta* (Print Law), which closed autonomists press such as *El Agente* (Cortes Zavala, 1997) and infuriated local leaders. Thus, after the San Narciso hurricane-seismic

⁸⁷ Some of them moved to the U.S. and launched lasting pro-independence associations, which lauded the U.S. civil liberties, constitutional rights and economic growth as the standard to which the future nation of Puerto Rico should aspire to. Thus, they promoted the image of the U.S. as a pioneering democratic nation.

crisis, the political scene was a roller-coaster for decades. Yet, none of the historical records consulted points to changes in the understanding of disasters as a governmental responsibility that required sustained investment and planning, to decrease hurricane vulnerability. The implicit message was that, severe destruction and political changes aside, the regime considered unnecessary to shift the equation of resource extraction towards proactive and systematic forms of planning and investment that protected the survival of Puerto Ricans as a basic right.

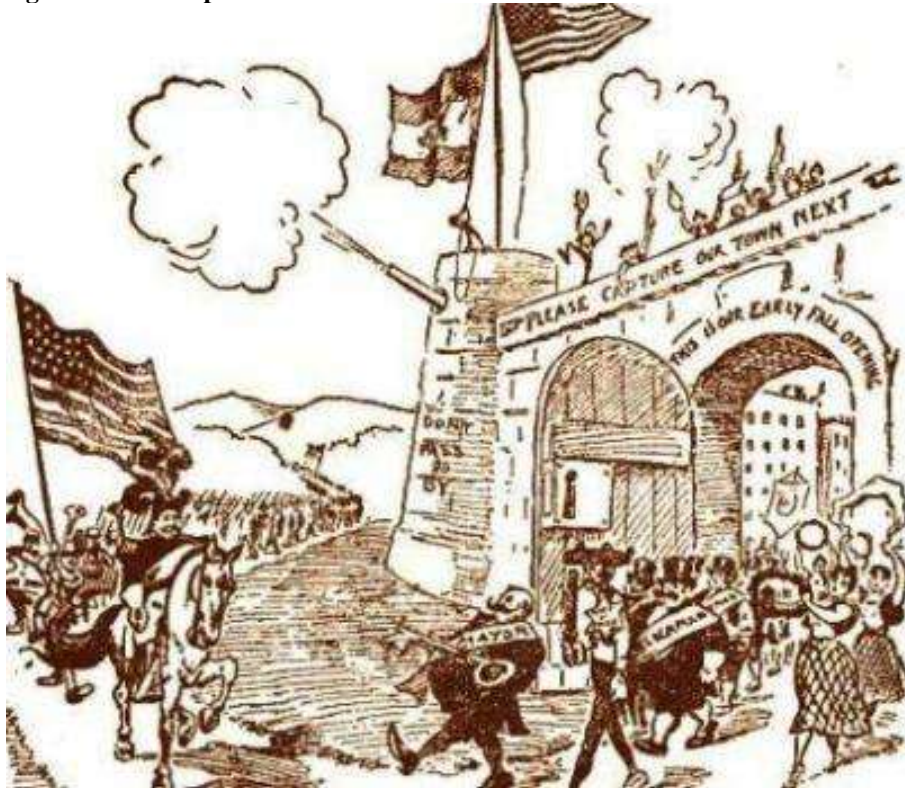
Tellingly, two years before the U.S. invasion, the pro-independence and liberal Ponce Press organized a literary contest, won by the novel ‘*Huracán. Leyenda Puertorriqueña*’ (Hurricane. Puerto Rican Legend) (del Toro Soler, 1897). It was based on the folktale of Roberto Cofresí, a mythical southern Mulatto pirate active during the turn of the 18th century; he resisted tight Spanish vigilance and iterative storm fury at sea, to the point of being considered a hurricane himself. According to the fable and the novel, Cofresí was caught and killed; yet, he became a popular emancipatory symbol. In other words, pro-independence journalists and intellectuals backed a narrative of respect to a local confronting Spain and hurricanes, the barriers impeding Puerto Rico to become a nation.

The Spanish-American war erupted in 1898; predictably, few skirmishes broke in Puerto Rico to express alliance with the Spaniards and rejection to the Americans. Lay citizens and organizations expressed fear, disorganization but also approval of the U.S., which an American military correspondent attested:

“We went to Porto Rico expecting battles. We arrived there and were invited to receptions. It was a somewhat incongruous situation, with a side which savored of the opera house. Such of our enemies had been stationed in the vicinity of our landing, made a hasty and undignified exit, with only an occasional shot as they ran. The people bade us welcome, hung out American flags,

and called down the blessings of Heaven upon our heads. Like all invading armies, we had carried with us a very large spirit of belligerency. We were much puzzled to know what to do with it when we got to Porto Rico”(Gardner Robinson, 1899, p.47).

Fig. 26 "Please capture our town next"



In this satire cartoon, Puerto Ricans welcome the invading army. The U.S. flag ascends, the Spanish flag descends, weapons are shot to celebrate; a hospitable procession is led by the mayor and officials wearing their regalia, and women in Spanish-like attire bringing gifts. City gate and walls show pleas: "Please capture our town next", "Don't pass us by", "This is our early Fall opening" (n.a. circa 1900 in EEPR 2011).

The newcomers' presence embodied contrasting meanings (Meléndez, 1993; Quintero, 1986; Silvestrini & Luque, 1991). Some locals saw it as a promising inclusion into the idealized, enlightened first democracy of the New World -the 'Colossus of the North'- which would cut ties with oppressive Spaniards, replenish the war-stressed economy, generously open markets and launch progress. For others, it was a step towards independence. According to a third viewpoint, a new brand of colonialism was unfolding. After the Treaty of Paris, the renamed island of *Porto Rico* became an unincorporated U.S. territory, unable to determine language,

currency, customs administration, military service and defense, migration, citizenship, postal system, communications, voting rights, foreign affairs, commerce and taxation. Months later, San Ciriaco would pose extreme demands on such unstable socio-political landscape.

V.6. San Ciriaco relief and incipient policy trends

San Ciriaco happened at a historical turning point. It was a challenge to launch relief and speed up policy-making against a background of new and inexperienced authorities, multifaceted political tensions, cash-depleted Creoles and municipalities, meager U.S. federal engagement, entrenched poverty and widespread destruction, religion and superstitions trumpeting very incipient science and knowledge.

For untested Americans, the hurricane also meant differentiated impacts; none died and their main losses were replaceable military equipment or facilities, some obtained from Spain. Yet, it was a shocking event, as attested by the San Juan librarian:

“Whoever has witnessed the awful magnificence of what the primitive inhabitants of the West Indian island called Ou-ra-can will never forget the sense of his own utter nothingness and absolute helplessness. With the winds rushing at the rate of 65 or more miles an hour, amid the roar of waves lashed into furious rolling mountains of water, the incessant flash of lightning, the dreadful roll of thunder, the fierce beating of rain” (Van Middeldyk, 1903, Chapter XLI p. n.a.).

Fig. 27 Damage to the American mounted troop's stables, undisclosed location



Images of San Ciriaco damages inflicted upon U.S. citizens and property are scarce, in comparison to those concerning the islanders. Source: (Alonso, 18-?, p.104) .

Spared from mourning, they had to launch efficient relief that confirmed to *Porto Ricans* the benefits of being under the wings of an enlightened and generous civilization (Van Hoff 1899 in (Schwartz, 1992). And relief came via military supplies, War Department funds; and food, clothing and monetary donations gathered in the U.S. from appeals made to mayors of cities with more than 150,000 inhabitants, charitable committees, private businesses and general public (Schwartz, 1992).

Yet, relief came with strings attached. In the history of U.S. disaster relief, two lasting precedents were set before the Civil War; general Congress bills were more successful if presented as "disaster narratives" of sudden, unpredictable losses for which claimants were morally blameless; and they were often administered through temporary federal bureaucracies located within the executive -particularly the War Department- (Landis, 2005). In the late nineteenth century, relief measures started to increase and there were several initiatives to expand in scope. Yet, they were essentially minimal improvised actions underpinned by three assumptions: 1)

federal involvement in state and local affairs had to be limited, locals were to provide for themselves; 2) charity and entrepreneurial entities were endorsed to undertake relief and reconstruction; 3) aid was stigmatized as vagrancy indulgence, recipients had to earn it. Those assumptions were sustained by federal politicians but also by local officials. For example, after the devastating fire of 1871, Chicago officials questioned the little federal assistance offered as interventionist. Following droughts in Texas during 1887, President Grover Cleveland vetoed \$10,000 for relief arguing that the Constitution did not contemplate the use of public funds to pamper charitable and benevolent sentiments. After the 1889 Johnston Floods in Pennsylvania, President Benjamin Harrison did not offer a governmental compromise; instead, he made a modest public plea for charitable donations to the newly created American Red Cross, in charge of relief (Barry, 1998; McClure, 2011). The Army stepped in only in very large disasters, if local authorities and relief organizations lacked means and capacity (Foster, 1983).

When San Ciriaco struck, the military government was building links with local authorities and elites who were cash strapped, and there were no U.S. or local emergency organizations. Relief became a top-down army operation led by Gov. Davis, who offered biased help to the municipalities, elite creoles and impoverished masses. Davis endorsed discriminatory frameworks, like many of his compatriots and prior travelers to the island. Those frameworks shared notions of welfare as advanced by reformers and planners of the Progressive Era, and also shared similarities with those supported by Spaniards and Creoles. The combined approach of protectionist or benevolent paternalism, with old and novel social hierarchies essentially targeted to edify the base populace as proper Americans; and it subsisted in the following decades. Yet,

during disaster relief, deprecating and bigot assertions emerged and endorsed a tight disciplinary grip over people thought to be born into habits of torpor, debauchery and lack of self-discipline.

On August 19th, the government issued the first of several General Orders denying or conditioning relief to robust and unemployed men unwilling to work in cleaning and reconstruction tasks demanded by the military inspector in charge of the area (Aráez y Fernando 1905 in (Santiago Caraballo, 2000). Gov. Davis appointed Major John Van Hoff as relief director and president of the newly created San Juan Charity Board. Under the motto of “*No one shall die of starvation, and no able-bodied man shall eat the bread of idleness*” (Schwartz, 1992, p.328); the Board became a reference for boards in each town, an advisory board on insular policies and military inspection zones that covered the island, all part of Davis’ improvised relief plan. Such makeshift institutional setup multiplied and strengthened the logic of martial relief concerning the poor, as evident in a message to the Charity Board by Eben Swift, military division inspector of Humacao:

"the whole barefoot population is indigent; that is, they are idle, shiftless, without ambition, and will not work except under the prospect of starvation. This does not mean that they ought to be fed" (Schwartz, 1992, p.313).

Davis also requested the cooperation of municipal administrations, which the war and occupation left broke, politically at odds and unprepared for a sweeping disaster. After providing damage reports, municipal demands included tax breaks, immediate relief donations, long-term reconstruction funds or loans, crop insurance and free trade restrictions with the U.S. Davis and the Board approved tax breaks to municipalities but also to planters and entrepreneurs, even if unscathed from San Ciriaco (Schwartz, 1992).

Fig.28 “They have no stockings to hang”



Fig.29 “American Camp”



Photography and post mail were gaining wide use around San Ciriaco, thus these black and white/hand-painted images (postcard on top, photo below) illustrate the contrast between powerful Americans and disenfranchised *Porto Ricans* of color. Top, unhappy barefoot ‘native’ children against exuberant vegetation are cast powerless, the title centers on their dire needs (Waldrop Photographic Co., n.d.-b). Below, properly equipped white male military rulers rest in a provisional camp, where tamed nature has given way to some comfort (Boletín Mercantil, 1899).

Concomitantly, merchants and planters claimed that universal relief provision would prompt a costly and unstable supply of labor or beggars. Davis, Van Hoff and other officials agreed. Therefore, the relief scheme essentially appointed planters to distribute food among their workers, with few obligations including a tight grip so that the aid would not create vagabonds. Coffee planters used more that scheme than sugar planters. Their battered plantations took longer to recover, delaying their investment returns; profits had reduced in the previous years and markets contracted as Spain stopped buying. Thus, the relief program was beneficial even if it lasted only a year (Schwartz, 1992). Yet, it co-opted the planters' thinking of potential relationships with the new government and created reliance on foreign capital. Ultimately, Americans did not favor Puerto Rican coffee over Hawaiian or Latin American cheaper offers; such choice sent the industry and highlands into a downward spiral and increased vulnerability during the next disasters. In the interim, mortgage laws favoring local farmers were suspended, sugar became the main crop, and increasing competition from American capital altered the equation of power and territorial decision-making. Cane benefited from flood deposits, whilst ruined mills gave way to hefty modern ones, owned by large U.S. corporations; soon, sugar Creole planters were displaced.

Unsurprisingly, San Ciriaco further propelled widespread diseases due to poor healthcare, working and living conditions, including malaria, uncinariasis-caused anemia, smallpox, enteritis - dysentery, diarrhea, and typhoid fever-, tuberculosis and anemia (Espinosa, 2000). The hurricane deluge, housing and field destruction facilitated excellent breeding grounds for sickening pests, including mosquitoes. Consequently, malaria bouts escalated even further according to eyewitnesses (Espinosa, 2000). Concomitantly, Dr. Bailey K. Ashford, Colonel in

the Medical Corps of the U.S. Army, was puzzled by the extreme “debilitating condition of the jíbaros” (Espinosa, 2000, p.10); highlanders were matching in record numbers the depictions of islanders being lazy, prone to napping, eluding efforts, and dying massively. Ashford obtained permission and war tents to open a hospital in Ponce; within months, he found out that it was uncinariasis-caused anemia, a parasitic disease which caused lethargy and deaths considered natural (Ashford, 1934). San Ciriaco left ubiquitous damp shady soils, ideal for hookworm to grow until it pierced the skin of barefoot pedestrians, reached their intestines through the bloodstream or lymph, and weakened them to death. Ashford’s rural fieldwork, clinics and efforts in the Puerto Rican Commission for the Study and Treatment of Anemia transformed the disease cure worldwide. Yet, with slow improvements on public health, it took decades to eradicate it on the island and dismiss the associated detrimental stereotype of laziness of the poor. One year after San Ciriaco, its disjointed health impacts due to class were summarized in a report about the exponential death rate in Ponce:

“The class of people among whom this high mortality exists are the lower classes. The better classes have not furnished more than their normal quota, and these from the usual causes” (King, 2006 (1900), p.39).

Meanwhile, U.S. Congress discussions were addressing substantive controversies concerning the island; it was unclear if they were legislating for U.S. citizens to begin with. On December 15, 1899, the Committee on Pacific Islands and *Porto Rico* was established, with Senator Joseph Foraker (R-Ohio) as chair. Contentious post-disaster actions emerged framed by his revealing statement that *Porto Rico* was not the U.S. or a part of it, but *a belonging*. For example, since direct taxation was impossible given the crisis, Foraker envisioned a bill according to which relief expenses incurred by the U.S. would be returned with interests through a scheme of

governmental bonds payable as soon as prosperity flourished again in the promising possession.

Senator Edmund Pettus (D-Alabama) opposed the bill because it put the U.S.:

“in the unseemly attitude of generously relieving the sufferings of some of its citizens... and then taxing those people to get back a generous donation. That is a thing which this government never did before and I hope Senators will not allow such thing to be done. It is illegal and hardly decent” (Congressional Record 1900 in R. Fernández, 1996, p.1).

The decision was to follow Pettus’ advice, and eventually return 2 million dollars from taxes generated on the island since occupation (Schwartz, 1992). Though insufficient to palliate the crisis, part of those funds went to infrastructure repairs, a key activity that also validated ‘aid’ to those willing and able to earn it the hard way.

On the ground, injustices stemming from relief provision included rotting food that was finally condemned, as Dr. King stated. More gravely, workers, the unemployed and poor in general - although saved from immediate famine and death- were placed in a dreadful dependency at a time of dire need, with no options but migration. Coastal towns, mainly San Juan after its primacy validation over Ponce, received impoverished migrants who patched their housing needs creating slums. The first organized exodus of Puerto Rican peasants left for Hawaii, bearing conditions similar to indentured labor; others went to Cuba, Ecuador and the Dominican Republic (I. Fernández, 2000). Davis successor was Gov. Charles Herbert Allen (1900-1901), who would soon rule a vast sugar empire based on his tainted Puerto Rican investments and connections⁸⁸. He wrote on his Annual Report:

“These islanders are essentially a home-loving people, and are remarkably attached to their native land. But particularly since the hurricane of San Ciriaco some of the poorer classes have found it difficult to procure the means of a livelihood...Many of them would prefer to remain in

⁸⁸ During his one-year term, Allen appointed well-paid public servants who would be strategic for his business. Next, he became president of the American Sugar Refining Company, later called Domino Sugar Company, and kept great leverage on Puerto Rican politics during the following years.

idleness until someone solicited their services. A few potatoes and bananas will sustain life, and clothing is a luxury in this climate. In this state of affairs the emigration agent found an excellent field for his enterprise. He penetrated the rural districts and offered golden inducements to these simple folk to travel and see foreign lands. Laborers are wanted in Hawaii to work in the sugar fields and in Cuba for the iron mines” (Allen 1901 in Martinez, 1984, p.61).

Contrastingly, on July 19th of 1900, the newspaper *La Correspondencia de Puerto Rico* published a critical view on migration, and a call to the U.S. authorities:

“What are the reasons behind the emigration that has been going on in Puerto Rico for several months?...Puerto Rican agriculturists have been forced to emigrate as a result of the damages caused by the August 8th hurricane, the suspension of the mortgage laws that favored the native farmer and the increasing competition from American capital now taking hold of existing industries and exploiting the island's natural resources...Wise governments prevent emigration at all costs since it usually causes a country's ruin. There is still time to adopt sound economic measures that will save Puerto Rico” (Martinez, 1984, p.62).

In the following decades, particularly after disasters or political repression, the migratory survival strategy would be repeated as an improvised action by citizens, until it became massive and organized by the Commonwealth government in the 1950s. Overall, the incipient actions by the new rulers, particularly those concerning the neediest ones, implied a pathetic vision of what constituted development and how to achieve it.

In a nutshell, San Ciriaco was instrumental to weaken the option of independence and laid the ground for another form of underdevelopment. On the one hand, politicians in Washington were convinced to keep the recently acquired colony, based on its strategic location and the promising profitability of sugar. Persuasive documentation and personal testimonies -such as the one provided by Gov. Davis in congressional debates- strengthened the decision to reject independence. On the other hand, it is hard to imagine most Puerto Ricans opting for independence at that vital juncture. Economically, physically and emotionally appalled after the

hurricane, they were unable to launch a successful insurrection against a powerful army, had they wanted to. Urgent priorities met lack of choices: the Creole elites needed capital and a new market to resurrect their businesses, the poor needed food and clothes to survive, and returning to oppressive Spanish domination was unimaginable. Hence, those islanders in a position to negotiate rapidly tried to make the most out of the impasse, without confronting U.S. rule. After talks, on April 12, 1900, Washington responded with the Foraker Act, which conceded Puerto Ricans some control over a civilian government, an elected House of Representatives, a judicial system shadowing the American one and a non-voting member of U.S. Congress. Puerto Rico was no longer under military control, but embarking on a civil era of expectations, achievements and disillusion.

V.7. Conclusions

Through San Ciriaco, disaster management in Puerto Rico can be evaluated as essentially non-existent. Systematic local knowledge construction had started a few months before, with the establishment of the Weather Bureau. Moreover, Gov. Davis was responsible for a post-hurricane report that launched official secular disaster evaluations and policy-recommendations. Both changes deserve recognition for advancing one meaningful facet of disaster management; but they were value laden in ways that would be limiting. They were influenced by military aims and procedures –including bellicosity, secrecy and undemocratic decision-making- and by the contemporary ethos of meteorological recordkeeping, meaning generic listing of casualties and damages, and storm descriptions with emerging technology. In other words, this time was vital for establishing on the island the epistemological and ontological foundations to characterize

hurricanes, understand their causes and propose actions. Those foundations would solidly make their way well into the mid 20th century, as my dissertation shows.

Throughout the studied time period, it is possible to establish the correlation between social hierarchy and disaster vulnerability, despite generalized limited technical knowledge, awareness and means of communication. During the deadliest hurricane recorded in Puerto Rico, there were no American casualties and their material losses were minimal. Also, when arguing a year later that hurricane-ravaged Ponce had an epidemic death rate without the epidemic, Assistant Surgeon of the U.S. Marine-Hospital Dr. King explained that the poor were the ones dying massively. Death rates of higher income groups remained unchanged and were attributed to customary causes. Thus, there was nothing ‘natural’ about the dissimilar impacts of San Ciriaco on diverse social groups. Differences in selective vulnerability were caused by purposive lack of preventive planning and investment in hard and soft infrastructure⁸⁹ on the one hand; and on the other hand, the combined effects of permanent precariousness -present in working conditions, healthcare, food security and education for example-, and harmful side effects of hurricane relief. Selective disaster vulnerability was engrained in the Spanish legacy of planning decisions that defined urban life, as even Spaniard officials criticized post-San Narciso. Examples were locating settlements on the coast, acceptance of ‘uneven geographical development’ as the standard of urban growth, implementation of the ‘*Leyes de Indias*’, plans and modern technology only in central elitist areas, simultaneous occupation of risk-prone areas by the poor due to exclusionary land markets, investment in infrastructure and service provisions just for the upper echelons and extraction of exports, extremely precarious housing, and insecure land tenure. Pre-

⁸⁹ The former refers to planning, housing, roads, public hospitals, shelters, levees for example; the latter to awareness, community organization, warning mechanisms, relief savings.

Columbian empirical knowledge and superstitions concerning hurricanes seemed to have been systematically dismantled during the Spanish colony. I could not find evidence of the contemporary secular popular superstitions, as religion had a profound influence. Catholic practices included calling hurricanes depending on the corresponding saint day, preventive processions, using churches as shelters, praying for divine protection, using objects deemed as blessed to ward off storms, and public discourses of religious leaders explaining disasters as God's punishment for sins.

Organized disaster relief in Puerto Rico saw its infancy in the turn of the 20th century. As my research of the 1967 San Narciso hurricane-seismic crisis demonstrated, Spain left an extremely crude form of reactive, improvised disaster relief that completely dismissed the survival of Puerto Ricans as a basic right, and neglected hurricanes as a governmental responsibility demanding systematic investment and planning to increase resilience. Compared to that baseline, the highly questionable military relief scheme suddenly organized and implemented by Gov. Davis was an improvement; it averted an even worse humanitarian catastrophe, it provided some benefits to the local elites and set the island for an economic transition instead of a total collapse. For the first time, the highest figure of governmental authority stepped up to a challenge usually left for the municipal scale, in which religious authorities, volunteering groups and individuals had gained influence by offering short-term, biased, unaccountable charity.

In the next chapter, I will assess long-term changes made by the U.S. administrators concerning other critical components of disaster management, whilst the following information provides a

transitional background to it. Months after San Ciriaco, Creole intellectual Manuel Fernández Juncos told Gov. Allen:

“the coffee agriculture is desperate, the weakest jornaleros [farmers] succumb of starvation and misery, and the ones that still have some spirit flee for the first time from their cherished land, threatened by hunger” (Fernández Juncos 1901 in Espinosa, 2000, p.3).

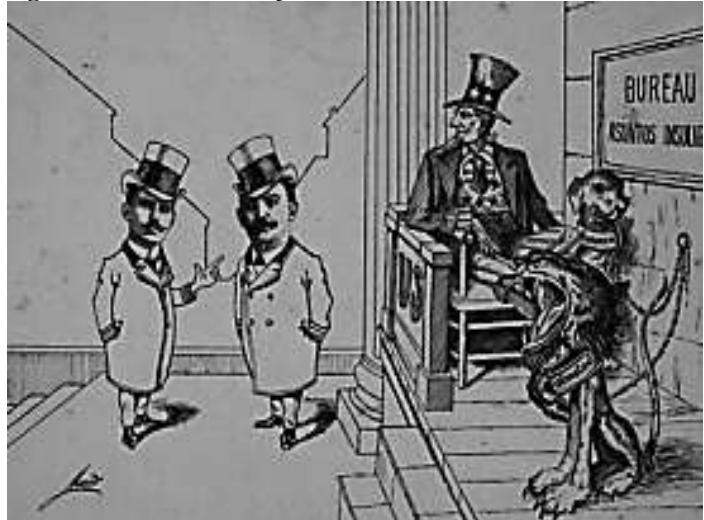
During the initial years of American occupation, living conditions declined for multiple reasons including the Spanish neglect legacy, costs of the Spanish-American War, San Ciriaco impacts, U.S. inexperience as an imperial power (Espinosa, 2000), and changes in the socio-economic structure that benefited Americans at the expense of hurting Puerto Ricans. Consistently, U.S. authorities impugned overpopulation -not unequal power relations- for unemployment and precarious housing, healthcare, nutrition, and education. Their public policy initiatives were shaped by such assumption, planning included although not necessarily executed under that name. Soon, elite creoles were increasingly disenchanted with the new regime, even if they were spared from the worse sufferings. Almost a decade after San Ciriaco and despite censorship, such frustration was captured in political satire cartoons by Mario Brau de Zuzuárregui, wealthy and famed pro-independence poet, journalist, cartoonist and newspaper artistic director.

Fig.30 “Independence”



Uncle Sam violently closes the mouth of politician Luis Muñoz Rivera (father of future Governor Luis Muñoz Marín), silencing his cry for independence (Brau 1915).

Fig.31 “Yankee Courtesy”



In front of the U.S. Bureau of Insular Affairs, Uncle Sam is comfortably seated. By his side, a guardian mastiff wears a collar saying Foraker and a roaring lion nearby wears a collar saying Olmsted (current Governor of the island). He severely looks down at two leading Puerto Rican politicians; Luis Muñoz Rivera and Cayetano Coll y Toste, who speechlessly look at the reader with their hands empty or in their pockets (Brau 1915).

By the late 1920s, U.S. detachment from the development of Puerto Rico in tandem with exploitative policies had cemented inequality, poverty, vulnerability and turmoil. Hurricanes San Felipe (1928) and San Ciprián (1932) harshly exposed the fault lines of this lopsided relationship. Besides, pitiable federal relief response would add to the bonfire of economic, social, cultural and political frustration, leading to the most violent years on the island.

V.8 References

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Chapter N.VI. Hurricane San Felipe (1928): Imperialism by neglect

VI.1. A tale of destructive landfall: Characterization of San Felipe

*“¿Qué será de Puerto Rico, cuando pase el temporal⁹⁰?
San Felipe, San Felipe, ¡Qué tremendo temporal!*

*What will be of Puerto Rico, when the temporal passes?
San Felipe, San Felipe, What a tremendous temporal!*

Rafael Hernández Marín (1892-1965), beloved Puerto Rican composer and musician, immortalized San Felipe in those *Plena*⁹¹ lyrics, popular until today. His song ‘*Temporal*’ asks what will be of municipalities at risk, such as Arecibo on the north coast towards the west, Aguas Buenas and Barranquitas in the central mountain range, Bayamón adjacent to San Juan. Ultimately, his concern was the fate of Puerto Rico after the dreadful hurricane landfall on September 13th, day of Saint Philippus according to the Roman Catholic calendar, in which hurricane San Felipe I had made landfall 53 years before.

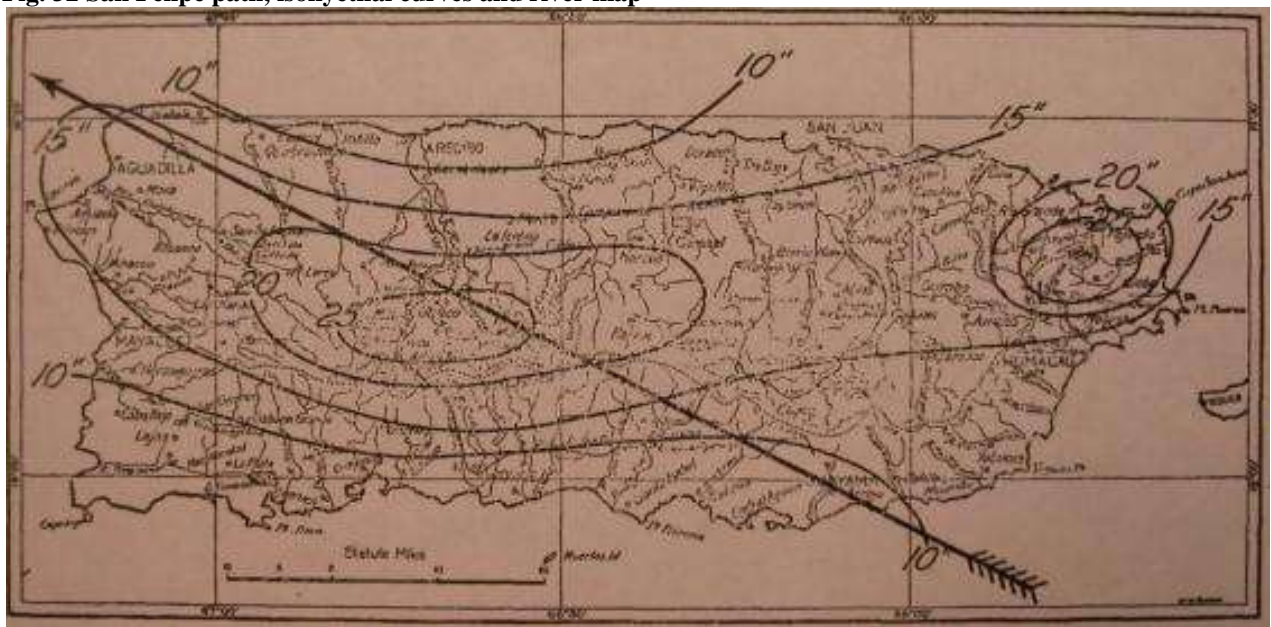
San Felipe was a Cape Verdean hurricane like San Ciriaco, and it followed a similar path although with the highest strength ever registered on the island, Category 5 in the Saffir-Simpson Scale. Around 2 pm, the hurricane made landfall near Guayama and Arroyo, in the southeast,

⁹⁰ *Temporal* means bad weather conditions equally associated with hurricanes or storms.

⁹¹ The grass-roots rhythm *Plena* emerged in during turn of the 20th century, and served to communicate local stories. Thus, it was considered the newspaper of the slum, of the people.

where pressure reached 931 millibars and winds 160 mph, although eye wall winds might have reached 180-200 mph (Fassig, 1928). The San Juan Weather Bureau registered 160 mph winds until the anemometer was shattered, the roof collapsed and the building was wrecked. San Felipe left by the northwest, close to Aguadilla, at around 10-11 pm. The accompanying deluge lasted 18 hours in Guayama and 12 hours in San Juan; whilst rainfall in the central mountain region reached 30 inches in 48 hours. The Weather Bureau documented San Felipe through sophisticated maps and statistical charts, unlike understudied hurricanes and storms of the previous three decades.

Fig. 32 San Felipe path, isohyethal curves and river map



This new analytical tool (Fassig, 1928, p.352) mapped the hurricane path, record rain amounts over El Yunque on the northeast and Utuado on the central mountain range. Flash floods hit valleys and flatlands.

Fig. 33 San Felipe chart

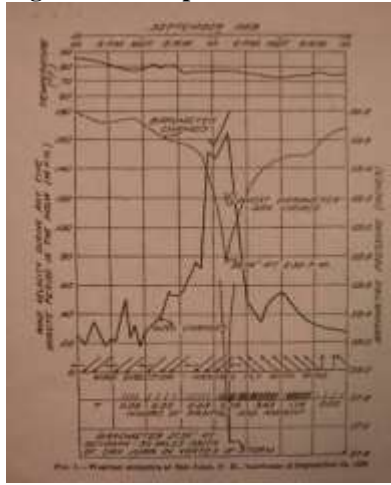
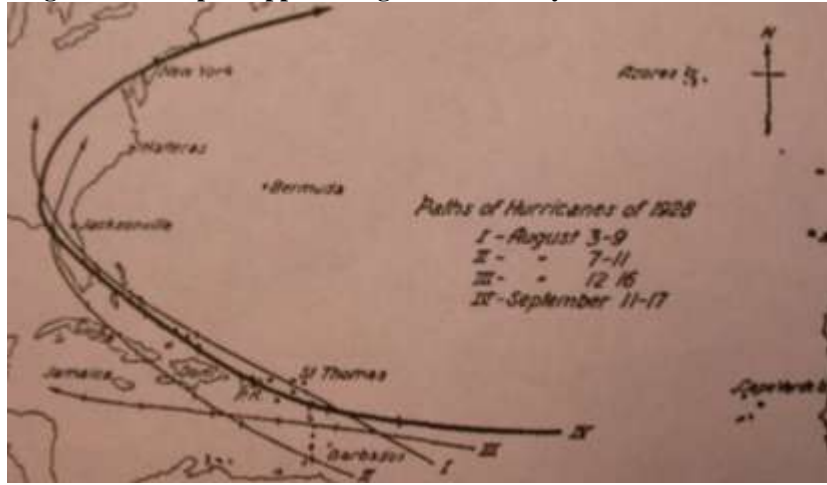


Fig. 34 San Felipe mapped along storms of the year



Hurricane reports increasingly gathered scientific data about wind velocity and directions, temperature, barometric pressure, rainfall amounts, track and timing. Both images by (Fassig, 1928, p.351).

Widespread destruction ensued, yet the worse happened in the path of the eye and strongest part of the eye wall. Guayama, Arroyo, and towns on the way north to Naguabo and westward became rubble. Casualties amounted to 312, a great progress compared to San Ciriaco. Police districts were warned and radio broadcasts provided constant warnings to ships 36 hours in advance (Mújica-Baker, n.d. after 1998). Radio, telegraph, telephone, flags, door-to-door police and neighbor communications were credited with lowering casualties (Beverley, 1933). Another factor could have been the use of churches and chapels as refuges, and rural self-built shelters called *tormenteras* or *barracas*, according to two documentaries addressing hurricanes (Doniger, 1958; Molina Casanova, 1988). *Tormenteras* were small semi-underground structures made out of wood, palm thatch or discarded materials reinforced with knots or nails to withstand strong winds and rain. Even if cheap and often unsafe, they were unaffordable for destitute peasants⁹². Oddly, documents for San Ciriaco do not mention *tormenteras* blurring their origins until San Felipe, and there is no subsequent research on their effectiveness.

⁹² One of the documentaries reenacts a scene of a poor family welcoming their even poorer neighbors to survive San Felipe, along with hens and few precious belongings.

Fig. 35 Drawing and photograph of a tormentera or barraca



A large *tormentera* fitted people, pets, some livestock and a few belongings, images by (DIVEDCO, 1965, p.43) p.43. (Gingerich, 1946-1948). It became temporary shelter when the house or *bohío* was destroyed.

Fig. 36 Initial news of hurricane damage on the island and the U.S. spread alarmingly



This Mid-West newspaper cover attributed the storm to God's rage, image by (The Omaha Bee-News, 1928).

Three days later, President Calvin Coolidge (1923-1929) called all executive departments to cooperate, appointed the American National Red Cross for relief, and published an appeal to the nation:

“An overwhelming disaster has overtaken our fellow-citizens in Porto Rico and the Virgin Islands as the result of a devastating West Indies Hurricane. Full extent of the damage is not

available, but several hundred thousand are known to be homeless and in instant need of food, shelter and emergency relief. Governor Towner of Porto Rico has appealed for immediate aid... As President of the United States and as President of the American Red Cross, I am therefore urging our people to contribute promptly and most generously, so that sufficient funds may be received to alleviate the suffering among so many thousands” (Coolidge, 1928).

Coolidge was correct, devastation was widespread (American Red Cross, 1929; Miner Solá, 1996; Schwartz, 2005). Preliminary property losses reached almost US\$ 4 million, twice the island’s annual budget. Subsequent estimates of urban losses reached US\$ 6,242,790, less than one tenth of rural losses according to the Central Survey Committee created by Gov. Horace Mann Towner to evaluate the situation. Later, property damages were estimated at \$50 million, \$641 million 2011 USD (Mújica-Baker, n.d. after 1998), which does not include precarious housing losses. Even modern and large American sugar mills became rubble and their harvest was badly affected; like tobacco, citrus and coconuts; and urban and forest vegetation (C. G. Bates, 1930; C. Z. Bates, 1929). Coffee ruin was worse; more than half of the plantations were destroyed. Puerto Rico, formerly a top producer of high quality coffee, became an importer to satisfy local consumption and the industry never recovered. Since San Ciriaco, planters faced heavy mortgages and unstable sales; in 1928 though, they finally expected a promising crop and had borrowed on it to pay for labor. Thus, losing that harvest meant bankruptcy; some planters became destitute and had to ask for food donations. Even worse was the situation of rural workers who subsisted on a meager pay, could not save cash reserves for emergencies and had been buying on credit from overpriced local stores to pay after the harvest. Moreover, according to the Department of Education, 2,308 schools out of 4,198 were wrecked or damaged; public buildings, bridges and roads were in a state of dismay and the bonds with which they had been funded were still outstanding (American Red Cross, 1929). Most poor housing, likened by foreign relief workers to the ‘original huts of the aborigines’, was left in terrible conditions. Over

40,000 homes had to be rebuilt for the 250,000 rural homeless; when adding urban losses, almost a third of the 1.5 million Puerto Ricans was homeless; relief became vital for survival:

“The cabins of the poor [bohíos] were everywhere damaged or destroyed. With the winter prospect of employment reduced to a fraction of the customary, with no reserves of cash or credit left for the purchase of food, clothes, shelter, these people became totally dependent upon the available relief funds” (American Red Cross, 1929, p.12).

Senator Hiram Bingham, Chair of the Committee on Territories and Insular Possessions, made a tour to advise Congress about relief, months later. To him, San Felipe was:

“a hurricane of greater intensity than was ever before reached in any West Indian Hurricane we know about (R. Fernández, 1996, p.99).

Fig. 37 Untitled view of San Felipe damage



A vehicle is covered by the rubble of what appears to be a sugar mill, image by (Coll Ferrer, 1928).

Fig. 38 Housing destruction in Guayama



The hurricane razed a concrete and brick house to its foundations, image by (Anonymous, 1928c).

Fig. 39 Housing destruction in Guayama



Remnants of roofs and walls made out of wood and tin are scattered among damaged coconuts, another devastated export crop, image by (Anonymous, 1928a).

Fig. 40 Housing destruction in Guayama



San Felipe tore apart this wooden house from its stilts and left it down a hill, among uprooted trees, another destroyed house and debris, image by (Anonymous, 1928b).

Fig. 41 ‘Temporal’ artwork by Rafael Tufiño commissioned by the Commonwealth



In a modest urban setting, this engraving (Rafael Tufiño, 1954?) depicts how San Felipe blows away a complete wooden house, as happened in reality.

Fig. 42 'Temporal' lyrics and music score by Rafael Hernández Marín, artwork by Rafael Tufiño



An Indian-like flying giant blows people, homes, poles and lines into chaos (Rafael Tufiño, 1954?).

Fig. 43 'Temporal' lyrics by Rafael Hernández Marín

T E M P O R A L

Temporal, temporal,
¡qué tremendo temporal!
San Felipe, San Felipe,
¡qué terrible temporal!

¿Qué será de Puerto Rico,
cuando pase el temporal?
Temporal, temporal,
¡qué tremendo temporal!

¿Qué será de Bayamón,
cuando pase el temporal?
¿Qué será de Barranquitas,
cuando pase el temporal?

Temporal, temporal,
¡qué tremendo temporal!
¿Y qué será de Aguas Buenas,
cuando pase el temporal?

San Felipe, San Felipe,
¡qué terrible temporal!
¿Y qué será de Arecibo,
cuando pase el temporal?

Temporal, temporal,
¡qué tremendo temporal!
Etc.

TEMPORAL

Temporal, temporal,
What a terrible temporal!
San Felipe, San Felipe,
What a terrible temporal!

What will be of Puerto Rico,
When the temporal passes?
San Felipe, San Felipe,
What a tremendous temporal!

What will be of Bayamón,
When the temporal passes?
What will be of Barranquitas,
When the temporal passes?

Temporal, temporal,
What a tremendous temporal!
What will be of Aguas Buenas,
When the temporal passes?

San Felipe, San Felipe,
What a terrible temporal!
What will be of Arecibo,
When the temporal passes?

Temporal, temporal,
What a tremendous temporal!
Etc.



Fig. 44 A cross formed by a palm tree traversed by a metal pole

This anonymous image has been interpreted as a symbol of Puerto Rico left in disgrace, crucified, after the hurricane (Schwartz, 2002).

Contextually, this time period is key; it corresponds to a turbulent era before the most violent years on the island. Three decades of U.S. detachment from the development of Puerto Rico and extractive policies had cemented inequality, poverty, vulnerability and turmoil; and San Felipe exposed the fault lines of this asymmetrical relationship. Original writings reflect that information producers were White, wealthy adult men in positions of power, such as U.S. and Puerto Rican politicians, relief providers, elite members, and intellectuals. The U.S. Red Cross reported its relief provision in Puerto Rico, the Virgin Islands and Florida (American Red Cross, 1929). Also, a Catholic group reported losses in Puerto Rico, St. Thomas, St. Croix; their brief relief interventions and benefactors (Redemptorists under the Southern Cross, 1928). The voices of marginalized citizens due to gender⁹³, class, race, and age remained silenced from entering their experiences in the public record, and from shaping policies according to their needs. An upper class, top-down view of the event prevails.

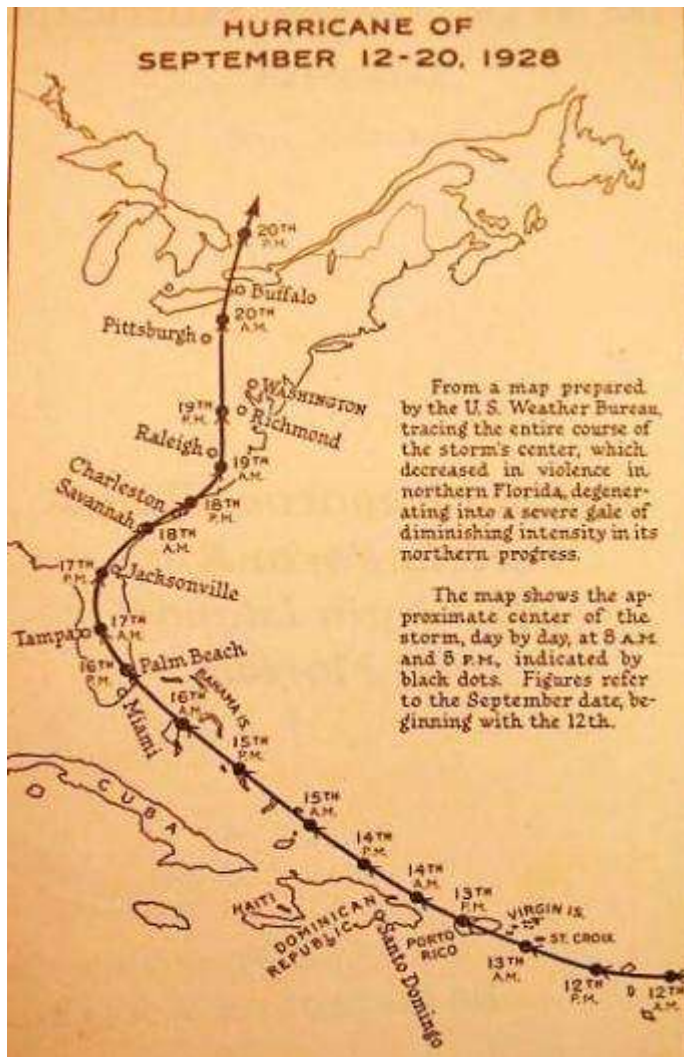
⁹³ A rare testimonial newspaper article in English, by a U.S. woman, narrates hurricane San Ciprián landfall (1932), an incisive proxy for San Felipe used in this chapter.

VI.2 San Felipe characterized in multidisciplinary, artistic, Circum-Caribbean, local, multi-hazard, multi-storm terms

The multidisciplinary production of knowledge is very incipient for San Felipe. Compared to San Ciriaco, it is less studied as part of other topics or in itself. I found that few disciplines have examined it, including forest biology (C. G. Bates, 1930; C. Z. Bates, 1929), meteorology (Fassig, 1928) and history (Schwartz, 2005). The latter reviews it in Puerto Rico and Florida without comparisons, focusing the discussion on Caribbean hurricanes; which has been useful for this research.

Although contemporary artistic works or literary writings were unavailable, San Felipe remained relevant decades later. For instance, René Márques' novel '*La Vispera del Hombre*' (The Eve of Man) won the first prize in a contest organized by the *Ateneo Puertorriqueño*, in 1958. It initially unfolds in the highlands months before San Felipe made landfall, and it uses the hurricane crisis as a crucial background to represent a love and humanitarian tragedy affecting Puerto Rico (Márques, 1959). The novel became standard text for secondary and high-school students. Also, the Commonwealth commissioned Master Rafael Tufiño to paint '*Temporal*' in a mural dedicated to *Plena* music, between 1952 and 1954. The song has been rearranged and performed by many, including pop superstar Ricky Martin who introduced it to new generations. The award-winning hurricanes documentary '*Allá viene el Temporal*' (There comes the *Temporal*) is structured around San Felipe (Molina Casanova, 1988), reenacting algid moments.

Fig. 45 Regional track and timing of San Felipe



(American Red Cross, 1929).

disastrous; a 6-9 foot storm surge killed around two thousand people -mostly Bahamian migrant workers of color-. San Felipe hit inland Florida and the eastern coast, Savannah and Charleston suffered rains, and it finally dissipated near the Great Lakes on the 20th.

Together with the Mississippi floods of 1927, Okeechobee marks a turning point in flood control management by the Corps of Engineers⁹⁴, state and federal legislation that would reach Puerto

San Ciriaco affected several territories in the Circum-Caribbean. It hit first Dominica, Guadeloupe –where circa 1,200 deaths were registered- and the Virgin Islands. The hurricane gained strength in the warm sea to slam Puerto Rico. Next, the northern part of the Dominican Republic was moderately affected by its passing, and when it reached the Bahamas Islands it had lowered to Category 4. West Palm Beach, Florida, was the following landfall site with estimated sustained winds of 150 mph, close to Category 5 again. After heading west and north, its passing over Lake Okeechobee was

⁹⁴ In 1917, the first Flood Control Act had authorized the Army Corps of Engineers to be involved with flood protection and damage reduction. Yet, as most institutions, the Corps considered disasters essentially as a

Rico in the following decades. The Okeechobee catastrophe was captured in Nora Zeale's celebrated book 'Their eyes were watching God' (1937). It has been the subject of academic research, popular songs and publications. Yet, despite regional damages, there are no contemporary or retrospective Circum-Caribbean comparative studies. I only found the usual data of storm level, imprecise losses and images when looking for scholarship that transcended the paradigmatic vision of the region as a broken cosmos due to geography, colonial legacies and ideological animosities. Also, local studies within Puerto Rico are missing.

The possibility of learning from San Ciriaco in multi-hazard terms remains unexplored. An expanded temporal frame would enable to study another recent and influential complex emergency, because the unlikely worst case scenario of multi-risk exposure happened within a few years gap. Destruction by hurricane San Hipólito (1916) was magnified by the San Fermín earthquake in 1918 and subsequent seismic activities, in 1918. On October 11, the earthquake - approximately 7.5 on the Richter scale- originated northwest of Aguadilla in the Mona Canyon, between Puerto Rico and the Dominican Republic. In that region, the ocean withdrew and exposed reefs and stretches of seafloor unseen during low tide. About 4–7 minutes after the main shock, the first tsunami wave crest broke upon the shore reaching up to 20 feet high. It slammed coastal homes and villages, and tide gauges were noticed as far as Galveston, Texas. Seismic-triggered mudslides exceeded Level VII in the worst areas and damaged infrastructure, although they were not considered catastrophic for human life. Reported casualties ranged between 91-116 deaths, of which almost 40 were attributed to the tsunami. The worse aftershocks, Oct. 24 and Nov. 12, increased damages. Most affected settlements and infrastructure were on the west

responsibility of municipalities and states. In addition to the limited flood control activities by the Corps of Engineers, the federal government's roles on disaster included data collection by the Weather bureau and either law enforcement or cleanup tasks undertaken by special military detachments (Arsenault, 2005).

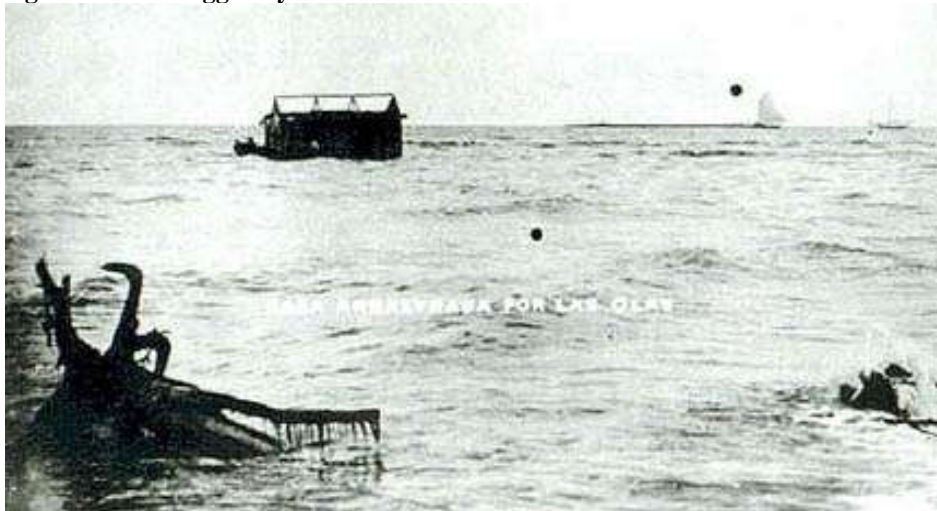
and north coast, particularly if located on alluvium -loose soils eroded by water-, built out of expensive yet rigid materials, such as masonry, and lacking structural reinforcement. In Aguada, the church built before 1876 was destroyed, masonry buildings had to be razed whilst frame buildings were not damaged appreciably. In Añasco, all brick buildings were wrecked or had to be condemned; concrete structures without reinforcement were destroyed instantly or during aftershocks; wood frame buildings collapsed if the structure had rotted. In Aguadilla, most masonry structures on the alluvium were badly cracked. Mayagüez, the third largest city on the island, was left in shambles. The brick Catholic Church had to be demolished, like numerous factories, public buildings and homes. Sugar mills in the area were virtually destroyed, tall brick chimneys were scattered on the floor. Railroad tracks were bent and displaced; pipelines and flumes were wrecked; bridges and roads were severely damaged like the strategic west port facilities. In Mona Passage, two cable links were broken. The earthquake caused destruction as far as Ponce. For example, the wrecked cathedral and theater La Perla were not reconstructed until 1938 and 1941 respectively, as municipal finances were bankrupted. Agriculture, commerce, exports and everyday life entered a crisis (Online Puerto Rico Seismic Network, 2005; R. Picó, 1974; Reid & Taber, 1919a). The resulting palimpsest of chaos and losses paved the road for a hurricane as San Felipe to devastate the island. Yet, I did not find changes in construction and urbanization patterns and in the way in which disasters entered mainstream historical narratives. Moreover, I did not find studies about this complex emergency from disciplines such as history, economics, planning, preservation and disaster management; which reduces even further the possibilities of learning from it.

Fig. 46 Earthquake destruction in Mayagüez



The streets of Mayagüez were full of debris from collapsed buildings made out of masonry, brick, with weak structural reinforcement such as rotted wood, image by (Cifuentes, 1928).

Fig. 47 House dragged by the 1918 tsunami



A house washes away along the west coast shore, image by (Online Puerto Rico Seismic Network, 2005).

The opportunity of learning from San Felipe in multi-storm terms has not been developed. The worse hurricanes after San Ciriaco were San Hipólito, in 1916, and San Liborio, in 1926; but when looking for information, mainly the mainstream listing of events, physical characteristics and generic losses are available.

Box N.4 Summary of 20th century storms in Puerto Rico: 1901-1926

1901, July 7th; Tropical Storm San Cirilo the storm eye moved over the southwest in a northwesterly direction with estimated sustained winds of 70 mph. In San Juan, the wind reached 52 mph and pressure 29.60 in/hg. Rain reached 5-6 inches in 72 hours in Caguas, Humacao and Barranquitas.

1901, September 11th-12th; Tropical Storm San Vicente moved over the north coast in a westerly direction with estimated sustained winds of 60 mph. The wind report from San Juan was of 52 mph and a pressure of 29.89 (1012 mb). The storm affected all the crops, but particularly citrus.

1910, September 6th-7th; Hurricane San Zacarías passed around 20 miles south of southern Puerto Rico with sustained winds reaching 100 mph in a westerly direction. However, the worst conditions were experienced in the northeast. In San Juan winds reached 72 mph with a pressure of 29.66 in/hg (1004 mb).

1915, August 11th; Hurricane San Tiburcio passed around 100 miles south of Puerto Rico in a westerly direction with winds estimated in 100 mph near the center. Two persons drowned in Cabo Rojo due to the sea swell. The minimal pressure in San Juan was of 29.77 in/hg (1008 mb) and winds of 62 mph. The strongest winds hit the south and central mountain range affecting coffee and tobacco crops.

1916, August 22nd; Hurricane San Hipólito reached 90 mph sustained winds at time of landfall and weakened as it crossed the island from east to west. San Juan reported winds of 92 mph and a pressure of 29.82 in/hg (1010 mb). One death was attributed to the storm and the worst damage was reported in the east and north, especially Santurce. Losses amount to \$1,000,000 dollars.

1921, September 9th-10th; Hurricane San Pedro passed south of Puerto Rico in a west-northwesterly direction as a category one storm, it headed north towards eastern Hispaniola, then it re-curved into the open Atlantic and passed nearby Bermuda. The winds measured 60 mph in Cabo Rojo and 44 mph in San Juan; pressure reached 29.68 in/hg (1005 mb) and 29.82 in/hg (1010 mb) respectively. The main effect of the storm was heavy swell in the south coast and damage was minimal, one death was reported.

1926, July 23rd-24th; Hurricane San Liborio entered the Caribbean Sea by Martinique and made landfall in southwest Puerto Rico with estimated sustained winds of 80 mph. The winds in San Juan were measured of 66 mph and a pressure of 29.62 in/hg (1003 mb). The hurricane killed 25 people and damage estimates are of \$5,000,000 dollars. Many houses were destroyed around the island.

(Miner Solá, 1996; Puerto Rican Hurricane Center, 2011; Salivia, 1972; Ivan Ray Tannehill, 1945).

VI.3 Economic growth and urbanization vis-à-vis disasters

Differentiated vulnerability or resilience to San Felipe was influenced by the overlap of economy, urbanization and disasters generated in a time period called ‘imperialism by neglect’ (Matthews 1960 in (M. R. Rodríguez, 2002); post-San Ciriaco, the U.S. mode of domination emphasized extractive policies whilst neglecting lay Puerto Ricans -elite Creoles were increasingly frustrated also-. As Gov. Davis advised and Gov. Allen used for his benefit, government funding went to the sugar industry. It recovered fast after storms due to easiness to replant -which meant safer and quicker investment returns compared to coffee-, increased soil fertility caused by flood sediments, dominant participation of large American agro-corporations and growing U.S. market demands (Schwartz, 1992). The U.S. imported 86 percent of its sugar needs before 1898 (R. A. Martínez, 1984). In the first decade of the 20th century, a U.S. controlled sugar-based export economy was set and endorsed by peak prices during and immediately after World War I. By 1932, the U.S. imported less than 1 percent of its sugar needs (R. A. Martínez, 1984).

U.S. corporations had vast sway on territorial decisions; they intensified deforestation, water and land rights changes, and soil degradation to increase profits. Sugar was planted even in the steep slopes of Jayuya and Adjuntas, former coffee bastions where small and medium-scale planters had lost their properties (Ortiz Colom, 2005). A glimpse of such transformation is expressed by a *jíbaro* descending for the first time to the lowlands near Ponce in the awarded novel ‘Ballad of another Time’, by José Luis González -famed writer, university professor, and journalist-, and in the postcards below:

“Sugar cane everywhere, the man notices, as far as the eyesight reaches, covering the land like an inundation, he tells himself. Have there been trees here ever? Not like the ones he sees now, scattered, one here near and another one further away, were a blow with a stone would reach, lonely, orphans, he thinks; but like those far up there [in the mountains], abundant, leafy, custodians of all that grows and fructifies under the shelter of their shadow. And this absence of birds, he confirms it with his accustomed ear” (González, 1990, p.109).

Fig. 48 "Planting sugar cane in Porto Rico"



(A.C. Bosselman & Co., n.a.).

Fig. 49 "Cutting sugar-cane in Porto Rico"



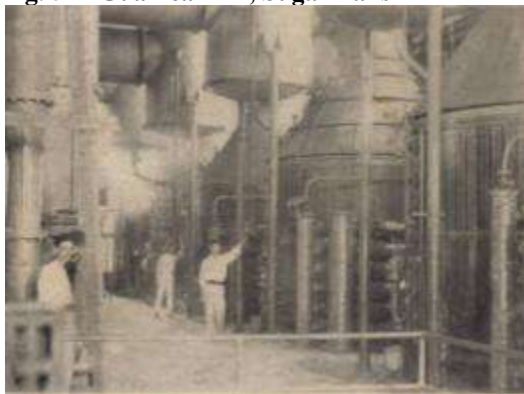
Sugar planting and harvesting remained manual, providing hard, abundant and brief employment; and long unemployment periods called *‘tiempo muerto’* (dead time). Only processing stages were mechanized (Waldrop Photographic Co., 1913). Among the intensified ecological transformations were loss of native fauna and flora, soil depletion and hydrological changes to guarantee irrigation.

Fig. 50 “An Old Cane-Mill in Porto Rico”



Animal and even human traction served to grind cane in the oldest moscovado Spanish mills. For Americans, this quaint image was part of the repertoire of outdated curiosities worth sharing as postcards (Waldrop Photographic Co., n.d.-a)

Fig. 52 “Guánica Mill, Sugar Pans”



The largest and most modern mill on the island included a boarding house and the American Club (n.a., 1903).

Fig. 54 Guánica Mill, overview



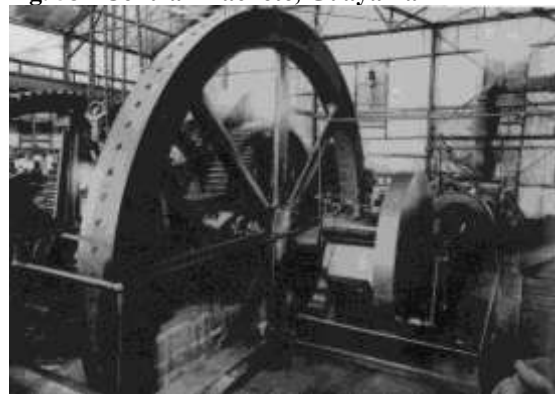
Picture taken from tanks on top of the hill, as typed behind the postcard (n.a., 1922). Railroad tracks went into the mill, where cranes lifted out cartloads full of cane to be grinded.

Fig. 51 “Old Sugar Mill, Cacique River” Postcard



“The machinery is most primitive, the propelling power being an immense water wheel. Many of the mills in Porto Rico are of the old fashioned type, although there are some fine ones worked by steam” (Raphael Tuck and Sons "Oilette", n.d.)

Fig. 53 “Central Machete, Guayama”



U.S. corporations modern processing rapidly increased profits (Moscioni, Between 1898-1917d).

Americans also invested in tobacco, the second export crop grown in Cayey, Aibonito, Cidra and municipalities in the east central mountains (J. L. Dietz, 1989). Yet, jobs were scarce, including underpaid domestic cigar packaging. Other ventures controlled by Americans were coastal fruit plantations –citrus, pineapple, banana- and coconuts, attracting the unemployed. Needle work and straw hat making were top domestic feminine and child jobs, even less paid than average adult male jobs (Findlay, 1999).

Fig. 55 'String tobacco in curing barn'



Barefoot male *jibaro* workers prepare tobacco leaves in the island interior (Moscioni, Between 1898-1917f).

Fig. 56 “Making straw hats”



Women in Cabo Rojo sell hats (Moscioni, Between 1898-1917f).

Coffee controlled by creoles was on a roller coaster trajectory towards the bottom. Exports never reached late 1880s levels due to San Ciriaco, limited credit options with high interest rates, high taxes, and the U.S. preference for cheaper Hawaiian, Brazilian and Central American imports. Puerto Rican sales to Europe and Cuba grew when prices stabilized after 1900, and increased from 1904 until to World War I. European exports fell during the war; they hit a high record for a couple of years and dropped again since 1921 (Lewis, 1983; Rodríguez Centeno, 2000).

Meanwhile, territorial choices for settlement location confirmed the Spanish colonial pattern, concentrating investments and urbanization on the coast over mountainous areas, which reinforced previous hazards. Before San Ciriaco, San Juan was less populated than the main export hub, Ponce. In less than thirty years, San Juan became the top growth pole, doubling Ponce's population. Coffee stagnation, disasters, joblessness, and the Mayagüez crisis pulled people into the capital. In parallel, planning and investment in infrastructure by governmental authorities and U.S. corporations increased compared to Spanish levels, but shared core assumption. The priority was to protect commodities, which were crops; not citizens. Often financed through bonds, the bulk of public works were transportation and export-oriented infrastructure including motorways, bridges, railroads, waterworks and docks like the ones at Aguirre and Ensenada (R. Picó, 1974). Driven by private interests, such projects followed a trickle-down logic, disregarding lay citizens' development and resilience. Favoring exports over passengers, U.S. and Canadian investors built over 90% of the railroad network between 1900-1920; partly circling the coast but leaving the highlands isolated due to topography and unprofitability (Santamaría García, 1994).

Fig. 57 Train near Central Lafayette, Arroyo



Uniformed workers bow to an incoming train, in one of the largest American sugar mills (Moscioni, Between 1898-1917c).

Other influential public works started in 1908, through hydraulic changes that protected the investment of corporations, marginally improved potable water provision and would influence disaster management. Insular legislature created the Puerto Rican Irrigation Services (R. Picó, 1974) to build reservoirs for irrigation canals and energy production, the latter given to private enterprises. In 1917, tasks of the new Department of Interior included buildings, public roads and bridges, hydraulic forces, non-navigable rivers, underground waters, mines, public archives and lands (Departamento de Transportación y Obras Públicas, 2010). In 1925, the Bureau for the Use of Water Resources was created, and it kept transforming the hydraulic regime through dykes, irrigation canals and dams -Carite #1, Carite #2 and Toro Negro-; but also filter beds, mains, and pipes that usually served better-off urban areas. Large-scale engineering interventions to control floods became a desirable disaster management and planning strategy. Paradoxically, technology enabled new forms of vulnerability. Purposive agricultural and urban growth on desiccated flood-prone areas would be affected by extreme events or the failure of hydraulic systems (López-Marrero & Tschakert, 2011).

Fig. 58 Tanamá River Dam, Arecibo



An example of early small-scale hydrological modifications near the north coast (Moscioni, Between 1898-1917j).

Private and public investment cemented uneven urban growth also, a trickle-down logic increased inequality. High-end coastal urbanization outside of Old San Juan started in El Condado, between the ocean and Condado lagoon, and Miramar, bordering the lagoon.

Fig.59 Condado seashore, Santurce, late 1890s



In the pristine Condado beach, (Alonso, 18-?, p.32) a solitary person walks on the sand, close to thick short vegetation, habitat of native fauna and stabilizer of dunes from erosion. The large coral reef on the lower right hand side, dunes and vegetation on the left absorbed shocks from severe weather events. The entire ecosystem would be aggressively transformed by permanent high-end urbanization in the next decades.

The lavish Condado Vanderbilt Hotel⁹⁵, the first of its kind, was built in 1919, with U.S. capital and by U.S. architects in a Mission/Spanish Revival style. It heralded privatized beach access and permanent transformations of ecosystems such as sand dunes, mangroves, coconuts and coral reefs, increasing vulnerability to storm and surges.

⁹⁵ Later known as Grand Hotel Condado Vanderbilt, The Condado Hotel, Hotel Condado, Condado Beach Hotel, or Hyatt Puerto Rico Hotel.

Fig. 60 and Fig. 61 Hotel Condado Vanderbilt and Condado Lagoon



Photos taken from Santurce and lagoon border (González Padín Co. Inc., c. 1920's; Real Photo Post Card, c. 1930's) respectively show palm trees and a thick mangrove, which buffered storms and coastal surges.

Fig. 62 “Condado Vanderbilt Hotel”



Original view (Real Photo, early 1920s) of the exclusive hotel guests boat landing, initial changes of the lagoon and surrounding vegetation.

Fig. 63 “Hotel Condado”



The building scale and manicured landscape contrast with the mangrove (González Padín Co. Inc., 1930-1945).

Fig. 64 “Vanderbilt Hotel” beach front



Private beach access up to a reef (n.a., c. 1920s-a).

Fig. 65 Vanderbilt beach front verandah



Most of the San Juan seashore towards the east is undeveloped. (n.a., c. 1920s-b).

Luxurious buildings in concrete, masonry, wood and brick ranged from neoclassical, neo-vernacular, Art Deco, ginger-bread, Spanish Revival to modernism; and catalogues of clap-on-imported pine constructions were available. Housing for the better-off could be essentially outlined in two preferences:

“Within the Porto Rican’s homes one glimpses shady, flower filled patios, tinkling fountains, charcoal braziers, cool corridors, and huge open, unglazed windows. Within the American homes are all the surroundings of Northern life, absolutely unsuited to tropical comfort. The walls extend unbroken from ceiling to door, allowing no free circulation of air; the windows are small, there are no charming patios, gas ranges are used for cooking, and canned goods, American dishes...Of course there are exceptions” (Verrill, 1914, p.17).

Fig. 66 Residence in Miramar, SJ



Czech architect Antonin Nechodoma’s legacy in the Caribbean includes this house, inspired in Frank Lloyd Wright’s work (Moscioni, Between 1898-1917i).

Fig. 67 Presbyterian hospital in Condado, SJ



A private hospital in prime real estate land close to the sea (Moscioni, Between 1898-1917h).

Fig. 68 Residences in Santurce, SJ



Beach front houses, including Mr. Charl Hartell’s (Moscioni, Between 1898-1917k).

Fig. 69 Apartment complex in Miramar, SJ



Property of American citizens Axmayer and Son (Moscioni, Between 1898-1917a).

The U.S. government timidly launched housing and land tenure provision. Yet, exclusionary land markets and slow housing construction pace - individual or in small groups- still prompted

citizens to occupy marginal risk-prone areas and build precarious dwellings. In 1903, the Homestead Act enabled *agregados*⁹⁶ to own the land they tilled; yet, U.S. agribusinesses and local elites remained the main land owners (Ayala & Bergad, 2002). The 1903 Act signaled affordable, low-density, individual ownership housing for the formally employed; yet, it excluded rural and urban unemployed, self-employed or informally employed. It was endorsed by laws in 1906 and 1920; however, it was dented by the disregard of the 1917 Jones-Shafroth Law -also called Jones Act-, which limited private corporations to own until 500 acres, unlike private individuals.

In 1923, the law *Hogares Seguros de Puerto Rico* -Secure Homes of Puerto Rico- created the Homestead Commission to “guide urban development, guarantee an orderly fashion, supply adequate housing by providing parcels or housing for urban workers” (Dinzey-Flores, 2007) p. 471. The Commission bought land and built three *Barrios Obreros* -urban workers districts- in San Juan, Arecibo and Salinas. “More than five hundred model houses were erected...which were sold to worthy applicants at very moderate prices, divided into easy payments...but in Puerta de Tierra, in 1921, a fire [had] destroyed the homes of five thousand people” (Mixer, 1926, p.202-206). In other words, new provisions could not cope with housing deficits, multi-hazard exposure and migrants lacking formal jobs, access to the Commission’s few slots or stable income to buy from the private sector. By 1916, the ill-reputed San Juan slums *Sal si puedes* (Exit if you can), *Hoyo Frío* (Cold Hole) and *Gandulito* (Small Pea) thrived in Puerta de Tierra and Santurce mangroves. Their constructions remained fragile and easy to dismantle, but their increasing density caused ecosystemic damages such as deforestation, pollution, and reduced mangrove capacity to minimize storm damages.

⁹⁶ Indigent workers living in latifundia with the right to cultivate a small area for self-subsistence.

Fig. 70 Hato Rey neighborhood, SJ



Consolidated working class housing (Moscioni, Between 1898-1917m).

Fig. 72 Workers' housing divided by train tracks in Puerta de Tierra, Old San Juan



Formal low income housing (Moscioni, Between 1898-1917n).

Fig. 74 "Native house, Carolina"



Isolated precarious rural household near San Juan (Moscioni, Between 1898-1917g).

Fig. 71 Ponce neighborhood



Consolidated working class housing (Phipps, c.1907).

Fig. 73 El Fanguito slum partially over a mangrove, SJ



Slum under consolidation (Moscioni, Between 1898-1917e).

Fig. 75 "Typical huts of Porto Rico"



Unlocated precarious housing considered usual by the photographer (Moscioni, Between 1898-1917l).

To conclude this section, I reviewed the built environment emphasized in architectural, planning and policy records until now, as part of public narratives that strengthen or weaken fair

remembrance of how differently urban life and disasters were experienced. Again, the focus is the formal well-off built environment (Marvel, 1994; Rigau, 1992a; Rivera Ruiz & Llanes Santos, 2008; Vivoni, 1989), with emphasis on exceptional architects -such as Nechodoma- and the protection of contemporary elitist areas⁹⁷. Such one-sided approach undermines a multi-layered and pro-equity learning process about everyday life and crises.

VI.4 Socio-cultural hierarchies, memory and knowledge of disasters

Differentiated vulnerability or resilience to San Felipe was also shaped by the contemporary juxtaposition of socio-cultural hierarchies, memory and knowledge of disasters. A novel manipulation of country of origin, language, class, race, gender and religion justified social integration or exclusion; which reflected on rights, resources and obligations. New and old social hierarchies coexisted, competed and permeated into collective memory-making processes and degrees of hazard exposure. For example, racism, country of origin and the Black Legend⁹⁸ (R. Fernández, 1996) justified occupation of top positions by white English-speaking Americans, dissemination of anti-Puerto Ricans stereotypes, and legal vacuum of citizenship since 1898. Second in rank were white, male, rich Creoles. Yet, entrepreneurial and landed elites or those working in public administrations could be discriminated by foreigners as unreliable and sub-par; and some were accumulating sourness for their displacement from economic and social preeminence. Poor Puerto Ricans were at the bottom of the social ladder; especially if *jíbaros*, black, women, children and elderly. Poor and working class citizens were characterized as lazy, ignorant and stubborn. In response, some of them joined unions and launched strikes to fight for

⁹⁷ An exception is the book focused on the neighborhood of Santurce, San Juan: (E. Quiles Rodríguez, 2009)

⁹⁸ A term coined in 1914 to comprise negative traits due to the legacy of Spanish colonialism.

their rights (Ayala & Bergad, 2002; R. Fernández, 1996; A. G. Quintero Rivera, 2003). The Serrallés family epitomized the landed elite's crisis. Their Central Merceditas mill was a company town in Ponce, with its own rail line, workers' housing, transportation fleet, police, and airport. Merceditas superseded traditional small moscovado sugar factories. Yet, it could not keep up with the new extra-large U.S. mills such as Guánica, Aguirre and Fajardo; which attracted migratory workers and business. Circa 1910, famed Ponceño historian Eduardo Neumann conveyed the overpowering of his peers, territorial and urban changes:

“agricultural property was highly divided in Ponce and it was the cause of the relative comfort that social classes enjoyed there. Meanwhile, now it is concentrated under the power of two large mills, Guánica and Aguirre, monstrous octopuses that with their suckling tentacles have ruined commerce in Ponce through direct exports, and have reduced to the minimal expression the movement, animation and joy that prevailed before; to the point that now Ponce is like a Semi-Pompeian city given its silence and quietness” (Neumann Gandía in J. L. P. Lizardi, 2008, p. 12).

Coffee planters and merchants also felt powerless, as the following cartoon expresses:

Fig. 76 “U.S. Porto Rico's only purveyor”



Physically imposing Uncle Sam runs a shop full of essential import goods, such as food, tools, machinery, garments and hygiene products. Moreover, Uncle Sam controls shipping and is the only trader for a small coffee bag offered by a petite barefoot *jibaro* representing Puerto Rico, image by (Brau de Zuzuárregui, 1915c).

Other frictions overcame social boundaries. Pro-Americanization policies continued censorship, and equated affirmations of cultural identity with subversion and separatism to be punished; even displaying the Puerto Rican flag was illegal (Paralitici, 2004). English remained imposed as the official language and medium of instruction in public schools (Barreto 2001), which further undermined limited investment on education. A representative of the Young People's Missionary Movement of the United States and Canada endorsed linguistic dominance as part of a larger assimilationist goal:

“Children ought to receive their education in the language of the country of which they form a part. If more is desired, it should be paid for privately. The Porto Ricans do not understand American ideals and American ways because they have had almost all of their associations with Spaniards...It is imperative that the new generation shall absorb the real spirit of American life... we believe that English alone should be the language of the schools” (Fowles, 1910, p. 91).

English was highly unpopular and made Spanish a basic element to delineate Puerto Ricanness (Barreto, 2001; Dávila, 1997; Jorge Duany, 2005; Verrill, 1914):

“Although English is,—according to theory,—the “official language” yet those who speak it are few and far between. English may be “official”, but the officials do not speak it, save in a few instances or where they happen to be of American birth or education. Even the policemen in San Juan cannot speak the “official language”, and a visit to the offices of the Interior Department or to many other Federal and Insular offices will demonstrate that the officiousness of the English tongue has scarcely gone beyond the theoretical stage. ... American though Porto Rico may be, yet it is merely on the surface; at heart the Porto Rican is a Porto Rican first, last, and all the time” (Verrill, 1914, p.13, 14).

Among the few open critiques to the new regime were the satire cartoons by pro-independence intellectual Mario Salvador Brau de Zuzuárregui. He was relatively protected being heir of Salvador Brau -writer, historian and liberal autonomist Creole politician- and himself a famed journalist, poet, cartoonist and newspaper artistic director.

Fig. 77 “Hammering on Cold Iron”



In an urban area, Uncle Sam hits a nail - Americanization- with a hammer -English Language-. Yet, the bent nail has not entered the pavement. Puerto Ricans are embodied by a barefoot disdaining man resembling Creole autonomist Luis Muñoz Rivera, father of future Gov. Muñoz Marín (Brau de Zuzuárregui, 1915b).

Fig. 78 “Woodrow Wilson”



U.S. President Thomas Woodrow Wilson (1913-1921) wears the Spanish conquerors regalia and checks the only missing piece, a helmet (Brau de Zuzuárregui, 1915d). The author exploits the symbolism of Old San Juan placing the scene in *La Fortaleza*, the Governor’s palace.

Fig. 79 “The last Straw”



A cornered, emaciated and suffering cow named Puerto Rico incarnates rural decadence during the 1910s. A pensive Uncle Sam ruminates the final possible exploitation to the cow (Brau de Zuzuárregui, 1915a).

Male writers, artists and journalists from an upper and middle class background captured post San Ciriaco accelerated economic demise, social turmoil, political and cultural changes. Ramón Juliá Marín, José Elías Levy, Matías González García, Eladio Ayala Moura and Manuel Zeno Gandía addressed misery, hunger, overcrowding, children mortality, Hawaii emigration, coffee losses, impoverished Creole businessmen and planters, return to semi-feudal conditions on the coffee highlands and tobacco plantations, bankruptcy, suicide and the establishment of American power, land ownership and sugar cultivation (Centeno Añeses, 2000). Intertwined with those themes was a sense of longing for an idealized time before the advent of American rule, which grew in the following decades through a refreshed version of *hispanophilia*.

Poor Puerto Ricans still withstood the worst forms of exclusion and disaster vulnerability, especially if black, women, children and elderly. Their exposure to disasters remained high because of precarious living and working conditions, healthcare, food security and education. Employment figures are hard to grasp, seasonal unemployment was so prevalent that annual averages are not trusty; but according to governmental data, unemployment rose steadily 17.9% in 1910, 20% in 1920; 30.2% in 1926, over 36% in 1929 (Ayala, 1996), 60-70% by the late 1930s (Ismael García-Colón, 2006). Cutting sugar -men's most widely available job- was seasonal, underpaid, rudimentary, exhausting, and risky. Mastering a machete implied hand bleeding and acute pain, until becoming callous. Workers had to overdress withstanding intense heat and humidity to avoid leaf cuts, insect bites and sunburns. If distracted, their eyes could be poked out by cane fragments. Plantation life was comparable to slavery:

“A few of the large plantations, the lot of the poor is hard. They are not much better than slaves...At some of these estates, the people are herded together like cattle. A long, narrow, shed-like building is constructed, divided into small rooms, each of which is rented to a family. These people are perhaps amongst the most unhappy of the island” (Fowles, 1910, p.25,26).

For poor women, burdensome and exploitative paid occupations included needle work, laundry, cooking and serving, sewing, cigar packing, coffee picking, hat weaving and sex work. Legal divorce was a new and empowering policy; yet, attempted moral reforms by men -American officials supported by local liberals- were colored by double standards and had contentious effects on women's living prospects (Findlay, 1999). The experiences of the poor and excluded entered historical narratives limitedly, through the lens of others. In the absence of their written testimonials of everyday life and life changing events, such as disasters, their opinions did not shape backbone identitarian or political discourses. For instance, I only found one published testimony about differentiated hurricane vulnerability between Americans and lay Puerto Ricans, written by an American woman in a relatively privileged position after San Ciprián. Although it corresponds to 1932, it shows the frustration of islanders affected by a disaster vis-à-vis the seemingly unperturbed lifestyle of Americans:

"Three men are approaching. One hacks fiercely at branches with his swift machete. Another supports, almost carries, the third—a middle-aged man painfully hopping on one leg, his other leg in a bulky bloodstained bandage, his head blood smeared, a coarse burlap sack across his half-clothed shoulders, his face haggard with worn-out eyes. A man assists a limping woman using boards as crutches. A native policeman hurries along, dispatched to rescue.

"Are many hurt?" we ask.

"Many," he gravely answers. "Just around that corner is a leap of concrete blocks. Yesterday it was a house. Three people were crushed to death there."

A native soldier comes up as we talk.

"Look!" says the policeman, greeting him, his face distorted into a sour ironic grin as he points to our standing house. "The house of the Americans! With the roof still on! The lucky devils!" (Kairns Champlin, 1933, p. 69).

In sum, the disparities of the new regime had different impacts over different peoples; yet they contributed to create collective imaginaries of a frail Puerto Rican way of life against that of powerful foreigners. Independence ideals reemerged before the 1920s, for more people there were no benefits in the asymmetrical relationship with the U.S.:

“people without an address, suspects, running away from justice, children fugitives from their homes, agregados evicted because of repetitive stealing or because they protested injustices with enough vehemence, migrant rural workers climbing up and down the mountain range in search of a seasonal job, a rustler circling the juicy pastures of the countryside, watching here and there a little bull unsurveiled or a tame mare that would not resist to be tied” (F. Picó, 2006, p.27).

Fig. 80 “Plantation Joe. Ponce P.R.”



The old sugar worker’s extreme penury is evident in his ragged clothing, scarred skin, and deformed and callous bare feet (Kilburn, 1898-1899).

Fig. 82 Barefoot children carry tobacco leaves



Child workers endured hard conditions, and very low pay or none (Moscioni, Between 1898-1917b; Waldrop Photographic Co., 1918).

Fig. 81. Laundresses of color in Ponce



Barefoot laundresses withstood polluted waters, sun, abrasive detergents, rain, insects, weights on their head and damaging postures (Zahner, 1899).

Fig. 83 Barefoot child carries wood



Fig. 84 U.S. labor federation leader in Ponce



Samuel Gompers traveled to organize workers in 1904 (CDOSIP, 1904).

Fig. 85 San Juan dock workers on a strike



Large strike on Sept. 25, 1918 (CDOSIP, 1918).

After mounting pressure on the island and debates in Washington, the 1917 Jones-Shafroth Act brought cautious power redistribution and benefits to neutralize resistance. It established a bill of rights that included the local election of a four year term Resident Commissioner and a Senate to complete a bicameral Legislative Assembly; which integrated more elite creoles in the colonial administration. It finally provided U.S. citizenship to Puerto Ricans. Yet, it also brought contentious obligations, such as drafting from World War I onwards while the draft was effective, which later would be criticized for over-exposing islanders (Paralatici, 2004; Rodríguez Beruff, 1988). Essentially, the foundations of an imperialist scheme remained unaltered, without economic reforms or anti-discriminatory policies that reflected in daily life or extreme crisis. To make matters worse, all crop prices went down in the early 1920s and the Puerto Rican economy entered a recession. Mainly foreign stakeholders of the large sugar mills could withstand the situation, transferring the burden to workers. Social fractures intensified due to migration, crime and violence. In sum, unemployment, drop in average salaries, higher living costs yet degraded living conditions radicalized the forms of resistance that the poor had, including strikes (García Colón, 2000; Paralatici, 2004). It also radicalized patriotic movements and discourses. In the 1920s, competing strains of nationalism emerged in tandem with identity constructions that

agglomerated contending elite, worker and peasant factions. Fast rural decay vis-à-vis American oppression were central themes of merged identitarian and political assertions. Since the 1920s, coffee became a reference to Puerto Ricanness in the arts, literature and other cultural expressions (Rodríguez Centeno, 2000). Moreover, along the founding figure of the *hacendado*, the hard working and supposedly light-skinned *jíbaro* was added to an idealized harmonious Puerto Rican family, unlike afro-Puerto Ricans. Young politicians Pedro Albizú Campos and Luis Muñoz Marín, partially educated in the U.S., used identity and colonialism as political magnets differently (García Colón, 2000). Albizú Campos was an out of wedlock son of a wealthy Spaniard and a mixed-race domestic worker, raised modestly in Ponce. Excelling Harvard Law School graduate and multilingual, he gained power in the Puerto Rican Nationalist Party. He correlated his ideological and pro-independence views to a cultural identity that had catholic, agrarian, *hispanophilic* and patriarchal roots, without strong open emphasis on race. His constituencies were sugar workers and autonomists (Santiago-Valles, 2007). Muñoz Marín was a light-skinned son of the famous highland politician Luis Muñoz Rivera, who did not finish his journalism studies at Georgetown University. As a militant of the Socialist Party, he criticized large U.S. corporations and lauded suffering *jíbaros* (Cordova, 2005) and the Spanish language, without emphasis on religion. He attracted poor peasants, workers and his elite peers. Divergences between them ensued, and Muñoz Marín changed his stance to found a party that did not campaign for socialism or independence, getting U.S. support. Yet, their shared appeal to a peaceful rural and patriarchal *hispanophilic* past contrasted with the imposing American identity became a significant identity theme (Dávila, 1997), and both disregarded disasters as a core political topic. Their commonalities would contentiously impact future decisions of economic redistribution and social recognition, shaping the island official historical narrative.

Months before San Felipe, political tensions were mounting. For example, editorials in *El Agricultor Puertorriqueño* accused insular and federal administrators -particularly Gov. Towner- of being unethical, uncaring, abusive, and eager to sell out farmers when politically opportune (Levy, 2010). Aviator Colonel Charles A. Lindbergh visited the island on February, and local dignitaries asked him to bring a message to President Coolidge questioning the underdeveloped state of the island and demanding the freedom and autonomy that they lacked as a mere colony. Starkly, Coolidge answered that the Treaty of Paris contained no promise to the people of *Porto Rico*; yet Americans had generously provided means for economic growth and even a very liberal organic law that enabled local elections. Problems were caused by elected representatives; *Porto Ricans* were unprepared to govern themselves and should not insist on trying his patience (R. Fernández, 1996). Thus, the background preceding San Felipe was sour and stingy; the American dominance model had consolidated economic, spatial and social conditions that would turn even minor hazards into disasters.

Concerning the grassroots remembrance of hurricanes, I found limited data. Basically, prevailing lack of education reflected on superstitions and religious beliefs. Highlanders believed that hurricanes could be forecasted in advance based on avocado crops; and in the short-term noticing spider webs falling from structures, animals in distress -chickens, crickets, frogs, and lizards-, and the presence of a coastal bird flying inland to avoid storms, summarized in the proverb “*Rabojunco en tierra, tormenta en la mar*” (coastal bird Rabojunco inland, storm at the sea) (DIVEDCO, 1965). Protestant branches gained feligresy, thanks to Americans who coupled Catholicism to Spain and backwardness. Yet, Catholicism was widespread, and some traditions concerning hurricanes were kept. Hurricane naming matched the Saint name day; churches were

improvised refuges due to their sturdiness and lack of options; people begged for God's protection when in danger and even put palm branches blessed during Palm Sunday on their entrance door against storms (Schwartz, 2015). However, there were no recorded public diatribes by religious leaders explaining disasters as God's wrath towards deserving sinful people⁹⁹.

Meteorology was less important in military terms, as the U.S. was not at war. Yet, S.J. Weather Bureau equipment improved and adjacent WKAQ radio station rapidly broadcasted. Formal knowledge limitedly advanced secularization. For instance, San Felipe relief workers noticed lists of hurricanes and dates printed on the back of school history books (American Red Cross, 1929). This could have helped to remember a critical condition from an early age, despite narrow teaching of local history and pro-American public school curriculum (McCoy & Scarano, 2009). Yet, the approach followed simplistic mainstream assumptions of data about hurricanes. The social dynamics that sustained the construction of disasters throughout history and the ways in which Puerto Rican society was reshaped by disasters remained unaddressed.

VI.5 Mississippi floods 1927 relief: the presidential rise of Herbert Hoover

The development of San Felipe relief in Puerto Rico can be properly understood examining first its template, the 1927 Great Mississippi River flood relief. A disaster so vast, called "the Flood of the Century" (Arsenault, 2005), prompted more than the usual response of Congress to pass a bill to aid victims; and, the relief stage paradoxically became the propelling opportunity for a U.S. president candidate and his subsequent challenge. On New Year's Day of 1927, after a

⁹⁹ Catholic Bishop Giddens and the Redemptorists under the Southern Cross limitedly engaged in San Felipe relief, but steered away from coupling disasters, God and sins.

semester of copious rains accumulating in the central basin of the Mississippi River, the levee system had multiple break downs. Vague estimates of the death toll reach the thousands. More than 700,000 persons, almost one percent of the U.S. population, became homeless; and losses equaled a third of the national budget (Slivka 2005 in J. D. Rivera & Miller, 2007)). The tragedy happened during a period of Republican preeminence, since the end of Wilson's presidency in 1921, all through which taxation and domestic spending reduced. Moreover, it happened in a lasting context of pervasive assumptions towards societal crises, governmental roles and victims' portrayals. Disaster management was growing in funding and number of cases (Landis, 2005); yet essentially meant minimalistic relief reactions by the government, including passing Congress Acts and sending the Army if havoc exposed insufficient means and capacities of local authorities and relief organizations. The implicit consensus was that the government, particularly the federal, should not intervene in what were understood as local 'natural' crisis (Barry, 1998, 2005; Foster, 1983; McClure, 2011; Mills, 2006). For example, in 1907, the federal government asked New Orleans banks to put up front \$250,000 as a condition for the Surgeon General to join in a yellow fever epidemic. The rejection of federal intervention came from below also. In 1922, Louisiana Governor John Parker refused all aid, including the Red Cross, after a flood left 35,000 homeless. Likewise, Tennessee Governor Austin Peay initially rejected aid after the 1927 Mississippi floods; he argued locals were to provide for themselves. President Coolidge confirmed those views when commenting on the Mississippi floods, which he never saw for himself although the seven-state flooded zone equaled the size of New England:

“The Government is not the insurer of its citizens against the hazards of the elements. We shall always have flood and drought, heat and cold, earthquake and wind, lightning and tidal wave, which are all too constant in their afflictions. The Government does not undertake to reimburse citizens for loss and damage incurred under such circumstances. It is chargeable, however, with

the rebuilding of public works and the humanitarian duty of relieving its citizens of distress” (Coolidge 1927 in Kosar, 2005, p.7).

Another assumption was that charitable and private entities should undertake relief and reconstruction, instead of the government. The American Red Cross, created in 1889, gained prominence in relief provision by trial and error, gathering professionals and volunteers. It could have incorporated experiences from San Ciriaco relief through Brigadier General George W. Davis, the first U.S. Governor of Puerto Rico, the Central Committee Chairman (1907-1915). After World War I, the Red Cross became the closest to a federal disaster-response agency. As a congressionally-chartered quasigovernmental organization, its mandate was to establish:

“a system of national and international relief in time of peace, and to apply the same in mitigating the suffering caused by pestilence, famine, fire, floods, and other great national calamities, and to devise and carry out measures for preventing the same” (Kosar, 2005, p.4).

Contemporarily, Congress withdrew its support for Army relief engagement; thus, the Army reduced its field interventions, including medical personnel (Foster, 1983).

Yet, the scale of the Mississippi River floods demanded a new approach. The federal government opted for a centralized response policy that was decentralized in its execution, a ‘governing by network’ scheme (Kosar, 2005). Coolidge created a quasi-governmental commission that included five appointed cabinet secretaries and the Red Cross. This commission appealed for public donations; and it coordinated relief with local, state and federal resources, Red Cross personnel and volunteers, and the private sector. Herbert Hoover, Secretary of Commerce and elected member of the Red Cross Central Committee, was appointed to direct the relief commission. He was known as ‘The Great Humanitarian’ for supervising food distribution in

occupied Belgium before the U.S. joined World War I, and for running post-war food programs for Europe. Hoover used the media to spread the paradigm of minimalist government intervention; insisted on volunteerism, self-sufficiency and entrepreneurialism as values to confront the aftermath (McClure, 2011); and the onus of aid recipients to earn it as soon as possible. A dominant figure like Hoover clarified the chain of command to federal, state, and local officials and the public. Quick inter-institutional coordination included free railroad transportation for victims, Coast Guard and Navy boat rescue, and delivery of urgent Army supplies to the Red Cross. Yet, those services were loaded with class and race prejudices that Hoover and other authorities overlooked. For instance, complaints noted poor African-Americans being allowed to take supplies or boats only after Whites did, sometimes even animals received priority for rescue (J. D. Rivera & Miller, 2007).

Meanwhile, the Red Cross launched a national campaign for donations and activated a web of thousands of experienced volunteers with connections on the ground. They sent information to Hoover's headquarters for tailoring the effort; and distributed food, clothing, blankets and supplies. Also, the Red Cross created 154 refugee camps, which were a key but contentious mechanism for the survival of almost 330,000 persons, mainly African-Americans (Anthony Oliver-Smith, 2006). The camps usually provided shelter in tents donated by the Department of War, rustic shared bathing and toilet facilities, food, rudimentary medical care, clothing, tobacco, some even provided entertainment and home economic courses. Yet, the underpinning assumption was that aid indulged vagrancy, recipients had to earn it. Thus, in some camps Black evacuees were brutalized, obliged to work at gunpoint or barred from leaving. Also, the Red Cross distributed seeds and farm implements to reactivate agriculture. Some planters received

the evacuees' allotment and conditioned or charged distribution though. Other complains included denial of supplies to Black farmers and workers not interned in camps, arbitrary support for housing rebuilding and essential furnishing distribution, and insufficient funds to reestablish a life¹⁰⁰. Yet, decentralized execution implied minimal federal supervision and lax accountability of relief workers; and Hoover purportedly disregarded race and class-based abuses, controversies and criticism (J. D. Rivera & Miller, 2007).

The Mississippi tragedy triggered several policy changes. One was a credit provision plan to help disaster victims. Private and state reconstruction corporations established by Hoover were to lend money to farmers, sell these loans to the Federal Intermediate Credit Corporation, and continue making loans based on the proceeds. Hoover stimulated industrials, merchants and banks in affected areas to provide working capital for the corporations by buying stock in them (Kosar, 2005). Yet, the corporations failed to make loans to those who needed them and ended up being a fiasco. Also relevant were the passing of the Mississippi Flood Control Act, in 1928, the most expensive governmental undertaking besides participating in World War I (Barry, 1998), reinforced by the River and Harbor Act (1930). Both set a precedent for federal involvement into spheres traditionally left to state and local authorities and contributed to reshape the role of government in the public eye (Arsenault, 2005; Barry, 1998); pivotal to endorse post-Okeechobee flood control projects –including the path breaking Hoover Dam- and the New Deal. An unforeseen policy change was a template of disaster relief, which included social engineering in times of dire need, and was used in Puerto Rico months later.

¹⁰⁰ From citizens' donations to the Red Cross, not governmental contributions, an amount of US\$ 77.42 ought to suffice for a family of four to leave the camp and restart from scratch.

In terms of political consequences, at first a few editorials complained that federal expenses did not translate into direct aid to flood victims, in a year with record budget surplus. Essentially, rescue supplies and salaries for military personnel were covered. Yet, Hoover was in charge of reporting relief with no oversight, which enabled his manipulation. Besides, he gained vast sway over the media (Kosar, 2005; McClure, 2011), which projected him as a national hero who had enough efficiency, intelligence and humanitarianism to become president in the 1928 elections. Disaster relief was the opportunity to quickly launch a non-contender into the presidency and, paradoxically, it also became his challenge four years later. Abuses in the camps and Hoover's failed promises to African-Americans contributed to alienate Black voters in his re-election campaign (J. D. Rivera & Miller, 2007) against Democrat Franklin D. Roosevelt.

VI.6. San Felipe relief and incipient policy trends

San Felipe relief preceded the turning point in the development of disaster management as a U.S. federally funded professional endeavor. It also happened at a critical moment in history for Puerto Rico. It was a challenge to launch effective relief in a background of multifaceted political tensions, meager federal engagement, top-down oppression, bottom-up frustration, entrenched poverty, superstitions and widespread destruction.

On the 14th of September, 1928, the Red Cross dispatched men experienced in Midwest tornados and mostly in the Mississippi floods; they gathered in Charleston S.C. by train, and sailed for Puerto Rico the next day on a Navy destroyer. The Red Cross became the administrative office of relief, surmounting anti-aid assumptions voiced by local politicians. For example, Natalio

Bayonet Díaz, ex-member of the House of Representatives, asked Gov. Towner to steer clear of relying on external aid because recovery was a duty of the Puerto Ricans (Schwartz, 2005). Deprived of federal funds or a buoyant local economy, U.S. Red Cross chapters launched a national campaign to collect cash and in kind donations, which would add to the supplies bought with their savings. Although well-meant, gathering and shipping in kind donations became costly and inefficient. Once on the island, used clothing was insufficient and inadequate for the tropical weather, and the Red Cross hired insular factories for production. Initial relief funds essentially came from Red Cross reserves, public donations, improvised grants from governmental institutions –particularly the diversion of military stores such as tents and blankets - and free or below rate concessions made by public entities and commercial firms on the island and mainland (American Red Cross, 1929). The priorities were to avoid food and health crises, provide basic shelter and tend to the worst agricultural damages -which became a coffee clean-up program- whilst avoiding rebellion.

The fear of famine was well-founded, given the deep-rooted dependency on food imports and sudden ruin of foodstuff. Thus, the first step was to distribute mainly rice, beans and dry codfish; small amounts of lard, sugar, coffee, salted pork and condensed milk; and direct donations of fruits and vegetable from mainland packers or the Dominican Republic. The aim was to provide rationing only to children and women tending families or unable to work, but reduce it steadily as work opportunities emerged; food would pay for reconstruction works (American Red Cross, 1929). In other words, the underlying assumption remained that selected aid recipients had to earn it as soon as possible. This turned out to be a noxious compensation scheme for workers, as in San Ciriaco. They were paid 10 percent in cash and 90 percent in food rations (Schwartz,

2005), and put under the strict supervision of municipal committees, relief workers and planters interested in deterring ‘vagrancy’. Borrowing a lesson from the Mississippi flood relief, vegetable seeds were distributed to promote quick and acclimated crops. Months later, an agricultural expert and member of the Insular Department of Agriculture noted in press better produce provision and quality in markets, and lauded the quick avoidance of malnutrition (American Red Cross, 1929). Yet, the opening flaw of this initiative emerged soon; seed distribution was not neutral. During the first phase, school kitchens feeding the triple amount of poor children and farmers in general were said to benefit (American Red Cross, 1929). During the next phase, coffee planters received seeds assuming that they would share seeds, produce and profits made from sales with their workers. Neither the Red Cross nor any institution reported how the latter dynamic unfolded, seemingly trusting the planters’ good will. The next and grave flaw of this plan was vented a year later by the new Governor, Theodore Roosevelt Jr. In his compelling article for the New York Herald Tribune titled ‘Children of Famine’, December 8th; Roosevelt’s objective was to extract money from charitable U.S. citizens, not the federal government (R. Fernández, 1996). He often saw mothers carrying skeletons, pitiable groups of people carrying home-made coffins, around 60% of children being malnourished and many starving towards a slow death; all of them Americans he insisted (Roosevelt Jr., 1929).

Fear of a health crisis had a solid foundation also. The Department of Health had established hospitals and clinics in the previous decades; yet, average public health before San Felipe was precarious. For example, bed capacity was insufficient throughout the island. In order to get basic attention, sick isolated highlanders depended on family and neighbors to carry them on litters made of sugar-sack hammocks suspended on a pole; a scene that became too common in

the aftermath of the hurricane. Insular health inspectors conducted searches on foot for remote patients and distributed basic medicines among those unable to move. The Department of Health and Red Cross coordinated opening 14 emergency stations in schools, dwellings, tents and clubs; whilst the Red Cross extended assistance to 14 established hospitals. Their joint campaigns of multiple inoculations and potable water monitoring limited epidemic bouts and leveled general health conditions in the short-term. Emergency stations closed by late November and reported only a typhoid fever epidemic in Aguadilla, controlled by February (American Red Cross, 1929). The Army contributed with hospital supplies, including two field hospitals of 1,000 beds each and five medical corps. Following Congress guidelines though, it reduced its engagement compared to San Ciriaco regardless of the crisis.

Concerning shelter, as in the Mississippi case, provision divided into refugee camps and materials for housing construction or repairs. Information about the Red Cross camps is scarce, noting that a few cities like Yabucoa and Arecibo provided land (American Red Cross, 1929). Yet, the post-San Ciprián newspaper article by the mentioned American woman provides a glimpse to life in the camps. In a primitive location, teepee-like tents of canvas donated by the military are the background for refugees on the grass, including naked children, elderly, wounded people and a young woman of color rudimentarily cooking outdoors.

Fig. 86 “Sufferers from a Puerto Rican Hurricane in a refugee camp” after San Ciprián



Destitute refugees carry-on basic activities in a rustic setting (Wide World photo on (Kairns Champlin, 1933, p. 10).

The Red Cross vaguely reported giving to San Felipe refugees a small sum to start a new existence, in which they would somehow replace the tent with a home and provide for themselves, as in the Mississippi case. In the absence of support for transitioning, life prospects were bleak giving the prevailing conditions of poverty, unaffordable housing, unemployment and competition among migrants. They could join slums or create new ones, but violent eviction was a reality. Some unauthorized post-hurricane camps or slums “menaced the health and morals of their inmates and accordingly had to be broken up” (American Red Cross, 1929, p. 33).

Meanwhile, the distribution of materials for housing repair and construction took longer. Supplies on the island were finished by those who could afford to fix their properties; thus, the

Red Cross had to import all materials. Moreover, the aim to stop rural exodus from the coffee highlands translated to rebuilding negotiations with titled planters, not peasants. Addressing agricultural damages evolved from an immediate relief task to a reconstruction priority, influenced by the planters' lobby. Repeating the Mississippi experience, the Red Cross first distributed pruning implements and cash for seedling among coffee planters, not workers. Yet, those actions failed to cope with the extensive damages and make use of unemployed pauper peons. The latter were excluded from cash advances, seed and pruning implements donation; they were tightly conditioned to receive food rations; and, as importantly if not more, on the brink of unleashing a social crisis as agreed by Red Cross administrators, the local political class and U.S. government officials (Schwartz, 2005). In response, a coffee clean-up program calculated to have 10,000 workers on payroll, but it started with 25,000 and reached a peak of 67,000. Those high numbers expose the extent of the destruction, unemployment and the workers' willingness to earn a living, even if low paid and under a tight grip. It also helped that the Red Cross arranged insurance given the primitive and hazardous manual work, when the Workmen Compensation Act was loosely enforced and non-for profit entities were not required to comply (American Red Cross, 1929).

Contemporarily, planters proposed a plan targeting the urban working poor, small planters and rural workers -either *arrimados* or migrants staying in barracks-; in which landowners' supremacy was non-negotiable. Guillermo Esteves, Resident Commissioner of Puerto Rico, promoted the plan arguing that those groups were entitled to different levels of trust; small proprietors were morally reliable but untenured workers should be controlled and deterred from migrating to towns. Funds ought to go directly to the landowners for recuperating their

properties; the workers' needs could be addressed later by distributing small parcels and rebuilding houses. As a veiled threat, he affirmed that the Red Cross had to face consequences if that process was to be accelerated (Schwartz, 2005). Bayonet Díaz favored "solving once and for all the problem of hygienic dwelling for our laboring men, and causing to disappear from the countryside the wretched sight of the hut [*bohío*] which is a stigma upon our civilization" (Schwartz, 2005, p.44). He proposed an idealized repopulated mountainous landscape where eyesore *bohíos* would give way to orderly cottages inhabited by dedicated small farmers; in other words, the materialization of the ancient rural lore of the enduring *jíbaro* (Schwartz, 2005), but without land redistribution. Finally, allocation of materials took place without tenure changes. Workers were to build or fix their homes with imported Southern pine boards, roofing of fluted galvanized iron, nails and hinges provided by the Red Cross and their meager salary, under the vigilant eyes of planters, municipal committees and relief workers.

Meanwhile, U.S. Congress controversies about relief aid resembled San Ciriaco debates; the core proposition was to request for interest on funds expended and for third mortgages on destroyed properties. Should there be complete or partial waiver of payment of interest on deferred payments? Senator Bingham, eyewitness of the devastation and who affirmed that San Felipe was the worst hurricane experienced in the West Indies, suggested that the waiver should target only those truly bankrupted; and that repayments could start in a year or two. Worse, Minnesota representative (R) Harold Knutson pressed for cutting all U.S. involvement; it was time to answer autonomy calls:

"How about Porto Rican resources?...I do not see anything that gives any idea of the capacity of the Porto Ricans to take care of themselves...I say that if Porto Rico can independently handle the difficulty, she should be given that degree of autonomy" (Join Committee on Insular Affairs 1928 in R. Fernández, 1996, p. 98).

Kentucky representative (D) Ralph Gilbert was unwilling to help undeserving people. In person, Gov. Towner responded clarifying his class-race based argument for aid:

“It is vastly important that these coffee growers should be helped in this dire necessity because we want them to remain in Porto Rico. They are white people. They are good, dependable, meritorious class of people. They need more help than anyone else” (Joint Committee on Insular Affairs 1928 in R. Fernández, 1996, p. 101).

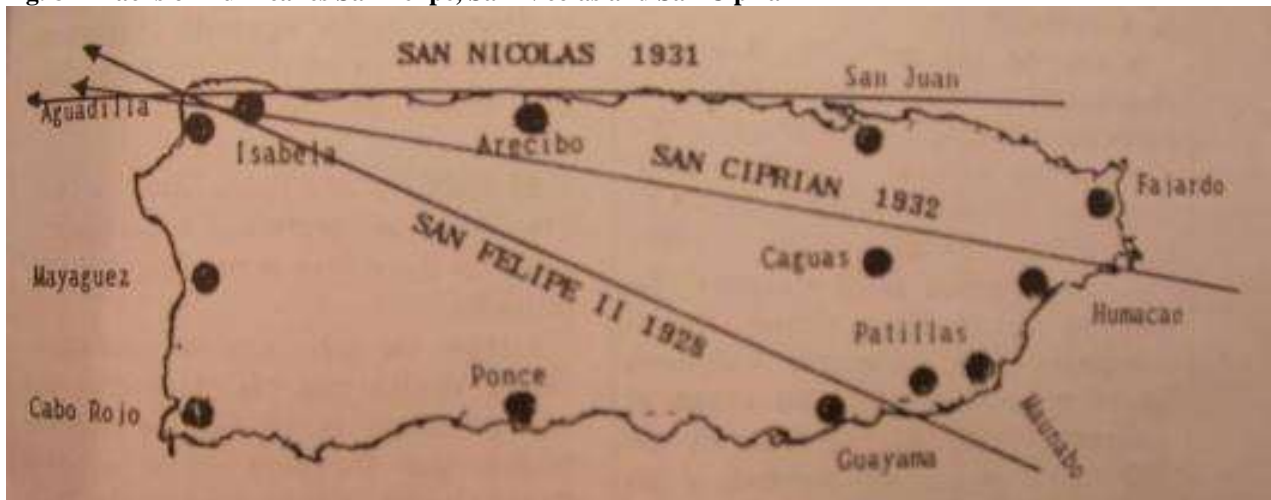
As a result of those negotiations, the Puerto Rican Hurricane Relief Commission (PRHRC)¹⁰¹ was established by joint Congress resolution on December 21, 1928. It was administered in Puerto Rico by the Department of Agriculture, the U.S. Army Corps of Engineers, and Collector of Customs at San Juan (National Archives, 2011). Essentially, it was delinked from redevelopment, planning, or disaster management goals; its mission was limited to offer credits to farmers who reunited tenure, assets or other economic conditions; as Hoover proposed for the Mississippi floods. After being the relief torch bearer and main sponsor, the Red Cross left on February 28th, 1929, expecting arrival of federal funds for reconstruction. Yet, the Wall Street Crash in the fall and ensuing Great Recession further reduced federal involvement whilst worsening the Puerto Rican crisis. For example, the PRHRC meager options of agricultural credits weakened even more when banks with large investments in the sector went bankrupted, such as the Banco Territorial Agrícola de Puerto Rico, the American Colonial Bank and the Banco Masónico (Sanz 1969 in (Rodríguez Centeno, 2000)). Moreover, a succession of hurricanes worsened the situation. In 1930, hurricane San Zenón -also known as Dominican Republic- caused minor to moderate wind damage to southern plantations, whilst rainfall was dispersed across the island. In 1931, Category 1 hurricane San Nicolás affected the north coast

¹⁰¹ In 1935, it became the Puerto Rican Hurricane Relief Loan Section (PRHRLS), which essentially continued the adjustment of loans. Its functions were transferred to the Puerto Rico Reconstruction Administration in 1946.

(Hartwell, 1931), resulting in agricultural losses. Worse was hurricane San Ciprián in 1932; it affected a smaller and different area than San Felipe and with less strength -Category 3- yet damages were comparable (National Climatic Data Center, 1932; Weightman et al., 1932). Again, the American woman's notes provide judicious knowledge, this time about the poor's vulnerability in the face of San Ciprián. She lived in Carolina but took refuge at her workplace, an exclusive private hospital in which damages concentrated on the fifth floor. Whilst she feared death, she confused the order in which towns would be hit; but her testimony echoes the lament of 'Temporal':

"That first phase of the storm is moving on westward. It is in Carolina now. Then Luiza, Rio Grande, Arecibo. What will it do to those poor towns? To all the tumble-down houses near Luquillo? To thatched bohíos up in the mountains? So flimsy. Houses on frail-looking pikes. Tiny huts jammed full of people. How will people manage to live? Babies? Children? Heaven help all those naked children. What's happening even now back in San Juan? Perhaps the second half of the storm is already there. Crushing down the hundreds of poor little shacks in Puerta de Tierra, wrecking the squatter houses on stilts over the swamplands of Catano..." (Kairns Champlin, 1933, p.67).

Fig. 87 Tracks of Hurricanes San Felipe, San Nicolás and San Ciprián



In four years, three hurricanes devastated the island, map (Miner Solá, 1996, p.50).

Acting Governor James R. Beverly, who held that post in 1929 between Towner and Roosevelt Jr., had planned some rudimentary disaster management. He had instructed mayors to organize

emergency committees and created a plain relief fund. Also, he had asked to publicize a warning plan of signaling flags flying from city halls and churches, which he credited with lowering casualties to 257 (Beverley, 1933). Yet, no other source confirms the effectiveness of these signals, unevenly implemented since hurricane San Roque (1893) and useless to isolated people. In parallel, police districts were warned 36 hours in advance and radio broadcasts provided constant warnings to ships (Mújica-Baker, n.d. after 1998). Although human casualties lowered, damages demonstrate extensive vulnerability, 25,000 were homeless, 76,925 families in distress, 49 municipalities gravely affected, and damages to citrus, one of the few surviving export crops (Beverley, 1933). Losses reached U.S. \$30-40 millions. In the absence of a disaster management institution, Beverly directed the National Guard and Insular Police to launch immediate rescue tasks, prisoners and volunteers went to clear streets, local officials activated relief committees focused on collecting cash and in kind donations, whilst the Red Cross established feeding stations and distributed medical supplies.

Fig. 88 "Ruins at Central 'Carmen', San Ciprián Hurricane, Porto Rico"



Extensive roof and wall damage of a large sugar mill, possibly in Mayagüez, image (Real Photo Post Card, 1932).

Fig. 89 San Ciprián devastation probably in San Juan



According to Gov. Beverley, in San Juan, Hato Rey and Río Piedras hundreds of houses were totally destroyed, debris took over roads and streets, all light and telephone poles and wires were down and trees were uprooted everywhere (Wide World photo on (Kairns Champlin, 1933, p.10) .

Beverley received condolences and instructions from President Hoover; when radio station WKAQ reopened, he announced them along an appeal for civic participation and the news of reduced federal support compared to San Felipe relief:

“due to the difficult economic situation in the continental United States, we must not and could not expect to receive such generous aid as we had received after the disaster in 1928” (Beverley, 1933, p. 4).

During the previous month of July, Hoover had signed the Emergency Relief and Construction Act (ERCA) and created the Emergency Relief Administration (ERA) to launch public works and operate relief programs via loans given to states. Those initiatives should come into play urgently, as destruction by the recent hurricanes was undeniable even for conservative ex-Governor Theodore Roosevelt Jr.:

“At periodic intervals the Island is swept by violent hurricanes. These are bad enough when they merely destroy the crop, as in the case of sugar; but with citrus fruits and coffee they often destroy the trees, which means that the damage can only be repaired by an entirely new planting and after a long period of growth. In recent years these disasters have been unusually common. Thus there was an exceedingly bad hurricane in 1928 and another in 1932; while in between was a somewhat slighter one which, however, did destroy a large percentage of the crops on the north coast”. (Roosevelt Jr., 1934, p. 274).

Yet, Puerto Rico should anticipate even less federal support than before, as communicated by Beverley on Hoover’s behalf. Another mechanism of federal relief disengagement during San Ciprián was the Army’s negligible contributions; namely the use of barracks, limited supplies and rescue personnel. Such abandon given the catastrophe stirred arguments on the island and mainland; thus, the War Department asked to clarify the situation and reevaluate the Army’s role in disaster relief. General Douglas MacArthur, at that time Chief of Staff of the U.S. Army, attributed the decision to a reduced budget and congressional refusal to reimburse the institution. A report endorsed by MacArthur suggested waiting for the ‘repercussions of the Porto Rican controversy’ to water down, before announcing further relief restrictions. The argument was that stocks left after World War I were reduced to a minimum, forcing the Army to cease its generosity:

"The time has arrived when the War Department must cease to be regarded as an eleemosynary institution and insist upon a strict observance of the law regarding the use of public property" (Foster, 1983, p. 116).

Politically, Puerto Rico was heading for havoc without safety breaks. Again, the incipient plans and actions by the not so new rulers, particularly those concerning the neediest ones, implied a pathetic vision of what constituted development and how to achieve it. In brief, disaster relief extended the foundations for more underdevelopment and fueled demands for independence. On the one hand, politicians in Washington reached the point of debating Puerto Rican autonomy,

but in terms of cutting U.S. involvement to overcome San Felipe mayhem. Although this proposition did not materialize, meager federal relief and reconstruction funds were insufficient to confront the catastrophe. Even worse, they were meant to diminish in the aftermath of San Ciprián, irrespective of the aggravated situation. On the other hand, the expanding crisis, neglect and injustices motivated more Puerto Ricans to join armed pro-independence platforms.

VI.7. Conclusions

San Felipe -and San Ciprián- preceded the turning point in the development of disaster management as a U.S. federally funded professional endeavor. Some facets of disaster management show improvement; others were extremely backward, in correspondence with a feeble understanding of human rights, development policy-making and planning. Systematic local knowledge construction became more sophisticated in technological terms; still shaped by military aims and procedures, and standard recordkeeping that neglected the political economy of disasters and unscientific characterizations. Better means of communication preventively informed citizens according to official sources, which could partially explain why there were significantly less casualties even if San Felipe is the strongest hurricane recorded locally. Moreover, a few new agencies had undertaken initial and uncoordinated actions that would have spatial consequences on disaster management. For instance, the Puerto Rican Irrigation Services, substituted by the Department of Interior and next by the Bureau for the Use of Water Resources, started to change the hydraulic regime to secure water and electricity provision. During the late 1920s in the U.S., there was a new understanding of engineering interventions controlling floods as a disaster management strategy. Resultantly, in Puerto Rico small interventions on dams,

canals and the like were launched; desiccated flood-prone areas started to be used for agriculture and urbanization, which extreme events or systemic failures would put at risk decades later. Also, urbanization of coastal ecosystems for high-end tourism and housing started in San Juan. In parallel, several acts and the Homestead Commission launched housing and land tenure provision without improving large deficits.

Social hierarchy and disaster vulnerability remained correlated as implied in qualitative information. Insufficient planning and investment in hard and soft infrastructure augmented selective vulnerability; combined with structural precariousness -reflected in appalling working conditions, healthcare, food security and education-, and with the deleterious impacts of questionable relief. Once more, at the core of causing selective disaster vulnerability were planning decisions, including coastal urbanization, 'uneven geographical development' as the standard of urban growth, limited use of modern technology in exclusive areas, discriminatory land markets that left risk-prone areas for the poor to settle in, infrastructure and service provision investment for the upper echelons and extraction of exports, extremely precarious housing, and land tenure insecurity. Self protection in *tormenteras* was the only protection mechanism that some of the rural poor could plan and implement. Besides, low investment in education reflected on superstitions concerning hurricanes, whilst some religious practices remained solid. Highlanders forecasted based on avocado crops and odd animal behaviors. Catholic practices included naming storms according to saints, using churches as refuges, praying and putting branches or burning them to ward off storms. Noticeably, there are no traces of religious leaders arguing that sinners had been punished by God with disasters. During

accelerated economic downfall, social fractures, political and cultural changes; independence ideals and rhetorical constructs emerged disregarding disasters as a core political topic.

After San Felipe and San Ciprián, direct communications from the respective U.S. presidents in office showed the visibility of the Puerto Rican crises, in a national appeal for donations in the first case and in a message broadcasted by a local radio as soon as it was possible in the second case. Yet, such visibility did not imply commitment because relief was not a governmental responsibility and the survival of Puerto Ricans was not a basic right. Correspondingly, there was no governmental leadership in that critical phase of the disaster cycle; only because the situation was extremely terrible the Army intervened, but with increasing limitations. For San Felipe, the U.S. Red Cross stepped up in the absence of federal institutions, local Red Cross chapters, analogous entities, or strong municipal authorities. Without the accountability, funding and full professional staff of a federal disaster-response agency, the U.S. Red Cross played such role for a couple of months, depending on volunteers and professionals, donations and its experience in the mainland –specifically the controversial 1927 Mississippi floods-. In sum, relief was characterized by inequality, minimal improvised procedures, and lack of stable, liable institutions. Again, an ad hoc and highly debatable relief scheme was better than nothing; it avoided an even worse humanitarian catastrophe and it granted some benefits to the local elites. Yet, its power scope was too limited and short to set the island for an economic transition instead of the ensuing collapse, accompanied by violence.

The next chapter will examine what happened after F.D. Roosevelt defeated H. Hoover in the 1932 elections, with radically different visions of government. Soon, he expanded on the

precedent set by the Flood Control Act and launched the New Deal, which on the island started with the Puerto Rican Emergency Relief Administration, in 1933, turned into the Puerto Rican Reconstruction Administration, in 1935. This strategic move would be accompanied by other vast developmental efforts, not free from controversy, when political effervescence and governmental repression exploded. Tensions escalated to the civilian massacre of Río Piedras (1935), and news about the critical situation reached Vito Marcantonio, progressive New York Congressman and spokesman for the island. During his first Congress intervention concerning Puerto Rico, in 1935, he asked to rethink the U.S. relationship noticing how land grabs by large sugar corporations and the hurricanes had desperately cornered people in welfare and urban slums (Marcantonio 1935 in Meyer, n.d.). Yet, his singular voice did not find echo, whilst pressure on the ground was intensifying. A year later, Colonel Francis Riggs was assassinated on the island by two nationalists, which led to retaliation through the Massacre of Ponce in 1937, considered the worst bloodbath in recent Puerto Rican history.

Fig. 90 Ponce Massacre



On Marina and Aurora streets, eighteen armed policemen exhibit brutality and some prepare to shoot not “at the uniformed nationalists [on the right] but at a terrorized crowd in full flight” (Muñoz Marín 1937 in Rosario Natal, n.d., p. 6) on the left. Image: (Fundación Puertorriqueña de las Humanidades, 2005)

Next hurricane, Santa Clara (1956), would take place at a different historical crossroad because Puerto Rico had become a U.S. Commonwealth in 1952. Santa Clara posed a multifaceted challenge because the island experienced structural reforms without a disaster crisis. Thus, Santa Clara would be a test to the Governor and the Commonwealth's capacities; the connections between the President, Governor and local opposition; new disaster legislative and institutional frameworks, and emerging technology and modernity paradigms confronted with popular beliefs.

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Chapter N.VII Hurricane Santa Clara (1956): the New Deal legacies and the Commonwealth, between avocado forecasting or storm bombing

VII.1. A tale of destructive landfall: Characterization of Santa Clara

“we heard sounds of ripping wood, tearing down neighboring shacks, only one hundred yards to our right. Then, the zinc plates started to fly shooting, as when a croupier cuts cards in a casino. Horrified, we saw how neighboring shacks became roofless, naked, whilst others started to collapse. First was Mr. Ramírez, then Miss Jackson and they continued like domino pieces, full speed. Very soon, the entire façade of that block seemed completely destroyed. And all had happened in fractions of seconds. “My God! This looks like an atomic bomb!” my father exclaimed. The lashing kept merciless. My little town continued under that unforgiving attack for at least two more hours. Then, the much mentioned virazón¹⁰² started hitting from the other side...the final blow, as our grandparents said happened during San Felipe or San Ciprián” (Fernández Gordián, 2003, p.31).

That was the landfall of hurricane Santa Clara in the city of Yabucoa, southwest Puerto Rico, according to a 16 year-old middle-low income boy. The testimony is written in a short but revealing story self-published almost 50 years later by a diasporic Puerto Rican, and it usefully frames the initial discussion of Santa Clara. Unlike typical writings of the day, it is a vivid grass-root experiential account that also reflects an updated perspective of contextual changes such as urbanization, social hierarchies, migration, religious beliefs and superstitions, technology, leadership, and institutional vacuums concerning disasters.

¹⁰² Virazón is the popular name of the winds blowing in opposite direction after the calmed eye passing.

Octavio, the protagonist boy, and his family of *jíbaros* safely witnessed the hurricane because they had fled the decaying countryside. They had sold their small property to rent an apartment in a new and dense public housing project, *caserío*, outside the historical center:

“the latest in social justice in Puerto Rico at that time, where Muñoz Marín had given an opportunity to live in an ‘optimal’ house to those from the slums and poor neighborhoods” (Fernández Gordián, 2003, p. 18).

Saturday the 11th of August started as a cloudless day and some locals did not believe a storm was approaching; one argued that television meteorologist ‘Mackdowell’¹⁰³ had not given certainty. Also, only minor storms occurred after San Felipe and San Ciprián, 28 and 24 years before respectively; and such time lapse debilitated the perception of danger to inexperienced generations. Octavio’s mother heard the warning from an American pilot; and his father believed him because “those Americans know more than the devil” (Fernández Gordián, 2003, p. 11) p. 11. In other words, they thought there was a relevant knowledge gap between them and Americans. In the afternoon, they bought supplies such as canned food, kerosene, matches and candles; but they carried on as usual. Octavio went playing and swimming in the river with his friends; eventually they noticed a sudden perturbing silence of birds and general quietness, and hurried back in the midst of light rain. Still, meteorological conditions were not menacing, and Octavio went on to spy an exclusive Black-tie ball at the local casino. He headed home when the rain increased, although people at the ball kept partying with the band singing a *Plena* jingle “*Al son de la virazón*” (To the rhythm of the *virazón*).

After midnight, a civilian woman improvised a hurricane alert call from her car, equipped with loudspeakers for her business. She urged people to wake up, get ready and search for refuge.

¹⁰³ Professor Dr. Dawson Clay McDowell presented the daily weather news on Telenoticias del Mundo (WKAQ-TV Canal 2) for more than 20 years, starting in the mid-1950s; he became a reliable public figure.

Thus, Octavio's father went to pick up his mother, who had left her old house searching for refuge at her neighbors' basement; he also brought along family friends. Meanwhile, Octavio's mother started to prepare coffee and an extra-large pot of rice fearing an electrical blackout. When the winds and rain worsened, women started praying the rosary and men were busy sealing windows and doors inside the house. After the *virazón*, people rushed to bare handedly rescue neighbors trapped under collapsed structures. According to Octavio, there were no helicopters, walkie-talkies, Civil Defense or federal agency to rely on. He compared the aftermath destruction to Hiroshima, his grandmother lost her mind when she saw her little house had vanished, and they spent six months without electricity and school. The woman who launched the alert was celebrated as a national heroine by newspapers and Governor José Luis Alberto Muñoz Marín.

Fig. 91 "Yabucoa is a ghost town, like Okinawa"



As Octavio's story, the daily newspaper *El Mundo* compared the extensive destruction in Yabucoa to WWII destruction in Japan, image by (Tooker, 1956). Federal and island agencies addressed together nuclear fallout, hurricanes and other disasters; as part of the Cold War logic.

Contemporary non-literary accounts show coincidences with Octavio's story and other data that expands the characterization of Santa Clara. For instance, the secularization of disaster management was advancing, and one reflection was the dual naming of Santa Clara. In Puerto Rico, it was named after the saint day of landfall, according to Catholic tradition. Meanwhile, American scientists called it Betsy¹⁰⁴, based on their proposition to name hurricanes according to alphabetical order, which was standardized a few years later. Also, the newly launched National Hurricane Research Project was funding novel air borne and land-based radar observations, combined with upper air soundings and other techniques to improve forecasting. As part of the project and just a few days before Santa Clara landed, a storm detection radar had been installed in the San Juan Weather Bureau at the Airport. It was one of the three earliest radar stations in U.S. territory¹⁰⁵; and these radars could cover approximately 250 miles, which limited their precision. The Ramey Air Force Base on the northwest of Puerto Rico and the U.S. Naval Base in San Juan collected customary and novel meteorological data also (R. J. Grace, 1956).

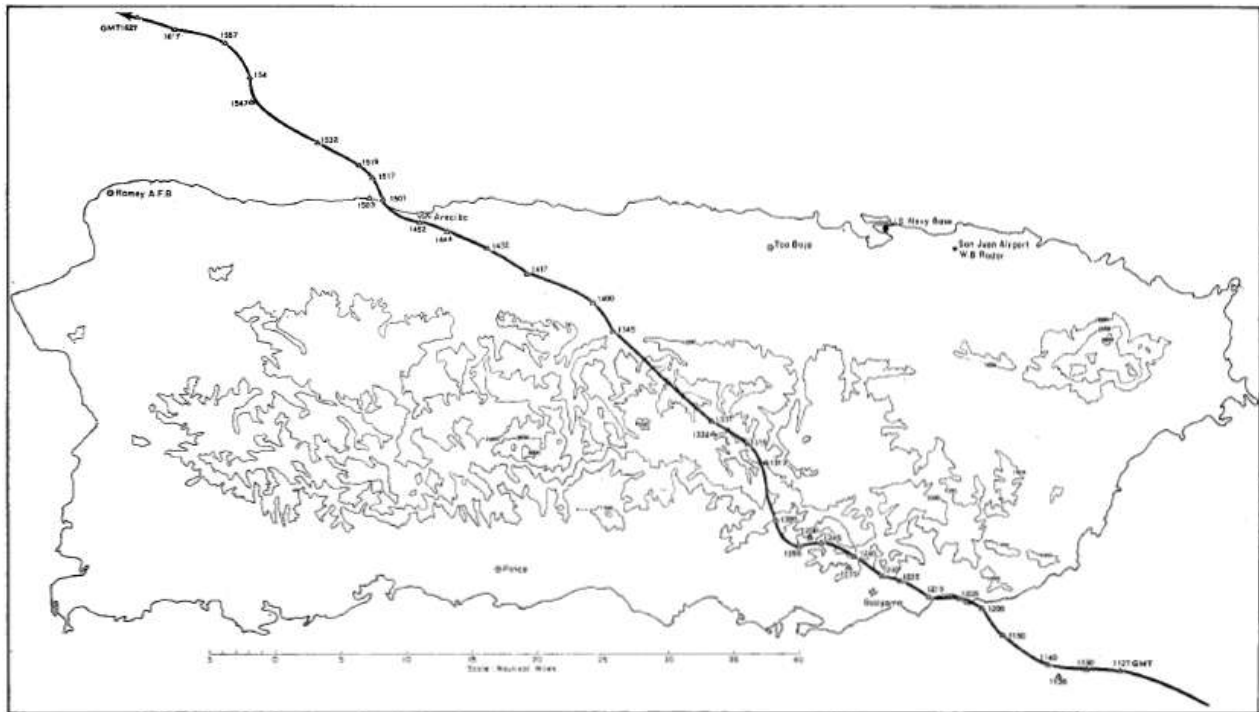
On August 9th, surface ships sent storm warnings to Puerto Rico; a day later an aircraft penetrated the storm and confirmed the need to announce hurricane watch, changed and televised as hurricane warning on the 11th. In the early hours of the 12th, Santa Clara bounced 2-3 times off the southeast coast and made landfall in Maunabo as a Category 1 hurricane in the Saffir-Simpson scale, with sustained wind speeds over 90 mph. It moved towards Yabucoa, and then towards Guayama and Patillas. It traversed the island in a northwesterly direction, passing over Cayey, Aibonito, Barranquitas, Orocovis, Morovis and Ciales. Yet, the eye of the hurricane deteriorated as the central mountain range slowed the lower part of the system and the upper part

¹⁰⁴ Another hurricane called Betsy severely hit Louisiana and Florida in 1965.

¹⁰⁵ The others were at Cape Hatteras, N.C. and Nantucket, Massachusetts.

continued its forward displacement; altogether wind velocity decreased¹⁰⁶. When leaving the mountains, the eye recuperated its structure and widened, passing over Manatí, Arecibo and leaving by Camuy between three and four hours after landfall. Overall, Santa Clara was a rather small, weak and fast Cape Verdean hurricane, with an average speed of 17 mph. It followed an erratic course and the rainfall average was also modest, 3.16 inches, with extremes of half an inch on the southwest, and 8 inches in the central range, southeast and northeast. The worst damages took place approximately 20 miles north and south of the eye track, in lower southeast areas (J. A. Colón, 1959; Dunn et al., 1956; R. J. Grace, 1956).

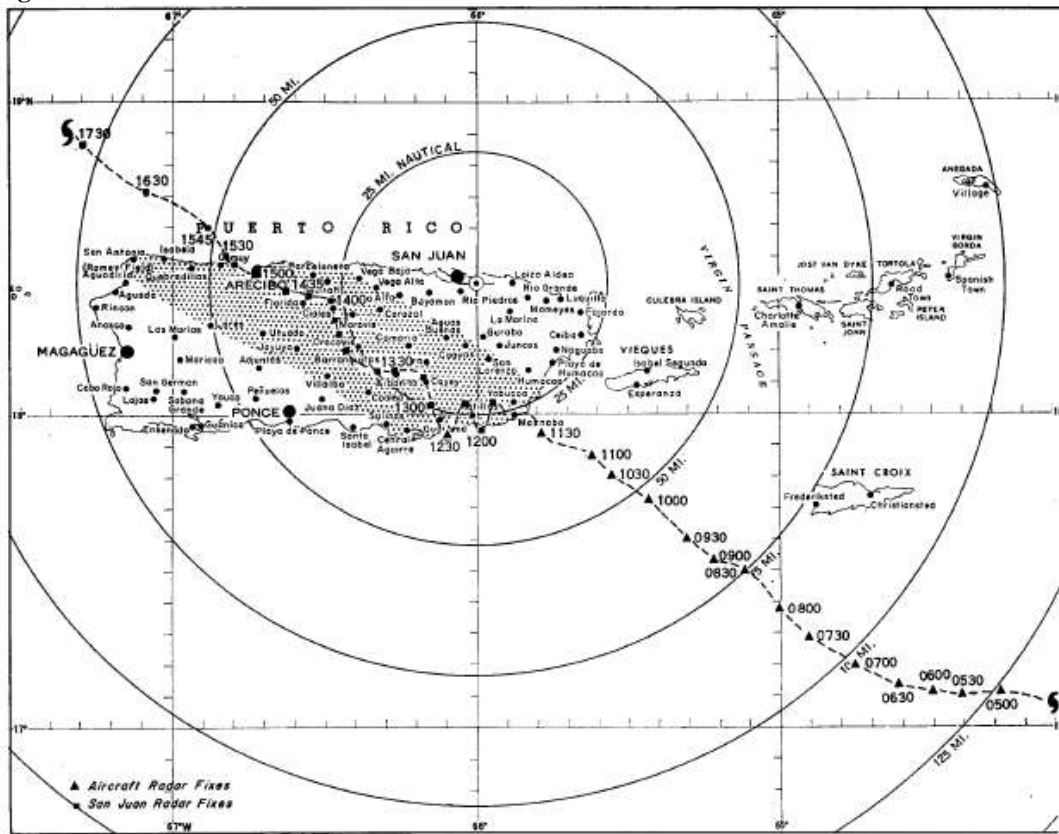
Fig. 92 Santa Clara track, rainfall, and island topography



The heavy line indicates the hurricane track based on the San Juan Radar. The map also shows contours in 1000 ft intervals and distribution of total recorded rainfall, image by (J. A. Colón, 1959, p. 79). This information was a new analytical tool to understand the interaction between topography, hurricane track and rain.

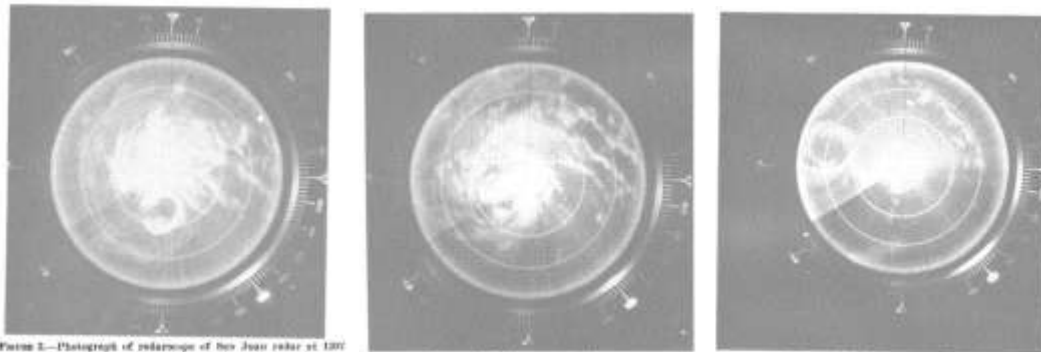
¹⁰⁶ This finding confirmed the *Taíno* belief in a tall northeast mountain, *El Yunque*, as a barrier to hurricanes.

Fig. 93 Santa Clara track and worse destruction



The central line is the hurricane path, plotted numbers give aircraft and land radar fixes in GTM and stippled area is where the greatest damage occurred, image by (R. J. Grace, 1956, p. 312).

Fig. 94 Radar scope images of Santa Clara



After WWII, reduced security constraints on military technology enabled the use of radars to gather meteorological data. Santa Clara radar scopes (J. A. Colón, 1959, p. 78) were used by the Puerto Rican media to communicate the event and by U.S. and Puerto Rican scientists to expand crucial knowledge

Santa Clara caused between 9 and 16 casualties, which have been credited to its weakness, little rainfall and quick passing compared to San Felipe or San Ciriaco (1899); improved

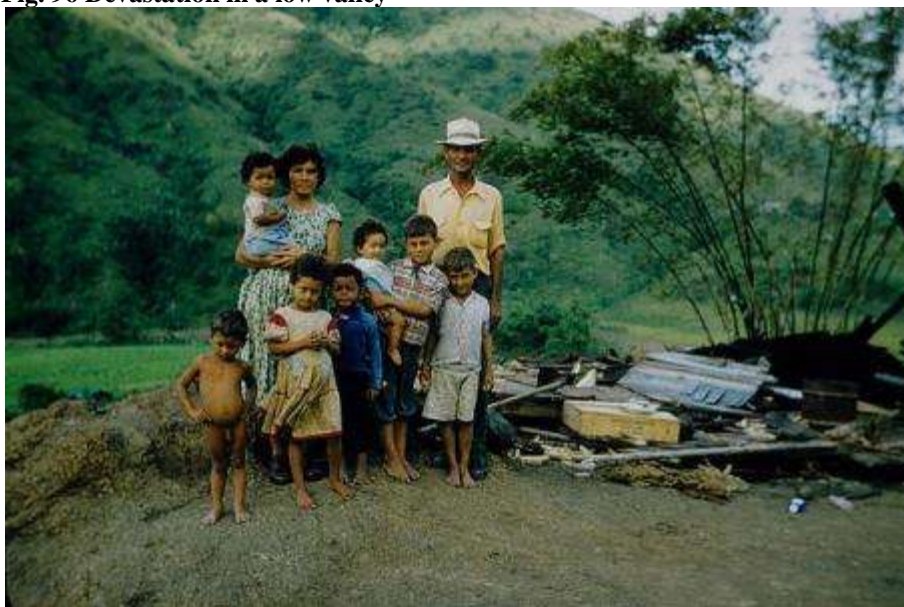
meteorological knowledge, warnings and built environment; and use of rural self-built refuges called '*tormenteras*'. Yet, destruction was widespread. In the following days, the devastation in the southeast came to the forefront news, including public health concerns of epidemic outbreaks in places such as Yabucoa and Maunabo (UP, 1956), and vast impacts over the economy and built environment -infrastructure, industries but mostly precarious housing-. Initially, mainstream media published that three percent of the housing stock was destroyed -approximately 15,000 homes- (Tooker, 1956). Yet, those numbers could indicate underestimation hard to track in scarce official contemporary data. For instance, in Yabucoa alone between 12,000 and 15,000 homeless were reported at the outset. Another proxy of housing ruin was the improvised widespread use of public schools as shelters, not churches, as it had been traditional. Almost fifty thousand students found their schools occupied as shelters (undetermined number), destroyed (156) or severely damaged (315), and hastily interrupted their lessons, a situation lasting months; as a result, the hurricane affected the education of a generation (Bluedorn & Cascio, 2005). Damages totaled over U\$40 million, approximately 5% of annual GDP, with large losses in agriculture -export crops and foodstuff-, which had impacts on food security. For example, in the fertile lower valleys southwest of Cayey, an eyewitness account reported complete destruction of vegetation; whilst in the mountain ridges -where no crops were planted- trees seemed unharmed (R. J. Grace, 1956). An evaluation by forestry professionals confirmed far-reaching vegetation damages (Wadsworth & Englerth, 1959).

Fig. 95 Devastation in the Central Mountain Range, Rabanal, Cidra



On a razed house ruins, a man laments Santa Clara passing (Brandenberry, 1956).

Fig. 96 Devastation in a low valley



A poor *jíbaro* family stands by the remains of their humble shack (Hower, 1956)

Puerto Rican newspapers *El Mundo*, *El Imparcial*, and the *Puerto Rican World Journal* focused on Santa Clara in the following weeks. My review of *El Mundo* reveals that as the days passed data, flaws and contradictions emerged, changing the characterization of this hurricane. Initially,

Gov. Muñoz Marín was projected as a benevolent leader in control. For example, the next day headline was “Muñoz will give funds, another help for the people” (El Mundo, 1956g, p. 1).

Hours after Santa Clara left, two *El Mundo* journalists travelled on separate inspection flights. According to their reports, San Juan experienced relatively few damages, mostly fallen vegetation and minor flooding. However, to the east of San Juan, Río Grande de Loíza had caused extensive flooding in Carolina and Loíza; to the west, Bayamón and Trujillo Alto and industrial facilities in Barceloneta were flooded. Outside the metropolitan area, damages increased. For example, sugar, pineapple, bananas, plantains, minor crops and dwellings were devastated in the northwest of the island; and descriptions of ruin grew sharper as flights approached the path of Santa Clara:

“When the plane moved over the course of La Plata River, we were seeing the destruction caused by hurricane winds; numerous houses, big and small, were scattered over the hills. When we flew over the municipality of Naranjito, we realized that we were over the area where the hurricane vortex passed. All plantain areas seemed destroyed and at least seven out of ten ranchos [rural homes, bohíos] had been totally wrecked and the rest were damaged. In some places, only empty plots remained, wood and zinc plates were scattered all over the mountains....[when flying over the Central Range] we saw again scenes of destroyed houses and by the side of a bunch of rubble or empty lot, the tormentera, salvation table of the jíbaros from our mountains, through which many lives are saved when a hurricane hits us”(Uffret, 1956, p. 38).

Another debated topic was the forecasting practiced by farmers from the interior called *aguacateros*, because they used *aguacate* -avocado- crops for their predictions. On July 26th, *El Mundo* had published an interview with two *aguacateros*, who announced a hurricane. Based on this article, the Coffee Planters Association recommended to its members buying insurance for crops and plantations (Margenat, 1956). Two days after Santa Clara landed, the same *aguacateros* were quoted in an article titled ‘Meager Crops: the Hurricane passing over the

Island confirms the Avocado Forecasting'. Businessman Segismundo Galinanes did not work on agriculture, yet he was treated as a forecasting authority:

“Really the meteorological forecast of the avocado trees has been disliked by everybody, because when it became a reality last Sunday, it caused anxiety, intranquility and fears; and in addition, it caused considerable agricultural losses and interrupted vital services such as electricity and telephone. However, those who joked about the avocado tree forecast are thinking right now that there must be some truth in the theory sustained by thousands of persons in cities and countryside of Puerto Rico: that when the avocado trees do not flourish and the crop is meager, there are great probabilities of being hit by a hurricane” (Galinanes 1956 in Margenat, 1956, p. n. a.).

The other avocado forecasting expert interviewed, Mr. Herminio Rodríguez Álvarez, affirmed that his technique went beyond his simple experiences; he was based on his ancestors' expertise, they had always considered the avocado trees seriously. Another factor validating his knowledge was the observation of his poultry. Hens, roosters and chickens got down from tree branches and upper racks of the henhouse to hide underneath his house, running nervously and making noises around 5 am. Based on his animals' behavior, he figured out the hurricane was making landfall soon, half an hour before the next Weather Bureau radio bulletin confirmed it (Margenat, 1956).

Contextually, Santa Clara happened at a historical crossroad, after the New Deal and the most violent years the island had become a U.S. Commonwealth (1952), which technically meant self-governing powers bound by U.S. federal jurisdiction. Almost two decades of U.S. rule over Puerto Rico since San Felipe had contradictory aims and effects. Continuous extractive policies created inequality, poverty, vulnerability and turmoil (J. L. Dietz, 1989). As this chapter discusses, the New Deal overcame havoc moving from scant relief aid to a comprehensive planning paradigm, integrated in the island economic growth equation; later bolstered by the Commonwealth. The New Deal developmental agenda -in tandem with repression- shrank the

pro-independence sector represented by the Nationalist Party (M. R. Rodríguez, 2002). Santa Clara showed inconsistencies of this asymmetrical relationship. Using a new style of political leadership, the first elected Puerto Rican Governor carved his leading role during relief, reassuring his government's capacities. Oddly, I did not find any post-hurricane evaluation; the proxy used has been the yearly Governor's speech to Congress, who underplayed Santa Clara and his administration failures. Perhaps documents of a critical nature were not widely circulated, have been lost, or remain uncatalogued in the archives consulted. The experiential and unfiltered testimony by the man from Yabucoa, used to begin this chapter, was not the type of printed information circulating at that time. The two male aguacateros' are an unusual presence of grassroots interpretations about hurricanes in the media, but they only made headlines because of their correct guessing. In 1958, the Commonwealth Division of Community Education (DIVEDCO) finished pedagogic materials, including a movie called 'Huracán', two posters, a booklet and bulletin. The U.S. director of 'Huracán', filming crew, narrator and most empowered actors are men. The booklet writers, editor, illustrators and printers were men (except one). All original writings consulted reflect the views of influential men although not necessarily in top positions of power, such as U.S. and Puerto Rican politicians, elite members, intellectuals; but also middle-income journalists, artists, and scientists. Such change could point to increased access to education¹⁰⁷ and media outlets. Thus, in the reporting of Santa Clara the voices of marginalized citizens due to gender, class, race and age remained silenced from entering their experiences in the public record, and from shaping policies accordingly. An upper class, top-down view of the event prevails.

¹⁰⁷ From 1940 to 1965, public and private school enrollment increased from 297,000 to 690,000; UPR enrollment increased from 5,000 to 25,000 (R. Picó, 1969, p. 253-255).

VII.2 Santa Clara characterized in multidisciplinary, artistic, Circum-Caribbean, local, multi-hazard, multi-storm terms

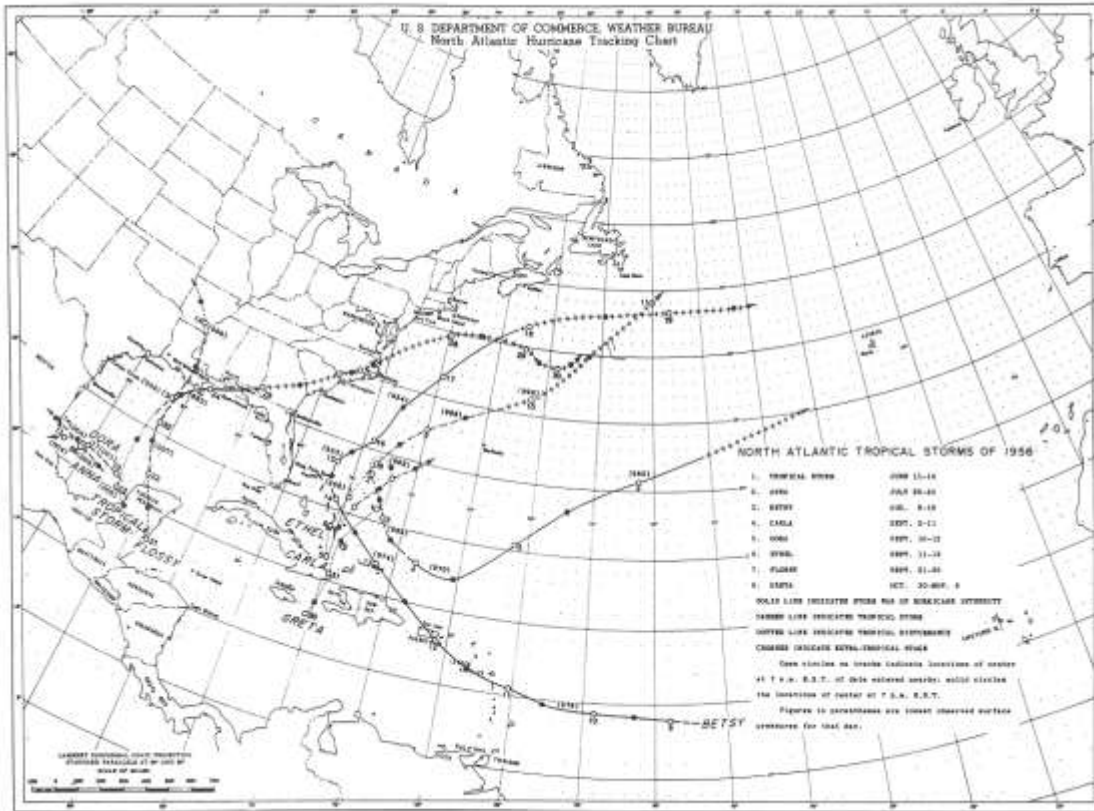
In terms of a multidisciplinary production of knowledge, Santa Clara can be characterized as a lost opportunity. Compared to San Ciriaco and even San Felipe, Santa Clara has been essentially understudied as part of other topics or in itself. I found that few disciplines have examined it, including meteorology (J. A. Colón, 1959; Dunn et al., 1956; R. J. Grace, 1956), forest biology (Wadsworth & Englerth, 1959), epidemiology (Masi et al., 1958), and economics (Bluedorn & Cascio, 2005) more akin to social science due to its focus on education.

In the arts, there are several traces of Santa Clara that are under examined. DIVEDCO film ‘Huracán’, related posters, booklet and bulletin involved known and upcoming multi-disciplinary artists, as I show later. It is the only Commonwealth cultural project concerning hurricane awareness, and it was meant to have ample circulation even in remote locations through official initiatives. In 2007, a Texan-based Puerto Rican dance company launched the musical ‘*Sembrando Herencia*’ (Planting Inheritance), attributing to San Ciriaco and Santa Clara key historical roles (Angelito Borincano, 2007); the latter because of its connection to the 1950s ‘Great Migration’ of Puerto Ricans to the U.S.

Santa Clara affected several territories in the Circum-Caribbean. It was detected as tropical wave when moving through the eastern tropical Atlantic on August 6th. The system organized quickly, and on August 10th, Santa Clara changed from a tropical storm to a Category 3 hurricane on the Saffir-Simpson scale, with sustained winds between 111-130 miles per hour. On August 11th, it passed over the Lesser Antilles and caused damages on Marie Galante, Des Saintes, Dominica

and Guadeloupe, where 18 persons died. After emerging into the northeast Caribbean Sea, the hurricane turned to the northwest, passing close to the Leeward Islands and south of the Virgin Islands. It left Puerto Rico as a Category 1 hurricane yet Santa Clara regained strength in the ocean due to warmer temperature and humidity. From August 13th to August 16th, it was designated a Category 2 hurricane; it recurved across the southeast Bahamas, causing damages in Salvador and Turks. Then, it followed an erratic path north, threatening the eastern part of Florida. It moved between the East coast and Bermuda before becoming an extra tropical cyclone on the 18th, and dissipating off the coast of Nantucket (Dunn et al., 1956), although it sunk a ship in the Grand Banks offshore Canada (Government of Canada, 2009). Santa Clara caused less regional damages than San Felipe or San Ciriaco; but the Lesser Antilles –chiefly Guadeloupe-, San Salvador and Turks were battered. Regional damages notwithstanding, I found out that comparative in-depth research is lacking. Local studies within Puerto Rico are missing also.

Fig. 97 Tracks of Santa Clara (Betsy), tropical storms and hurricanes during 1956



Hurricane tracking reflects an improvement in precision and an understanding of the need to visualize hurricanes in a hemispheric perspective (Dunn et al., 1956, p. 437).

The possibility of learning from San Ciriaco in multi-hazard terms is not feasible; two minor seisms and one associated tsunami happened (1943 and 1946) and their damages were negligible (Gobierno de Puerto Rico, 2009-2012).

The opportunity of learning from Santa Clara in multi-storm terms has not been developed. Exceptionally, only two hurricanes affected the island lightly with no casualties but extensive flooding. Minor and medium storms and floods damages are not evident in the mainstream information, which maintains the profile of a static and imprecise listing of track, physical characteristics, generic casualties and damages, and technical descriptions.

Box N.5 Summary of 20th century storms in Puerto Rico: 1933-1955

1943, October 14th, Hurricane San Calixto initially passed far south of Puerto Rico in a westerly direction. Abruptly, the storm took a northward direction and passed 70 miles west of Puerto Rico; 60 mph winds caused housing destruction from Cabo Rojo to Aguadilla. Rainfall reached 12 to 18 inches and caused flooding throughout the island. San Calixto also hit the Dominican Republic and finished in Nova Scotia.

1949, September 21st, Hurricane San Mateo caused damages in Saint Croix before passing approximately 40-60 nautical miles south of Puerto Rico. The winds reached 80 mph near the center and caused minor damages in the south and southwest of the island; however, flooding damages were widespread.

(Miner Solá, 1996; Puerto Rican Hurricane Center, 2011; Salivia, 1972; Ivan Ray Tannehill, 1945).

VII.3 Economic growth and urbanization vis-à-vis disasters

Differentiated vulnerability or resilience to Santa Clara was partially shaped by the New Deal and –to shorter extent- Commonwealth policies that changed the interplay between economic growth, urbanization and risks, with long-term improvements but also flaws. In the 1932 U.S. presidential elections, Franklin Delano Roosevelt defeated Herbert Hoover; a different vision of government was endorsed. During the start of four consecutive terms (1933-1945), the Roosevelt administration New Deal centered on the “3 Rs” -relief, recovery, and reform- and would directly address vulnerability and disasters as discussed in section VII.5. In Puerto Rico, the New Deal (1933-1948) eventually created the platform to launch key changes, including the Commonwealth status (*Estado Libre Asociado* or Free Associated State) and Muñoz Marín becoming its first and lasting Governor¹⁰⁸. In 1933, the Federal Emergency Relief Act was

108 In 1947, U.S. Congress enabled Puerto Ricans to elect their Governor. Senator Muñoz Marín campaigned under the *Partido Popular Democrático* (PPD), Popular Democratic Party banner, without his socialist pro-independence goals. In 1948, he became Governor and was re-elected three consecutive terms (16 years).

passed¹⁰⁹, and with its funds Roosevelt's administration reconstituted the Emergency Relief Administration (ERA)¹¹⁰ into the Federal Emergency Relief Administration (FERA)¹¹¹. As a counterpart, the Puerto Rican Emergency Relief Administration (PRERA) was created to distribute food, create jobs, stimulate the economy and build infrastructure. All tasks required planning skills as understood now; yet, only the latter was part of the urban planning profession then¹¹². Soon, three outstanding U.S. figures visited the island and advanced plans and changes. Lady Ann Eleanor Roosevelt, economist Rexford Guy Tugwell –then part of the New Deal 'Brain Trust', later New York City's Planning Commissioner, Puerto Rican Governor and prominent pioneering figure of 'blueprint' or "rational' model of planning (Friedmann, 1981)¹¹³ that under his aegis would mark the island-, and President Roosevelt. In parallel, political effervescence was rising.

In March of 1934, Eleanor Roosevelt traveled to Haiti, the Virgin Islands and Puerto Rico. In San Juan, she visited areas devastated by San Ciprián such as '*El Fanguito*' (The Little Mud hole) and '*La Perla*' (The Pearl) slums, much to the chagrin of local elites and tourism boosters (Ducas, 1934). She was accompanied by Rexford Guy Tugwell and Luis Muñoz Marín, then a rising politician who capitalized on his links to the U.S. administration. Eleanor's compelling

109 This act superseded the Emergency Relief and Construction Act (ERCA) signed by Hoover, in 1932.

110 ERA was created during Hoover's presidency based on ERCA, to launch public works and operate relief programs via loans given to states.

111 FERA was replaced by the Work Progress Administration (WPA) in 1935.

¹¹² Centered on spatial regional planning, zoning, ordinances and covenants, and city beautification projects.

¹¹³ In theory, it emphasized extensive quantitative assessments, predictive modeling, and design to improve the built environment, particularly through spatial factors. It relied on specialists such as architects, urban designers, and engineers; it incorporated public officials and private developers, yet disregarded public participation. Such choice raised claims of social detachment favoring an elitist logic of power unrelated to scientific assessments.

report of the hurricane aftermath, poverty and exploitation; and the media coverage of her trip paved the road for the New Deal. For instance, next October, she published an editorial directed to U.S. women titled “Our Island Possessions”, in the monthly magazine *Woman's Home Companion*, which at that time reached a circulation peak around four million:

“Puerto Rico has a better rainfall than the Virgin Islands and we hope that the frequent hurricanes of the past three years are not going to continue for hitherto she has only suffered occasionally from these. They have done a great deal of harm, practically ruining the coffee plantations and citrus and coconut groves.

On this account many Puerto Ricans have gone from the rural districts into the outskirts of the cities where dangerous slums have been formed. The population of about 1,600,000 people cannot be fed by what is produced on the land no matter what improved methods of agriculture are instituted. We are at last waking up to the fact that a long term plan must be made for this island and it is at present being worked out, including all the government departments concerned and a committee of Puerto Ricans themselves...the standards of living in Puerto Rico are low. The population is increasing rapidly. This island is closely tied to our country the people are constantly coming here to establish themselves and we are sending some of our own people to Puerto Rico to work and live on the island. Therefore, let us take a more intelligent interest in our beautiful possession with its possibilities for a happy people who unfortunately have been buffeted by nature and exploited by man. So women let us think a little about our future citizens in all these islands and try to bring about wherever our flag lies conditions of which we can be proud”(E. Roosevelt, 1934).

President Roosevelt visited the island next July 6–7. He arrived to Mayagüez on board the USS Houston (CA 30), traveled to Ponce and San Juan, where he made a farewell radio speech in which he also emphasized the need for planning:

“I was here thirty years ago and it seems to me than in those years a great deal of progress has been made, but I believe also that the progress that you have made in the past is very small compared with the progress that you are going to make in the future...We cannot accomplish everything in one year. In fact, we must look ahead for a great many years, and that is why we have all come to an agreement in principle for the rehabilitation of Puerto Rico. That plan, of course, will take a great many years to accomplish, but I hope and I am confident that all of you will do your part in making the plan a success” (F. D. Roosevelt, 1934).

Fig. 98 Eleanor Roosevelt (wearing a white hat) visits La Perla slum, San Juan



“During her inspection trip through this section of town Mrs. Roosevelt came upon this pool and asked the photographer to take a picture of it, "to show really what it is like". During her shocking journey in squalor and disease, the First Lady was followed by members of the populace clad in rags, naked children and barking dogs. She was deeply touched by the desolate scene and conferred with local welfare workers regarding possible remedies” (Bettmann/CORBIS, 1934).

Fig. 99 Franklin D. Roosevelt with Sen. Valdés Cobián in Mayagüez, Puerto Rico (n.a., 1934)



“I believe in better homes -that means bringing back a better family life, better living conditions, a better chance for education, and a better chance for every person to earn their livelihood...I am looking forward to the solving of these problems just as fast here on the island as we will solve them in the continental part of the United States ...I know that you will cooperate in what we are trying to do for the United States, not only here but in all parts of the nation ” (F. D. Roosevelt, 1934).

In 1935, based on Executive Order 7057, PRERA became the Puerto Rican Reconstruction Administration (PRRA) and channeled the New Deal. The same year, the Puerto Rican Hurricane Relief Commission (PRHRC)¹¹⁴ became the Puerto Rican Hurricane Relief Loan Section (PRHRLS) and essentially continued loan adjustments¹¹⁵. Those institutional shifts signaled how the New Deal economic development equation integrated more than scant relief aid during emergencies, but a comprehensive planning paradigm that transcended the contemporary planning profession. PRRA developed scientific programs to address socioeconomic issues and

114 PRHRC was established by joint Congress resolution in 1928, to undertake San Felipe reconstruction emphasizing credit to farmers who reunited tenure, assets or other economic conditions; as Hoover did after the 1927 Mississippi floods. Essentially, it was not linked to development, planning, or disaster management goals. Its success was very limited, and options of agricultural credits weakened even more when banks with large investments in the sector went bankrupted after the 1929 stock crash.

115 PRHRLS functions were transferred to the Puerto Rican Reconstruction Administration in 1946.

deficits of the built environment, protecting commodities and eventually lay citizens also; while preserving the U.S. interests and other questionable aims by force if needed. Such inconsistent goals had a lasting sway. Since then, influential studies¹¹⁶ sustaining rational planning were produced with two aims: a) gather and produce knowledge including economics, development, healthcare, agriculture, meteorology, mining, calorie intake, geographic and photographic works; b) justify policies in areas such as birth control, medicine testing, nutrition, agriculture, social work, industrialization and public works –i.e. electrification, dams, highways, housing and schools-. In sum, PRRA promoted the image of the U.S. as a modern state engaged with daily life during chaos (M. R. Rodríguez, 2002), whilst introducing a supposedly scientific yet questionable logic of domination over people, nature and the built environment. For instance, since 1898, U.S. authorities blamed overpopulation for unemployment and precarious housing, healthcare, nutrition, and education; instead of focusing on extreme power asymmetries. In 1937, the passage of Law 116 institutionalized a population control program created by the Eugenics Board, known in Puerto Rico as ‘*La Operación*’ (The Operation). Sponsored by private foundations first and later by federal and island governments, the program officially targeted economic depression-related unemployment to prompt economic growth. In practice, it promoted uninformed and coercive permanent sterilization of individuals; loaded with class, race and gender biases (Rodríguez-Trias, 1994). For decades, surgery subsidies, industrial employer preferentialism toward sterilized women, and selective domestic visits by health workers pushed

¹¹⁶ E.g. The Brookings Institute Report “Porto Rico and its Problems” (1930), the ‘Chardon’ Plan (1936, led by Dr. Carlos E. Chardón, chancellor of the University of Puerto Rico, and supported by Muñoz Marín), the ‘Zimmerman’ report (1940, led by Dr. Eric W. Zimmerman of the Interdepartmental Committee on Puerto Rico), the ‘Dorfman’ report (1946, led by U.S. Tariff Commission Chief Economist Ben Dorfman).

economically disadvantaged and unapprised Puerto Rican women towards *La Operación*; disproportionately compared to average U.S. women¹¹⁷.

Similarly, contentious aims buttressed PRRA economic growth plans, which reshaped the island and its people. Next I discuss how in the following two decades planning and investment shifted from agriculture to a modernization formula that merged industrialization, institutional reform, emigration, tourism, and construction –mainly public works and housing-; with corporations reaping major gains and mixed results on lay citizens.

Concerning agriculture, sugar remained the main export crop, controlled by a few large U.S. stakeholders profiting from cheap costs, public investment, tax exemptions and subsidies. The sugar economy remained susceptible to unstable market cycles and hurricanes, and its monopolistic and exploitative organization was a cause of growing local discontent (Polk, 1942). Public discourses contradictorily articulated the links between underdevelopment, the unfair structure of the industry and U.S. rule; which in turn reflected polarized ideologies concerning Puerto Rico. For instance, prominent ex-Governor Theodore Roosevelt Jr. lauded the U.S. benevolence towards the island via the sugar industry, underdevelopment notwithstanding:

“In one fashion or another the United States has been contributing to the support of Puerto Rico. In the first place, a considerable part of the sums expended for governmental purposes in the Island comes from the federal treasury. In addition, of course, Puerto Rican sugar, which is by far the biggest cash crop of the Island, literally depends for its existence upon the tariff wall of the United States within which it stands. In spite of this, misery is great. There is insufficient work, and poverty, sickness and hunger stalk the island”(Roosevelt Jr., 1934).

¹¹⁷ In 1968, research on Puerto Rican women of childbearing age showed that they were over ten times more likely to be sterilized than U.S. women, and more than one-third of those Puerto Rican women ignored they had gone through a permanent form of contraception. In the 1970s, local women’s groups and the movement for independence launched a campaign against these practices (Rodríguez-Trias, 1994) .

Contrastingly, New York Congressman Vito Marcantonio¹¹⁸, allied with pro-independence leaders and less known than Roosevelt Jr., argued that Puerto Rico was:

“reduced to a monoculture, a sugar colony of the United States. To the people of Latin America, Puerto Rico has a diabetic economy. Its main industry is sugar, and 70 percent of the arable land is owned by four large Wall Street corporations” (Marcantonio 1935 in Meyer, n.d.).

First, the New Deal promoted subsistence and experimental crops. Yet, sugar lobbyists, cheap U.S. imports, low salaries and land scarcity blocked local farmers. Light industrialization became a goal of Gov. Tugwell (1941-1946) and Sen. Muñoz Marín. Moreover, fears of a German blockade during WWII motivated federal funding for enterprises around San Juan; reinforcing its urban primacy vis-à-vis the decline of southern Puerto Rico initiated after San Ciriaco. By 1953, 44.7% of all industrial jobs would be located in an area of 507 km² comprising San Juan and nearby municipalities, almost 6% of the island surface (Severino, 1999). After WWII, Puerto Rico became the first example of the rise of export processing zones and special economic zones as a major rearrangement of the global political economy of capitalism; this strategy attracted foreign-direct investment to manufacturing in underdeveloped nation-states or territories by offering extremely advantageous conditions to corporations. When visualizing the future of the island, increasingly powerful Senate President Muñoz Marín endorsed modern economic development through industrialization (Perloff, 1950), like contemporary populist figures in Latin America. First, light industries were prioritized, including garments, machinery, canned food and electronics. Yet, the radical leap happened when Muñoz Marín became Governor; he endorsed heavy industries, such as oil refining and petrochemicals, based on imminent import restrictions to the U.S. by a system of quotas -implemented from 1959 to 1973-. *Operación Manos a la Obra* -Operation Bootstraps- was a large-scale project to redirect investment from

¹¹⁸ He was the only member of the American Labor Party in Congress, representing East Harlem (1934-1936, 1938-1950); and his struggles included labor, civil rights and Puerto Rican independence.

decaying agriculture towards labor-intensive manufacturing and export-led industries. Bootstraps responded to the decline of southern Puerto Rico through petrochemical industries; the Commonwealth Oil Refining Company (CORCO) was established by the sea in Peñuelas and Guayanilla, municipalities adjacent to Ponce. The first CORCO unit was built in 1954 and the company started operations in 1956. CORCO represented a large investment at that time, \$25 million, in an 800-acre site (3.2 km²). It could refine 23,500 oil barrels daily, which added to storage and waste treatment facilities attracted giants like Union Carbide, Rico Chemical, Caribe Nitrogen, and Gulf Caribbean. Yet, Bootstraps metamorphosed the dependency of the island framed by U.S. interests (E. Pantojas-García, 1990). It cemented a modern brand of ‘corporate welfare’ sustained by cheap production costs - wages and rent-, pre-built industrial infrastructure and tax exemptions that made the island “the greatest tax haven for U.S. transnational corporations” (Emilio Pantojas-García, 2007, p.218). Besides, lax environmental controls created vast brown fields and risk-prone areas, needing large public investment to mildly palliate the worst impacts (R. Pérez, 2002).

Fig. 100 “Storer, Cartner and Glavin observe the refinery model to be built in Southern Puerto Rico”



CORCO lured industries with subsidies and tax exemptions; it left destruction, waste and poverty, image (El Mundo, 1954b).

Fig. 101 Playa de Ponce dock workers on a strike



Poor salaries and working conditions sparked protests, image (El Mundo, 1955).

Institutional reform was another pillar of modern economic growth. A myriad of new institutions reveals changing conceptions of governmental responsibilities towards citizens. It also reveals increasing disciplinary separations that often reflected on specialized and uncoordinated public policy. In the 1940s, large public entities were setup to shape planning and investment, such as the Land Authority, Economic Development Administration, Development Bank (*Banco de Fomento*), Industrial Development Company (PRIDCO), Water Resources Authority, Transport Authority, Agricultural Corporation, Communications Authority, Housing Authority, and Planning, Zoning and Urbanizing Board (R. Picó, 1974; Sepúlveda, 2009). Those agencies integrated elite members and emerging technocrats, increasing support for Muñoz Marín. For example, Gov. Tugwell consolidated the Puerto Rico Planning, Zoning and Urbanizing Board in 1942, derived from the Project Analysis Office for the War Emergency Program (Tugwell, 1945) and backed by Act 213. The Board chairman was Dr. Rafael Picó, a U.S.-trained economic geographer who cultivated a prominent career¹¹⁹. Based on five technical divisions¹²⁰, the Board would steer development through a) master plans, b) inter-agency co-ordination, and c) advice to the Governor on public works, economic and social development, and fiscal policy (R. Picó, 1953). In practice, the Board copied U.S. zoning frameworks, adhering to a rational planning model and modernist ideas of separating activities; moreover, it neglected municipal decision-making by being centered in San Juan (Sepúlveda, 2009). Noticeably, the Board excluded disaster management; as was the contemporary norm of the planning profession. Instead, disaster management was mentioned in larger policy-making reports (Information Research Section PRRA, 1938); I could not find a subdivision or institution that addressed them specifically. On

¹¹⁹ Picó taught at the Universidad de Puerto Rico and was a trusted PDD member. He became President of the Government Development Bank, Secretary of Treasury, Senator, international development adviser, visiting professor and director of the American Society of Planning Officials.

¹²⁰ Urban Development, Economic, Engineering, Bureau of Permits, and Finance and Special Studies.

the one hand side, only minor weather-related events happened, not requiring a particular entity to step up. On the other hand side, societal and environmental crisis were merged for practical purposes under the three “R’s”. For instance, the first available example of the insurance sector literature on the island set minimum rates in case of fire, hurricane, riot and civil commotion alike (Puerto Rico Board of Fire Underwriters, 1937). As section VII.5 examines, WWII and the Cold War strengthened a bond between war and disasters. Thus, in 1950, the new U.S. Federal Civil Defense Administration was in charge of both. Marking a turning point in disaster management, a matching Puerto Rican Civil Defense Office was created to produce prevention and mitigation policy documents, setup local and inter-institutional committees, conduct public meetings, and define island-wide roles and procedures to follow. Also during this decade, new agencies related to investment, planning, and the built environment included the Water Resources Authority, Department of Public Works and Institute of Puerto Rican Culture (ICP).

Another pillar of modernization was large-scale planned emigration with vast economic, spatial, social and cultural impacts. Economic growth trends repositioned local elites and American firms; and although some middle and low-income segments gained strength, others were excluded¹²¹. Since San Ciriaco, migration had been an escape valve for the growing jobless rural and urban population, and for political opponents. In the late 1940s, its pace exploded. San Juan¹²² remained the top magnet for education, integration to labor markets, and healthcare; increasing the housing deficit which in turn expanded disaster vulnerability. Soon, Puerto

¹²¹ Unemployment figures are problematic to interpret due to seasonal jobs, ranging from 75% in 1934 (Information Research Section PRRA, 1938) to 60-70% by the late 1930s (Ismael García-Colón, 2006). In the 1950s, around two thirds of employed men worked in decaying agriculture (Bluedorn & Cascio, 2005), often temporarily; women had fewer chances in their main paid occupation, domestic needle work (Ayala, 1996). Both were not provided with the skills and opportunities to enter new jobs.

¹²² Nearby growth poles were Bayamón, Carolina, Cataño, Guaynabo, Trujillo Alto and Río Piedras; distantly followed by Mayagüez; and Caguas -between Ponce and San Juan-.

Ricans. migrated massively to the U.S., mostly looking for unskilled work. From 1900 to 1940, roughly 70,000 persons emigrated; by the late 1940s, the annual average of migrants reached 35,000 (R. Picó, 1969).

Following Neo-Malthusianism, the influential 1946 U.S. Tariff Commission Report -the so-called ‘Dorfman’ report- affirmed that one million inhabitants had to leave to launch growth (A. W. Maldonado, 2006). Instead of reconfiguring exclusionary trends to avoid emigration, in the early 1950s, the Commonwealth endorsed it by promoting low-cost airfares¹²³. From 1950 to 1955, the yearly average reached 49,000 persons; from 1955 to 1959, it reduced to 40,000 persons yearly (R. Picó, 1969). In other words, emigration absorbed 3% and 85% of the population increase in 1942 and 1951 respectively (Senior, 1953). In a process known as *la Gran Migración* (the Great Migration), Puerto Ricans took cheap agricultural, manufacturing and service jobs arranged by the island administration, private agents, friends and family. The manifold and irreversible effects of migration changed parts of the U.S. (Maldonado-Denis, 1980)¹²⁴ and the island (Maldonado-Denis, 1987) through micro-decisions. Remittances supported modernization and the Commonwealth. Moreover, they were a key financing mechanism to reduce poverty and vulnerability via household investment in housing projects, education and healthcare. Again, a trend tested in Puerto Rico became the norm decades later, with trans-continental labor migration and the catalyzing role of their remittances.

¹²³ To New York mainly, but also to Chicago, Massachusetts, Miami and Philadelphia.

¹²⁴ For example, during a welcoming party in New York, in 1946, Puerto Rican Gov. Jesús Piñero listed among his top concerns to address the conditions of almost 350,000 Puerto Ricans there. The ‘problems’ created by their massive entrance worried decision-makers on both sides (Meléndez Vélez, 2005) Islanders endured subordinate forms of assimilation despite legal equality (Jorge Duany, 2007)

Post WWII, U.S. and local officials endorsed tourism given its links to construction; its allegedly benign nature without factories, pollutants and disruptive labor; and the beautiful and underused coast. Such decision endorsed beachfront urbanization, thus increased disaster vulnerability. PRIDCO was in charge of upgrading the tourist infrastructure and attracting investors and travelers. Its emblematic project was a luxurious hotel in Old San Juan islet, which would overpower the Condado Beach Hotel -formerly Condado Vanderbilt-; yet it met open criticism in the media from skeptics about the potential of tourism¹²⁵. The government paid 7.4 million dollars for it and leased it to Hilton, the operator offering the best bid (Mings, 1968). The weight of the Caribe Hilton Hotel was evident in the involvement of top PPD politicians¹²⁶, an international advertising campaign by McCann Erickson, a pompous inauguration in 1949 compared by the local press to the recent first swearing in of Gov. Muñoz Marín, and the building style. The latter was the result of an international competition won by young local architects Toro, Ferrer and Torregrosa. It fitted the aesthetic vocabulary of PPD projects as an avant-garde leap, matching the idealization of modernism in Latin America as a paradigm of development, planning and architecture (Correia de Lira, 2010).

¹²⁵ In 1948, the fate of the Caribe Hilton was in doubt, “one columnist speculated that it would become a hospital, while another suggested that it would be turned into a prison” (A.W. Maldonado, 1997, p.111) . Critics called it “white elephant”, “Coca-Cola box” or “Moscoso’s madness”. (Vivoni Farage & Gallart, 2003, p. 12) .

¹²⁶ Teodoro Moscoso (Bootstraps chief) and Roberto Sánchez Vilella (Muñoz Marín’s successor in 1965).

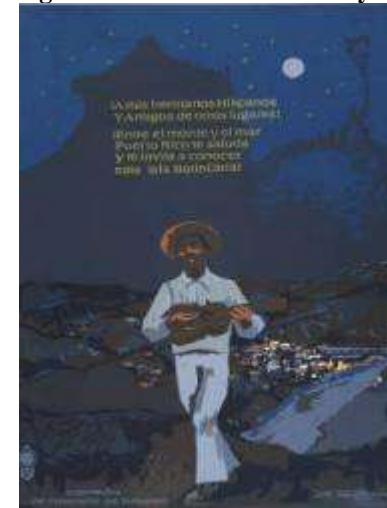
Fig. 102 Media publicity



Fig. 103 Private Publicity



Fig. 104 Government Publicity



Contemporary tourism campaigns used images of the Caribe Hilton (Hilton Hotels, n.d.; n.a., n.d.) or folksy characters and landscape (Rafael Tufiño, n.d.). Puerto Rico was the ‘Island of Enchantment’, ‘Switzerland of the Americas’, an idyllic Caribbean destination for the growing U.S. middle-class and elites in the Americas, with an exotic but tamed twist compared to volatile parts of the continent.

Fig. 105 Caribe Hilton Postcard publicity



“The gem of the Caribbean, at the crossroads of the Americas. Magnificent setting overlooking the ocean, beach, pool and gardens. 300 Air Conditioned rooms”, image (n.a., 1953).

Fig. 106 San Gerónimo fort/Hilton



The beach, an archaeological site and artificial reef added to the hotel’s allure, image by (Rahola Photo Supply, n.d.-a)

La Concha¹²⁷ would be the next luxury hotel though private; inaugurated in 1958 and by the same designers of the Caribe Hilton. It symbolizes the extreme urban contradictions taking place, in tandem with purposive environmental destruction that would become the norm. La Concha

¹²⁷ It took its name from a seashell-shaped restaurant structure facing the Atlantic Ocean, projected by the famed Italian architect Mario Salvadori.

was located in El Condado, an area adjacent to Old San Juan islet, between a lagoon and beach front that had been a thick and large mangrove, where low-density exclusive coastal urbanization included the Condado Beach Hotel and housing during the previous three decades. High-density exclusive urbanization crystalized in the 1950s, and La Concha sparked a debate to stop the growth of a so-called tourist 'wall' between Puerto Ricans and their sea -as Condado Beach Hotel had pioneered-, resulting in denial of permission for other luxury hotels (Mings, 1968). Yet, high-rise condominium apartments for wealthy locals and foreigners were allowed; which prompted throughout the island the urbanizing trends of coastal ecosystem annihilation and privatized beach access, until then used for military or export purposes. On the other side of the Condado lagoon, going inland, slums were growing in a flood-prone, insalubrious area left out of formal land markets to lower income groups; as in previous decades, this was common practice and worsened the mounting housing crisis and disaster vulnerability. When slum clearance and urban renewal became public policy priorities, as I explain below, the lagoon slums were demolished and residents were forcefully evicted. The objective was not to restore the environment but to free the area for high-end urbanization enabled by new technologies. In other words, this is the decade when ecosystems that evolved boosting resilience to storms and tsunamis -such as wetlands, coral reefs, sand dunes, mangroves, lagoons and estuaries- started to be systematically destroyed for urbanization purposes with the support of novel technology. Such process increased disaster vulnerability in the long term to middle and high income groups.

Fig. 107 La Concha Hotel drawing



The hotel embodied 'Tropical Architecture', a 1950s notion of modernism in fringe locations, image by (Toro Ferrer/Courtesy Archivo de Arquitectura y Construcción de la Universidad de Puerto Rico, 2012).

Fig. 108 Miramar, Condado, Old San Juan in the 1960



Urbanization in Miramar, the Condado lagoon border and beach front, and Old San Juan included high-end tourism, housing and highway Baldorioty de Castro, image by (Rahola Photo Supply, n.d.-b).

Fig. 109 Condado in the 1950s



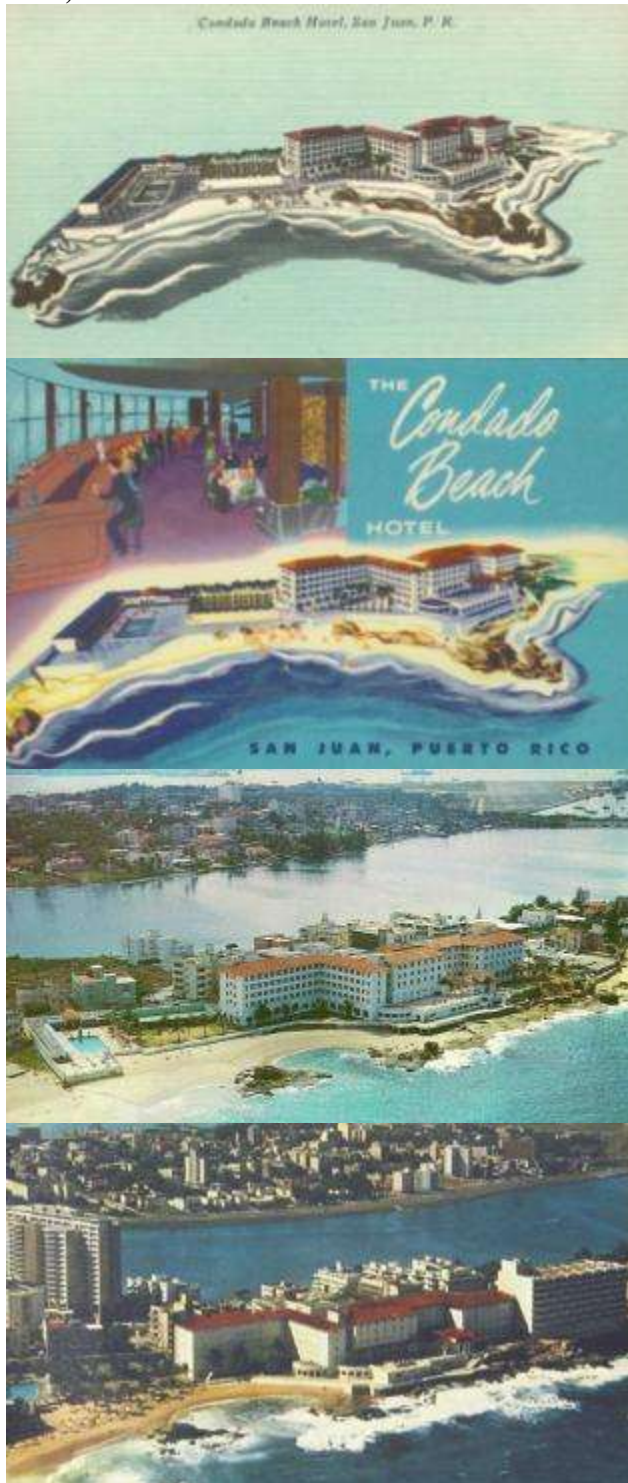
Growth along Ashford Av. closed beach and lagoon access. Condado Beach hotel upfront and Hilton behind (n.a., c. 1950s).

Fig. 110 Condado in the late 1960s



Rapid, high-end and dense urbanization of Condado seen from La Concha, image by (El Mundo, 1969).

Fig. 111 Condado Beach Hotel postcards (1930s-1960s)



The hotel and surroundings changes included La Concha, Av. Baldorioty de Castro bordering the lagoon, and multi-story exclusive housing, images by (Mathias Photo Shop, c. 1930's; n.a., c. 1960s; Peerles Litho Co., c. 1950s; Rahola Photo Supply, c. 1950s).

The concurrent Condado Beach hotel makeover included a change of private owners and image, which alluded in the 1930s to its multi-million dollar reconstruction and proximity to Old San Juan (Mathias Photo Shop, c. 1930's); in the 1950s to its focus on rest, comfort and pleasure through exclusive facilities for tennis, dancing, swimming, casino gambling, sailing and fishing (Peerles Litho Co., c. 1950s); and in the 1960s to its '*Spanish*' atmosphere and location in the re-named '*Gold Coast*' of Puerto Rico (n.a., c. 1960s). Even more drastic was the conversion of its surroundings. As the two photos below show, taller buildings, roads, water-sealed areas and a lastingly altered coastline affected buffering vegetation, open spaces, beach and lagoon access, sand dunes, and coral reefs.

Infrastructure was another modernization element that fed territorial and economic

changes, prioritizing water projects and transport. In 1935, PRRA and island legislature expanded the Utilization of Water Resources System institution to increase hydroelectric power. Initial funds went to enlarge hydroelectric plant Toro Negro #1, build Toro Negro #2 and Carite #3, and plan Dos Bocas and Las Grazas (Information Research Section PRRA, 1938). In 1937, the Insular Government acquired the Ponce Electric Company, as the first move to publically centralize electricity production and distribution (R. Picó, 1974). Water management and disaster prevention merged in Puerto Rico, following U.S. trends after Congress passed the Flood Control Act, in 1936. Moreover, physical flood control became the focus of disaster planning, shaped by federal management and legislation relying on hydro modifications as the key structural measures (López-Marrero & Tschakert, 2011). In 1941, the newly created Puerto Rican Water Resources Authority aimed to provide irrigation -mainly to large sugar plantations-, serve domestic and industrial uses, and protect against floods (R. Picó, 1974). In other words, it was a preeminent institution and had direct influence on disasters. Wartime and post-war difficulties delayed the construction of hydroelectric plants; but ensuing large-scale engineering projects comprised river channel modifications, canals, levees, dykes, and flood walls. Paradoxically, flood control both mitigated and created vulnerability. In the short term, hydraulic systems coped with minor and moderate hazards, and flash floods. Yet, flood control promoted a false sense of security increasing the use of flood-prone areas through agriculture, housing, industrialization and tourism. Artificial waterways, paved riverbeds and fields, and desiccated wetlands meant less soil capacity to absorb and filter rainwater, besides wildlife habitat reduction. Such changes increased danger during unusual weather-events, when systems failed or became outdated; they also hardened recovery. Floods became the most recurrent disaster associated with the highest casualties and economic losses on the island (López-Marrero & Tschakert, 2011).

Fig. 112 Projected Caonilla Dam near Utuado



Lines draw the vast project scale over the landscape and the old dam (Delano, 1946).

Fig. 114 Finished Caonilla Dam



Impressively, the dam was finished in three years (El Mundo, 1949); it was part of an epic story of progress.

Fig. 116 Governor Luis Muñoz Marín tours a dam



Muñoz Marín and technician discuss the isolation of barrio Jaguas, Gurabo, by the dam (Torres, 1954?).

Fig. 113 Caonilla Dam in progress



Fast construction required intense shifts (El Mundo, 1948).

Fig. 115 Toro Negro 2 overflow canal in progress



Cemented canals were also used to control urban floods mixed with untreated sewage (PRRA, 193?-c).

Fig. 117 Small-scale agricultural drainage



A minor pump to desiccate wetlands (Puerto Rico Reconstruction Administration 1937?).

Investment in transport shifted when the traditional economy stagnated; private railroad companies lost their profitability and they could not easily reconvert due to technical limitations, such as track narrowness and incompleteness. Moreover, PRRA sponsored a competitive network of motorways which in essence ran parallel, completed the coastal circuit, and connected to the interior. The railroad lines of lesser extension stopped operations in the 1930s-1940s; fuel shortages during WWII briefly reinvigorated them, yet, by the end of the 1950s, the large American Railroad was the last to close (Santamaría García, 1994). During WWII, the federal government established a road construction program to connect military bases and, correspondingly, a local cement plant was built (Ayala, 1996). In July of 1952, the newly created Department of Public Works undertook tasks of the former Department of Interior; particularly highway construction (Departamento de Transportación y Obras Públicas, 2010), which became its priority after the passing of the powerful 1956 American Highway and Defense Act. Six-lane Av. Baldorioty de Castro built in the mid-1950s epitomizes contemporary major roads. Without value-capture instruments, those roads aided private owners and developers, individual car ownership, and suburban growth; whilst razing bionetworks, precarious and sometimes even formal housing.

Fig. 118 Santurce slum demolished for Av. Baldorioty de Castro



(M. Rodríguez, 1954a).

Fig. 120 Av. Baldorioty de Castro in Santurce, from tram stop N.24 until Condado Lagoon



(Casenave, 1961).

Fig. 119 Formal housing demolished for Av. Baldorioty de Castro



(Torres, 1955).

Fig. 121 Av. Baldorioty de Castro in Isla Verde, near Llorens Torres housing



(Trías Photographer, 1955).

Housing and land tenure provision completed the modernization formula. Elites kept using vanguard designs and technologies; yet, the housing crisis was severe. In his first Congress intervention about the island, Congressman Marcantonio blamed the rural exodus to burgeoning slums on the recent hurricanes -like Mrs. Roosevelt-, but also on corporate land grabs:

“The people, through the taking over of the lands and as a result of the hurricanes, have been driven from pillar to post, into the slums of the city, and on relief” (Marcantonio 1935 in Meyer, n.d.).

Fig. 122 Slum Berlin, Ponce, 1935



Morell Campos housing project was planned to substitute this slum (PRRA, 1935).

Fig. 123 Slum La Playita, Condado, San Juan



El Mundo published that demolishing 42 houses of this slum would beautify the area, which was prime housing and tourism real estate (M. Rodríguez, 1955).

In response, “PRRA undertook to point the way toward a new standard of living for under-privileged families by constructing sanitary, comfortable and low-cost houses in a healthy and decent environment” (Information Research Section PRRA, 1938, pp., p. 9). PRRA bought land for housing development and improvement, and creatively worked on rural and urban schemes of diverse density and materials. Between 1935 and 1938, PRRA built six large projects for workers in four cities, reaching 1,244 units; in addition to rural isolated or collective dwellings, habitually preceded by slum clearance.

Fig. 124 Model house and subsistence garden for rural workers and homesteader, Arroyo



(PRRA, 193?-a).

Fig. 125 Experimental concrete house for homesteaders with wooden windows and doors



(PRRA, 193?-e).

Fig. 126 Land and utility municipal housing project, Ponce



(Delano, 1941).

Fig. 127 Suburban low-density housing in San Juan



(PRRA, 193?-g).

Fig. 128 Bird's eye view Ponce de León Housing Project, Ponce



(PRRA, 193?-b).

Fig. 129 Falansterio apartment complex, Old San Juan, built in 1937



(PRRA, 193?-f).

Until then housing was built individually or in small groups; thus PRRA projects increased construction scale and pace, but did not make a dent on accumulated shortages. Remarkably,

urban projects of higher density illustrated a transitional solution; the goal was that slum families would make their way out of poverty into ‘proper’ single detached units (Dinzey-Flores, 2007), and that goal filtrated into the upcoming Commonwealth ambitions. In 1937, the Wagner-Steagal Housing Act established the U.S. Housing Authority. In 1938, the Puerto Rican Housing Authority was created, with five local entities–San Juan, Mayagüez, Ponce, Arecibo and Río Piedras-. Concomitantly, land concentration was fervently debated, and Sen. Muñoz Marín harvested followers based on his land reform promise, as his slogan announced -Bread, Land and Liberty-. During the 1940s, almost 80 percent of the rural population was landless, lived in abject poverty on their employers’ property and were subject to arbitrary power relations (Ismael García-Colón, 2006), including evictions. In reply, the newly created Land Authority finally enacted the 1917 Jones-Shafroth Law, which specified that private corporations could not own more than 500 acres. Title V of the 1941 Land Law enabled public expropriation for resettlement communities, targeting landless families; which was speculatively used by large landowners envisioning rural decline. The means, ends and overall success of land reform has received mixed reviews (Edel, 1962, 1963; Ismael García-Colón, 2006; Rosenn, 1963); yet, its timing enabled transformations.

Fig.130 Eleanor Roosevelt Project, San Juan



The project (PRRA, 193?-d) was low-density, with quality connections and layout, mixed uses, public facilities and trees.

“My idea was to go just outside centers of population, pick up cheap land, build a whole community, and entice people to there. Then go back into the cities and tear down whole slums and make parks of them” (Ghirardo 1989 in Sepúlveda, 2009, p. 4).

Tugwell left an ambitious yet contentious imprint on urban planning and design. He appointed a committee for the Design of Public Works and hired as architects and consultants of the committee two renowned international figures, Richard Neutra first, and Heinrich (Henry) Klumb next. Between the autumn of 1943 and early 1945, the Austrian-born U.S.-naturalized Neutra worked on an ample design and construction program for public health and education. Mixing progressive and colonialists opinions; Neutra saw the program as a helpful transition in socio-economic, political and technical terms; but also a “mental reconditioning of tribesmen” in “a friendly manner” (Richard Neutra, 1948, pp. 122, 159), which would:

Eleanor Roosevelt was the most influential New Deal urban project and it presaged suburbanization, unlike the denser Art Deco Falansterio apartments. Plans included a central square, parks, schools, churches, police and firemen stations, prison, post and phone office, clinic, community market and a transport system; which were underdeveloped (J. Lizardi, 2013). Other projects were Mirapalmeras (San Juan), Morel Campos (Ponce), and La Granja (Caguas). Behind was Tugwell transplanting his experience, including living in Greenbelt Maryland:

“make the villagers – who for centuries had not much cause to trust a distant government – feel these buildings as their own community property, where in the evenings they can play their domino, strum a guitar for dancers on the community porch, and incidentally, learn by suitable programs something on many things such as child care, diet, cloth making, and more practical housekeeping” (Richard Neutra, 1944, p.4).

Neutra’s local team included young professionals who would cultivate notable careers, including Osvaldo Toro, Miguel Ferrer¹²⁸, Antonio Calderón and Raul Reichard. The team planned and designed open air schools for more than 150 villages, 128 rural health sub-stations, four district hospitals, several milk dispensaries, cisterns, village fountains, storage buildings, community centers with dance halls, stages, speakers’ platforms and broadcast equipment for varied purposes –including political, educational, assistance, and leisure uses (Correia de Lira, 2010). To overcome basic shortages, those projects were prioritized over higher professional training institutions, such as Industrial Arts schools, Medical College and Nurses’ Training Centers. Prototypes were developed and deemed formative by Neutra and the team (Correia de Lira, 2010; Richard Neutra, 1948); yet, few were built as construction underwent a halt due to WWII. Since Neutra planned to embark on an international consulting career, Tugwell invited Henry Klumb to join the Public Works Design Committee in 1944. Klumb, a German émigré, was an apprentice of Frank Lloyd Wright in Taliesin North and later contributed to the design of Greenbelt, New Jersey (Vivoni Farage, 2006). On the island, he started governmental projects, joined the Housing Authority (1945), and sculpted a leading public and private practice for the rest of his life (Vázquez-Pérez, 2006; Vivoni Farage, 2006). Following modernist planning, for Klumb the built environment crisis would only be solved developing basic modules with standard pieces easily assembled in situ; which usually happened in peri-urban agricultural areas

¹²⁸ Toro and Ferrer later designed the Caribe Hilton and La Concha, among many relevant buildings.

whose speculative value was rocketing, with feeble connections among them and to urban centers (J. Lizardi, 2013).

In 1940, the construction industry contributed to 4% of the GNP, in 1945 its contribution was close to none, in 1952, it surpassed 10% of the GNP (De Jesús Toro, 1982). Besides, after WWII, housing dominated the construction industry; as a proxy, it amounted to 70% of the total value concerning permits for private purposes (De Jesús Toro, 1982). Between 1937 and 1948, 27 housing developments -for 5,768 families- were built; in other words, Puerto Rico competed with the states receiving top per capita housing investment (Dinzey-Flores, 2007). Consistent with the prevalent ethos and funding, the resumption of affordable private and public housing programs shifted to massive slum clearance and urban renewal. Between 1948 and 1949, the Farmers Home Administration, Veterans Administration and the *Banco de Fomento* financed *Puerto Nuevo* (New Port), then the largest worldwide low-cost social housing program. Located in Hato Rey, it included 6,000 housing units each at a cost of US\$1,750, totaling US\$10.5 million (Alameda & Rivera Galindo, 2005). Leonard Darlington Long, who built it in record time, embodied a new figure in the production of space in Puerto Rico, the large-scale private developer who funneled abundant public funds and captured the public imagination through novel marketing techniques endorsing suburban dreams (Sepúlveda, 2009). The project scale changed production, organization and financing methods (De Jesús Toro, 1982). Besides, it epitomized a recurrent formula for housing: disjointed, car-dependent, low-density individual homeownership with minimal collective facilities, and insufficient vision to foresee enhanced risk scenarios leading to expensive retrofitting often carried out by public institutions and not the developers involved. Rather soon, in 1953, *Puerto Nuevo* exemplified the trouble of technology-

enabled risk-prone urbanization. A storm was enough to flood sections, as a result of aggressive deforestation, massive topographical changes, sealed infiltration areas, transformation of a nearby water body and poorly calculated drainage capacity. It would take decades for preventive mechanisms such as Environmental Impact Assessments –launched by the federal government– to evaluate hazards posed by new developments and requests palliative changes or deny permits.

Fig. 131 Puerto Nuevo project



N.a in (Alameda & Rivera Galindo, 2005).

Fig. 132 Flooded section H of Puerto Nuevo



(Trías, 1953).

In 1949, HUD and the Housing Act were established in the U.S., along with the National Law of Homes; and they cemented that demolition and new construction were the governmental synonyms of progress¹²⁹. On the island, those ideas were highly influential. Just in a year (1949-1950), combined Puerto Rican and federal funds built projects to resettle 4,700 families from demolished slums (R. Picó, 1955). Based on Title I of the 1949 Housing Act, removing precarious housing became a priority. The 1950 census counted 929,000 residents in the 76 urban centers of the island, out of which 45 per cent lived in slums (R. Picó, 1955), and at least 2,000 families joined yearly (Alameda & Rivera Galindo, 2005). Hence, the projection was to

¹²⁹ The 1954 Housing Act was a partial exception for it also contemplated historic buildings (Stipe, 2003)

build in a six year period thirty thousand units of dense urban public housing, '*caseríos*', to replace an equal number of cleared dwellings (Dinzey-Flores, 2007). Thus, unprecedented housing investment was planned as a defining element of modernity and would become a symbol of the Commonwealth. Suburban middle and low-income housing construction and systematic slum destruction took place, chiefly affecting communities of color (Fuste, 2010) located in San Juan prime real estate (Cotto Morales, 2006); but also in Ponce, Mayagüez and a few other towns. In the 1950s, the reverberating effects of the construction industry included jobs, demands for transport, qualified professionals, local and imported construction supplies, domestic appliances and service provision. In early 1954, new public developments housed almost 5,047 families, out of a total of 10,334 targeted. By late 1955, the remaining 5,287 targeted slum families were anticipated to resettle in 27 new projects. Other 20 projects would relocate 17,000 slum families, and the new target was to build 6,000 dwellings yearly. Meanwhile, 43,000 squatter rural families were relocated to rural villages and, within the next five years, 65,000 families were planned to be resettled (R. Picó, 1955). Despite large investment in housing, uneven urban growth trends and the most extreme physical vulnerability were questionably reduced when Santa Clara made landfall. For instance, most houses lacked indoor toilets and electricity (Bluedorn & Cascio, 2005).

Fig. 133 Corea slum, Cantera peninsula in San Juan, under demolition



Named after islanders drafted in the Korea War, this lively community was flood prone (Casenave, 1954b).

Fig. 134 Hoare slum ruins after demolition by the Housing Authority, San Juan



(El Mundo, 1954a)

Fig. 136 Workers finishing demolition of Condado Lagoon huts on stilts



(M. B. Rodríguez, 1953).

Fig. 135 Planning Board workers destroy huts close to Israel School, San Juan



(M. Rodríguez, 1956).

Fig. 137 A commission from Bella Vista slum in San Juan protests its impending demolition



(Morales, 1951).

Fig. 138 Public officials buy the first house to eliminate a slum in Ponce



(Mariani, 1953b).

Fig. 139 Irrizarry family in their new housing project unit, Pedro Juan Rosaly, Ponce



(Mariani, 1953a).

Fig. 140 Public Housing Project under construction in Carolina, for Catañito slum residents



(Casenave, 1953).

Fig. 141 Inauguration of the Public Housing Project Caserío Llorens Torres



In a few decades, this project would epitomize domestic violence, drugs, gangs and crime (Torres, 1953).

To conclude this section, I reviewed the built environment emphasized in architectural, planning and policy records until now, as part of discursive frameworks that strengthen or weaken fair remembrance of how differently urban life and disasters were experienced. Emphasis on formal

well-off built environments, exceptional authors and the protection of elitist areas and buildings remain in place (J. A. Fernández, 1965; Oficina Estatal de Conservación Histórica de Puerto Rico, n.d.; Tarr, 1977). Yet, non-elitists projects of high quality made by famed architects -such as Neutra, Toro, Ferrer, Klumb, Jesús Amaral or Santiago Iglesias hijo- have received attention (Correia de Lira, 2010; Richard Neutra, 1948; Vivoni Farage, 2006; Vivoni Farage & Gallart, 2003). Contemporary specialized and governmental publications addressed the ongoing urban transformation from their top-down viewpoint, without incorporation of grassroots viewpoints and experiences (Information Research Section PRRA, 1938; R. Picó, 1955). Recently, the informal and precarious built environment has been the subject of critical articles (Alameda & Rivera Galindo, 2005; De Jesús Toro, 1982; Dinzey-Flores, 2007; Esterrich, 2009; Fuste, 2010) and even books (Cotto Morales, 2006; E. Quiles Rodríguez, 2009), which provide multilayered approaches to the urban past, capable of strengthening fair remembrance of how differently urban life was experienced. Disasters are barely discussed though reflecting the need for more scholarship.

VII.4 Socio-cultural hierarchies, memory and knowledge of disasters

Differentiated vulnerability or resilience to Santa Clara was also shaped by the juxtaposition of socio-cultural hierarchies, memory and knowledge of disasters. There were changes in the contemporary manipulation of traditional vectors of difference such as country of origin, language, class, race, religion, and gender to justify social integration or exclusion; which reflected on rights, resources and obligations. The most quarrelsome social divergences were based on overlaps of country of origin, class, ideology and political status preferences. Such

background shaped the Commonwealth; it is vital to examine its emergence because -after armed clashes- it became the official framework in which new and old hierarchies coexisted, competed and permeated into varying degrees of risk exposure, and also processes of collective memory-making and formal knowledge development -including disasters-, reshaping the island.

During the 1930s, poverty, social injustices and increasing frustration were recorded by respected external and local voices. In 1939, Roosevelt mandated Gov. Admiral William D. Leahy to reinforce the island's defenses, in the advent of WWII. Leahy reported to Congress that something ought to be done about the terrible economic and social conditions pertaining most Puerto Ricans because a frustrated, starving, and poor population was a threat to military strength (Polk, 1942). For geographer Picó, in 1940 "there was exploitation of the working classes, unequal distribution of wealth, chronic unemployment and apathy towards the future" ((R. Picó, 1955, p. 114). Journalist John Gunther, who authored a series of famed 'Inside' continental surveys since the late 1930s, highlighted in 1941 the vast developmental gap between the island and the U.S. on his 'Inside Latin America' book¹³⁰:

"I saw, in short, misery, disease, squalor, filth. It would be lamentable enough to see this anywhere. It would be shocking enough in the remote uplands of Peru or the stinking valleys of the Ganges. But to see it on American territory, among people whom the United States has governed since 1898, in a region for which our federal responsibility has been complete for 43 years, is a paralyzing jolt to anyone who believes in American standards of progress and civilization. The picture seen by the eye is bad enough. The story heard by the ear is even worse...I found that in some villages a flat 100 per cent of the population has malaria. I found that infant mortality in Puerto Rico is the highest in the world, four times that of the United States. I found that the average income of the jibaro (peasant) is about \$135 per year, or less than 40 cents a day. I found that a pound of meat costs 30 cents in Puerto Rico, whereas in Santo Domingo 45 miles away it is 6 cents. I found that there is no milk fit to drink, and that even the public water supply-on American territory!-is not safe, because the island cannot afford proper sanitation methods" (Gunther 1941 in Polk, 1942, p.484).

¹³⁰ (Gunther, 1941)

As frictions and rebellion grew, New Deal responses included developmental projects but also surveillance, harassment, persecution, imprisonment, tortures to prisoners and the civilian massacres of Río Piedras (1935), and Ponce¹³¹ (1937). By the 1940s, new political relationship formulas between the U.S. and Puerto Rico were under discussion: dominion state, statehood or independence. Roosevelt's death would slow down the process, as his successor Harry S. Truman was less vinculated to Puerto Rico (Sepúlveda, 2009).

Fig. 142 "Puerto Rico will choose"



A cartoon from The Pittsburgh Courier (Holloway 1945 in (Almaguer, 2012) shows a curvy, smiling young woman representing Puerto Rico, dressed in a supposedly traditional, bare shouldered and ruffled costume, wearing a cross necklace and head attire. Independence, Statehood and Dominion States are options linked to wedding bands that she is checking on a tray, offered by U.S. Congress, represented by an elderly obese man from beyond the dark sea. Completing tropical allusions are palm trees, waves, and a woman seemingly carrying a fruit basket on her head.

Next, governmental responses to undermine separatism oscillated in a two-fold, non-mutually exclusive strategy; their results would silence left-wing voices in the political spectrum and direct public life and policy-making towards conservatism, including planning, disaster

¹³¹ Considered the worst bloodbath in recent Puerto Rican history, it took place during Palm Sunday, to avenge the murder of Colonel Francis Riggs. Gov. Winship ordered to ambush authorized unarmed demonstrators who commemorated the ending of slavery, demanded independence and protested Albizu's incarceration. A girl, one woman, seventeen men, and two policemen were killed; almost 235 protesters were wounded, whilst hundreds were arrested and charged with breaking the law without proof. Next, "hysteria and near civil war swept the island. Nationalists were hunted and arrested on sight. Some headed for exile in New York City or Havana" (J. González, 2007)

management and culture. One strategy was to continue repression¹³²; the other was to negotiate autonomy. In 1949, Gov. Muñoz Marín and Congress worked on a Constitution to turn Puerto Rico into a Commonwealth, a political form:

“developed to fit the economic facts, the cultural realities, the free and yet non-nationalistic ideals of the [Puerto Rican] people. It also had to meet the legitimate economic and military interests of the United States” (Luis Muñoz Marín, 1954, p. 546).

In 1950, understanding the Commonwealth as a betrayal of the dream of independence and despite reinforced punishments, nationalists led by Dr. Pedro Albizú Campos launched an armed revolt¹³³. Muñoz Marín declared martial law, ordered the arrest of hundreds of nationalists including Albizú and called for the U.S. National Guard to crush the uprisings, leading to the Utuado and Jayuya massacres, heightening of island-wide militarization and emigration of thousands of independence and left-wing supporters (J. González, 2007). The challenge to American and Muñoz Marín’s rule met stark repression¹³⁴, marking the decline of the most popular separatist option and rejection to ideologies that emphasized redistribution, collective organization and communitarian development¹³⁵; which in due course increased pro-Statehood adherence and narrowed governmental roles for welfare and development with incongruities.

¹³² During 1948, the last U.S. appointed Governor and the first Puerto Rican to have such position, Jesús Piñero, approved Law 53, infamously known as *Ley de la Mordaza* (Gag Law). It enabled captivity for displaying the Puerto Rican flag, expressing pro-independence ideals or attending left-wing political rallies –even without proof of engagement in revolutionary activities- (Paralatici, 2004).

¹³³ They attacked *La Fortaleza* -the Governor's mansion-, failed to murder President Truman in D.C., and staged uprisings in Ponce, Peñuelas, Naranjito, Mayagüez, Arecibo, San Juan, Jayuya and Utuado.

¹³⁴ The most symbolic example was Dr. Albizú Campos, who during an incarceration period was subject to painful unconsented radiation experiments that caused him fatal cancer.

¹³⁵ In the 1940s, U.S. and Puerto Rican conservatives often disqualified Gov. Tugwell and his New Deal plans, policies and projects as socialist or communist. (Tugwell, 1974).

Fig. 143 National Guard troops marching in Jayuya after the uprising, October of 1950



After rebellion was violently extinguished, surveillance in everyday life increased, photo (n.a., 1950).

The suppressed uprisings re-exposed the need to address cultural sensibilities, attached to patriotic sentiments. The Gag law established a durable repressive framework¹³⁶; yet, a more tolerant compromise could hinder separatism and channel the profound transformations experienced by Puerto Ricans. Vast population segments quickly went from being rural peasants to urban, industrial, diasporic and transnational communities. Some traditional gender roles were challenged by the incorporation of women to paid employment, migration (Simpson, 2006) and reduction of extended families. The island became a tourism spot, medicine and birth control testing laboratory, and unequal tax heaven. Also, it became a weapon testing site of U.S. Navy bases and a recipient of conservative Cuban migrants before the Cuban Revolution (1959). As Cold War tensions escalated, Puerto Rico became a paradigmatic showcase of U.S. ‘foreign’ policy to stop communism, despite capitalism’s contradictions¹³⁷.

¹³⁶ The Gag law was repealed in 1957, but political harassment subsisted. The 1994 Electronic Freedom of Information Act Amendments made federal agencies disclose that, from 1950s-1970s, forced radiation experiments were conducted on prisoners, including Albizú. The FBI and island government had a network of informers feeding the *Carpetas* (dossiers), used to deny employment, college admission and child custody or back punitive actions such as unlawful arrests until the 1980s. (Paralitic, 2004).

¹³⁷ Such as massive emigration, low salaries vis-à-vis tax exemption and subsidies for large corporations.

In a period marked by turmoil, mobility and rapid change, Gov. Muñoz Marín visualized that defining shared history and cultural identity would maintain ‘ontological security’; that is a sense of order and stability in regard to people’s experiences (Giddens, 1986). Muñoz Marín adhered to the paradigm that preserving parts of the traditional built environment, practices, history and values provided continuity and a sense of normality (Blake, 2000); helpful to withstand modernity, social chaos, crises and violence:

“The people of Puerto Rico eagerly wait to continue being kind and tranquil in their understanding, in their attitudes, while they utilize fully and vigorously all the complex resources of modern civilization. They do not want that the complexity of those work instruments upsets them”(Luis Muñoz Marín, n.d.).

“As Puerto Rico grows in its cities and diminishes in its fields, shall the preservation of the basic good knowledge be one of the first achievements of urbanization instead of being one of its first victims” (Muñoz Marín 1952 in Sepúlveda Rivera, 2004, p. 52).

Those thoughts crystallized in the cultural counterpart to Operation Bootstraps, called *Operación Serenidad* - Operation Serenity-, a project to advance education, appreciation of the arts, identity promotion and preservation of cultural heritage. The *Instituto de Cultura Puertorriqueña* (ICP) was thought as the cornerstone, with a relative local autonomy and centralized mandate for setting cultural policies -including historic preservation-. The proposition to create the ICP sparked debates because it implied recognition of a validated island identity by commanding foreign rulers and contending Puerto Rican representatives in the Senate. The later disputed that a) since Puerto Rican culture was a Western hybrid, at best, it was more suitable to promote a universalistic culture to facilitate Statehood; b) preserving a local culture would instigate separatist belligerency; c) the scope of culture would be reduced according to the PPD ideology, co-opting independence (Dávila, 1997).

In 1955, Law 89 created the ICP to set the tone for institutions dealing with cultural affairs¹³⁸; a doctrinally moderate archaeologist and anthropologist, Dr. Ricardo Alegría, was appointed as director. In political terms, the resulting compromise to create the ICP had limitations because it could not confront colonial rule. Also, the ICP had epistemological limitations, because its essentialized vision of culture selectively turned traditional objects, buildings and practices into its means and ends to preserve, according to the overlap of mainstream paradigms developed in the U.S. and Europe, and local power struggles with historical backgrounds. As contemporary institutional benchmarks abroad, the ICP did not frame culture as a changing everyday life process linked to justice, human development, environmental sustainability or political agency. On the contrary, the ICP understanding of culture comprised biases that perpetuated certain injustices. For example, following notions of *habitus* established during the Spanish colony, the official definition of cultural heritage was embodied by *Hispanophilia* and the myth of harmonious *mestizaje* which privileged *blanqueamiento* ideals, *Jíbaro*, Spanish, and even *Taíno* heritage over African heritage (Jorge Duany, 2005). Early examples of ICP hispanophilic and elitists biases in preservation were the restoration of the Spanish Fort San Gerónimo (adjacent to the Caribe Hilton), Caparra ruins, and the house and mausoleum of Luis Muñoz Rivera –Creole politician and father of Gov. Muñoz Marín-, also honored with a yearly festival in his highland hometown and an exhibit traveling throughout the island. Meanwhile, there were no efforts to preserve the built heritage of Afro-descendants. Also, preservation discursively emphasized an imagined pristine, peaceful and static colonial history, mainly in the agrarian highlands, populated by white *jíbaros* (Cordova, 2005). Such choice minimized the violent patterns of coastal, multi-

¹³⁸ Including the Pablo Casals Festival (1957), Symphony Orchestra (1959), Music Conservatory (1958), Free Music Schools, Radio and TV services of the Puerto Rican People (1958), and ICP municipal centers soon established.

racial Spanish colonization and American domination (González, 1990); and was out of synch with current social trends, since most Puerto Ricans were becoming urban citizens on the island or the U.S. In addition, a private, for-profit logic filtered into preservation from its inception. For instance, Alegría quickly undertook Old San Juan, the most visible urban case menaced by speculative pressures, decay and modernist assumptions. Old San Juan became a seminal Latin American model of preservation (Rigol, 2005) that circumvented collective rights and benefits to favor a pro-market trickle-down approach, paving the road to gentrification, commodification and tourism. In sum, incipient cultural heritage preservation endorsed exclusionary memorializations of marginalized citizens in discourses, representations and urban interventions; and an unfair appropriation of profits. The choice between the politics of remembrance and forgetting (Appadurai, 1996) reinforced the historical inability of subalterns to speak (Spivak, 1988), be acknowledged and empowered in the public sphere of culture. Besides, in my view, emphasizing an idealized rural past (Esterrich, 2009) blurred the role of culture in challenging previous and current unjust distribution of resources and power, which had consequences on risk-prone urbanization and disaster management. Those ideas were barely sketched out when Santa Clara made landfall, questioning how the Commonwealth should address hurricane memorialization.

Meanwhile, grassroots remembrance of disasters was similar to the days of San Felipe, in the sense that superstitions remained well entrenched although religious beliefs were less important. The continued precarious state of education was a decisive factor for superstitions to remain solid on collective imaginaries about how to understand hurricanes. Initially, PRRA funded the constructions of schools throughout the island, as increasing literacy was one of the New Deal

goals; yet its pace was insufficient. Moreover, English as the official language of public education remained a detested obstacle, most Puerto Ricans could not speak it and even teachers lacked a solid command of it (Barreto 2001); which did not deter U.S. leaders from pushing it. For instance, in 1937, President Roosevelt appointed José M. Gallardo as Puerto Rico's Commissioner of Instruction; he denied intending to diminish the rich Spanish cultural legacy, including language. Yet, English had to be promoted to achieve bilingualism so that Puerto Ricans could master the language of the country they were part of, know its principles, and also gain economic opportunities (Kerry Picket, 2012). By 1940, almost 56 per cent of the children of school age -between 350,000 and 400,000- did not attend to school due to insufficient schoolrooms (Gunther 1940 in Polk, 1942, p. 484); and that data did not mention those skipping education due to child work. In 1949, Gov. Muñoz Marín was invested with the authority to designate the Commissioner of Education, for which he chose a Puerto Rican. In parallel, Muñoz Marín instituted Spanish as the official language of public education through a decree. In the same year, a far-reaching approach to overcome education deficits started with the establishment of the División de Educación a la Comunidad (DIVEDCO, Division of Community Education), under the Department of Instruction. DIVEDCO would help to guide the transition envisioned by Muñoz Marín and his team from a rural backward past into the modernity promised by the Commonwealth, linking governmental policies to peaceful democracy (Smithsonian Institution, 2001-2004). Officially, DIVEDCO was an instrument to address the especial needs of the community. However, the agenda was set by the Commonwealth creators to advance their political needs, not free from contradictions (Esterrich, 2009). Emulating the U.S. Farm Security Administration and the Works Progress Administration, and with the help of renowned artists¹³⁹;

¹³⁹ Composer Amaury Veray; writers Pedro Juan Soto, Emilio Díaz Valcárcel, René Marqués, José Luis Vivas Maldonado; graphic designers Rafael Tufiño, Irene Delano, Lorenzo Homar, Julio Rosado del Valle; filmmakers

DIVEDCO produced a wide range of pedagogic materials such as booklets, bulletins, pamphlets, posters, short and long films. DIVEDCO focused its work in rural areas, although Law N. 372 which authorized its establishment did not specify it (Esterrich, 2009). DIVEDCO combined work on community meetings -mainly targeting adults- and children classrooms. Among the topics addressed were illiteracy, housing, healthcare, infrastructure, agriculture, and political corruption. Some of those topics related to disaster management, without making explicit ties.

In spite of all the investment, the median level of completed schooling was roughly three years when Santa Clara struck (Bluedorn & Cascio, 2005). Moreover, Santa Clara exposed the widespread belief in short-term forecasting noticing spider webs falling from structures, animals in distress - chickens, crickets, frogs, and lizards -, the presence of a coastal bird flying inland to avoid storms, summarized in the proverb “*Rabojunco en tierra, tormenta en la mar*” (coastal bird Rabojunco in land, storm in the sea) (DIVEDCO, 1965), and even feelings pain in callus feet (Margenat 1956). Another dominant social and media dynamic, allegedly rooted on ancestral heritage, was the hurricane forecasting based on avocado crops. It was trusted by professional associations to advice their members, as the Coffee Planters Association did for storm insurance. Thus, education deficits, superstitions and the impacts of Santa Clara would also call for a pedagogic role of the Commonwealth in disaster memorialization and management.

The decline of religious beliefs to explain hurricanes needs further research, but it can be rapidly assessed as an irregular process in which meteorological advances and media communications had a relevant counterbalancing role. Catholicism was widespread, although Protestant religions were gaining space; and people still begged for God’s protection when in danger, as explained in

Benjamín Doniger, Jack Delano, Angel F. Rivera, Luis A. Maisonet, and Aníbal Tirado.

the experiential story used to begin this chapter. Yet, by the time Santa Clara hit, naming of hurricanes according to saint day was under challenge mainly by U.S. scientist; there were more sturdy buildings other than churches that could be used as improvised refuges, particularly public schools; and there were no recorded public diatribes by religious leaders explaining disasters as God's wrath towards deserving sinful people.

Moreover, scientific knowledge advanced secularization of disasters in the previous decades, with mutable impulses obeying martial U.S. objectives. First, PRRA included launching academic weather studies to complement the military. A small building at the Universidad de Puerto Rico-Río Piedras became a hurricane relief facility and laboratory, in close consultation with the San Juan Weather Bureau.

Fig. 144 Hurricane Relief building at Universidad de Puerto Rico-Río Piedras



(Puerto Rico Reconstruction Administration 1936).

Fig. 145 University hurricane researchers Mr. Kenninck and his assistant



(Puerto Rico Reconstruction Administration, 1936).

During World War II, modest weather studies in Puerto Rico underwent a radical change because aviation was vulnerable to weather-related events. Again, understanding meteorology and hurricanes became a tactical war necessity for the U.S. government (Mooney, 2007), and the

island had a strategic location which eased funding disbursement for bellicose purposes¹⁴⁰. In 1943, the U.S. Air Corps -later the Air Force- teamed up with the University of Chicago to establish the Institute of Tropical Meteorology at the Universidad de Puerto Rico-Río Piedras, as part of a larger project that also included Pacific Ocean studies. Meteorologist Herbert Riehl, appointed director of the institute, pioneered hurricane research and used wartime technology, such as radar. He also used emerging technology such as storm flying, improvised that year by a military plane that departed from Puerto Rico to penetrate a storm. On August 1944, the War Department created the Weather Reconnaissance Squadron, a military team with an instrument equipped aircraft originally conducting military missions. After WWII, reduced security constraints on military technology enabled the use of radars to gather data such as wind force and direction, key to build theoretical interpretations concerning hurricanes, showers, squall lines, typhoons, tornadoes, thunderstorms, cold fronts, warm fronts, and occluded fronts (Maynard 1945). Riehl and colleagues got on board to collect new reliable data of hurricane intensity and position, enabling longitudinal sets of regional records. Their refined layers of knowledge over the 'Viñes laws' and other discoveries changed the understanding of hurricanes, tracking, warning alerts and technology. For example, Riehl confirmed the thermodynamic nature of hurricanes, with the evaporation of warm seawater as the main energy source; which would influence climate change theories. Gradually, radar and storm flying data increased the time window to launch warnings before hurricanes were too close.

During the Cold War, meteorological studies in Puerto Rico remained relevant for two reasons. One was that 'weather control' became a top military concern for the federal government. The

¹⁴⁰ Favoring military expenses, federal funds for Puerto Rico reached \$33,300,000 in 1941 and 133,600,000 in 1945; (Badillo-Veiga, 1981).

military aimed to engineer storms, hurricanes and clouds as weapons for an all-weather air force (Mooney, 2007). The other validating reason was the impact of two continuous Atlantic hurricane seasons. In 1954, hurricanes Carol, Edna and particularly Hazel left a path of destruction in several countries and states. Soon, the Weather Bureau in Florida launched the National Hurricane Research Project to advance ‘tropical cyclone science and forecasting’, with a base in Puerto Rico (Mooney, 2007). A year later, devastating hurricanes Connie, Diane and Ione justified more applied research and policies, also related to Puerto Rico. Resultantly, public policies to address hurricanes on the island were consolidating as top-down measures in the hands of the military, bureaucrats and technical scientists; essentially delinked from professionals in the social sciences and humanities, or participatory grass-roots approaches. According to contemporary news, the Commonwealth government kept a close communication with the recently established Puerto Rican Civil Defense Office, and a sometimes stiff interaction with the Red Cross, traditional leader in emergency relief. Puerto Rican Civil Defense documents referred to the Cold War logic unfolding in the U.S. and expressed concerns about nuclear bombing¹⁴¹. For instance, its first available document preceded Santa Clara, and it was a Vigilante’s Manual (Oficina de la Defensa Civil, 1954) that outlined the organization of the Civil Defense volunteer base, regional coverage, chains of command, detailed tasks to undertake – such as communications and evacuation-, and equipment to be used in case of hurricanes, floods, storm surges, fire and radioactive bombs alike.

¹⁴¹ Provisions for nuclear, radiological, biological and chemical attacks remain a worry. A private university recently published related guidelines in its security manual for the Metropolitan Campus. (Universidad Interamericana de Puerto Rico Recinto Metropolitano, 2012).

Fig. 146 Inter-institutional meeting to discuss a hurricane season plan



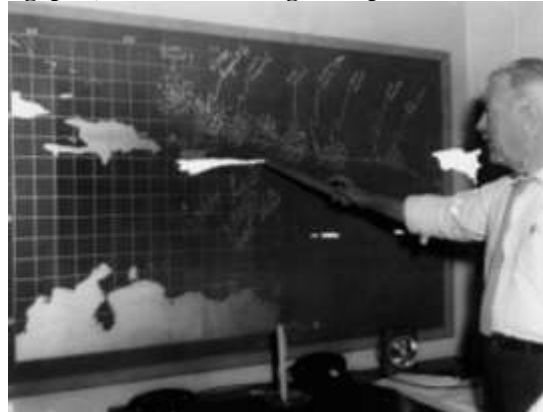
(M. Rodríguez, 1954b).

Fig. 148 Mr. Higgs and Mr. Roseblatt track hurricane Hazel



(Casenave, 1954a).

Fig. 147 Ralph Higgs, Weather Bureau Director, points to hurricane Connie (San Agapito) in the most dangerous point for PR



(Martí, 1955).

Fig. 149 Dr. McDowell demonstrates an instrument to visiting students and officials



(Official Navy Photo, 1951).

Meanwhile, Riehl invited his former meteorology student from the University of Chicago, Dr. Dawson Clay McDowell, to join his project. McDowell became a professor and eventually the director of the Institute of Tropical Meteorology. As importantly if not more, he improvised a fundamental change in the public understanding of hurricanes since the mid-1950s, with the advent of television. He presented the daily weather news on Telenoticias del Mundo (WKAQ-TV Canal 2) for almost three decades, initially at 6.15 pm then after the evening news. In a 1988 documentary called ‘Here comes the Hurricane’, McDowell explains that he really wanted to get

lay people interested. He noticed that *aguacateros* were famous and trusted, although they lied - like the Weather Bureau he jokes-. Thus he thought:

“Why don’t I search for an avocado to interview? Because they know so much about storms, they are the storm authority” (McDowell circa late 1970s in Molina Casanova, 1988).

His initial thinking was to buy one avocado from a market. Subsequently, he came up with a more elaborated idea to give it a ‘high-tone’; he created *Alberto el Aguacate* (Albert the Avocado), an avocado-like puppet that every night forecasted the weather news with him. In his own words, he got a reputation of being a slightly crazy comedian that spoke Spanish poorly, not really a scientist. Yet, in a column published in the newspaper San Juan Star, April 28, 1973, reprinted in a book, respected historian Fernando Picó wrote a tribute to McDowell as an inter-generational family figure that protected Puerto Rico. People all over the island would stay up late and stop what they were doing to hear him and follow his advice (F. Picó, 2008).

Fig. 150 Tribute to Prof. McDowell on Alberto El Aguacate facebook fan page



He became a reliable public figure on the island; in the company of his friend Albert the Avocado, he daily forecasted the weather from studios and site visits for almost three decades (Alberto el Aguacate, 2011).

He was trustworthy, as mentioned in the story used to start this chapter. Besides, using his intuition and reasoning, he spread technical knowledge inimitably appropriating a popular *jíbaro* superstition, with a respectful sense of humor that resonated among his viewers. McDowell overlooked beliefs of coastal people- such as shell forecasting- in line with the mainstream idea that ancestral knowledge and Puerto Rican identity were rooted in the highlands.

In sum, when Santa Clara made landfall, religion had a reduced societal role, novel expensive technology and modernity paradigms were gaining weight, albeit their lack of certainty; whilst traditional forecasting beliefs were considered equally if not more valid.

V.II. 5 The New Deal, WWII, the Cold War and hurricanes: U.S. disaster management towards a bellicose approach

The framing of Santa Clara relief is best understood when examining first how the U.S. mechanisms to address disasters considerably changed from the 1930s- to the mid-1950s. Instead of reviewing a specific preceding disaster, reviewing the process shows how executive power significantly increased and adjusted crisis management through diverse cases, with repercussions fully experienced in Puerto Rico until Santa Clara.

During the New Deal, the federal government expanded its role in disaster assistance through old and new institutions such as the Federal Emergency Relief Administration, Reconstruction Finance Corporation, Federal Civilian Works Administration, Works Progress Administration, Civilian Conservation Corps, Army Corps of Engineers and Department of Agriculture. For

instance, the Army Corps of Engineers helped communities to prevent and recover from floods, and the Department of Agriculture offered aid to farmers who sustained economic losses in disasters. The federal government initiated low-interest loans and outright grants for disaster relief—features of subsequent disaster laws. In 1933, President Roosevelt created the National Emergency Council to coordinate emergency programs among all agencies involved in preparedness and develop programs unrelated to civil defense. Contemporarily, Congress considered turning the American Red Cross a government agency, but Red Cross officials chose to keep it private. Also, Congress passed the Flood Control Act, motivated by a large inundation in New England during 1936; which built upon the 1928 Flood Control Act, Mississippi floods and Okeechobee experiences. Water management and disaster prevention official merged, and the federal government -particularly the Army Corps of Engineers- engaged in flood control at a vast, unprecedented scale. The management of so-called ‘natural’ catastrophes consolidated as a technocratic endeavor concerned with the spatial implementation of science and engineering solutions, with implicit connections to economic growth and allegedly separate from politics and culture. Moreover, in the late 1930s, using novel arguments, evidence, and historical precedents¹⁴², New Deal Congressmen casted the Great Depression as a national disaster and won the Supreme Court approval for increased governmental powers of taxation and expenditures on ‘general welfare’¹⁴³ (Landis, 2005).

The political climate of 1940 added strong military biases to disaster management. Responding to the beginning of WWII, Roosevelt reestablished the Council of National Defense to handle

¹⁴² Such as the 1893 Depression, for which Congress debates firstly viewed mass unemployment as a national catastrophe, instead of a personal failure, that merited federal aid.

¹⁴³ Following that line of argument, the New Deal could have been the result of reframing disasters (Landis, 2005), which is an idea that has met criticism (Gillman, 2005) but deserves attention.

crisis, which grouped war and disasters. Federal funding targeted attack preparedness, whilst non-belligere crisis preparedness had to be afforded by states; which created disincentives and conflicts among federal, state and local authorities concerning resources and power (McClure, 2011; U.S. Homeland Security, 2006). A year later, Roosevelt established the Office of Civilian Defense (OCD) to answer increasing concerns about civilian bombing, as experienced in Europe. OCD tasks comprised protective services, such as attack preparedness generally carried out by men; and non-protective activities –also called social welfare services-, usually carried out by women. The latter included nutrition and physical education, morale upholding and the promotion of volunteerism. Non-protective activities sparked critics; they were labeled ‘sissy stuff’ by the first OCD appointed director, Fiorello LaGuardia, and ‘pink’ by leading politicians (U.S. Homeland Security, 2006). Moreover, non-protective activities were criticized by congress members and public despising the program’s social aims, and questioning what they saw as an inflated budget and encroaching governmental intervention in everyday life. In fact, the OCD fell short from its goals; it basically established civil defense plans, including black outs, air raid drills, and sand bag stockpiling (U.S. Homeland Security, 2006). After the war, calls for dissolving the OCD were based on the emerging consensus that attacks on the U.S. homeland were unlikely. The National Security Act of 1947 created the National Security Council and National Security Resources Board, with diminished funding and goals concerning civil defense.

However, the Cold War, nuclear fallout and the Korea War soon became a worry for politicians and lay citizens, strengthening again a belligere bias in meteorology and civil defense. ‘Weather control’ became a military priority. Already in WWI, Germans used poison gas to exterminate adversaries; thus, they made the leap from traditional means of combat -centered on attacking the

enemies' bodily functions-, towards the attack of the environmental conditions that sustained life, an approach also called 'terror from the air' (Sloterdijk, 2009). During the Cold War, such approach would be used in wartime as well as in peacetime, in an attempt to create and direct storms, clouds and hurricanes as weapons of an all-weather arsenal. In 1946, Nobel Laureate Irving Langmuir led a team at General Electric Corporation to control weather, they used silver iodide and dry ice as cloud seeding agents. A member of the General Electric team, Vincent Schaefer, bombed a cloud near New York with dry ice causing snow. Resultantly, 'Project Cirrus' was launched a year later with the backup of the U.S. military, and it tried to deflect a hurricane threatening Florida by dropping almost 200 pounds of dry ice into the storm's eye. The hurricane diverted to Savannah (Georgia) due to natural steering currents, not seedling; and it caused more than U\$5 million in local damages (Scarpino, 2009). Nevertheless, the cause of the path change was confirmed years later; at that time the experiment was believed to be successful notwithstanding losses. Thus, it motivated further attempts to generate large-scale climatic effects for combative and civilian purposes. When the race with the Soviet Union started, President Dwight David "Ike" Eisenhower's weather advisor -Harold T. Orville- was convinced that the country controlling the weather would control the planet (Fleming, 2009). The project 'Complete Weather Control' was approved in 1954 by Orville, disguised as drought relief. Cloud seedling became a popular commercial venture, with estimates of 15% of the U.S. surface being bombed to mitigate droughts (Scarpino, 2009). The rationale of chemical modifications to hurricanes by the military would extend through the 'Stormfury Project' (1962-1983), for which Puerto Rico was an instrumental base.

Concomitantly, the perception of risks across the nation changed due to the advent of television. News about the arms race with the Soviet Bloc and vivid imagery of distant fellow citizens suffering created public anxiety and required governmental leadership (Eisenhower 1955 in McClure, 2011, p. 5). The turning point was August of 1949, when the Soviets successfully tested a nuclear weapon, shattering the U.S. monopoly. President Truman was criticized by Congress, officials and citizens for the lack of leadership during a potential crisis (U.S. Homeland Security, 2006). In December of 1950, Truman's executive order created the Federal Civil Defense Administration, undertaking responsibilities of civil defense from the National Security Resources Board (W. J. Cohen & Boyer, 1951), including the mix of war and disasters. A month later, the Federal Civil Defense Act of 1950 was passed; it established that the Federal Civil Defense Administration would guide state and local governments on the implementation of programs to face nuclear threats and disasters that included education, training, creation of shelters and evacuation scenarios. The underlying assumption was that individual preparedness – called 'self-help' – was optimal to reduce federal spending and citizen's dependency on government, avoid creating a garrison state, and satisfy skepticism towards the actual need to invest in physical and social programs. The result was a civil defense policy that depended on educating citizens to protect themselves separately, until the government could respond. Following the WWII British Civil Defense scheme, the aim was to establish a local, decentralized, volunteer based structure (U.S. Homeland Security, 2006). In theory, state and local governments were able to request federal funds to launch precautionary and post-attack programs –mainly reconstruction and healthcare-. In practice, the Federal Civil Defense Act provided minimal resources during Truman and Eisenhower's administrations. Most investment went to diplomatic and military actions to prevent conflict. The Civil Defense Administration

used its limited resources to store supplies, guide shelter building programs, enhance multi-scalar coordination, institute an attack warning system, and launch a famous education campaign (U.S. Homeland Security, 2006). The campaign produced pedagogic materials such as pamphlets, posters and films –including children classroom movies ‘Duck and Cover’-, that taught Americans to prepare themselves constructing domestic shelters and stocking food and supplies for family consumption. Those materials also included anti-communist propaganda, weakening collective grass-roots actions to handle crisis. Subsequent debates basically oscillated between shelter construction and evacuation plans, further distancing civil defense from non-protective activities and cultural interventions. Complementarily, the Disaster Relief Act of 1950 established a bureaucratic process for federal emergency response and relief. After an official request from state governors, the President had the authority to designate federal disaster areas and provide assistance to complement local and state resources, excluding private losses to individuals or businesses.

The combined effects of those influential pieces of legislation framed civil defense and disasters executive orders, ordinances, and institutional reorganizations that persisted in the following decades and had an influence on Puerto Rico. In the short term, those acts also shaped improvised federal choices concerning infrastructure, housing and loans. In 1951, Truman designated as federal disaster an area catastrophically flooded in Kansas, Oklahoma, and Missouri (Comerío, 1998 in (J. D. Rivera & Miller, 2006)). Losses reached over U\$870 millions, including private homes, businesses and farms. The federal government stepped in to complement local and state initiatives, and added funds for temporary housing in the light of that

legislative vacuum. In 1953, Eisenhower partially filled such vacuum with the Small Business Administration, which provided disaster relief loans to private owners.

The powerful 1954 Atlantic hurricane season included hurricanes Carol, Edna and Hazel; they affected Haiti, Jamaica, Mid-Atlantic States, New England and Canada. In response, Congress authorized funding for the seminal National Hurricane Research Project, comprising surveys and protection works –such as floodwalls and levees-, and for emergency responses -including evacuation, legally defined then as volunteer or mandatory-. The Army Corps of Engineers and the Weather Bureau developed the concept of a Standard Project Hurricane (SPH) to classify a hurricane, which was used until the early 1970s, when the Saffir-Simpson scale was developed. The SPH would influence building and zoning codes, and urban growth along states at risk; and it served to define hurricane flooding protection systems, such as the levees of New Orleans (Louisiana)¹⁴⁴. Deplorably, the SPH concept was methodologically faulty (ASCE Hurricane Katrina External Review Panel, 2005). The database excluded worst storms to characterize a representative one; crucial infrastructure designed accordingly was flawed, remained unretrofitted against National Oceanic and Atmospheric Administration (NOAA)¹⁴⁵ advice and failed during an extreme event such as hurricane Katrina. Besides, cost-benefit ratio calculations neglected the greater economic and social costs of failure in urban areas compared to rural ones.

¹⁴⁴ The Flood Control Act of 1965 (FCA 1965) was passed after another hurricane also called Betsy flooded large sections of New Orleans; and it mandated the U.S. Army Corps of Engineers as the federal agency in charge of levee design and construction. The latter used the SPH as the defining instrument.

¹⁴⁵ It was created in 1970 to integrate the Weather Bureau, the U.S. Coast and Geodetic Survey and the Bureau of Commercial fisheries.

In 1955, the Atlantic hurricane season included hurricanes Connie, Diane and Ione, which caused widespread flooding, casualties, and property damages along the Middle Atlantic and New England coasts. During two brief radio and television speeches broadcasted nation-wide, Eisenhower projected himself as a compassionate man of action, established key elements of presidential disaster discourses (McClure, 2011) and set the tone for federal engagement in hurricane relief and reconstruction. He summarized the events and damages, valued Red Cross, private and governmental rescue and relief efforts, confirmed the country and his empathy, offered support in rescue and relief stages, urged for charitable contributions and individual volunteer engagement, and listed future actions such as mitigation of potential disasters. In line with the Disaster Relief Act of 1950, Eisenhower skipped reconstruction support. It remained a local and state governments task, which would express the soul and temperament of communities and individuals (McClure, 2011). He mentioned increased prevention and endorsed private entrepreneurialship, focusing on insurance companies, as the government would evaluate:

“whether we can prevent these floods in the future on a long-range basis, whether we can get insurance through some cooperation between insurance companies and State and Federal governments to prevent the kind of losses that have been suffered by our industries” (McClure, 2011, p. 5).

Succeeding federal administrations added agencies, programs and legislation to manage disasters ad-hoc and reactively, such as the Emergency Flood Control Work Act (1955), the Flood Peril Act (1956), and the Flood Insurance Act (1956). As a result, affected areas increasingly received federal disaster assistance funds (J. D. Rivera & Miller, 2006). Noticeably, all federal administrations skipped cultural interventions to manage disasters, but the education campaign that insisted on individual responsibility during the emergency phase, and would echo in Puerto Rico.

VII.6. Santa Clara relief and incipient policy trends

Santa Clara relief was a multifaceted challenge because the island underwent structural reforms during the New Deal and early Commonwealth years, without experiencing a hurricane since San Ciprián (1932). Thus, the crisis tested the Governor and the Commonwealth's capacities; the linkages between the President, Governor and Puerto Rican opposition; novel disaster legislative and institutional frameworks; emerging technology and modernity paradigms confronted with traditional beliefs; entrenched poverty and widespread destruction in a context of pervasive deficits in housing, healthcare, education, and food security. Uniquely, Santa Clara had an official cultural response finished two years later, which needs a thorough separate analysis.

Gov. Muñoz Marín followed Eisenhower when launching relief, using his experience as a journalist and writer –nicknamed ‘the poet in La Fortaleza’- in addition to a seasoned politician. His prose and image projected him as a compassionate man of action through radio message broadcasted island-wide hours after Santa Clara passed, and his frequent declarations to the newspapers, radio and television speeches. For example, in his initial communications to *El Mundo* newspaper, he evaluated damages in San Juan as mildly after a car tour, endorsed Red Cross and governmental efforts, confirmed his personal empathy and commitment, urged individual volunteer engagement, and offered support in rescue and relief stages specifying his orders to use emergency funds for road clearing, increased police force, and food for shelter refugees in schools distributed by the Red Cross and the Department of Instruction (Santiago Sosa, 1956b). After visiting the Weather Bureau, he met chief representatives of Public Works, Planning, Agriculture, Police, Firemen, Water and Sanitation Department, Treasure, Instruction, Civil Defense and American Red Cross. Post-hurricane initiatives were an improvised, difficult,

but also exceptional chance to exhibit the soul and temperament of the newly launched Commonwealth, and the Governor's leadership.

Fig. 151 Gov. Muñoz Marín and his wife greet people affected by Santa Clara



Having been a journalist, he was keen on solidifying his image in the media (Orduña 1956).

Fig. 152 Gov. Muñoz Marín talks to a survivor, along the Caguas-Cayey highway



As San Felipe, Santa Clara almost torn a wooden house from its stilts (El Mundo, 1956e).

Right during the aftermath, Muñoz Marín rejected requesting to Eisenhower the designation of Puerto Rico as a federal disaster area. He emphatically denied the possibility of calling for a special session of the Legislative Assembly in order to discuss asking for federal help (Santiago Sosa, 1956a). According to him, the Commonwealth emergency funds and extra resources from insular departments would suffice (Santiago Sosa, 1956a). He implicitly framed disaster relief as a question of political sovereignty; thus, he behaved like U.S. state governors refusing federal aid since the late 19th century and 1920s Puerto Rican politicians after San Felipe. Also, being a key player in development policy-making since the New Deal and architect of the Commonwealth status, he seemed to judge that admitting dependency and underdevelopment vis-à-vis a hurricane was a political peril. Soon, a White House speaker confirmed that the President could not offer federal disaster relief because the Governor had not requested it (UP, 1956), as stated

by the Disaster Relief Act (1950). So the right-wing opposition fought back, as Sen. Luis A. Ferré contacted Eisenhower. Ferré, industrialist, newspaper owner, founding leader of the new oppositional *Partido Nuevo Progresista* (PNP New Progressive Party) and endorsing a pro-Statehood and Republican-like stance, hit the news writing to Eisenhower about the need to declare the island a federal emergency area (UP, 1956)¹⁴⁶. Thus, he used Santa Clara to challenge the Governor and disaster protocol whilst publically building ties with the President, and hardening Muñoz Marín's position against federal help (Combas, 1956).

The crisis was mild compared to San Ciriaco, San Felipe, and San Ciprián aftermaths. Yet, it was still a crisis and entrenched vulnerability was re-exposed as historical post-disaster issues reemerged critically. For instance, there were scarce construction materials; housing, food and clothes deficits; medical emergencies; towns and rural areas completely isolated, and vast agricultural damages. Soon economic losses reached US\$ 25,500,000 and kept increasing. Diverse organizations joined impromptu given the dire situation and deficient Commonwealth responses. For instance, the U.S. Red Cross offered help for 18,000 families; the U.S. Department of Children and Families provided equipment, medicine and personnel; the International Ladies' Garment Workers' Union and the American Federation of Labor and Congress of Industrial Organizations-which had Puerto Rican members on the island and New York- donated a mobile hospital to Yabucoa and US\$ 25,000 to disaster victims; the Evangelic Council distributed donations from several Christian denominations in ten towns; higher education institutions such as the Engineering College of Mayagüez and the Metropolitan Vocational School engaged; the U.S. Army donated 1,300 shelters for refugees, and even modest

¹⁴⁶ He would also be in the news donating US\$10,000 from his pocket for victims (R Santiago, 1956).

migrant workers in the U.S. flew back to see their relatives, help with money and unpaid work (El Mundo, 1956c, 1956i; Mundo, 1956b; R Rivera, 1956; B Santana, 1956). Fears of epidemic outbreaks arose in Maunabo and Yabucoa (Sanchez Cappa, 1956); in Aibonito, Comerío and Naranjito there were flu outbreaks (El Mundo, 1956a); soon more than 3,000 persons in Yabucoa and 4,297 in Patillas alone had to be vaccinated against typhoid fever (Hernández, 1956d). Lack of construction materials was slowing down recovery (El Mundo, 1956b; R. Santiago, 1956a). Hunger became another increasing menace; in response, one thousand tons of food would be freely distributed each week amongst 100,000 families in need (El Mundo, 1956h). Public education was overburdened (Hernández, 1956c). Over 43,860 students were unable to attend damaged schools in 52 out of 72 municipalities (Hernández, 1956b), and since the crisis went on for months, the island government launched basic literacy lessons to refugees in schools (J. Martínez, 1956). In total, the education of a generation resulted compromised; children aged 4 to 7 living in high-wind regions seem to have finished less years of schooling as adults than their cohorts living in lower-wind regions (Bluedorn & Cascio, 2005).

On the 16th, news advanced another of Ferré's critical appeals to the Governor for a rectification in order to get federal help, implicitly advancing his pro-Statehood position (El Mundo, 1956f). Concomitantly, *El Mundo* did not publish critiques by pro-independence or left-wing sectors; which exposed their weakening after decades of persecution. In truth, *El Mundo* followed long-term conventional media and public policy biases to allow conservative, wealthy white men to characterize and respond to a hurricane although spared from suffering it, unlike grassroots representatives. A day later, the Governor capitulated, and made his official request to Eisenhower on the 18th. Next, the Governor was on the spotlight conducting meetings with

federal envoys to define relief; whilst touring the island on his car, giving away tools to clear roads, and talking to survivors in situ and refugees in shelters. Muñoz Marín was determined to impose his presence on top political meetings and everyday situations alike, which served to keep control and shield the Commonwealth from criticism. Nevertheless, even Teodoro Moscoso, proud brain behind Bootstraps and in charge of overseeing relief, publically accepted that it would take the help from everybody on the island to achieve reconstruction (R. Santiago, 1956b). Next, more spontaneous funding was gathered from private donors in Puerto Rico and the Dominican Republic, enterprises -such as the Rum Institute- and civil society organizations – including the Federation of Catholic University Women and the Civic Club of Ladies-. In the light of incoming federal compensations and credits, ensuing debates focused on distribution, revealing priorities and vacuums. For example, the countryside had been central in the news concerning destruction, with articles about the losses of small-scale Puerto Rican farmers growing export crops such as pineapple, tobacco, plantains and bananas, or foodstuff for local consumption. Yet, news vented that federal credits and compensations to rehabilitate agricultural properties went to sugar and coffee planters (Cunningham & Ramos, 1956; El Mundo, 1956d), both sectors traditionally successful at advancing their post-disaster requests during San Ciriaco and San Felipe. Other debates concerned the S.J. Weather Bureau's hurricane tracking imprecision and dependence from the Florida Center to launch warnings, which allegedly slowed decisions by local institutions (Mundo, 1956a). In response, Weather Bureau Director, Ralph Higgs, gave public statements and lectures (El Mundo, 1957b; B. Santana, 1956) to clear the image of the Weather Bureau. Also, the local Red Cross Director, Carlos Patterne, announced the preparation of a reconstruction plan (Hernández, 1956a). Interestingly, the news endorsed the

preceding construction of cement public housing for low-income citizens, using federal funds (El Mundo, 1956j).

By next January, most federal relief funds had been received (El Mundo, 1957a), although help from other sources kept pouring. It was time for the annual report of the Governor to the Puerto Rican Congress and, predictably given his underplaying of the crisis, he told a success story in which Santa Clara only deserved two brief mentions concerning agriculture and housing. For him, school enrolment had surpassed the goals. Registered students reached 94% instead of 91% of all elementary school children; 84% instead of 75% intermediate school students, and 43% instead of 41% high school students (Luis Muñoz Marín, 1957). Economic growth, external trade, public health, industrial development, employment and average family income also had reached remarkable achievements in his view. He advised funding a plan of modest public works adding to the existing basic public works, in order to alleviate the human suffering of seasonal unemployment; without mentioning the need to rebuild hurricane damaged infrastructure. His framing of agricultural calamity was ambiguous at best:

“We are worried that agriculture, despite the great progress in some branches, has not been up to the level of other factors of our economy in its contribution to the general progress of Puerto Rico. Excepting coffee and cattle raising, agricultural expansion has been relatively small. Coffee withstood damages of some consideration due to hurricane Santa Clara” (Luis Muñoz Marín, 1957).

Concerning housing, the Governor avoided mentioning hurricane and flooding destruction of slums, and their residents’ distress. San Juan was not on the hurricane path, which probably reduced damages in local slums; suspiciously though, there is no data available. Precarious urban housing “was against the legitimate aspirations of a good home that each Puerto Rican family has” (Luis Muñoz Marín, 1957), which had justified governmental demolition for decades

anyway. Thus, his exit was to briefly reinstate that the Planning Board was addressing housing through studies and the Commonwealth through projects. He did acknowledge vast partial or complete damages to rural housing, which affected a significant part of his hardcore constituency. His answers were to build using wind resistant materials, such as concrete; continue the cooperative and directed self-help scheme in which the government provided construction materials; promote individual ownership reducing apartments costs in semi-urban housing projects or establishing plots and services projects; provide an exemption on payments and arrears for some years; and restrict the right to sale for some years also, to avoid speculation. However, he skewed how to manage existing and future urbanization of flood-prone areas to stop increasingly perilous trends. In order to achieve such aim, institutions created in the preceding or contemporary decade could have intervened in land markets, property rights and private developers' roles; yet, that decision implied an anathema to pro-market dynamics solidifying on the island and the U.S. Noteworthy public policy changes include Law #8 of next June, which established the *Administración de Renovación Urbana y Vivienda* (ARUV- Urban Renewal and Housing Administration) and the *Corporación de Renovación Urbana y Vivienda* (CRUV- Urban Renewal and Housing Corporation). Both institutions intensified work in rural and urban housing. They were accompanied by the *Administración de Fomento Cooperativo* (Cooperative Promotion Administration) which aimed to organize cooperatives for housing acquisition, as mandated by 1957 Law N.4.

Post-Santa Clara, McDowell kept attracting lay citizens to his daily weather news with his style; and the media publicized scientific findings and technological changes, such as watching hurricanes with more precise radars and military attempts to deviate storms chemically before

they worsened (Rojas Daporta, 1958), along the lines of the ‘Complete Weather Control’ project. Although there is no available evaluation if the 1954 Civil Defense Manual was used and useful during Santa Clara; the military, Civil Defense and Red Cross continued preparing and circulating similar documents to face disasters and atomic threats jointly; including training, shelters and evacuation. Soon, an Operational Survival Plan mapped evacuation scenarios in case of nuclear fallouts and calculated the population to be displaced from the main cities, specifying travel times and roads to the main shelters (Commonwealth of Puerto Rico & Civil Defense, 1958). Also, the Civil Defense prepared a basic citizens manual of guidelines to implement in case of hurricanes, floods and storm surges (Oficina de la Defensa Civil, 19?).

Yet, grassroots beliefs concerning hurricanes would remain prominent until the end of the decade at least, as shown in the following *El Mundo* headlines:

“Experts interpret avocado blossoming, they say there will not be a hurricane” (Margenat, 1957, p. 2).

“Will there be hurricanes? Avocado trees keep forecasters perplex” (Margenat, 1958a, p. 16).

“Sixth sense of aguacateros: they affirm that they already knew Hurricane Fifi would not blow here” (Margenat, 1958b, p. 13).

“Sequels of [hurricane] Edith, pointed out that calluses, avocados and thunder timely said that there would not be a temporal” (Rojas, 1959, p. 1).

“Splendorous blossoming. Avocado meteorologists say that there will not be a hurricane this year” (Margenat, 1959b, p. 14).

“Confirming forecast. Avocado meteorologists say there will not be a hurricane” (Margenat, 1959a, p. 4).

“Avocado meteorologists sing victory concerning hurricane forecasting of this year” (Margenat, 1959c, p. 2).

Thus, there was an evident need to launch a cultural project capable of disseminating awareness in the light of superstitions, illiteracy, poor schooling and isolation. It turned out to be DIVEDCO –not ICP- the institution that would tell Puerto Ricans how hurricanes should be understood, remembered and managed; along the Civil Defense, military and scientist. ICP was in charge of recording and promoting the shared history and cultural heritage of Puerto Ricans. Although disasters were a structural feature of life on the island throughout history leaving numerous imprints on culture, they were not included in ICP tasks. Seen in retrospective, such choice was aligned with mainstream paradigms of cultural heritage. What is more controversial is the possibility that a frank effort to memorialize and disseminate what had happened before, during and after San Ciriaco, San Felipe, San Ciprián and Santa Clara would have included a critique to U.S. rule. Arguably also, if done in conjunction with the Planning Board, it would have challenged urbanization processes promoted by the Commonwealth and private entrepreneurs; and it could have legitimized social justice claims in order to promote a holistic culture of safety. Ultimately, a progressive and in-depth examination of how disasters had been triggered and poorly addressed could have questioned the serene and free yet non-nationalistic ideals that Muñoz Marín ascribed to Puerto Ricans, and could have challenged the legitimacy of U.S. military and economic interests. Instead, DIVEDCO followed the Federal Civil Defense Administration in producing four interrelated educational materials to address hurricanes, lacking pragmatic critiques or politicized allusions. A movie, two posters, a booklet and a bulletin were a remarkable investment that involved talented artists and scientists to rapidly launch a widespread campaign.

The movie *'Huracán'* was finished in 1958, under U.S. director Benjamin Doniger, with the participation of an all-male film crew. The movie combined acting scenes with Santa Clara footage; it was meant to be widely screened along the distribution of booklet, posters and bulletin, all of which were planned to be central topics of discussion in organized pedagogic groups and classrooms.

Fig. 153 Huracán Poster 1958

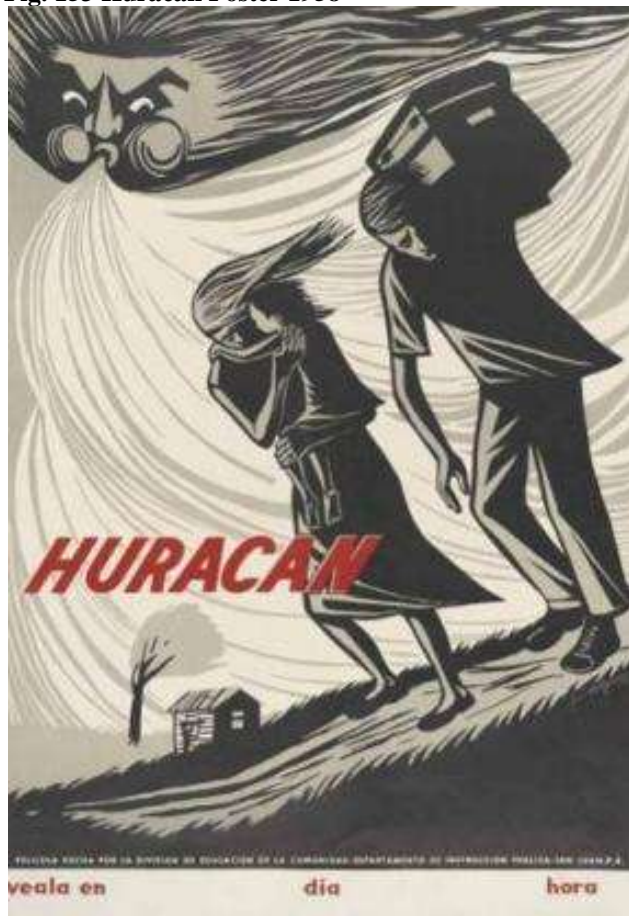


Fig. 154 Huracán Poster 1965



Both posters emphasize the fragility of one storey stilt houses. The left one (Figueroa, 1958), contemporary with the movie, depicts a rural scenario. The right one (Vera Cortés 1965) was done when Muñoz Marín was no longer governor and had lost his grip on the PDD party; it portrays a dense urban slum but also an urban solution to the problem, a five storey, white, modernist building behind. In both, the human suffering of frontal family figures and their precarious exodus is caused by hurricanes associated to anthropomorphic imagery.

The movie can be divided into four parts: introduction, preparations for an impending hurricane, passing of Santa Clara -although it is never mentioned by its name but follows its path-, and immediate aftermath. The introduction starts with an alarming music whilst the drawing of a

hurricane eye rotates and the letters *Huracán* fly away. A male narrator impersonates children playing outdoors before a storm hits, they watch the clouded sky and say a famous riddle:

“El cielo está encancaranublado. ¿Quién lo encancaranublaria? Aquel que lo encancaranubló, ¡Gran encancaranublador sería!”(Doniger, 1958)

(The sky is clouded. Who clouded the sky? Whoever clouded it, a great clouder must have been!).

The narrator states that children might continue playing, but there might be signs of something worse. Then, a poor and backward countryman looks up to the sky searching for birds and fruits. Contrastingly, the next images show professionals, mostly men, working for institutions engaged with weather monitoring during the hurricane season, such as the Civil Defense, military, Red Cross and particularly the Weather Bureau. The narrator explains that the latter institution does not rely on birds or avocados; but on efficient personnel, communications with other meteorological stations, modern instruments such as radar, thermometer, radio sonde, barometer, anemometer, etc. Using their hands, meteorologists map an impending storm, “that capricious vermin, monstrosity in the shape of a hurricane that snakes through Africa and the Caribbean feeding itself until dying of indigestion” (Doniger, 1958). A brief scientific definition of the hurricane follows, made out of two masses of cold and hot air, empty on its center around which rotate “all-consuming unstoppable and inevitable winds” (Doniger, 1958).

When preparing for an impending storm, men at the Weather Bureau are actively producing scientific knowledge, printouts, tables, and graphs; whilst women pass messages, type, answer the telephone or operate phone lines. Subsequently, a family gathers in their living room near a radio, listening to a male meteorologist’s advice to be aware of surges, floods, winds and rains; move away from sea and rivers into higher grounds; and keep attentive to the Weather Bureau

news as the hurricane may suddenly change. The radio man keeps explaining tasks to do, whilst women in rural homes watching the clouds hear him and start implementing his suggested tasks. A countryside family clears objects near their house; men use wood to secure doors and windows against the “strong hoofs of the shaking wind” (Doniger, 1958), reinforce the house structure and roofs, others leave insecure homes and go to a solid refuge -a *tormentera* -. Parallel preparations include getting food that does not need refrigeration because electricity may fail, and gathering potable water because aqueducts and pipes could be ruined and the rivers could be infected. After all precautions, nothing is left but “to wait with all hope” (Doniger, 1958); children, women and supplies are shown tightly fit inside a *tormentera*.

In the third part, Santa Clara footage shows first a well-built urban area being lashed and then it moves to rural locations, completely avoiding urban slums. During “the confabulation of wind and rain” (Doniger, 1958), the advice is to stay away from rivers and the sea, since flooding kills the most. The hurricane comes from the southeast, between Arroyo and Patillas, passes by Cayey, Aibonito and Ciales, and leaves by Arecibo “to get lost inside the sea, where the suffering it has collected feeds it up and undoes it” (Doniger, 1958). A map of the island is shown with an animation of a hurricane arriving and moving, a voice saying “it is here the gran *encancaranublador*” (Doniger, 1958), and recording of shaking branches and landscapes. The narrator admonishes that sudden calmness should not be confused with the end; it is the passing of the eye and avoiding exiting is an imperative because more violence is coming in the opposite direction (*virazón*). The value of preventive supplies is highlighted by mentioning gas or portable carbon stoves, first aid kit, canned food, waters, lamps, wood and tools for repair. Again the map

with the moving hurricane animation is shown, explaining that its small size did not enable great damage between Arroyo and Arecibo.

The hurricane aftermath part starts with a change of music, fast aerial and land footage show devastated areas. In proper urban areas, people are picking up things and cleaning debris; and whilst lamenting that human efforts were undone by the blows of the wind and rain, the narrator tells that all is reparable. Public services ought to be restored, yet there are no casualties which is very important he states. Everything else, “while there is faith, will be recuperated one way or the other” (Doniger, 1958). Further precautions include avoiding fallen electrical cables. A researcher interviews a local man who apparently gesticulates how his house was destroyed, but his voice has been silenced. Provisionally, the Red Cross has been installed in a public school. The narrator advises to heal wounds and get vaccinated against possible infections; whilst images show long lines of seemingly poor people getting vaccinated, and also waiting and receiving food -mainly children and women-. Food is available in each town refuge, and beds are shown with children, babies and their tending mothers. According to the narrator, remaining in good health is necessary to face difficult tasks ahead, which include burying dead animals to avoid epidemics, confronting rural damages in destroyed fields, clearing roads to restore communications, fixing electricity and communications and retrofitting homes. Men are shown on top of roofs hammering wood, picking up wood in a port, and ultimately building a compact geometric wooden house whilst an elderly lady gives them indications. The narrator admonishes that using “the old warmth and the ancestral faith, we can rebuild on the shadow of the fallen home an egregious building where we will continue taking care of our endless willingness to live” (Doniger, 1958).

A final review of key things to remember includes not confusing the passing of the hurricane eye with the ceasing of danger, attention to radio and TV messages by the Weather Bureau, buying food that does not need refrigeration, filling recipients with clean water, filling cars with fuel, and moving to the nearest refuge available such as schools, churches or *tormenteras*. Images inside the *tormentera* review basic items such as canned food, stoves, materials and tools for rebuilding, matches, lanterns, and candles. The last scene focuses on a new 4-5 story suburban housing project, one of the growing *caseríos* throughout the island. The narrator says that when returning to normalcy –implied to be the new life in the *caseríos*-, it will be time to teach the children the riddle:

“El cielo está desencancaranublado, ¿Quién lo desencancaranublaria?”(Doniger, 1958)
(The sky is unclouded. Who unclouded the sky?).

In sum, the film used a mixed language concerning science, religion, and storms being monstrous and uncontrollable creatures. It portrayed a calming yet unrealistic integration of assorted institutions into a coordinated disaster management ‘system’. All information was top-down; only one person affected by the hurricane spoke to the camera, yet the narrator’s voice was superimposed on the scene. Gender assumptions included men as capable of constructing information and fixing destroyed homes, infrastructure and fields; whilst women were secretaries, caretakers and main food recipients along children in shelters. Previous hurricanes or other potentially concurring disasters were unmentioned. The very short time-span covered did not intend to analyze root causes of vulnerability; it focused on the emergency phase and self-help. Rural housing, formal parts of towns and public housing projects were shown; unlike precarious urban housing, as the Governor omitted in his 1957 report to the Puerto Rican

Congress. The final scene indicates public housing projects as the solution, also backing the Governor's report; although reconstruction was vaguely addressed pointing to ancestral faith or sheer willingness to live. The acknowledgement of flooding as the worst danger had no repercussions for advice concerning permanent post-hurricane relocations or avoidance of future urbanization of flood-prone areas. The core message was that individuals and their families had to prepare for the emergency.

Meanwhile, the related 48 page booklet 'What do we know about the Hurricane' was meant to be a family property. It included works by famous illustrators Rafael Tufiño and Eduardo Vera, along five other men and a woman. After a brief introduction of the topic relevance, the booklet summarizes a historical overview of hurricanes in a plain language, with black and white illustrations, and some conceptual mistakes, unsubstantiated claims, and fabricated facts. The overview starts with indigenous populations and beliefs, it continues to the hurricane challenges faced by Christopher Columbus and colonizers, and it makes a hiatus to tell a short story by Cayetano Toll y Toste, in which Catholic faith is the decisive factor to avoid death. Next, an account of hurricanes in Puerto Rico is followed by a testimonial narrative of San Ciriaco by Ramón Arráez y Ferrando, former Spanish official, and a poem about a tempest, by Cuban author José María de Heredia. Subsequently, the booklet discusses the four main superstitions concerning hurricane forecasting, followed by scientific explanations of how hurricanes originate, latest technologies to evaluate them, and role of the Weather Bureau. Finally, it summarizes '*Huracán*' recommendations.



Fig. 155 Indigenous ritual for Huracán or Yuquiyú

The historical overview narrates that for the nomadic Asian tribes which crossed the Bering Strait to populate the Americas, used to snow storms, the first Caribbean hurricane would have been an otherworldly surprise. After serial experiences, they attributed the unknown phenomena to a new God, Jurakan; which eventually had a benign rival, Yuquiyú (DIVEDCO, 1965, p. 6).



Fig. 156 “Guadalupe Miracle”

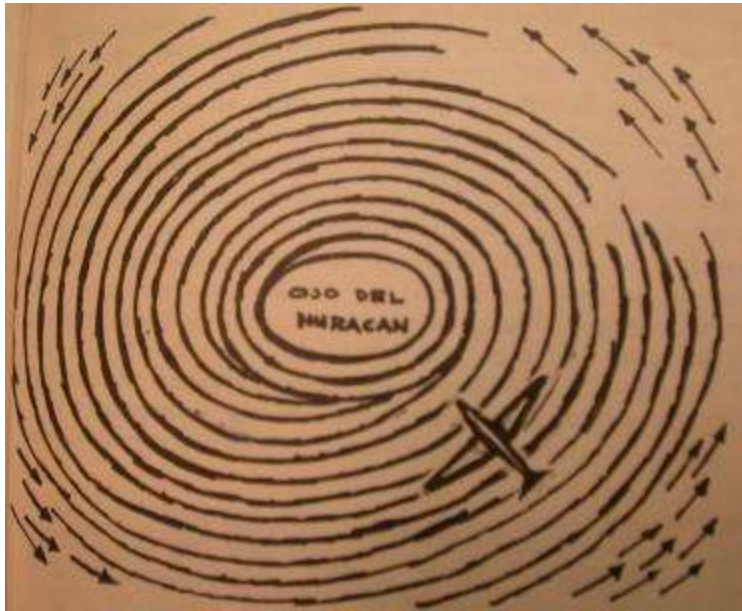
References to religion include depending on God, miracles and faith to survive, given limited human agency. For instance, a little girl was miraculously saved by the Virgin of Guadalupe in a story supposedly taking place during a 16th century hurricane (San Bartolomé), written by famous 19th century Creole writer Cayetano Toll y Toste (DIVEDCO, 1965, p. 15).



Fig. 157 “Hurricanes in Puerto Rico”

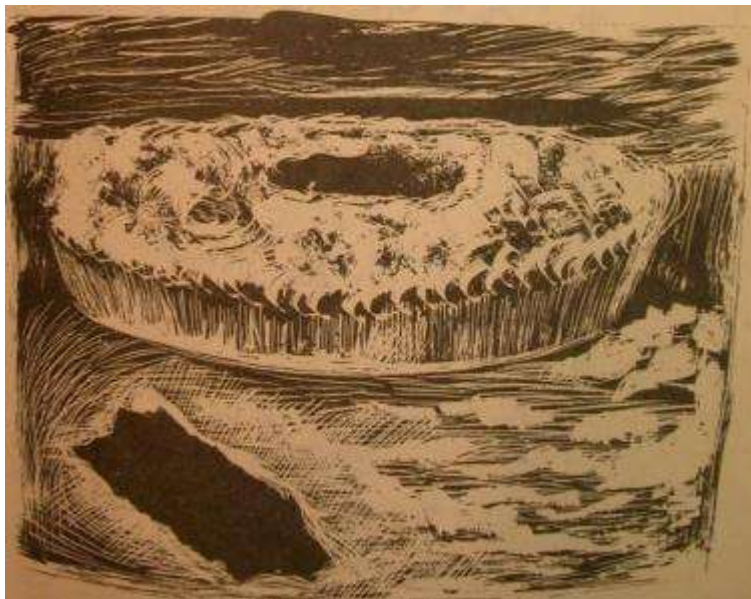
Influenced by a subtle hispanophilic bias, the historic writings tend to portray Spaniards as heroic. During colonization, Spaniards were said to incorporate indigenous knowledge about storms, despite religious and cultural clashes (DIVEDCO, 1965, p. 20).

Fig. 158 “Eye of the hurricane”



A goal was to introduce scientific knowledge to overcome forecasting beliefs based on avocado crops, nervous animals, spider webs falling, and coastal birds flying inland. In order to validate the scientific explanations of hurricane origins, the calmness of the eye passing, and the opposing winds afterwards – *virazón*- the booklet explains ‘hurricane hunter’ planes penetrated storms since 1943; without mentioning their military origins (DIVEDCO, 1965, p.35).

Fig. 159 A hurricane near Puerto Rico



Another objective was to provide basic geographic information combined with artistic renderings, in order to help people visualize a hurricane approaching the island, even if illiterate (DIVEDCO, 1965, p. 37).

Fig. 160 Sealing windows



Fig. 161 Rebuilding



Graphics emphasized urgent individuals and family tasks before and after a hurricane (DIVEDCO, 1965, p. 21, 46). Official agencies would organize relief subsequently. Relocation from flood-prone areas was not mentioned.

In sum, the crisis of Santa Clara unveiled iterative disaster issues. Puerto Rico was heading for a comparatively stable political future, vis-à-vis the previous historical periods. Still, that stability was fragile because it was based on a novel economic model and political status amalgamation that brought tangible benefits; but also implied sacrifices and repression, kept and created some forms of underdevelopment. I could not find post-hurricane debates in Washington about fund cuts or forcing Puerto Rican independence, which could indicate the recognition of the status change per se, and its benefits for the U.S. However questionable and limited by U.S. frameworks, autonomy transfer empowered local leaders, such as the Governor and his nemesis on the right-wing spectrum; but it also undermined pro-independence or left-wing options, since leaders were killed, in prison, exiled or silenced-. The public exchanges of the first two about relief were the results of a scuffle, not of mechanisms of transparent accountability. Implicitly, the Governor deliberated that admitting dependency and underdevelopment vis-à-vis the catastrophe was a too dangerous political risk. He opted for the risk of denial. Although opposing Sen. Ferré was increasingly powerful, Muñoz Marín still controlled his party, most media and the Commonwealth. The incipient relief plans and actions, especially those concerning the neediest ones, implied contradictory visions of what constituted development and how to achieve it. Yet, dismantled left-wing and pro-independence platforms could not denounce neglect and injustices, nor could nascent social organizations, limiting opinions about the process¹⁴⁷.

¹⁴⁷ In October of 1956, the *Federación de Universitarios Pro-Independencia* (FUPI Pro-Independence University Federation) emerged as an advocacy group supporting progressive causes, including housing. Almost a decade later, a large urban movement called *rescatadores* (rescuers) consolidated to fight for land and housing, in the light of failed governmental initiatives and social exclusion.

V.II.7 Conclusions

Modern disaster management emerged as a professionalized, identifiable field of practice during the New Deal; and it would be further developed by the Commonwealth. As an important point in the modern history of Puerto Rico; the New Deal surmounted the crisis that ensued hurricanes San Felipe, San Zenón, San Nicolás and San Ciprián and the Great Depression, moving from negligible relief aid to a comprehensive planning paradigm embodied in PRERA, PRRA, PRHRC, PRHRLS and other institutions, within a larger economic growth equation that favored the U.S. and brought some benefits to lay Puerto Ricans. In two decades, increasingly secular disaster management was taken up by diverse institutions, which reveals expanding disciplinary complexity and accountability, but also lack of critical coordination; and Santa Clara exposed inadequate preparations. The Weather Bureau, the Army and academia were concerned with meteorology. The advent of television in the 1950s and the daily weather news creatively provided by Professor McDowell disseminated vital information. The Utilization of Water Resources System and more so its successor, the Puerto Rican Water Resources Authority, jointly addressed water provision and flood control –central to disaster management- based on ever growing hydro modifications that increased access to potable water and electricity, diminished some risks, and simultaneously increased others. By Santa Clara, the local Civil Defense and the Commonwealth were in charge of hurricane relief. After Santa Clara, DIVEDCO came to the forefront on the pedagogy of hurricane awareness.

Meanwhile, the urban planning profession was also under redefinition, its actions -and lack of- were related to disaster management without an official integration. Before the New Deal, it was essentially circumscribed to city and regional planning, zoning, ordinances and covenants. Soon,

‘rational’ or ‘blueprint’ planning would become mainstream, and it was promoted in Puerto Rico by one of its main adherents, Gov. Tugwell. Under his leadership, in 1942 the new Planning, Zoning and Urbanizing Board expanded the scope of the profession and its power; but avoided disaster management, as was the contemporary norm. Overall, the New Deal put to the forefront the relevance of a particular set of top-down, technical planning skills to guide the myriad of new institutions addressing development policy-making, investments, and large-scale territorial transformations. Such choice was controversial, as it incorporated the voices of powerful stakeholders –for instance industrialists, developers, investors- but it ignored participatory processes that incorporated those most affected by the decisions. Moreover, many choices were not ‘rational’; they were justified by an unfounded belief in science and modernity that would be socially controversial, environmentally degrading, costly and disaster-enhancing.

Consequences of the vast 1930s-1950s changes by federal and island institutions included industrialization, more coastal urbanization vis-à-vis countryside depopulation, extensive growth in and around San Juan, urbanization of risk-prone areas enabled by technology, land reform, and vast emigration to the U.S. that eventually reduced poverty and vulnerability thanks to remittances. Also, tourism, prime real estate residential development, slum clearance, *caseríos*, low-density public and private housing projects and car-oriented mobility rose. Among the negative consequences were burgeoning slums, displaced low-income communities, privatized beach fronts, and highways; often damaging ecosystems that buffered storms and tsunamis.

Social hierarchies were reaccommodating with spatial consequences, as on its way to becoming a Commonwealth, Puerto Rico was changing from being a largely rural society to an urban,

industrial, diasporic and transnational one. The correlation between social hierarchy and disaster vulnerability prevailed less blatantly than before, as shown in the ways in which formal and informal urbanization differently occupied risk-prone areas. For lower income groups residing near mangroves and floodable plains for example, it was still the result of lack of safe affordable options provided by formal markets. For higher income groups recently relocated to transformed coastal ecosystems for instance, it was a pricey lifestyle choice enabled by technology. Other social processes influential for disaster management were decreased power of religion in real politik, official trust on technology uncertainty notwithstanding, popular unrelenting use of traditional forecasting beliefs and precarious education. Cold War geopolitics reflected on the crushing of the left and narrowing of communitarian values endorsed by the New Deal, as part of increasing conservatism in public life and policy-making, with contradictions.

Disaster relief advanced compared to San Felipe and San Ciprián, but it also exhibited an unprepared and ineffective character. The first elected Puerto Rican Governor undertook a leading manipulative position, without a clear role for the municipal scale. Furthermore, he refused federal aid in a poorly calculated gesture of sufficiency based on underestimated losses, overconfidence in local institutions, and unwillingness to open his administration to criticism. The local right-wing opposition and a White House spokesperson clarified that federal funds were available, only the unfulfilled legal protocol was stopping them. In other words, even republicans in Washington and Puerto Rico had internalized the understanding of federal disaster relief as a citizens' right, which was a considerable transformation in the ethos of public policy. For the first time, the island government was compelled to provide shelters shifting from dependence on religious buildings to public schools, even if improvised and with nefarious

consequences for the education of a generation. Also noticeable is the absence of rhetorical constructs that framed relief as a concession conditioned by the receivers' worthiness. Thus, food, vaccines and other valuable items were provided by the government and a plethora of public, private, local, external, permanent and improvised entities that jumped on board to patch large voids in the Commonwealth's response.

During WWII in the U.S., war and disasters were addressed together; public education played a role in preparing citizens through a massive campaign that generated pedagogic materials. Influenced by a prevailing anti-communist ideology, those materials undermined collective grass-roots organization and emphasized atomized family and individual level preparations for the emergency stage, particularly self-construction of domestic shelters and provision of goods for consumption. The Commonwealth essentially mimicked such process in its cultural response to Santa Clara, providing basic knowledge and practical advice. This educational mission was taken up by DIVEDCO, not the planning board or the ICP, which highlights how planning and preservation were not contributors to disaster management and even less so leaders. DIVEDCO's exceptional materials were quickly produced and must have been widely circulated, especially through the channels used by that institution –television, schools and organized group discussions-. Simultaneously, those materials show inconsistencies and vacuums in the Commonwealth's proposition to address disasters. Some contents remain valid now; others had no foundations or depended on technology that was incorrect. The studied time period is too short to evaluate DIVEDCO's work on the ground. It would be relevant to find out whether in practice it went beyond emergency preparations to encompass more stages of the disaster cycle; if it reduced or reinforced vulnerability by providing a mix of useful information with a false

sense of security based on erroneous assumptions, flawed procedures and technology, and disregard for collective organization.

Noticeably, just four years after Santa Clara, hurricane Donna dramatically re-exposed the vast vulnerability experienced by many Puerto Ricans. The Commonwealth had kept addressing disasters using scientific and military approaches, refining the roles of the Civil Defense and Red Cross, and supporting the leading role of the Governor.

Fig. 165 New Weather Bureau Radar, San Juan Airport



(El Mundo, 1960b).

Fig. 167 Gov. Muñoz Marín signs an agreement between Civil Defense and Red Cross



(El Mundo, 1960a).

Fig. 166 U.S. NAVY Hurricane Recognition Squad pose in front of their mission airplane



(El Mundo, 1952).

Fig. 168 Gov. Muñoz Marín using the Civil Defense communication equipment



(Casenave, 1961?).

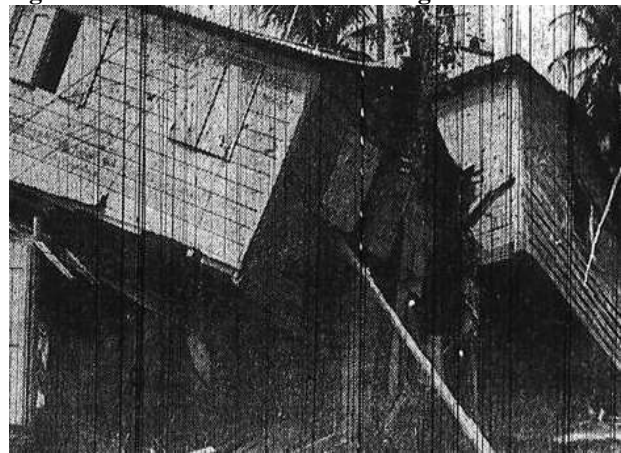
Ironically, after plans and investment to improve disaster management, only *aguacateros* guessed the arrival of a potent storm as *El Mundo* published months before the hurricane season: “Forecaster says: *The avocado flower indicates a serious threat of cyclone this year*” (Margenat, 1960, p. 29). Hurricane Donna –also named San Lorenzo- passed almost 60 miles north of the island on September. Its torrential rains caused 109-116 deaths, mainly due to flooding.

Fig. 169 Donna flooding



Contradictorily, flooded peri-urban agricultural flatlands became targets of urban developers (British Pathé, 1960).

Fig. 170 Donna destruction in La Vega



Humacao river and winds torn precarious wooden structures (El Imparcial photo 1960 in Rivera Quiñones, 2010).

Again, Governor Muñoz Marín insisted on the Commonwealth abilities to overcome the disaster without federal support, receiving ample criticism from Sen. Luis A. Ferré (Padilla, 1960), who became Governor in 1967. Subsequent policies distanced from non-protective activities, targeting shelter construction and evacuation plans, and combining disasters and bellicose attacks. An example was Project Stormfury, an ambitious experimental research program on hurricane modification through bombing (Willoughby, Jorgensen, Black, & Rosenthal, 1985). In the next decades, Puerto Rico would reach the record of almost one Presidential Disaster

Declaration every two years, mainly due to floods, among the top frequencies in any U.S. jurisdiction (Aponte Ortiz, 2011).

V.II.8 References

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Chapter N.VIII Case Study Comparisons, Recommendations and Conclusions

VIII.1.1 Theme 1. CHARACTERIZATION Sub-question 1.1 How are hurricanes San Ciriaco, San Felipe and Santa Clara characterized?

The three Cape Verdean hurricanes had similar tracks but diverse wind strength, associated rains and duration; leading to their retrospective categorization as level 4, 5 and 1 in the Saffir-Simpson Hurricane Scale respectively. For casualties, San Ciriaco can be characterized as the local benchmark because it is the deadliest hurricane recorded in Puerto Rico. Its severe impacts correlate to its strength, and widespread poverty, political instability, accumulated disaster effects, lack of planning, infrastructure, knowledge, warning, and comprehensive relief. San Felipe remains the strongest hurricane recorded on the island, yet its casualties reduced to almost a 10th of San Ciriaco's. Planning and other structural conditions remained feeble; yet, better forecasting, a basic warning system and precarious self-built rural shelters helped. Santa Clara casualties amounted to 0.4-0.5 per cent of San Ciriaco's; it was weaker and shorter; besides knowledge, warning, planning, investment, and relief had improved, whilst self-built rural shelters also helped. Vulnerability reduction was inconsistent though; four years later, hurricane Donna (category 4) and its torrential rainfall caused almost 110 casualties and severe losses.

Qualitative information shows that the three hurricanes affected the Puerto Rican economy, environment and society. They essentially hit the same sectors; export crops, food security, public health and the built environment. Testimonies expose subtle or blatant changes such as affected crops and owners, decaying agriculture and religion, recently established industries and public institutions, and developing technology, infrastructure, education, housing, public health, media and relief. Yet, lack of precise indicators or retrospective approximations hinders evaluations and comparisons. Data about economic losses is generic, uneven and unreliable; mainly concerned with the formal economy and built environment; I could not find reconstruction projections and budgets. More unknown are damages to informal housing and economies. Besides, records persistently disregard location of casualties and injured citizens, their socio-economic background and other circumstances that could clarify the political economy of disasters. Disaster images and testimonies were mostly the prerogative of wealthy, conservative, white men, usually in power. They also produced discourses, policies and official memories, although spared from suffering. For San Ciriaco and Santa Clara respectively, middle-income men limitedly left their imprint in literature and media. I could not find records of how marginalized citizens confronted and remembered the tragedies, or how they could have influenced policies accordingly.

The contexts of the hurricanes were differently characterized by instability; all reflected changing asymmetrical power relationships between the island and the U.S. through underdevelopment, inequality, vulnerability and turmoil.

VIII.1.2 Theme 1. CHARACTERIZATION. Sub-question 1.2. What characterizes the production of knowledge around hurricanes San Ciriaco, San Felipe and Santa Clara in multidisciplinary, artistic, regional, local, multi-hazard, and multi-storm terms?

In terms of multidisciplinary academic studies, meteorological research was constant whilst forestry studies addressed San Felipe and Santa Clara and epidemiology papers addressed San Ciriaco and San Felipe. Essentially hurricanes were climatological concerns; their social, economic, political, environmental and cultural dimensions were irrelevant to study, which in turn narrowed research and policy-making. San Ciriaco has been more investigated based on its proximity to the island's most dramatic change, whilst Santa Clara has been overlooked. Nearly all the meteorological, forestry and epidemiology publications were written by foreigners, in English; seemingly Puerto Ricans confronted barriers to higher education, research and publishing. The circulation of those publications is limited to a local university library or specialized journals, often unavailable online or only at a cost. Also, disciplinary knowledge production was sporadic and uneven, addressing recent events and with a short-term reflection margin. Retrospective research started in the 1990s, with history followed by economics.

The hurricanes have been memorialized through writings, plastic arts, audio, audiovisual and dance. All artistic productions were authored by island-based Puerto Ricans, except for one group in the U.S.; which signals a broader accessibility to the cultural sphere vis-à-vis the academic sphere. Those works were usually self-funded; the Commonwealth commissioned a mural slightly before Santa Clara, and multi-media pedagogic materials soon after. Municipalities and the federal government remained aside from artistic productions. In other words, the Commonwealth defined the official cultural sphere without clear interaction with

federal or local entities, regardless of their disaster management influence. Some works reached high circulation, such as the song ‘Temporal’, books incorporated in mainstream curricula and post-Santa Clara materials. Based on the dance performance “Angelito Borincano”, some diasporic Puerto Ricans cherished to commemorate and share hurricane experiences with other immigrants. Cultural manifestations probably influenced the collective memory and understanding of hurricanes; yet, they essentially continue understudied.

In regional terms, the three cases expose the Circum-Caribbean as a microcosm of insularism and rivalry, created by geography and colonial policies, which enhances underdevelopment. Those hurricanes affected several territories, outside and within the island; yet only for San Felipe relief entities wrote two brief multi-country short reports, without comparisons. Fragmented news and short references addressed local impacts but there were no studies, the island remained the unit of analysis. Lack of comparative multi-scalar data and studies exposing similarities and differences when facing the same threat undermines denaturalizing so-called “natural disasters”.

Potentially concurrent although less frequent events were overlooked as catalysts for integrated multi-risk knowledge and policy production. The worst earthquakes and tsunamis (1867 and 1918) exacerbated San Narciso and San Felipe respectively. Each risk challenged construction technologies, resilience and emotional endurance; but their similarities, differences and overlaps remain unknown.

In multi-storm terms, the three hurricanes catapulted knowledge production; contemporary minor storms and floods are under examined and isolated. Such emphasis blurs the understanding of multi-scalar disasters as long-term interconnected processes.

VIII.1.3 Theme 2. CAUSATION. Sub-question 2.1. How did economic growth and urbanization cause vulnerability or resilience to San Ciriaco, San Felipe and Santa Clara?

Throughout Spanish colonialism until the mid 20th century, all engines of economic growth were vulnerable to hurricanes and the structure of profit appropriation exposed people differently. Coastal occupation for gold extraction increased profits, accessibility, and exposure to floods, hurricanes, surges and tsunamis. Although colonizers and creoles exploited people and resources, storms undermined Puerto Rico as an economic venture until 18th century sugar and coffee exports boomed along coastal growth, without economic redistribution. Post San Ciriaco, U.S. corporations displaced elite Creoles, intensified environmentally degrading sugar production, invested in new export crops, and left declining coffee highlands. A crisis ensued, worsened by San Felipe, San Zenón, San Nicolás and San Ciprián. The New Deal and the Commonwealth promoted a less inequitable formula of economic growth, but environmental degradation continued, with great social and economic costs.

Urban primacy redefinition during the turn of the 20th century reshaped the island and risk exposure. A territorially spread network of cities was rejected, as San Juan regained preeminence whilst Ponce and Mayagüez declined. Macro and meso territorial decisions were made by appointed administrators -first Spanish, then Americans and finally some Puerto Ricans-, and foreign and local economic elites -first merchants and planters, and subsequently industrialists,

tourist investors and developers-. Self-interest undermined a political project of democratic, sustainable development with equitable redistribution. In the mid 20th century, remittances sent by Puerto Rican emigrants to the U.S. empowered lay citizens to make micro-level choices that reduced extreme poverty and vulnerability, reshaping urbanization.

Planning and investment increased from very low levels during the Spanish regime, slightly more in the early U.S. administration until the New Deal and Commonwealth expansions. Protection of lay citizens was added to commodities and elites; but planning, investment and state violence also secured questionable U.S. interests.

Infrastructure grew from mainly serving export-oriented needs to encompass production and consumption; transport and water works were prioritized, simultaneously diminishing and creating risks. Private foreign investors expanded the interrupted coastal Spanish railroads and maritime projects. New Deal-Commonwealth launched motorway networks overpowered railroads, bolstered private owners and developers, car over mass transport, and suburban sprawl over compact growth; whilst razing urban areas and degrading ecosystems –some of which buffered disasters-. Water management changed from very small engineering projects serving potable water to few buildings, next serving irrigation and limitedly expanding urban provision, to finally become a top federal strategy to jointly manage water and disasters. The local hydraulic regime changed through vast projects mainly for irrigation, human consumption, industrialization and hydroelectricity. In the short term, new hydraulic systems handled hazards and improved living conditions; later they enhanced hazards and hardened recovery vis-à-vis extreme weather-events, systemic failures and environmental degradation. Increased threats of

floods, overflow and collapse of levees, canals and dams became a top issue; floods became the most expensive disaster.

Risk-prone areas were habitually occupied by low-income groups based on exclusionary land markets, until 20th century technology created a false sense of safety based on the modernity belief that it was possible and desirable to dominate and recreate nature. New urbanization took place in desiccated areas and beach fronts that were risk-prone.

The main urban growth pattern can be described as ‘uneven geographical development’, with stark disparity between what upper income groups enjoyed compared with the abject poverty of the vast majority, vulnerable to disasters and everyday life hazards. The New Deal launched urban development interventions, which became massive post WWII.

Housing legislation and programs went from absent, to basically insufficient, to make Puerto Rico rival the top states receiving federal funds. The New Deal promoted diverse prototypes, low and middle density units, at a pace that was in short supply for the accumulated deficits. For the Commonwealth, housing was essential; suburban expansion and slum clearance became paradigmatic, prompting extensive, low-density projects that soon became problematic also for their inability to foresee disasters. Land tenure, housing production scale, construction methods and financing empowered vast segments of society, whose quality of life and hazard resilience changed from being destitute slum residents to titled citizens in formal, durable housing units. However, such processes were insufficient and contentious.

Architectural, planning and policy records conventionally prioritized the elitist historical built environment; recent works target precarious settlements using miscellaneous viewpoints to show diverse urban experiences. Disasters remain understudied though.

VIII.1.4 Theme 2. CAUSATION. How did socio-cultural hierarchies, collective memory and knowledge production cause vulnerability or resilience to San Ciriaco, San Felipe and Santa Clara?

Disaster vulnerability and social hierarchy correlated, and the most consistent vectors of difference were race, class, nation of origin and gender; religion and language lost preeminence. Ideology and political status were conflictive sources of social difference during late Spanish rule and the 1930s-early 1950s¹⁴⁸. Since the 1950s, high and middle-income segments also experienced vulnerability due to urbanization changes.

Powerful groups justified unfair hierarchy for their benefit through discursive constructs. American administrators took over Spaniards and Creoles keeping some discriminatory patterns, including disenfranchising locals vis-à-vis foreigners and impoverished and marginalized citizens vis-à-vis elites. Projects merging identitarian constructs with political reivindications were first voiced by pro-independence Creoles confronting Spanish discrimination; their claims endorsed exclusionary and vulnerability enhancing conditions for lay citizens. During initial U.S. rule, constructing a local cultural identity could be equated with punishable subversion and

¹⁴⁸ In between, pro-independence groups were not organized or large enough to make their claims noticeable public issues vis-à-vis surveillance and subjugation.

separatism. Merged identitarian and political reivindications criticized American oppression idealizing a peaceful, patriarchal hispanophilic history; a view shared later by top leaders.

Neglected public education worsened everyday life and crises during the Spanish colony and initial U.S. rule; whilst insufficient New Deal investment and English imposition were also detrimental. Puerto Ricans took charge just before the Commonwealth setup, introducing local history and institutionalizing Spanish. The Commonwealth negotiated a non-confrontational identitarian formula tied to public education. It shaped the official construction of history with Spanish notions of hierarchy and the myth of rural harmonious mestizaje. Thus, it followed core tenets justifying inequality and disregarded the hardship endured by marginalized citizens. The Commonwealth created ICP and DIVEDCO to guide a controlled transition to modernity, strengthening education through the arts, identity construction and cultural heritage preservation. DIVEDCO produced and disseminated pedagogic materials and ICP promoted 'apolitical' local culture and identity claims. Such approach cultivated cultural sensibilities attached to patriotic sentiments, but hampered separatism.

All identitarian-political and education initiatives omitted the construction of collective disaster memories and awareness; thus, religious superstitions and rural beliefs prevailed. For centuries, Catholicism determined what a disaster was, its causes and responses. Rural citizens trusted changes in animal behavior, vegetation and bodily sensations. Until the mid-20th century, even mainstream newspapers and professional associations followed popular beliefs, whilst the power of religion declined.

Meteorology went from no database and a brand new observatory, to cutting edge technology used for systematic regional longitudinal research, influenced by U.S. military aims. The complex growth of technical information reflects how emerging disaster studies and management prioritized science to advance knowledge through maps, graphs, tables and images such as land, aerial and satellite photography and radarscope. The 1950s advent of television transformed public awareness concerning hurricanes; Dr. Dawson Clay McDowell merged cultural and scientific understandings to attract viewers, which remains noteworthy as meteorology and anthropology are usually disconnected.

VIII.1.5 Theme 3. RELIEF Sub-question 3.1. How did a previous relief experience or process create influential conditions for the relief stage of San Ciriaco, San Felipe and Santa Clara?

The preceding benchmarks are respectively the San Narciso crisis, the Great Mississippi floods, and the U.S. disaster management transformation from the New Deal until the mid-1950s; they reflect that until the 1930s relief provision was a neglected governmental responsibility worsened by improvised trial and error. Throughout the Spanish colony, relief was delegated to local authorities; post-San Narciso, the Governor's unfeasible taxation demands showed irresponsibility even during an extreme emergency that risked insurgence. During the Mississippi floods, state and local institutions were responsible yet unable to undertake relief. Instead of a federal response, the Red Cross gained an ad-hoc quasi governmental role, unbound to public accountability, and emphasized volunteerism supported by professionals. Army presence only in acute crises also highlights detached federal responsibility and reliance on an undemocratic

institution. In the New Deal, old and new federal entities tackled crises with a wide scope, narrowed later by ideological biases; state and local authorities retained an important role.

Governmental relief neglect related to the prevailing underlying ideas of what caused disasters. With religion having a pivotal role in public life, ascribing disasters to a fair punishment of God served to deter plans and investment. Also, the scale in which the disaster was addressed served to detach unaffected remote governmental institutions. Local resources were intensively extracted, islanders had duties towards central and distant administrations but lacked rights to demand even relief; at best, they could negotiate. Thus, the local scale was conveniently positioned as a responsibility of home institutions and individuals. Another damaging idea was to correlate relief with vagrancy, not with entitlements; thus, citizens had to meet extreme demands to survive. Moreover, by blaming the forces of nature, not social interactions, it was hard if not impossible to tame disasters. Conversely, beliefs in domesticating and recreating ecosystems and environmental processes filtered among New Deal governmental tasks, which prompted hazards. Contemporary views linked disasters and war, or disasters and economic growth, and separated disasters from culture and politics, with contradictory consequences.

Relief biases and abuses in all cases are hazy, possibly because most records were not authored by suffering citizens, often illiterate, whose goal was survival. Yet, controversies highlight the contested nature of impromptu relief, with incongruities concerning evacuation, supply distribution, forced work or unfair payments, taxation, accountability, gender roles and political leadership.

Policy-making reflects the consolidation of disaster management and its transformation into a governmental duty. Post-San Narciso planning and infrastructure were unevenly implemented. Post-Mississippi flood interventions favored free markets and credit schemes resulting in fiascos. Yet, they precluded the most radical legislative change in U.S. history concerning flood control, reshaping and increasing federal involvement in municipal and state tasks; which the New Deal reinforced. Next, diverse institutions raised life standards and safety. Grassroots education for disaster awareness took priority over other cultural interventions, focusing on atomized agency during emergency.

All cases triggered political challenges. In the first, poor disaster management could have fed a pro-independence struggle, along other causes. In the second, relief flaws added to the frustration of African-Americans, influencing their presidential vote. In the third, federal lack of headship and perceived intrusiveness pressured powerful decision-makers.

VIII.1.6 Theme 3. RELIEF Sub-question 3.2. Which were the defining elements for hurricane relief and incipient policy trends concerning San Ciriaco, San Felipe and Santa Clara?

Iterative challenges to launch relief and priorities expose absence of responsible institutions, insufficient funds and clear procedures; besides complex political frictions, deep-rooted poverty, widespread destruction –with varying degrees-, and lack of awareness about hurricanes due to limited development of knowledge vis-à-vis beliefs. Inexperience was mentioned during San Ciriaco, as U.S. authorities had recently taken over; and during Santa Clara, because of the 24

year lapse after San Felipe, although federal and island governments had invigorated disaster management. Political dissent is prominent in the two last hurricanes, as during San Ciriaco locals were unclear about the new U.S. authorities and their potential interactions. Top-down oppression mechanisms and bottom-up frustration existed during San Felipe and Santa Clara; in the former they were about to get worse, in the latter grassroots dissent was obliterated. Avoiding starvation, public health outbreaks, homelessness, agricultural collapse, and governmental anarchy were prioritized in a context of scarce personnel, materials, medicines, clothes, food and other supplies. Moreover, harsh mechanisms of social control post San Ciriaco and San Felipe were central; relief was a magnanimous reward to be hardly won. By Santa Clara, that viewpoint had changed. Still, it was central to guarantee U.S. dominion, undermine non-conforming right wing voices -the left was dismantled-, and secure the Governor's position and the Commonwealth. Handling disasters always needed caution vis-à-vis frail political configurations that included changing equations of dependency and underdevelopment.

Unstable relief providers reflect lack of institutionalization and accountability. Given the emergency and weakness of local organizations, U.S. institutions stepped in during the first two cases. Their biases were not openly challenged by local authorities and citizens, exposing lack of avenues for dissent. Post-San Ciriaco, the Army's chain of command, strict supervision and derogatory assumptions undermined the short and long-term betterment of marginalized citizens in dire need. Post-San Felipe, the Red Cross' mistakes transplanted from the Great Mississippi floods, brief temporal engagement and derogatory assumptions again hindered marginalized citizens. Post-Santa Clara, a local yet unprepared institution took over, the Commonwealth, with the dominant presence of the proud and stubborn Governor blocking required federal support.

Underlying relief paradigms backing governmental neglect were difficult to change. One example is the separation between federal and local spheres, with emphasis on locals providing for themselves, superseded by Santa Clara. Another example is the constant presence of and calls for charitable and entrepreneurial entities and volunteers in charge.

Consistently, powerful groups gained relief advantages over those most in need. On the one hand were Creole planters, exporting entrepreneurs and unscathed municipalities initially, and large U.S. sugar corporations and coffee planters later. Their power to secure funding lasted until Santa Clara, with limited -if any- obligations to redistribute or report back. On the other hand were rural workers, small farmers, urban and rural homeless; they became more impoverished but were denied help to stop idleness. During Santa Clara the latter assumption was not aired in available records. Yet, during its key yearly speech to the Puerto Rican Congress, the Governor eschewed the worsened conditions of urban slum dwellers, the help they received and targets to help them; which could be seen as detachment from a large group of disempowered citizens.

VIII.2. Recommendations

My research finished in the mid 20th century, narrowing the scope of pertinent specific recommendations to the following:

The research should continue until now, in order to grasp what happened in the last six decades. Possible extreme or deviant cases to study are hurricanes Donna (1960), Hugo (1989), Georges (1998) and Irene (2010); of which the priorities would be Hugo and Georges. Donna is as a fresh

counterpoint to Santa Clara, the greatly increased flood casualties need a critical explanation. Hugo is more relevant because it happened during a critical timing, it enables a longer term view of disaster management, and it received media and research attention as it blasted other territories. The contemporary crisis was the dissolution of the initial Commonwealth political formula and economic model, dependent on outmoded and polluting industries, shrinking remittances and federal transfers, evaporated tax exemptions which propelled the flight of investors, long-term effects of corruption and mismanagement, and external changes such as the Oil Crisis and new fiscal paradises overseas. A plebiscite was scheduled to redefine the controversial political status, after alternance of PNP and PPD. Moreover, a beloved television character –Don Cholito- had incorporated hurricanes in his comedic repertoire, which can be seen as an indicator of a collective perception of disaster safety soon to be shattered. As shown below, a plethora of newspaper cartoons reflects old themes –destruction, underdevelopment, dependency, religion- and new ones –such as costly last minute ‘hurricane specials’, a fundraising Telemarathon, the fragility of formal, low-cost suburban housing and the hurricane burden on the impending plebiscite-.

Fig. 171 “Federal Help Hurricane Hugo”



The Puerto Rican Public Administration is tied and frustrated in front of the federal help for Hugo labelled for FEMA (Miche Medina, 1989b).

Fig. 172 "Plebiscite"



Debris from fallen construction and vegetation are heavy burdens on the “Plebiscito” locked box (Miche Medina, 1989e).

Fig. 173 “Vieques Hurricane Hugo 1989, emergency help”



Months later, Vieques island was still hard hit, and this image resembles Santa Clara; although all the family is well-dressed and the ruined house is modern (Medina, 1990).

Fig. 174 “The passing of Hugo”



A fallen tree “the passing of Hugo” tramples a man named “the People”; near, a water bottle is empty and damaged, a light bulb is broken. A bird carries the messages of “patience and understanding” (Miche Medina, 1989f).

Fig. 175 “Reflections after the passing of Hugo”



With a black island map behind, a larger than life figure of Jesus oversees widespread destruction; only two tall modern buildings emerge (Miche Medina, 1989g).

Fig. 176 “Hugo”



Hugo is about to blow a formal, low-cost, suburban house despite “precautions” taken by residents (Miche Medina, 1989d).

Fig. 177 “Help to Puerto Rico”



President Bush arrives with help; Gov. Hernández Colón says “the pieces are coming” to a man trapped inside a smashed old car representing Puerto Rico (Miche Medina, 1989).

Fig. 178 “Telemarathon give the hand to Puerto Rico”



Citizens of all ages, shapes and colors head to the fundraising Telemarathon, in the light of insufficient public resources to tackle the crisis (Miche Medina, 1989h).

Fig. 179 “Special”



An angry man searches his pocket to pay for seemingly expensive emergency groceries, whilst the cashier timidly offers the bill (Miche Medina, 1989c).

Fig. 180 “Here comes the hurricane”



Hugo is portrayed as a giant Big Bad Wolf blowing a tiny modern house (Miche Medina, 1989a).

Georges reached category 4 and it was the first hurricane to traverse the island after San Ciprián. Impacts include eight casualties, around \$2 billion losses in housing, electricity, water, sewage, roads, agriculture and tourism. U.S. and Puerto Rican officials prepared a plan that forbid rebuilding in risk prone areas and needs assessment. Although Irene was less destructive, it

exposed increasing impact of floods -particularly on basic infrastructure-, effectiveness of evacuation and shelters, and federal funds dependency.

Comparative multi-scalar disaster studies, from micro-territories to the Greater Caribbean region would advance disaster knowledge and policy-making. There is a gap about localities and their resources, coalitions, material conditions, leadership, conflicts, and memorializations. Filling such gap could explain strengths and limitations of municipal disaster management, and advance local empowerment. Also, micro-level community responses have been usually overlooked; yet, they could offer more diverse and creative solutions than top-down procedures, and expose how those failed on the ground.

It would be relevant to continue interdisciplinary studies covering multiple storm, hazards, minor incident, everyday life dynamics vis-à-vis disasters, and new extreme scenarios including pollution from old abandoned industries and modern pharmaceuticals, bombing zones-, and systemic hydraulic failures.

The contributions of the cultural sphere could shed light on resilience and vulnerability processes; particularly, post-Santa Clara DIVEDCO materials would be useful for countries in backward conditions. Interviews with related DIVEDCO workers and citizens could reveal achievements, failures and lessons learnt.

Capturing oral histories, pictures, mental maps and other testimonies of underrepresented affected groups would finally bring some justice to their experiences, and could clarify their fears, hopes, superstitions, knowledge, needs and assessments.

Resulting from participatory histories, an exhibit that travels to schools, universities, ICP centers or municipal entities -particularly in places hit by disasters or at risk-, would enrich the collective construction of disaster memories.

Cost benefit analysis of maintaining risk-prone urban areas vis-à-vis expropriations and demolition could sustain expropriations, limits to growth and densification.

Finally, appointing an institution or network of institutions to call for existing information, collect and disseminate it free of charge, online and in paper, would advance disaster knowledge and the foundations for policy-making.

VIII.3 Conclusions

Research Question: In terms of informing policies, what are the key lessons from the disaster management changes that happened during the transition of Puerto Rico from a Spanish colony to a Commonwealth of the United States?

Disaster management vastly improved mirroring shifting ideas of God, nature, knowledge and humanity; always influenced by the dependent position of the island. Historically, citizens tried to handle hurricanes through mythological beliefs, empirical observations, rituals and material

practices; some of which endured colonization and modernization into the mid 20th century. Disaster management emerged haphazardly; at first it was ineffective and improvised relief, without much preventive or reconstructive policy-making. The official perception of hurricanes changed from being essentially uncontrollable religious or natural events, to natural events that could be tamed with technology, physical changes and policies. Yet, it was a more nuanced confluence of environmental, economic, social, cultural, and political factors that enabled storms to become destructive disasters affecting the Puerto Rican economy, environment and society. The social groups that experienced higher resilience or vulnerability during a disaster respectively corresponded to the groups that were best and least served during relief and who could or could not produce public transcripts and policies. Such division resulted from entrenched social and political arrangements, including citizens' rights, colonial administrative policies, social hierarchies that merged local and external power dynamics, and notions of habitus. Eventually, the growing understanding of citizens' rights was critical to reduce hurricane casualties and the worst forms of vulnerability through New Deal and Commonwealth developmental projects. By also including contentious aims though, they created other forms of underdevelopment and dependency from the US; whilst technology and modernity paradigms bolstered new risks that would become rather costly. Simultaneously, disaster management became a federal responsibility, which reached Puerto Rico; but it was the unplanned intersection of a hodge-podge of disciplines, approaches and institutions, centered on physical interventions and neglecting the role of culture and the political economy of disasters with negative lasting impacts. Although improvised, contradictory and controversial; the main factors enabling the rise of disaster management were increased governmental leadership, knowledge construction, public awareness, planning and investment in hard and soft infrastructure, and relief provision.

VIII.3.a) Governmental leadership

Governmental leadership is basic, and becomes more competent if consistent, coordinated, self-critical and pro-equity. A designated governmental layer should foresee the integration of external entities -foreign or federal- and locals –such as proactive and reliable municipalities, religious and volunteering organizations, and individuals-. Contradictory effects of Army involvement demand caution. Likewise, media presence of leaders can be distortively used for personal, ideological and other inappropriate aims, demanding mechanisms of public accountability.

VIII.3.b) Knowledge construction

Disaster management is nurtured by the construction of different forms of knowledge. Science significantly contributes; yet it needs constant self-reflexivity to refine its aims, amalgamate disciplines in systematic, proactive approaches that have ample time frames and spatial scales, integrate infrequent and different hazards, and become useful. Quantitative and qualitative records of casualties that show differentiated vulnerability and impacts enable clearer diagnoses and can inform effective interventions. Similarly for information about damages of formal and informal built environments and economies. The construction and propagation of disaster knowledge through the arts can be a local, spontaneous, self-funded, positive process that fortuitously reaches high circulation. Yet, governments could significantly contribute sponsoring, elaborating and disseminating materials of pedagogic and aesthetic value; and supporting research that examines their effects. Knowledge from underrepresented citizens demands especial attention.

VIII.3.c) Public awareness

The construction of public awareness targeting different audiences is essential, with cultural sensitivity to address religious, rural and urban popular beliefs and practices –whether useful, harmless or counterproductive- and translate scientific knowledge to explain multiple disasters, their complete life cycles and interconnections. A humorous yet respectful, initially improvised blend of cultural and scientific meanings of hurricanes was efficient during decades in Puerto Rico. Warning systems are crucial and have been successful even with rustic means of communication backed by local participation—as in late 19th century in Cuba-, more so when combining modern technology with interpersonal and grass-roots dynamics. The same structures can improve post-disaster processes. Pedagogic audiovisual materials can be attention-grabbing, memorable and particularly useful to engage illiterate and under-schooled groups. A systematic effort to freely circulate and discuss such materials can reinforce general public awareness and should reach the most vulnerable citizens -due to location and vectors of social difference-. Preparing individuals and families for emergency is a basic facet of disaster management, better if integrated within a broader culture of resilience in which collective organizations request safety from preventable disasters and participation as rights.

VIII.3.d) Preventive planning and investment in hard and soft infrastructure

This factor is possibly the hardest to track due to multiple actions and stakeholders involved throughout time. A basic step is to discern the traditional path and political economy of planning and investment in relation to disaster vulnerability. Socially stratified vulnerability can be seen as a collective decision –of the most dominant societal factions, political representatives and technocrats- about the degrees of insecurity considered acceptable for different persons; in other words, different rights within a society. Planning can be part of the solution and problem. Even

when the profession would be considered nascent by today's standards, it reduced risks to the elites and protected commodities; thus, the problem was systematic exclusion of underprivileged citizens that multiplied and cemented their vulnerability. Although planning is increasingly specialized, it must incorporate disaster management and its cultural meanings, and relate them to more traditional areas of expertise such as land use policies. Also, it ought to question core tenets of modernity and technology such as unlimited resource use and ecosystemic changes. For instance, conventional systems to simultaneously deliver potable tap water, generate hydroelectricity and control floods can raise living standards and reduce vulnerability; yet, they may contain the seeds of their own crisis. Lack of closed systems of recovery, reuse and recycle generate unnecessary costs and pollution, triggering new systems pumping water from more distant reservoirs or aquifers. Extensive hydro-engineering modifications to control floods can become counterproductive. Purposive urbanization of risk-prone artificially transformed ecosystems tends to generate old or new hazards in due course. Planners in developed and developing countries need to re-examine modernity paradigms, particularly vis-à-vis increased risk scenarios. They must consider how and when to retrofit or change existing systems; and if planning for new ones, they can adapt successful examples, avoid costly and risk-enhancing mistakes or innovate.

VIII.3.e) Relief provision

Relief provision should grow in content and scope, reviewing its social meanings and trajectory. When seen as an improvised, devout or charitable act is problematical; more so if offered by unaccountable and inexperienced entities and individuals that see disaster survivors as potential vagrants who must earn it under tight scrutiny. It must become a universal, secular, ethical and

institutionalized task of legally responsible, multi-scalar governmental leaders. Crudely, this stage tends to expose and sometimes reinforce political dependency, underdevelopment, inequality and vulnerability. Simultaneously, the crisis may provide temporary political momentum in favor of progressive projects, policy and legislative changes.

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Annex 1. Cross-case comparison tables

Table 3. Theme 1. CHARACTERIZATION. 1.1 How are hurricanes San Ciriaco, San Felipe and Santa Clara characterized?

Theme 1. Characterization		Sub-question 1.1 Hurricane profiles		
	San Ciriaco (1899)	San Felipe (1928)	Santa Clara (1956)	
Basic data	Cape Verdean hurricane, estimated Category 4 in the Saffir-Simpson Scale; copious and lasting rain.	Cape Verdean hurricane, estimated Category 5 in the Saffir-Simpson Scale, the strongest recorded in Puerto Rico; copious rain.	Cape Verdean hurricane, estimated Category 1 in the Saffir-Simpson scale, relatively small, weak and fast; modest rainfall.	
	3,100-3,400 casualties.	312 casualties.	9-16 casualties.	
	Widespread destruction. Cataclysmic impacts on export crops, food security, public health, security, built environment –particularly scarce infrastructure and overabundant precarious housing-.	Widespread destruction. Impacts on export crops, food security, public health, built environment –particularly infrastructure and schools and housing-.	Vast Widespread destruction. Impacts on export crops, food security, public health, built environment – particularly infrastructure, industries and abundant precarious housing-.	
Context	Unstable times, the U.S. had taken over the island from Spain months before, after the Spanish-American War.	Unstable times, the U.S. consolidated ‘imperialism by neglect’.	Unstable times, from the New Deal to the Commonwealth, those were the most violent years in modern history.	
	Four centuries of detachment from Puerto Rican development and extractive policies created inequality, poverty, vulnerability and turmoil. San Ciriaco showed the fault lines of this asymmetrical relationship.	Three decades of U.S. overt detachment from Puerto Rican development and extractive policies created the conditions for an impending economic and civil breakdown. San Felipe showed the fault lines of this asymmetrical relationship.	Over two decades of incongruous U.S. rule included plans and actions to ameliorate socio-economic conditions, exploitative interventions and repression. Santa Clara showed the fault lines of this asymmetrical relationship.	
Information producers	Men in positions of power: Spanish, U.S. and Puerto Rican politicians, elite members, intellectuals, public officials, foreign military, merchants, planters, religious authorities, doctors, and scientists.	Men in positions of power: Puerto Rican politicians, elite members, intellectuals, public officials, foreign relief providers, and scientists.	U.S. Men in positions of power: elite U.S. and Puerto Rican politicians and elite members; and men part of a growing middle-class: intellectuals, scientists, artists, and journalists.	
Excluded information producers	Marginalized citizens due to gender, class, race, and age.	Marginalized citizens due to gender, class, race, and age.	Marginalized citizens due to gender, class, race, age, and left-wing/pro-independence ideology.	
Main biases	Upper class, top-down, male perspective of the event.	Upper class, top-down, male perspective of the event.	Upper class, top-down, male perspective of the event.	

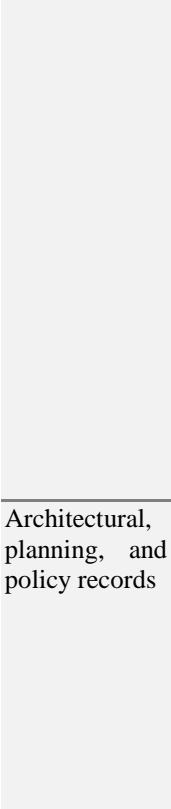
Table 4. Theme 1. CHARACTERIZATION. 1.2 What characterizes the production of knowledge around hurricanes San Ciriaco, San Felipe and Santa Clara in multidisciplinary, artistic, regional, local, multi-hazard, and multi-storm terms?

THEME 1. CHARACTERIZATION: Sub-question 1.2 Knowledge production			
	San Ciriaco (1899)	San Felipe (1928)	Santa Clara (1956)
Multi-disciplinary	Scientific studies: meteorology (1/1899) and epidemiology (1/1900). History (1/1992) and history-related (all 2000) discussing photographic and statistic overview of the damages (1), position of the military government (1) and Catholic church (1), literature (1), health (1) and migration (1).	Scientific studies: meteorology (1/1928), forest biology (2/1929, 3/1930). History (1/2005).	Scientific studies: meteorology (1/1956, 1956, 1959), forest biology (1/1959) epidemiology (1/1958) and economics with a focus on education (1/2005).
Arts	Novels ‘Estercolero’ (1901), ‘Mancha de Lodo’ (1903), ‘Gestación’ (1905), ‘El hijo de Carmen o Aventuras de un Obrero’ (1909), and ‘La Gleba’ (1912). Texan-based musical ‘Sembrando Herencia’ (2007).	Novel ‘La Víspera del Hombre’ (1903), (1959). Song ‘Temporal’ (n. d.). Mural ‘Temporal’ (1952-1954). Award-winning documentary ‘Allá viene el Temporal’ (1988).	‘Huracán’ film, 2 posters, booklet and bulletin (1958). Short story ‘Huracán Santa Clara’ (2003). Texan-based musical ‘Sembrando Herencia’ (2007).
Circum-Caribbean	No comparative regional studies.	No comparative regional studies. Two multi-site short relief reports (2/ 1928, 1929).	No comparative regional studies.
Local	No studies of local impacts.	No studies of local impacts.	No studies of local impacts.
Multi-hazard	No studies co-analyze concurrent and complex emergencies, possible if including droughts, hurricane Narciso, a seism, tsunami and aftershocks all in 1867.	No studies co-analyze concurrent complex emergencies, possible if including hurricane San Hipólito in 1916; San Fermín seism, tsunami and aftershocks in 1918.	Concurrent earthquakes and tsunamis (1943 and 1946) were expanding the temporal frame to insignificant.
Multi-storm	No studies, typical listings of preceding hurricanes and storms.	No studies, typical listings of preceding hurricanes and storms.	No studies, typical listings of preceding hurricanes and storms.

Table 5. Theme 2. CAUSATION.2.1. How did preceding economic growth and urbanization caused vulnerability or resilience to San Ciriaco, San Felipe and Santa Clara?

THEME 2. CAUSATION: Sub-question 2.1 Economic growth and urbanization vis-à-vis risks			
	San Ciriaco (1899)	San Felipe (1928)	Santa Clara (1956)
Growth engines	Export crops to Spain, mainly sugar and coffee; controlled by elite Puerto Ricans.	Export crops to the U.S., mainly sugar, tobacco, pineapple, banana-, and coconuts were relevant also; all controlled by large U.S. corporations. Decaying coffee chiefly exported to Europe, controlled by Puerto Ricans.	Decaying export crops to the U.S., mainly sugar; controlled by large U.S. corporations. Government targeted industrialization, institutional reform, emigration, tourism, and construction. Vast gains for corporations, mixed results for lay citizens.
Territorial patterns	Coastal over mountainous urbanization, enhancing hazards such as floods, hurricanes, surges and tsunamis. San Juan was the capital but Ponce was the top growth pole, and Mayagüez was declined, the ranked third.	Coastal over mountainous urbanization, enhancing hazards such as floods, hurricanes, surges and tsunamis. San Juan became the top growth pole again, Ponce and Mayagüez was declined, the highlands depopulated.	Coastal over mountainous urbanization, enhancing hazards such as floods, hurricanes, surges and tsunamis. San Juan remained the top growth pole, Mayagüez and Caguas distantly followed, Ponce declined, the highlands depopulated.
	Spanish administrators and elite Puerto Rican merchants and planters had made key territorial decisions.	U.S. administrators and corporations had made key territorial decisions.	U.S. administrators and corporations had made key territorial decisions. Remittance-receiving families made influential micro-level decisions.
Planning and investment	Very low levels; underlying assumption of protecting commodities, not lay citizens.	Relatively increased levels; underlying assumption of protecting commodities, not lay citizens.	Increased levels allegedly based on scientific studies; underlying assumption of protecting commodities and gradually lay citizens, but keeping questionable U.S. interests and aims by force if needed.
			Island government-promoted light industries first, heavy industries next; U.S. emigration coastal tourism, and construction.
Infrastructure	Mainly export-oriented public works and transport infrastructure.	Mainly export-oriented public works and transport infrastructure.	Export-oriented, production and consumption public works and transport infrastructure.
	Transport projects included ports, bridges, lighthouses, interrupted roads, and a tiny fractional private railroad network.	Transport projects included ports, bridges, private airports, an expanded private railroad network that circled the coast and did not link the highlands due to topographical hindrances and unprofitability.	Transport projects included bridges, an international airport, and a motorway network that connected the island, breaking railroads. The motorway aided private owners and developers, car over mass transport, and suburban sprawl over compact growth; whilst razing bionetworks, formal and precarious housing.
	Small water management interventions provided few well-off housing and official buildings.	Hydraulic projects included irrigation canals, river dams, hydroelectric plants, dykes and few filter beds, mains, and pipes to bring water to better-off	Hydraulic projects included irrigation canals, large river dams, hydroelectric plants, dykes, levees, flood walls, and far-reaching water systems for increasing numbers of citizens.

		housing and official buildings.	
Urbanization of risk-prone areas	There were no engineering interventions that enabled formal agricultural and urban growth on risk-prone areas.	By the end of this time period, Federal engineering interventions became a valued federal flood management, disaster management and planning strategy; and enabled limited formal agricultural and urban growth on risk-prone areas.	Federal large-scale engineering interventions merged water and flood management, expanding agricultural and urban growth on risk-prone areas, thus mitigating and creating vulnerability. New hydraulic systems coped with minor and moderate hazards in the short term; but flood-prone urbanization grew due to a false sense of safety. Danger increased during extreme weather-events and system failures; recovery hardened.
	Negligible formal beach front urbanization, export or military constructions.	Incipient high-end tourism in San Juan beachfront urbanization, privatized access and changes of ecosystems that buffered storms and surges.	Formal deluxe and aggressive beachfront urbanization privatized ecosystems that buffered storms and surges, increasing vulnerability.
	Exclusionary land markets prompted low-income groups to occupy marginal risk-prone areas. Due to the fragility of their structures, they mostly caused reversible changes to ecosystems that buffered storms and surges.	Exclusionary land markets prompted more low-income groups to occupy marginal risk-prone areas. Despite the fragility of their structures, their heavy density damaged ecosystems that buffered storms and surges.	Exclusionary land markets prompted large numbers of low-income groups to occupy marginal risk-prone areas. Despite the fragility of their structures, their heavy density destroyed ecosystems that buffered storms and surges.
			Heavy industries in the Southern coast caused degradation and toxic risks.
Urban growth patterns	Uneven trends, no systematic governmental interventions.	Uneven trends, few systematic governmental interventions.	Uneven trends insufficiently changed, despite public projects and funding.
	High-end areas incorporated vanguard designs and technologies.	High-end areas incorporated vanguard designs and technologies.	High-end areas incorporated vanguard designs and technologies.
	Average state of urbanization remained extremely precarious for the everyday life and vulnerable to disasters.	Average state of urbanization remained extremely precarious for the everyday life and vulnerable to disasters.	PRRA tackled urbanization deficits limitedly. Post WWII construction fed the GNP and improved safety gradually; housing was top. Suburban formal housing, car-dependent, low-density individual homeownership with minimal standards and facilities, vast deforestation and topographical changes. Slum clearance in prime real estate hit communities of color mainly in San Juan, Ponce and Mayagüez.
Housing and land tenure provision	No legislation or programs.	Insufficient legislation and programs.	Increased legislation and programs.
		The 1903 Homestead Act introduced affordable, low-density housing for employed citizens. It was endorsed by laws in 1906 and 1920. The 1923 Hogares Seguros Housing Act	PRRA, the Design of Public Works Committee and Puerto Rican Housing Authority bought land, cleared slums, and creatively but inadequately built urban and rural housing. The 1949 U.S. Housing Act backed slum clearance



law created the Homestead and new construction. Unrivaled post-Commission to guide urban WWII housing investment became a development and provide plots or Commonwealth symbol. housing for urban workers. Yet, deficits grew exponentially.

Housing was built individually or in small groups. PRRA increased scale and pace of construction insufficiently; post WWII massive production, organization and financing.

The 1903 Homestead Act allowed laborers to own the land they tilled, but did not affect corporations and local elites. The 1917 Jones-Shafroth Law and Title V of the 1941 Land Law; unapplied 1917 Jones-Shafroth Law limited corporations to own up to 500 acres.

Architectural, planning, and policy records Elitist emphasis blurs unfair differences in urban life and disaster experiences. Elitist emphasis blurs unfair differences in urban life and disaster experiences. Elitist emphasis still although popular projects by famous authors have received attention also. Contemporary specialized and governmental publications addressed urban changes from top-down viewpoints. Recent multifocal studies of the informal and precarious built environment show urban life variety, but neglect disasters.

Table 6. Theme 2. CAUSATION. 2.2. How did preceding socio-cultural hierarchies, collective memory and knowledge production caused vulnerability or resilience to San Ciriaco, San Felipe and Santa Clara?

THEME 2. CAUSATION:		Sub-question 2.2 Socio-cultural hierarchies, memories and knowledge of disasters		
	San Ciriaco (1899)	San Felipe (1928)	Santa Clara (1956)	
Social hierarchies	White, male, Catholic Spaniards in top positions during the Spanish colony; white, male, Protestant, English-speaking Americans during U.S. occupation. White, male, wealthy Puerto Ricans followed. Poor locals were at the bottom of both social ladders; mainly if <i>jibaros</i> , black, women, children and elderly. Country of origin, class, race, ideology and language were the most conflictive and political status were the most conflictive differences.	White, male, English-speaking Americans in top positions; white, male, rich Puerto Ricans followed. Poor locals were at the bottom of the social ladder; mainly if <i>jibaros</i> , black, women, children and elderly. All Puerto Ricans were in a legal citizenship vacuum from 1898 to 1917. Country of origin, class, political status preferences were the most conflictive differences.	White, male, English-speaking male, elite or technocrat Puerto Ricans. Poor Puerto Ricans were mainly if <i>jibaros</i> , black, women, children and elderly. Country of origin, class, ideology and language the most conflictive differences.	
	High disaster vulnerability correlated to adverse living and working conditions, education, healthcare, and food insecurity.	High disaster vulnerability correlated to adverse living and working conditions, education, healthcare, and food insecurity.	High disaster vulnerability correlated to adverse living and working conditions, education, healthcare, and food insecurity.	
Justification	First, Spanish birth and <i>hispanophilia</i> justified Spaniard supremacy and anti-Puerto Ricans stereotypes. Next, U.S. birth and the Black Legend -anti- <i>hispanophilia</i> - justified American supremacy with punishable and anti-Puerto Ricans stereotypes, akin to those embraced by Spaniards. Landed and business elites could be judged unreliable and sub-par by Spaniards and Americas. The poor and working class was seen as lazy, ignorant and stubborn Spaniards, Americans and Puerto Ricans.	U.S. birth and the Black Legend -anti- <i>hispanophilia</i> - justified American supremacy. Americanization endorsed censorship, affirmations of cultural identity with punishable subversion and separatism, and imposed linguistic dominance. Landed, entrepreneurial and public servant elites could be judged unreliable and sub-par by Americans. The poor and working class could be seen as lazy, ignorant and stubborn by foreigners and elite Puerto Ricans.	During PRRA, American supremacy was less blatantly justified; yet Pro-Americanization policies endorsed censorship, equated affirmations of cultural identity with subversion and separatism, and imposed linguistic dominance. Next, the Commonwealth used Spanish colony notions to define cultural heritage endorsing <i>hispanophilia</i> , the myth of harmonious mestizaje in the rural past, promoting blanqueamiento ideals, <i>Jibaro</i> , Spanish, and even Taíno heritage over African heritage.	
Public education and identity constructions	Extremely low public education levels.	Low public education levels.	Lacking public education. Since the mid 1950s, ICP and DIVEDCO advanced arts, education, identity and cultural heritage.	
	English substituted Spanish as the official language of public education (1899).	English as the official language of public education was a hindrance.	English ceased to be the official language of public education (1949).	
	Limited teaching of local history, the curriculum was pro-Spanish and turned pro-U.S.	Limited teaching of local history, pro-American curriculum.	Increased teaching of local history. DIVEDCO produced pedagogic materials. ICP	

			promoted ‘apolitical’ local culture and identity.
	Pro-independence promoted local culture and identity claims endorsing exclusionary and vulnerability-enhancing conditions.	creoles Merged identitarian and reindications; an idealized, peaceful, and patriarchal <i>hispanophilic</i> past vis-à-vis US oppression.	Future Commonwealth leaders addressed rural cultural sensibilities attached to patriotic sentiments, to hinder separatism and channel social changes.
	Identitarian constructions and public education excluded hurricane memories and awareness.	Identitarian constructions and public education excluded hurricane memories and awareness. School books included hurricane lists.	Identitarian constructions and public education excluded hurricane memories and awareness. Post 1956, DIVEDCO tackled disasters uncritically.
Beliefs and superstitions	Indigenous groups had developed superstitions but also valid knowledge, including storm forecasting. Spaniards believed that indigenous forecasting and all associated ideas were related to Satan, which justified destruction.	Although contemporary data was not found, a subsequent documentary indicates that people trusted forecasting based on animals in distress, the presence of coastal birds flying inland to avoid storms, and avocado crop forecasting.	People trusted forecasting based on falling spider webs, animals in calluses, the presence of a coastal bird flying inland to avoid storms, and avocado crop forecasting. Allegedly, ancestral heritage supported the latter belief.
	Catholic traditions included invoking God, the Virgin Mary and saints during a crisis; naming storms according to Saint Day; using churches and chapels as ad-hoc refuges (due to their sturdiness, lack of secular options and role of religion); and processions.	Catholic traditions included invoking God, the Virgin Mary and saints during a crisis; naming storms according to Saint Day; using churches and chapels as ad-hoc refuges (due to their sturdiness, lack of secular options and role of religion).	Catholic traditions included invoking God, the Virgin Mary and saints during a crisis; naming storms according to Saint Day (Americans proposed alphabetical order). Disaster homeless sheltered in public schools.
	Catholic authorities and parishioners explained disasters as God’s wrath towards deserving sinful people. No records of Americans matching religion, sins and disasters.	No records of public diatribes by religious leaders and parishioners explaining disasters as God’s wrath towards deserving sinful people.	No records of public diatribes by religious leaders and parishioners justifying disasters as explaining wrath towards deserving sinful people.
Scientific knowledge	Meteorology grew obeying martial U.S. objectives.	Meteorology lost weight; the U.S. was not at war.	Meteorology grew obeying martial U.S. objectives.
	During late Spanish control, Cuban meteorology included Puerto Rico. The Spanish-American War motivated the Army Signals Corp to launch Caribbean meteorological research. Under the U.S. National Weather Service, the San Juan Weather Bureau was barely established before San Ciriaco; it built useful knowledge.	S.J. Weather Bureau equipment improved and adjacent radio station rapidly broadcasted.	PRRA funded modest academic investment to enhance military weather studies. Meteorology rose during WWII to protect aviation, and the Cold War as ‘Weather control’ was a military priority and two hurricane seasons brought destruction. 1950s hurricane policies were top-down, controlled by the military, bureaucrats and scientists; delinked from social sciences and humanities, or participatory approaches. Cold War logic bonded floods, storms, fire and nuclear threats.

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Predominance of religion and Decreased dominance of Decreased dominance of
ignorance over underdeveloped religion, but widespread religion; traditional beliefs
science and knowledge. Very ignorance was not offset by widely valued as new costly
limited media dissemination. underdeveloped science and technology and modernity
knowledge. Growing media paradigms. Science and media
dissemination. confronted religious dogmas,
superstitions, and ignorance. TV
news changed public hurricane
awareness.

Table 7. Theme 3. RELIEF. 3.1. How did a previous relief experience or process create influential conditions for the relief stage of San Ciriaco, San Felipe and Santa Clara?

THEME 3. RELIEF: Sub-question 3.1 Previous disaster			
	San Ciriaco (1899)	San Felipe (1928)	Santa Clara (1956)
Disaster	1867 droughts, San Narciso hurricane, seismic crisis. Scarce data.	1927 Great Mississippi River floods.	Transformative processes: the New Deal, WWII, the Cold War, 1950s storms.
Relief provider	Municipalities, but most of them were broke, unable to launch successful post-disaster actions. The Spanish government first posed unfeasible demands, latter offered uneven help.	The American Red Cross, a congressionally-chartered quasi-governmental entity run by professionals and volunteers, became almost a federal disaster-response agency using a ‘governing by network’ scheme.	Old and new federal institutions expanded disaster management during the New Deal, WWII and the Cold War; Civil Defense became paramount. State and local governments had prominent roles also.
Underlying paradigms	The Spanish Crown and island representatives should not address local ‘natural’ disasters or God’s wrath towards deserving sinful people.	The federal government should not address local ‘natural’ disasters.	The federal government should address ‘natural’ disasters and war. Allegedly, technical disaster management with a martial bias was tied to economic growth, not politics or culture.
	The Spanish Crown stepped in only during critical situations endangering its rule.	The Army stepped in only if havoc was vast.	Civil Defense mainly taught self-protection to citizens, until the government stepped in.
	Religious entities and charitable wealthy citizens could engage and impose their prejudices without oversee or accountability.	Charitable and private entities were endorsed to undertake relief and reconstruction. Religious entities offered help.	Private entities and volunteerism were welcome to undertake relief and reconstruction.
	Municipalities undertook some relief and reconstruction tasks. Locals were to provide for themselves.	State and local institutions should undertake relief and reconstruction. Locals were to provide for themselves. Aid indulged vagrancy, recipients had to earn it.	State and local institutions should handle non-martial crisis preparedness and reconstruction. Anti-communist bias deterred collective organization.
	Biases in relief distribution	No data was found, possibly because relief was minimal, not systematized or records have been lost.	Race and class-based discrimination.
Controversies	Municipalities could not meet the island government’s request of overdue municipal relief supplies. payments due to increasing expenses; planters could not afford taxes and payments for the right to import goods for consumption. Both requests were eliminated; yet, tensions remained. Royal expenses had not translated into infrastructure that would have reduced	Poor African-Americans unjustly delayed from evacuation and request of overdue municipal relief supplies. In the worse cases, Black evacuees in Red Cross refugee camps were brutalized, forced to work or barred from leaving. Agricultural, housing and funding relief neglected evacuees. Decentralized execution implied minimal federal supervision and lax accountability of relief workers.	Sexist division of tasks, overvaluing so-called manly activities. President Truman increased military and civil defense expenses, after critiques for lack of headship during a potential crisis. Temporary housing in a legislative vacuum for federal funding.

	<p>calamities. Despite federal budget surplus, Lack of public utility works flood victims did not receive reinforced the Creoles' rebuff direct aid. of Spain, and rising grass-roots discontent.</p>	
Policy-changes	<p>Incipient proposal of extensive New private and state public works, including reconstruction corporations in reconstruction of bridges, charge of a credit provision plan, docks, roads and public but failed to make loans to services. citizens in need and became Highly variable fiascos. implementation; hard to The 1928 Flood Control Act and correlate to the disaster crisis, Okeechobee (San Felipe) local political upheaval, changed flood control changes in Spain or the management by the Corps of Governor's mood. Engineers, state and federal There are no recorded policy- legislation. changes to reduce and mitigate More federal involvement into disasters as a governmental spheres left to state and local responsibility, requiring authorities. investment and planning. A template of disaster relief used in Puerto Rico.</p>	<p>Disaster management became a federal task. Standard Project Hurricane to define flooding protection systems, building and zoning codes, and urban growth. It was methodologically flawed, as hurricane Katrina showed. Federal administrations skipped cultural interventions related to disasters, but an education campaign that insisted on individual responsibility during emergencies.</p>
Political consequences	<p>Some Spanish officials The man in charge of relief, The New Deal launched federal foresaw deplorable relief as a Herbert Hoover, gained control of disaster engagement, which catalyzer to fight colonialism, the media, minimized his shrank towards conservatives heralding the decline of Spain. administrations' failures and since the 1940s. A martial bias In September of 1868, before reshaped himself from a non- was brought grouping war and reconstruction was decided, contender to a national hero disasters, neglecting non- the failed <i>Grito de Lares</i> deserving the presidency in 1928. bellicose preparations, funding insurrection was launched. The Paradoxically, relief failures such climatic experiments, stressing crisis could have been an extra as abuses in the camps and individual preparedness and motivation to coalesce around Hoover's failed promises to voluntary engagement, and a pro-independence armed African-Americans alienated Black leaving reconstruction to local struggle (a claim that needs voters in his re-election campaign and state spheres. Leadership further research). four years later.</p>	<p>during a crisis was interpreted as a key political strength.</p>

Table 8. Theme 3. RELIEF 3.2. Which were the defining elements for hurricane relief and incipient policy trends concerning San Ciriaco, San Felipe and Santa Clara?

THEME 3. RELIEF: Sub-question 3.2 Case study			
	San Ciriaco (1899)	San Felipe (1928)	Santa Clara (1956)
Main challenges	Multifaceted political tensions, meager federal engagement, poverty, vast destruction, new inexperienced authorities, cash-depleted Creoles and municipalities, religion and beliefs trumpeting embryonic science and knowledge.	Multifaceted political tensions, meager federal engagement, top-down oppression, bottom-up frustration, poverty, vast destruction, beliefs trumpeting incipient science and knowledge.	Multifaceted political tensions, increased federal and island government partaking yet inexperienced for disasters, top-down oppression, bottom-up frustration, poverty, destruction, beliefs clashing with faltering science and knowledge.
	The priorities were to minimize starvation, tend to the worst agricultural damages, stop vagrancy, and secure U.S. control.	The priorities were to avoid food, health and housing crises, tend to the worst agricultural damages, stop vagrancy and deter rebellion.	The priorities were to avoid food, health and housing crises, tend to the worst agricultural damages, and secure the Commonwealth and Gov. positions.
Relief provider	The U.S. Army, which created the San Juan Charity Board, town boards, an advisory board and military inspection zones.	U.S. Red Cross. Organizations joined impromptu.	The Commonwealth. The federal government joined when asked. Organizations and individuals joined impromptu.
Underlying paradigms	Federal involvement in state and local affairs had to be limited to extreme crisis. The Army joined if havoc was vast. Locals were to provide for themselves. Charity and entrepreneurial entities were endorsed in relief and reconstruction. Aid was defamed as vagrancy indulgence, recipients must earn it.	Federal involvement in state and local affairs had to be limited to extreme crisis. The Army joined if havoc was vast. Locals were to provide for themselves. Charity and entrepreneurial entities were endorsed in relief and reconstruction. Aid was defamed as vagrancy indulgence, recipients must earn it.	Increased federal help depended on state authorities' request. The Army joined if havoc was vast. The Commonwealth would provide for locals showing sovereignty and solid policy-making. Charity, entrepreneurial entities and volunteers welcomed in relief and reconstruction.
Biases in relief distribution	Biased assertions by Americans and Creoles justified discipline and denial of universal relief provision. Tax breaks for intact municipalities, planters and entrepreneurs. Planters distributed food among workers, with few obligations including a grip to avoid vagrants.	Race and class-based discrimination in refugee camps, provision of food, seeds, farm implements, rural employment and housing rebuilding.	Most federal credits and compensations went to U.S. sugar corporations and coffee planters, used to secure relief. Limited funding to small-scale local farmers growing pineapple, tobacco, plantains and bananas, or foodstuff for local consumption.
Controversies	Relief on the coffee highlands was insufficient and caused unemployment, disease, migration, starvation and death among the poor. Rotting food distributed among workers and disaster victims was eventually	Inadequate donated used U.S clothing. Rationed food for children and women shrank to pay for medical crisis; isolated towns and work. Failed food relief set off hunger and death. Reconstruction payments hurt workers.	Entrenched vulnerability, i.e. scarce construction materials; housing, food and clothes deficits; agricultural damages. Deficient local responses; delayed federal relief because the Governor

	<p>condemned. Disaster migrants abroad endured harsh conditions; and faced eviction in urban slums. U.S. Congress debated harsh propositions.</p>	<p>Initial farming help to coffee planters failed. Second phase included underpaid clean-up and housing rebuilding without redistribution. Lack of supplies delayed repairs. Camp refugees lacked transitioning support. Migrants in urban slums faced eviction. U.S. Army helped less. U.S. Congress debated harsh propositions.</p>
Policy-changes	<p>Prioritization of sugar exports, controlled by U.S. corporations; coffee neglect; displacement of creoles, increased vulnerability. Return of US\$2 million from island generated taxes since occupation, used for insufficient infrastructure repairs and to coerce workers. Revalidation of San Juan primacy; increased migrants and slums. Suspension of mortgage laws favoring locals. Hookworm-anemia and treatment discovery. Meteorology used for political, fundraising and scientific purposes. Brief coffee relief program helped planters, but co-opted them and created dependency. Coffee workers disadvantaged.</p>	<p>The new Puerto Rican Hurricane Relief Commission was delinked from redevelopment, planning, or disaster management goals. It should give credit to farmers who reunited tenure, assets or ownership, reduce costs via plots and services, failed to make loans to those who needed them and became a fiasco. Reduction of federal relief and reconstruction funds. In 1932, acting Gov. James Beverly used his San Felipe experience for San Ciprián disaster management, such as instructing mayors to create emergency committees and a relief fund, and publicizing a plan of warning flags flying from city halls and churches.</p>
Political consequences	<p>Pitiable disaster relief weakened the option of independence and laid the ground for underdevelopment.</p>	<p>Pitiable disaster relief fueled underdevelopment and independence demands, worsened after San Ciprián (1932). The crisis, neglect and injustices radicalized Puerto Ricans in armed platforms.</p>