Figure 1

SAN JUAN
PUERTO RICO

2022 Exploring Urban Resilience Pathways

International Master CITY RESILIENCE Design and Management EDU | uic barcelona

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About the report and the collection

Exploring Urban Resilience Pathways

This report is part of a collection wishing to provide a global overview about different cities' experience in resilience, and how this is evolving. The series is titled "Exploring Urban Resilience Pathways" and each report is prepared by one student of the Int. MSc. in City Resilience Design and Management (URNet-UIC Barcelona). During the first semester, students develop these reports as a learning outcome for their acquired analytical skills: to find, understand, organize and communicate critically different perspectives, approaches and models of urban resilience implementation, in a chosen city.

The aim of each report is thus to offer an easy-to-read overview about how adaptive capacities have been evolving in a selected city. The reports explore the past and current mechanisms through which each city responded to overlapping shocks and stresses. Nowadays current City Resilience Strategies – launched and supported by the Rockefeller 100RC program – are included within these analyses, representing the ultimate trend of understanding and implementing city resilience. Finally, current COVID19 pandemic responses are the final lens through which resilience mechanisms are discussed, to understand the alignment of resilience with other key urban goals, and ultimately respect to urban living.

What is interesting to learn from this series of reports, is that each of them critically discusses how cities managed adaptive responses to different treats, and how the concept of resilience evolved. Although the scope of these reports is ambitious and the analysis could result complex, the presentation has been designed to be easy to read and accessible to the general public. Each report of this collection maintains a standard structure, facilitating the reading and the reports (and cities) comparison.

Hope this initiative contributes to spread the understanding about how resilience has been framed and implemented in many cities across the globe.

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Director of the International Msc. in City Resilience Design and Management

SAN JUAN **PUERTO RICO**

2022 Exploring Urban Resilience Pathways

SUMMARY

San Juan, Puerto Rico is a Caribbean city rich with heritage and culture with a legacy of colonialism still shaping its future. It shares a complicated history with the United States as a territory, which ties much of its planning, funding, and infrastructure to the mainland and its interests. This creates challenges in a location that is already precarious from a climate risk perspective.

After discussing the historical, geographical, and socioeconomic context of San Juan, this report will thoroughly examine the city through a lens of resilience. Much of the discussion will be framed around the most significant climate crises in San Juan's history – Hurricanes Irma and Maria in 2017, two massive hurricanes 12 days apart. Much of the literature, government response, and transition to resilience was catalyzed by these events. The momentum and planning that began in 2017 and continued through the present has culminated in the Disaster Recovery Action Plan – an extensive roadmap that incorporated input from the Resilient Puerto Rico Advisory Committee in partnership with 100 Resilient Cities. These governmental policies are occasionally, but not always in sync with the grassroots movements on the Island.

Though this report is focused on the City of San Juan, many of the strategies and vulnerabilities are shared by Puerto Rico, an Island with 3.3 million total inhabitants approximately one-fifth the size of The Netherlands. For this reason, the two are often used interchangeably to indicate the interconnected nature of the city and the multi-scalar nature of the responses in this context.

Many of the threats, as well as potential implementations and solutions discussed have applicability to other cities and island nations. Centered around social well-being, equity, inclusion, transparency, coordination, and collaboration – these strategies will help Puerto Rico rebuild stronger, vibrant, and more resilient in the face of crises.

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LIST OF **ACRONYMS**

100 RC	100 Resilient Cities
CARES Act	Coronavirus Air, Relief, and Economic Security Act
CDBG	Community Development Block Grant
COR3	Central Office for Recovery, Reconstruction and Resiliency
CRF	Coronavirus Relief Fund
DCER	Department of Natural and Environmental Resources
DOE	U.S. Department of Energy
EIA	U.S. Energy Information Administration
FEMA	U.S. Federal Emergency Management Agency
FOMB	Financial Oversight and Management Board for Puerto Rico
GIS	Geographic Information System
HUD	U.S. Department of Housing and Urban Development
IEEE	Institute of Electrical and Electronics Engineers
IRP	Integrated Resource Plan
NASEO	National Association of State Energy Officials
NFIP	National Flood Insurance Program
NRDC	Natural Resources Defense Council, Inc.
NOAA	U.S. National Oceanic and Atmospheric Administration
PR	Puerto Rico
PRCZMP	Puerto Rico's Coastal Zone Management Program
PREB	Puerto Rico Energy Bureau
PREPA	Puerto Rico Electric Power Authority
PROMESA	Puerto Rico Oversight, Management, and Economic Stability Act
SEC	Sustainable Energy Council
U.S.	United States

INTRO
SAN JUAN

History

The capital city of San Juan was first aptly named *Ciudad de Puerto Rico* ("Rich Port City") before the entire island became known as Puerto Rico. Located on the Northern coast of the Island on the Atlantic Ocean, San Juan was once home to the Taíno, an Arawak people who were the indigenous people of the Caribbean. Founded in 1519 by Juan Ponce de León, San Juan became an important strategic port, first as a colony of Spain and then later the United States (U.S.) (Pabón-Charneco, 2017). The relationship between the U.S. and Puerto Rico is complex and controversial, rooted in Puerto Rico's status as a colony, first established under the Spanish crown in the 15th century. Currently, it is a U.S. territory where residents retain citizenship but not full political representation. As such, there is no clear path to statehood yet no economic sovereignty. There are five major opinions on how to move forward from this perpetual limbo: s*tatus quo, enhanced commonwealth, statehood, independence,* and *free association* (Cheatham & Roy, 2022). Given the highly political nature of these decisions, it is uncertain how Puerto Rico's status will change, if at all, in the next five, ten, or fifty years. However, whatever the outcome, it will have a significant impact on the ability of San Juan to build resilience.

Figure 2


Figure 3

Figure 4

Spatial Context

Puerto Rico is comprised of three main types of geography – the mountainous region in the center that covers 60% of the island, coastal lowlands where San Juan is located, and the karst areas on the northern and southern coasts (CDBG, 2018). San Juan has a tropical monsoon climate, with an average daily high temperature of 27° C, with rain nearly 200 days per year. More than one-third of San Juan's area is made up of two natural lagoons and faces a variety of environmental hazards, including hurricanes, flash floods, tropical cyclones, riverine flooding, tsunamis, landslides, earthquakes, and droughts. Though the 2017 hurricanes were one of the most devastating events, there have been significant environmental and socioeconomic shocks for decades. The Resilient Puerto Rico Advisory Commission noted, "Between 1998 and 2017, the Governor of Puerto Rico has recognized over 45 emergency and disaster declarations associated with these shocks" (ReImagina, 2018).

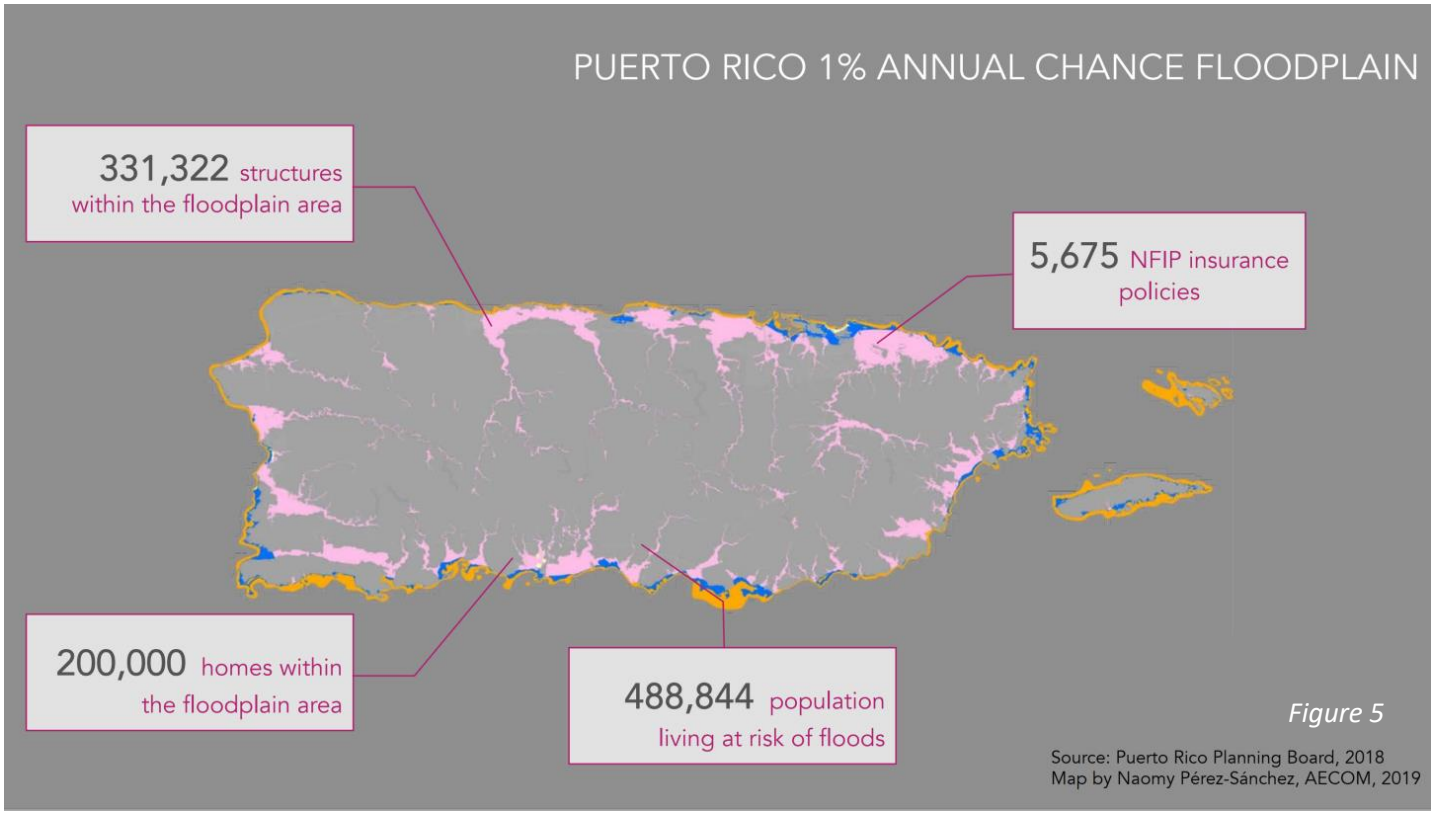

Figure 5

Built Environment

As one of the oldest European-established municipalities in the Americas, San Juan's infrastructure has aged significantly without the required maintenance. During the hurricanes, the rainwater and sanitary sewers are pushed past the limit of functionality. Similarly, the already aging electrical grid was devastated during Hurricane Maria – leaving 1.35 million without electricity for nearly six months (Budhoo, et. al, 2018). Power outages were common even before the hurricanes and there is rich architectural heritage to be preserved during the reconstruction.

Socioeconomic Context

The population of San Juan is approximately 337,0000 with nearly two million inhabitants in the greater San Juan metro area – accounting for more than 60% of the total population of Puerto Rico (U.S. Census, 2022). The demographics below highlight some key socioeconomic disparities that underlie all issues in the country. Compounding this, Puerto Rico has been in a state of sustained recession since 2006 with public debt totaling more than $70 billion and $43 billion in unfunded pension liabilities prior to Hurricane Maria (Torres, 2018). The reasons for the economic crises are varied but include federal funding shortfalls, tax policies that hinder economic growth, predatory lending by hedge funds, the Great Recession, outmigration, increasing healthcare and energy costs, and poor budget practices (Cordero-Guzman et. al, 2015).

Puerto Rico Demographics

41.2%
Families under poverty level
U.S. 11%

$19,606
Median Household Income
U.S. $55,332

24.2%
18 years+ with no high school diploma
U.S. 11%

0.54
Highest Gini* coefficient in the U.S.
U.S. 0.48

*The Gini coefficient is an indicator of income inequalities across populations and is higher in Puerto Rico than anywhere else in the United States

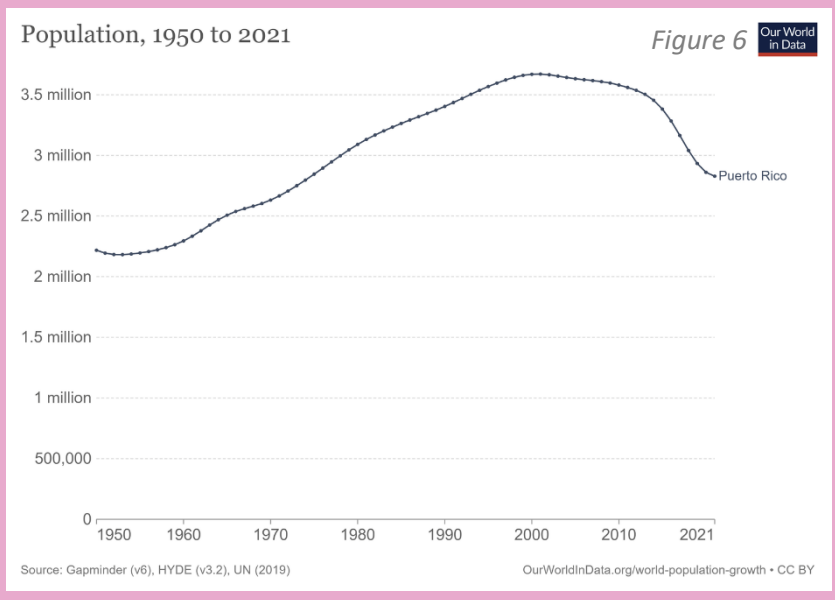

Figure 6

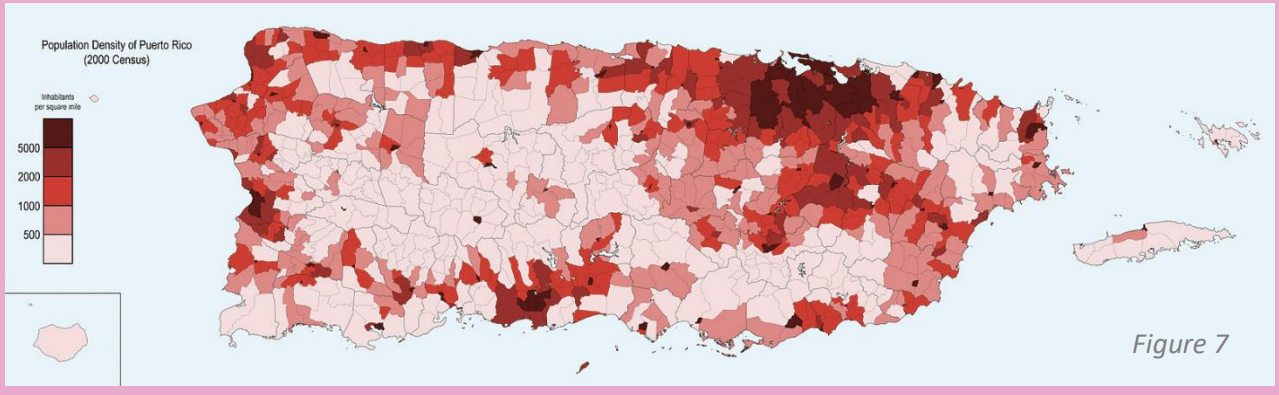

Figure 7

Figure 8

CITY PAST
ADAPTIVE PATHWAY

To better understand how San Juan has developed and responded to emergencies prior to the emergence of resilience strategies, it is key to identify its vulnerabilities as a city. These can be conceptualized as shocks and stresses which are highlighted below, adapted from the 2018 ReImagina report.

SHOCKS

- HURRICANES & TROPICAL STORMS
- HEATWAVES
- FLOODS
- EARTHQUAKES & TSUNAMIS
- LANDSLIDES & GROUND SUBSIDENCE
- EPIDEMICS
- FAILURE OF HEALTH, COMMUNICATION ENERGY, FUEL, WATER, AND FOOD DISTRIBUTION SYSTEMS

STRESSES

- LACK OF FISCAL INDEPENDENCE
- ECONOMIC DEPRESSION
- UNEMPLOYMENT & UNDEREMPLOYMENT
- INABILITY TO PAY MORTGAGES & FORECLOSURE
- PERSONAL DEBT & INCREASE IN COST OF LIVING
- VULNERABLE POPULATIONS IN HIGH-RISK AREAS
- LACK OF SAFE & AFFORDABLE HOUSING
- OWNERSHIP & TENURE MATTERS
- LOSS OF HOME AND PERSONAL PROPERTY
- OBSOLETE, DETERIORATED & AGING INFRASTRUCTURE
- URBAN DEFORESTATION & POOR ACCESS TO GREEN SPACES
- IMPROPER USE OF THE LAND
- INCREASE IN SEA LEVEL & EROSION OF COAST & RIVERS
- DROUGHT
- INCREASED ENERGY PRODUCTION COST
- POOR ACCESS TO MENTAL HEALTH, PREVENTATIVE & MEDICAL TREATMENT SERVICES
- MIGRATION OF HEALTH PROFESSIONALS
- AGING OF THE POP. & SOCIAL INSECURITY FOR RETIREES
- LACK OF PREPARATION BEFORE EXTREME SHOCKS
- LIMITED GOV. RESOURCES TO MEET ESSENTIAL NEEDS & SERVICES
- LACK OF MUNICIPAL AND COMMUNITY PARTICIPATION IN DECISION MAKING
- DISCRIMINATION
- VIOLENCE & CRIME
- SCHOOL CLOSURE

Figure 9

Though there are myriad issues, three major vulnerabilities are outlined in this section and addressed throughout the report – a *deteriorated electrical grid*, *housing instability*, and a *struggling economy*.

Deteriorated Electrical Grid

One of the most cross-sector vulnerabilities in Puerto Rico is an energy grid that has been underfunded and failing long before Hurricanes Irma and Maria in 2017. This unreliable grid impacts not only disaster recovery, but daily life on the Island. In Figures 10 and 11, there is a map detailing the energy grid a timeline of usage from 2011-2017, with a clear reliance on petroleum, natural gas, and coal. This reliance is not only environmentally problematic, but the Jones Act of 1920 makes it extremely unaffordable for residents. This obscure shipping regulation requires goods shipped from one U.S. port to another to be done on American-built, American-owned, and crewed by U.S. citizens or permanent residents which, for a variety of reasons, makes nearly everything in Puerto Rico more expensive compared to the U.S. mainland or nearby Caribbean islands (Yglesias, 2017).

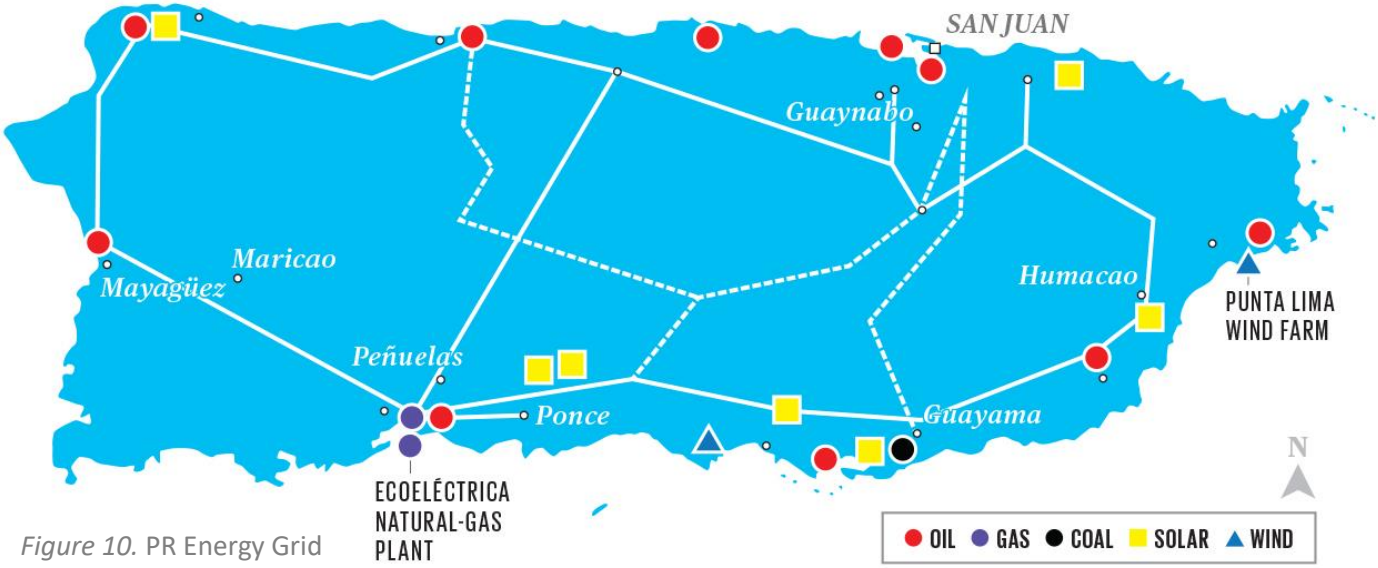

Figure 10. PR Energy Grid

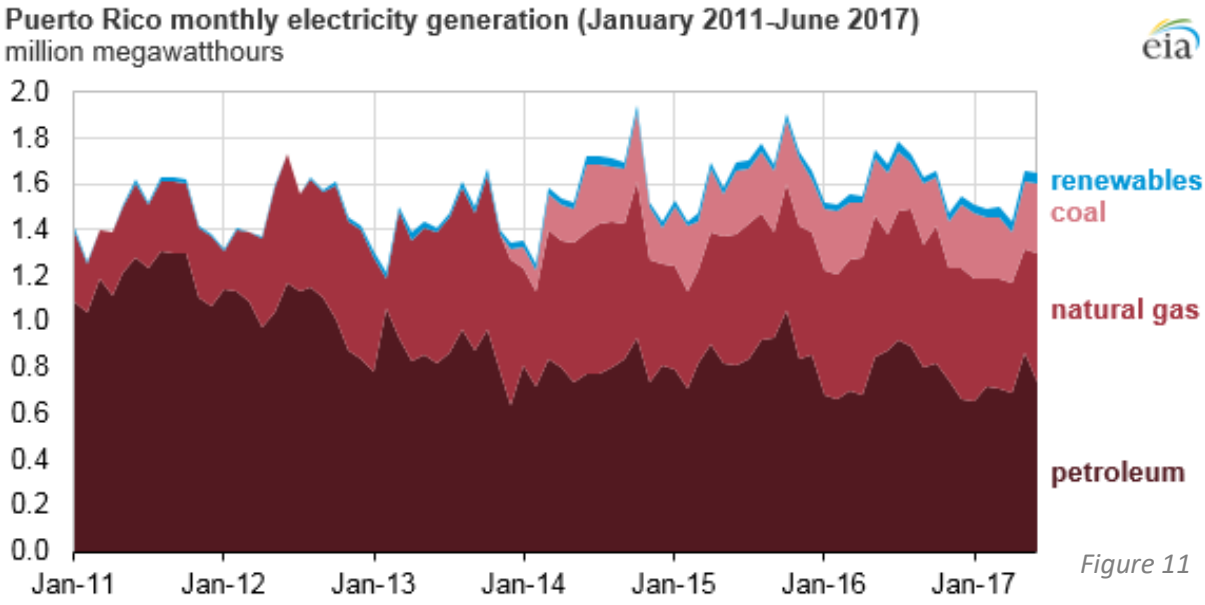

Figure 11

Since the 2017 hurricanes, there have been plans made to transition to 100% renewables, with potential mini-grid coverage outlined on the map in Figure 12. By switching from majorly centralized energy production, micro-grids could potentially avert hurricane damage that would wipe out the electrical system for the entire island as happened in 2017 and alleviate economic burdens of natural gas and oil.

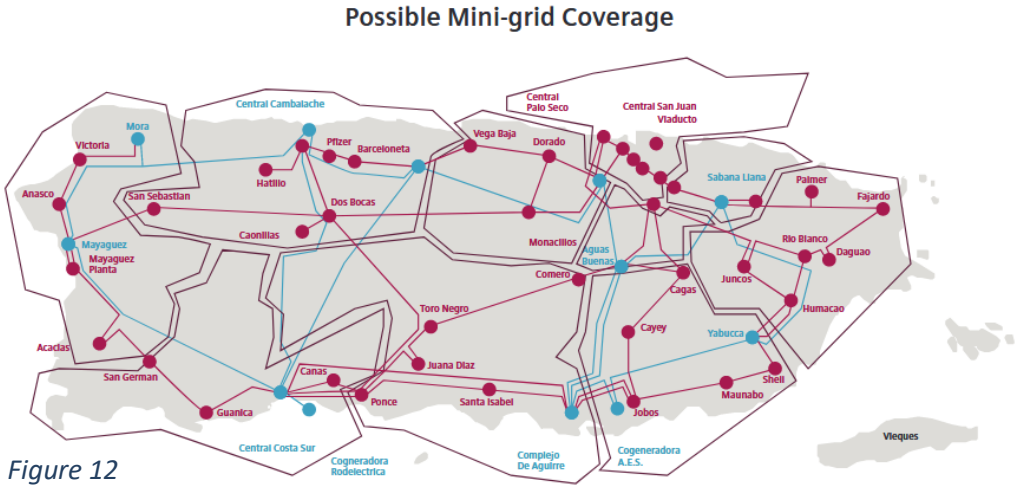

Figure 12

Hurricane Maria left 1.35 million residents without electricity and damaged 80% of the transmission lines leaving most of the island without power for 181 days (Bundhoo et. al, 2018). Even before this devastating failure, the Puerto Rico Electric Power Authority (PREPA) was in need of approximately $4 billion to upgrade infrastructure, having filed for bankruptcy just a few months before in July 2017. The failure of the power grid is the initial shock that leads to cascading failures such as loss of access to healthcare services, loss of communications, and water system failures. Approximately 70% of the potable water treatment and distribution system was damaged during the hurricanes, partially due to the grid failure associated with them (ReImagina, 2018). The image below shows the financial impact of Hurricane Maria and the wind speeds that caused much of this damage.

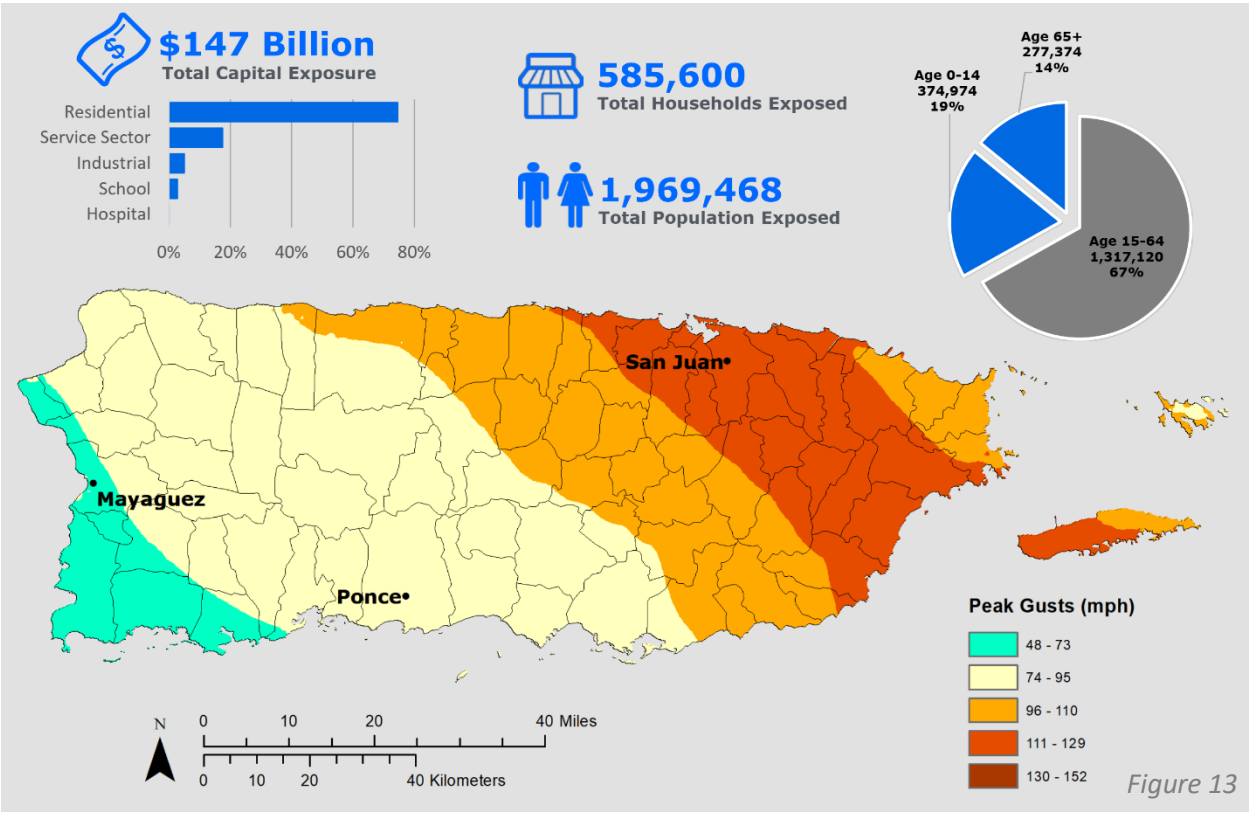

Figure 13

Housing Instability

The legacy of colonialism is felt clearly in the land ownership structure of many residents in San Juan which makes the housing market in Puerto Rico vulnerable from both a physical standpoint and from a legal one. An estimated, "45-55% of Puerto Rican households have erected or maintained houses through informal construction" (CDBG, 2018). Using these self-made methods is risky not only from a building code or design perspective, but many of them are done on land without proper real estate title. For those who cannot show proper title, ownership is tenuous, and in the face of disaster, traditional funds or relief options like homeowners' insurance or post-disaster Federal Emergency Management Agency (FEMA) funds may not be available. For example, FEMA denied approximately 62% of applications for aid after Hurricane Maria, arguing that applicants lacked proper title to the land on which their homes were built (Pérez Figueroa & Aponte Rolón, 2020). Land titles were historically only afforded to the sugarcane and factory landowners, not the workers who lived on these lands. Over generations, as farms shifted to become residential areas, the land titles were not accurately updated or transferred to the workers – resulting in a further marginalization for low-income residents.

Even for those with proper title, there is a significant risk of foreclosure due to economic woes – with nearly $2.6 billion in delinquent loans in Puerto Rico in 2018 following the hurricane. Outside of title and ownership, many properties are aging, as 40% of the single-family housing stock was built before 1970 and 31% between 1970-1989 (CDBG, 2018). The variability in these issues can make it challenging for institutional solutions to address each kind of issue. Many of the economic stimulus policies and responses in Puerto Rican history have been targeted to a traditional landowner, completing neglecting the many owners who fall outside of these bounds.

Figure 14. Building damaged after Hurricane Maria

Struggling Economy

While it may seem obvious that economic stability is key to urban resilience, the study published by Santos-Lozada et. al (2020) makes the argument that a struggling economy, not climate disasters, is the main cause of outmigration from Puerto Rico. Climate catastrophe and economy are intrinsically linked, and the investment needed to simply recover from the hurricanes is staggering. The Puerto Rican government estimated that they would need nearly $95 billion to fully recover, an estimate that is surely not going to be reached (ReImagina, 2018). To add to the difficulty, Puerto Rico filed for bankruptcy in 2017 prior to Hurricane Maria and was the largest municipal bankruptcy in U.S. history (Associated Press, 2022). The Puerto Rican government just formally exited bankruptcy in March 2022.

A difficult and expensive recovery aside, the demographics of Puerto Rico have been shifting for years – with an increase in the elderly population and those living below poverty levels. The graph below shows population and employment from 1990 to 2018 – with the colorful lines indicating major climate and economic shocks over the years. The dark blue line shows the population change and the dark red line the employment population adjusted for seasonality and excepting agriculture (Santos-Lozado et. al, 2020). Though there are small dips in population following climate shocks, the overarching trends point to a larger pattern of a struggling economy and longer lasting outmigration than simply during the recovery phase. This highlights the needs for a focus on resilience rather than recovery – as new patterns and methods for rebuilding for resilience need to be considered.

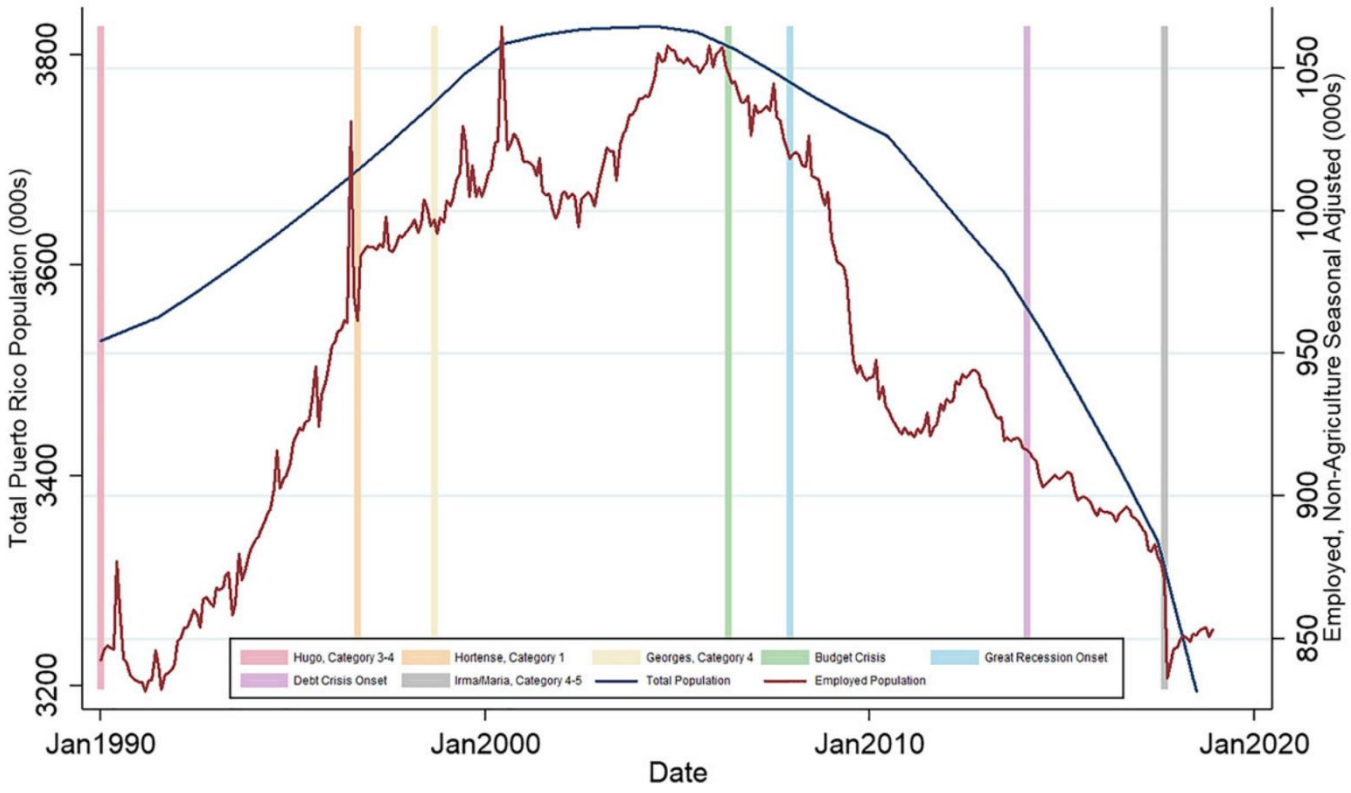

Figure 15. Population, Employment, and Major Shocks 1990 – 2018

Community Resilience

There is a tension in Puerto Rico between the governmental response to resilience and the communities that are – and have been – creating their own pathways to resilience for years. One example is in, "non-PRASA" communities, or ones that are not connected to the Puerto Rican Aqueduct and Sewer Authority (PRASA). Residents in these communities which number conservatively more than 100,000 have created their own water supply infrastructure and occasionally secondary treatment processes (Pérez Figueroa & Aponte Rolón, 2020). Though some consider this to be unsanitary, these external systems were critical following the collapse of the central water system and electric grid in the wake of the hurricanes. Community resilience through collective organizing for local food production also was necessary for those whom aid did not reach in the weeks after the storms. One such group called the María Fund is a network of grassroots organizing groups supporting community resilience. These decentralized, highly flexible and community driven projects provide an alternative model for resilience rather than all top-down from federal agencies.

Figure 16. Members of the Caño Community Land Trust

Translation: "...and for the first time, we the residents became actors of our own future."

Figure 17

Translation: "The land is ours."

Figure 18

MaríaFund REDES

Building Power... Together

Following this section is a timeline showing the prevalence of extreme weather events, coupled with a variety of tax law changes and urban policies that impact San Juan's ability to build and plan for resilience. Though tax laws do not have an direct impact on climate resilience, the economics of the Island cannot be ignored when considering the options and feasibility of any strategies. Due to the restrictions from the Financial Oversight Board for Puerto Rico and the U.S. Federal Courts on the budgeting of Puerto Rico due to its status as a U.S. territory, there are restrictions on recovery, rebuilding, and restructuring policies that other nations or cities may not encounter. This complicated relationship must be kept in mind when considering ways to make San Juan more resilient and know that it may require a drastic change in the structure of the Island.

A Timeline of Shocks & Government Decisions

Figure 19

NOWADAYS URBAN RESILIENCE

There are a variety of plans for the Island of Puerto Rico with some specific implementations focused on the City of San Juan. As noted earlier, this report will focus on both San Juan as a city and Puerto Rico as a whole, to better encompass the Island-wide solutions that will be necessary to change conditions in the city. Though most of these plans were created after the hurricanes, they continue to be adapted and changed as the needs of San Juan do as well. The residents of Puerto Rico have learned adaptability in the wake of these disasters but there is a limit to personal resilience, and it should be built into the plans and policies to truly create lasting change for the people.

Central Office for Recovery, Reconstruction and Resiliency (COR3)

This office was created in 2017 to receive and manage the major influx of federal funds in the wake of the hurricanes (Del Mar Quiles, 2018). It is a country-wide department and continues to handle much of the procurement and tracking of these funds. Figure 20 shows an example of the data published by this office to combine the outcomes of the many different infrastructure projects. This office is primarily focused on the physical infrastructure while other plans are more all-encompassing in addressing economics or social aspects of resilience (COR3).

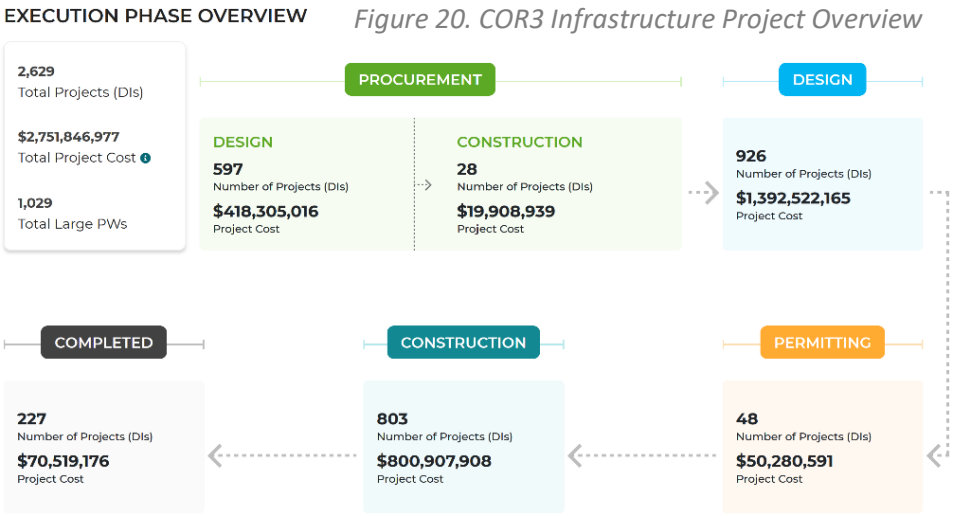

Figure 20. COR3 Infrastructure Project Overview

Disaster Recovery Action Plan, Updated 2022

This plan could be considered the "master plan" for the Island, though it is not titled as such. This plan recognized that in the wake of the significant destruction of the hurricanes, it was not enough to simply rebuild, but make significant upgrades to both infrastructure and social capital. Developed by the U.S. Community Development Block Grant (CDBG) office, this plan was developed as a hurricane recovery plan in 2018 that has been updated in subsequent years – most recently in February, 2022. This plan mirrors the major priorities identified in the ReImagina plan described below and was coordinated along with the many agencies that oversee and continue to work in Puerto Rico on these issues. Though this plan is centered around disaster recovery and is titled as such, it is notable here for the extensive nature and continual updates that include funding priorities. These are key to any realistic resilience plan as this funding will be key for feasibility.

This plan focuses on four main sectors with a variety of programs (Figure 21) for resilience centered around housing, but touches on the major vulnerabilities in San Juan. This report pays extra attention to the social vulnerabilities of populations and targets interventions to the most vulnerable neighborhoods and residents. Furthermore, there is a needed acknowledgement and concern for the significant amount of informally constructed houses. It will be key for all resilience measures to plan for these households – as some estimates are that 45-55% of all Puerto Rican households fall into this category (CDBG, 2018). Without creative assistance measures and a plan for transition to secure housing, recovery plans risk exacerbating the problem for the most vulnerable populations.

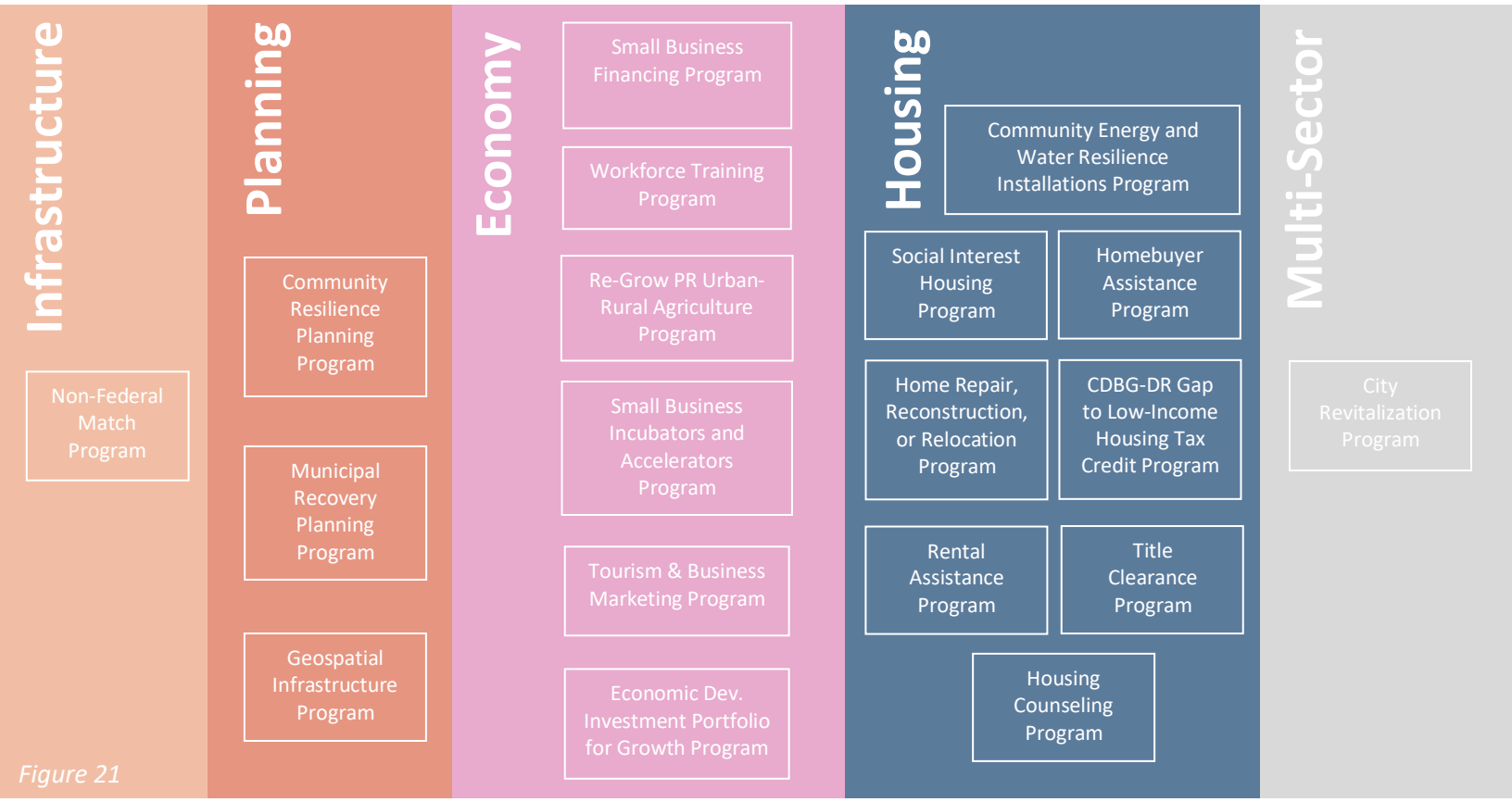

Figure 21

ReImagina Puerto Rico, 2018

The most specifically resilience-focused plan was written in 2018 by the Resilient Puerto Rico Commission and was the culmination of 77 meetings, involved 748 people and 485 different ideas for the reconstruction following the devastation of Hurricane Maria. Unique to many urban plans, this advisory commission was created as an independent, inclusive, non-partisan, and non-governmental body led by Puerto Ricans to navigate and coordinate a diverse group of stakeholders. This plan is country-wide, though focused on many implementations centered in San Juan, which is the capital, most populous region, and center of industry in Puerto Rico. One major positive aspect of this plan is the centering of community voices in communicating concerns and unmet needs. It could be considered an integrated plan but without specific funding attachment or long-term mainstreaming into departments, the plan has little feasibility for adoption. It included both long- and short-term implementations and considered many issues of equity, social justice, and building resilience at many levels.

Overall, the Resilient Puerto Rico Advisory Commission identified four recovery principles that would underlie all aspects of the recommendations:

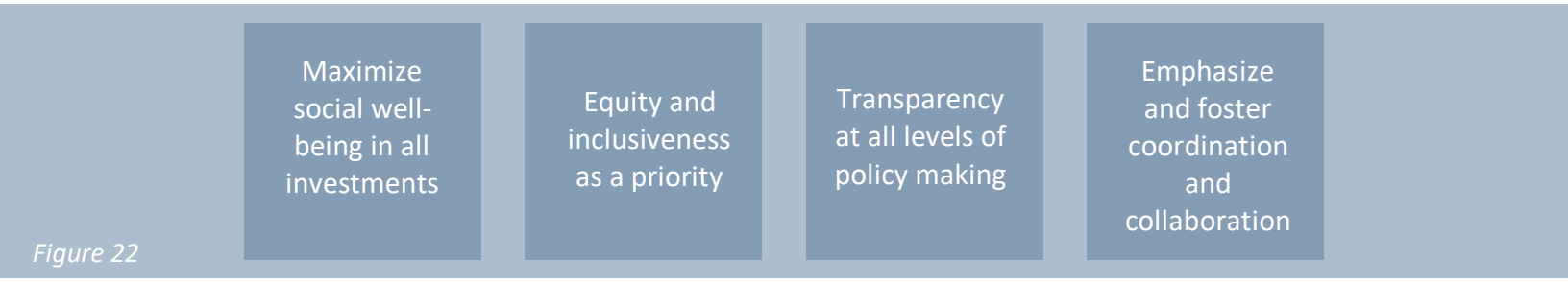

Figure 22

While these principles guided the work, there were sector representatives from six major areas:

Figure 23

For each of these areas, a portfolio of specific recommendations was identified. However, there was very little detail described for funding, feasibility, or timeline of implementation for these sector specific strategies. To better prioritize the most critical needs, the workgroup chose 17 unique recommendations that were of the highest priority – addressing issues that crossed multiple sectors. These 17 recommendations were broad and included primarily solutions that addressed physical infrastructure, digital infrastructure, the economy, and homeownership. For these in-depth recommendations, there was a potential lead organization, partners, funders, and timeframe identified – along with immediate next steps for implementation. However, as a non-governmental group with limited funding, it is likely many of these recommendations stalled after being written. There has been no update or follow-up to the variety of recommendations listed in this report since 2018, though many of them were incorporated into the Disaster Action Recovery Plan and taken over by the COR3 office.

Transformation and Innovation in the Wake of Devastation, 2018

This recovery plan was also targeted at disaster recovery and the economy, released by then Governor Ricardo Roselló and the COR3 office. It focused on four primary goals: society, economy, resilience, and infrastructure. There are short-term and long-term goals as part of this plan, but it's worth highlighting that the long-term goals are 3-11 years, which is a relatively short time period for rebuilding infrastructure of a certain magnitude. The proposed capital investments of this plan amounted to nearly $132 billion over an 11-year period, though there was $6.6 billion in strategic initiatives, "grounded in innovation, sustainability, and resilience." Though this sounds promising, it is important to note that this plan was written by the executive branch of government and noted that nearly $46 billion in the proposed plan was, "funding that will have to be sought out, but for which success remains uncertain."

Integrated Resource Plan, 2020

Unlike a city master plan, the Integrated Plan focuses specifically on the power grid of Puerto Rico, identified as a key area to build resilience. The Puerto Rico Energy Bureau (PREB) dictates plans for the Puerto Rico Electric Power Authority (PREPA) and in August 2020, issued an updated list of recommendations. Given the significant issues with the grid in Puerto Rico, improving this infrastructure for better use is critical. This update to the plan focuses on aggressive renewables deployment, a transition away from natural gas, and an encouragement of distributed solar and storage with an eye towards energy efficiency. It is important to note that this plan is focused on procurement regulations, not implementation requirements. Furthermore, there are few enforcement mechanisms built into the plan if the PREPA does not satisfy the requirements and there is a heavy reliance on private companies from outside the Island. Historically, there has been significant corruption in these contracts, going to politically connected firms with little evidence of success. One example of this was a $300 million contract to Whitefish Energy, a company based on Whitefish, Montana which employed only two people and was cancelled shortly after being awarded (Lu & Alcantara, 2018).

PR100: Puerto Rico Grid Resilience & Transition to 100% Renewable Energy, 2022

In contrast to the Integrated Resource Plan described above, the U.S. Department of Energy (DOE) has partnered with a team of national laboratories and local stakeholders to launch a two-year study starting in February 2022 to complete a comprehensive analysis on how to transition to fully clean energy. The Puerto Rico Energy Public Policy Act (Act 17) has committed to, "meeting its electricity needs with 100% renewable energy by 2050, along with realizing interim goals of 40% by 2025, 60% by 2040, the phaseout of coal-fired generation by 2038, and a 30% improvement in energy efficiency by 2040." This plan is top-down but appears highly integrated with a steering committee that involves stakeholders from PERPA, LUMA Energy (the main power provider in Puerto Rico), PREB, and the Puerto Rico Department of Housing. Though this plan is very new, it has significant potential to transition the energy grid to significantly more resilience, but it will be a few months or years until the outcomes are evident. There are outputs anticipated at regular intervals throughout the study with possible scenarios as outcomes and a clear outline of the potential funding that has already been allocated for recovery.

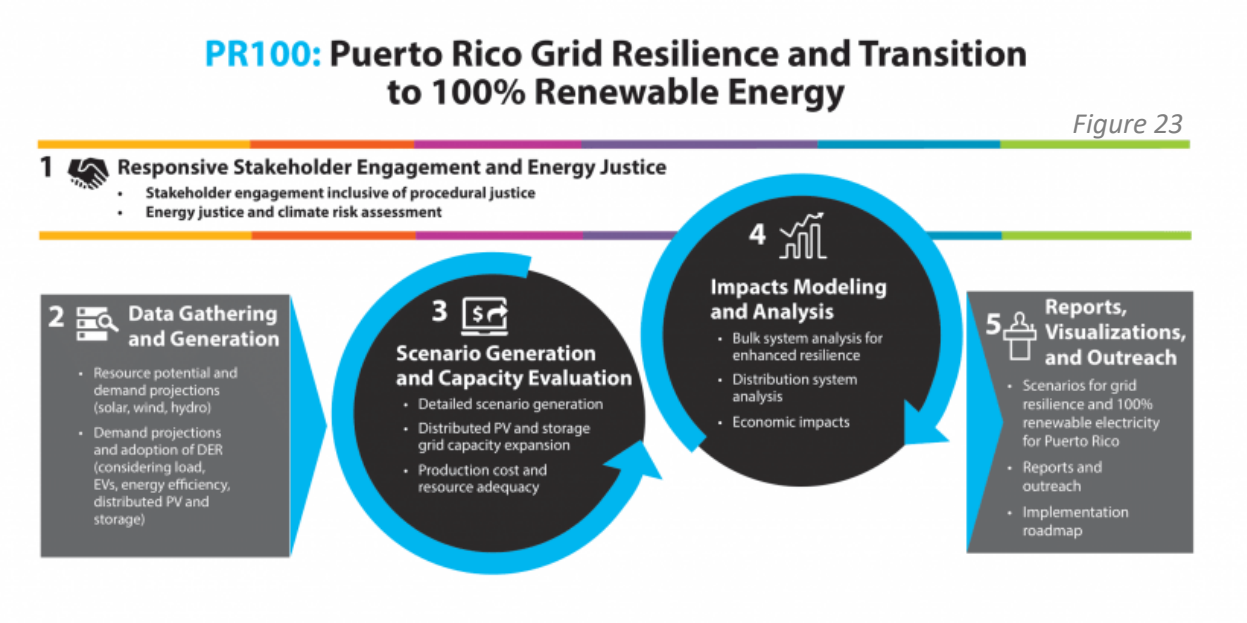

Figure 23

Readiness for Resilience, 2018

This last plan is another targeted plan that uses a frame of resilience, but it limited to technology implementations. Consisting of a partnership between the Smart Cities Council, Sustainable Energy Council, and the National Association of State Energy Officials, this plan makes the case for Smart Resilience but is largely a plan of recommendations and ideas. There is little data on specific next steps or coordinating agencies. For this reason, it may be useful to consider but needs further implementation development to be truly integrated or useful for practitioners.

Timeline of Resilience Plans

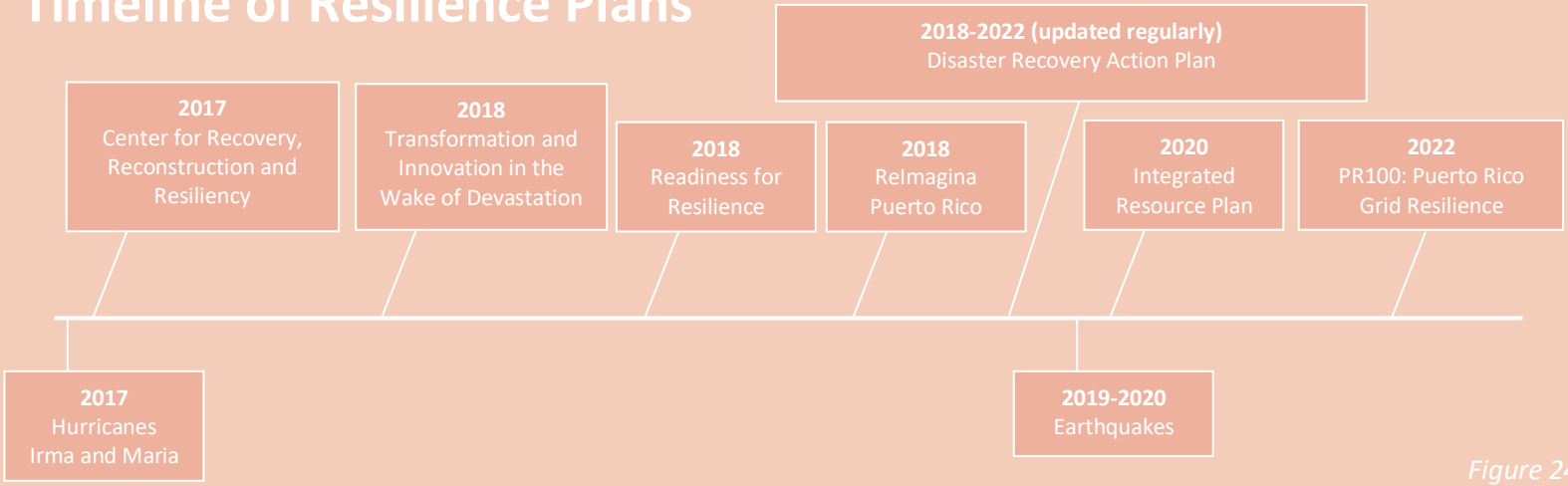

Figure 24

Figure 25

DISCUSSION & CONCLUSION

Can a city become be truly resilient while still living in the legacy of colonialism?

As a city planning principle, resilience was conceptualized and codified in Puerto Rico following the devastating hurricanes of 2017. This manifested in major plans to overhaul the infrastructure and ensure that the economy of San Juan could sustain the significant costs of rebuilding. However, the economic struggles of Puerto Rico began long before the hurricanes and have been complicated by the complex connection shared with the United States. In 2016, just one year prior to the hurricanes that spurred myriad disaster recovery plans, the U.S. government passed a law known as PROMESA, or the Puerto Rico Oversight, Management, and Economic Stability Act – at the time preventing a short-term financial collapse, but did not create long-term plans for stability, let alone resiliency. This is a prime example of 'status-quo' plans made to sustain the Island by both lawmakers locally and in the U.S. At the time, Senator Bob Menedez issued the following warning, "Mark my words – if we don't seize this opportunity to address this crisis in a meaningful way, we'll be right back here in a year from now picking up the pieces" (White, 2016). The crises he referred to was economic, but this report highlights that without funding to create or repair basic infrastructure, recovery will be severely challenged. During a review of PROMESA four years later in the midst of the COVID-19 pandemic, researchers highlighted the importance of investment in local governments, not austerity (Torres, 2020). This law, like the Jones Act of 1920, significantly hindered Puerto Rico's ability to self-govern and respond to crises. It also resulted in closure of many schools and community centers, all critical for resilience (Pérez Figueroa & Aponte Rolón, 2020). Though there are conflicting opinions on the status of Puerto Rico as a state, nation, or territory – it is obvious that policies that provide for half-measures or partial responsibility are not working.

After the hurricanes of 2017, earthquakes in 2019 and 2020, and the global COVID-19 pandemic that continues today, there is a shift towards resilience-focused planning that acknowledge that solutions must be ambitious and intersectional. That said, many of the plans about San Juan and discussed in this report do not address the governmental restructuring that must inevitably be a part of these solutions. In the academic study of resilience – whether is it from ecology research or social science work on communities – there is a key focus on the entire system and the holistic plans that need to account for the inherent complexity of systems. By exempting the fact that Puerto Rico remains in limbo, many of the plans will only function as band-aids to a broken bone, not as the inevitable surgery needed to reset the root causes of the inequities. There are many ways this restructuring could occur and this report will not focus on the politics – but will acknowledge that a change is necessary if Puerto Rico is to remain vibrant as a culture and Island.

One of the positive developments occurring in San Juan and Puerto Rico is that though nascent, these plans are considering long-term solutions, especially in terms of infrastructure. The Central Office for Recovery, Reconstruction and Resiliency (COR3) continues to be a centralized and more mainstreamed mechanism for integrating the various plans like the Disaster Recovery Action Plan, Integrated Resource Plan, PR100, and Readiness for Resilience. One trade-off in any centralized office is a lack of redundancy

or poly-centric governance, and occasionally a lack of diverse participation. This office could be strengthened by working more closely with the community organizers building resilience around Puerto Rico. Though COR3 was established for the purpose of recovery after hurricanes and climate risks, it has pivoted to address other crises like the pandemic. This adaptability is an important aspect of what scholars describe as "general resilience" rather than "specific resilience" (Chelleri et. al, 2015). Shifting from planning that aims to make buildings in San Juan more hurricane resistant to planning that aims to make the city more resistant to any shocks or stresses is quite different than traditional modes of planning – but is critical for the future of the city and the Island.

Outside of COR3, Puerto Rico is at a moment of potentiality for implementing many of the plans written in the last five years. There is significant federal funding from the climate disasters, American Rescue Plan funding that was allocated during the COVID-19 pandemic and the Puerto Rican government has just ended its bankruptcy. Additionally, there is a recognition at every scale that a continuation of the norms established prior to the pandemic are untenable. It remains unseen whether this moment of opportunity will be captured, but with studies like PR100 to establish 100% renewables on the Island there is some movement forward. Building all renewables often has a higher up-front cost, but the trade-off in future resilience is valuable. Furthermore, there are increasingly organizations like Proyecto ENLACE, G-8, Aqui Vive Gente, and Comedores Sociales – community organizing groups that are adopting placemaking practices and community-led measures towards resilience, regardless of government action (Negrón-Muntaner).

With so many disaster recovery plans citing resilience and as the word gets used by governments to describe their visions for the future, important questions emerge. Is resilience just a word to describe the people who have stayed and survived the decades of climate shocks and economic distress? Is resilience a trait for residents to cultivate or for the state that governs them? On an Island with its own culture and heritage, but with an undoubtable connection to the U.S. – what should this future look like? Who is responsible for reparations for harms done decades ago but where the legacy of marginalization lasts today? Can resilience in this city and Island occur without a reconciliation of this history?

When considering the resilience spiral established by researcher Bill Reed and adapted in Figure 26, it becomes clear that these questions underlie many of the established shocks and stresses of this report (2007). Currently, much of the system in Puerto Rico lies at conventional practice and may be striving for sustainability. To become truly resilient, a focus towards regeneration is required. This requires making long-term planning goals that require more short-term trade-offs. Though this is ultimately aspirational, there are steps that municipalities and communities can take to move away from conventional practice.

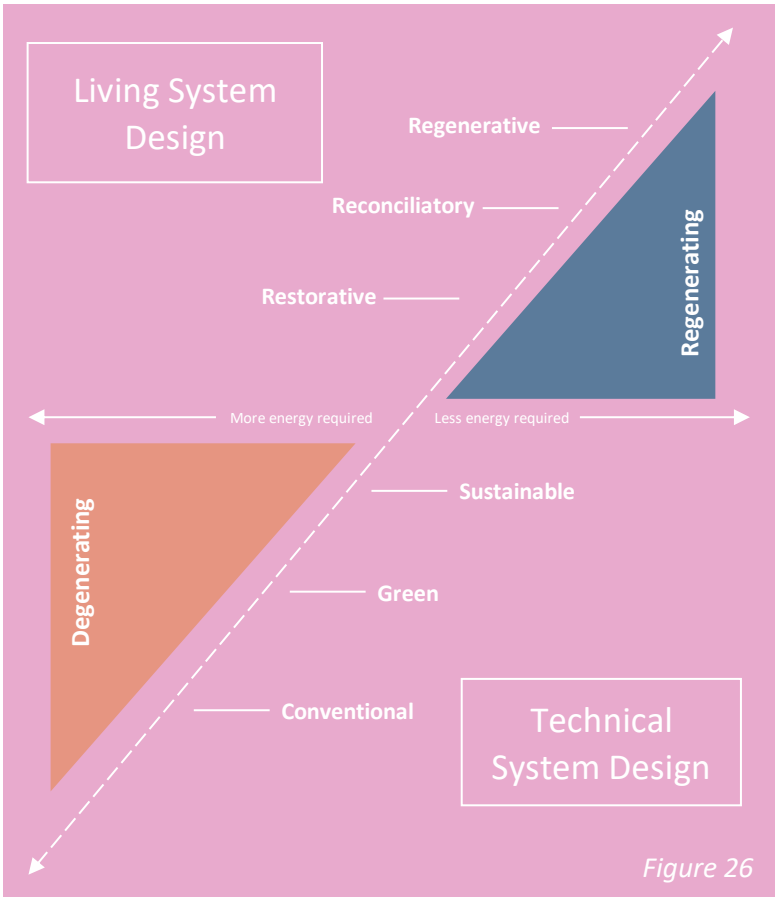

Figure 26

One way to do this is to focus on leverage points, originally developed as a heuristic framework by Donella Meadows' (1999). Her idea conceptualized the most advantageous points in a complex system where one could intervene by working not just on the easiest solutions but going deeper to the systemic issues that underlie the rest of the problems. One helpful way of identifying these leverage points is to use the metaphor of an iceberg, conceptualized to identify systemic issues and determine at which level to work. Figure 27 is an adaptation of this iceberg concept with many of the issues prevalent in Puerto Rico. Future resilience plans will only be successful if they keep in mind each level, not just the events on top.

One leverage point could be simple – like repealing the Jones Act – but is politically difficult. A 2019 study found that this measure could create more than 13,000 jobs and result in a $1.5 billion boost to the economy (Cheatham & Roy, 2022). This change would lie at the 'underlying issues' level while any change to the U.S. territory status would occur at the 'structure' level. Another option would be removing funding restrictions from the U.S. government, increasing the ability of Puerto Rico municipalities to be more creative in their solutions. Changing at these levels is harder but are leverage points for that reason, as they work deeper, allowing the top of the iceberg to shift around these new realities.

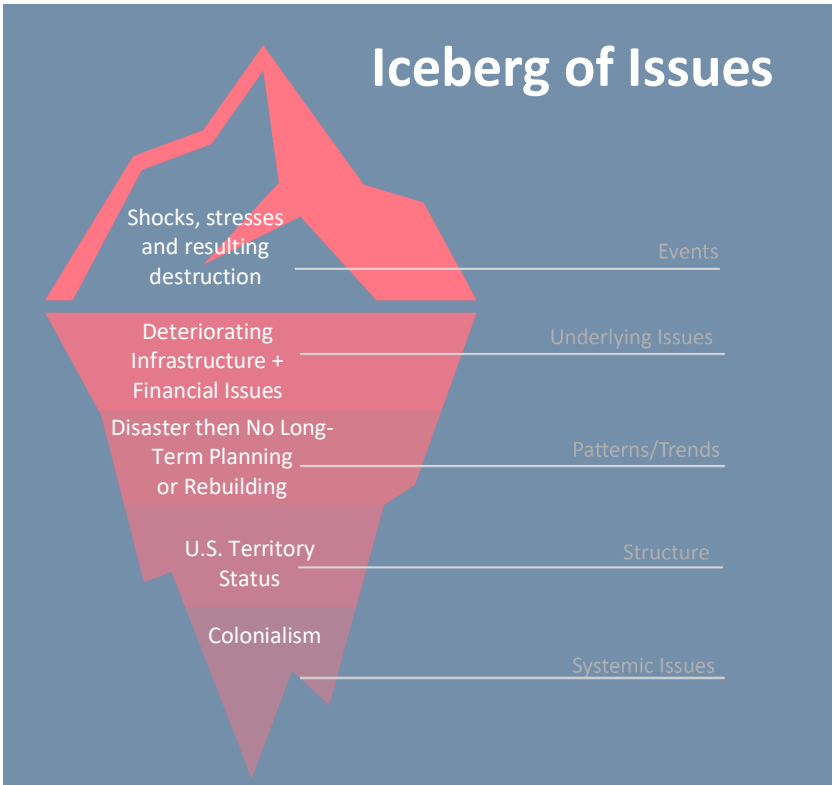

Figure 27

Though there are many different resilience frameworks and principles, the Stockholm Resilience Center has identified seven for which this iceberg can be helpful: 1) maintain diversity and redundancy, 2) manage connectivity, 3) manage slow variables and feedbacks, 4) foster complex adaptive systems thinking, 5) encourage learning, 6) broaden participation, and 7) promote polycentric governance systems. In the context of Puerto Rico, the system requires a move towards more polycentric governance systems and a broadening of participation as places to start. In a place where innovation and community resilience have been a part of life for centuries, encouraging and welcoming new technology and connections to community is key. As evidenced by the failure of the central systems during the hurricanes, there must be more redundancy and diversity of solutions. This also applies to the economic structure and housing, as these issues are complex and require unique and creative solutions. There is hope in the resilience planning and funding for San Juan and Puerto Rico, but whether true resilience is possible under the shadow of colonialism is debatable. To ask a community and government to deal with major shocks and stresses without giving the same resources, control, or decision-making to those same entities is making an impossible request.

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San Juan, Puerto Rico
Steph O'Connor