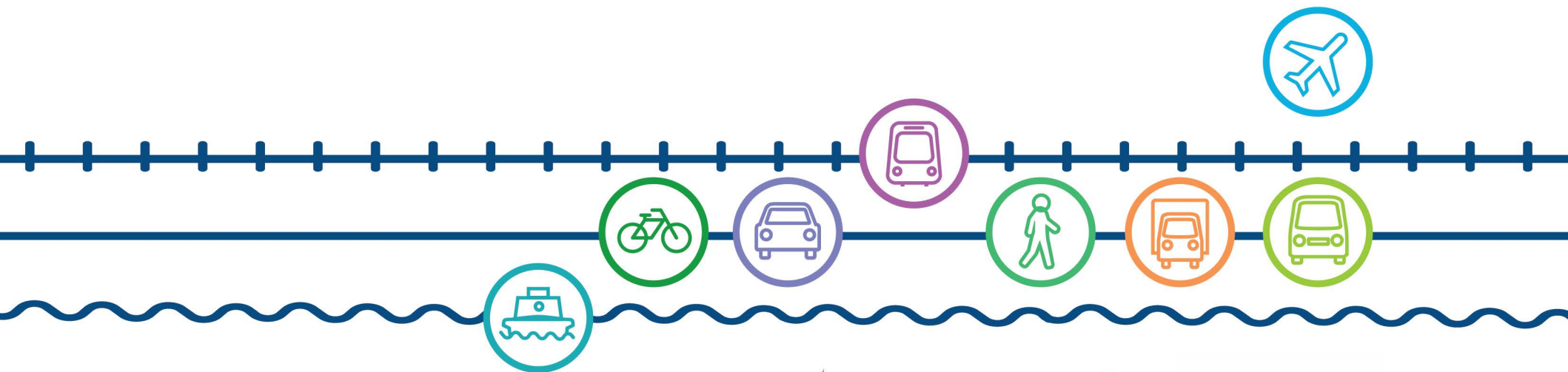
2050

Other Urbanized Areas

Multimodal Long Range Transportation Plan



PUERTO RICO DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

PUERTO RICO HIGHWAYS & TRANSPORTATION AUTHORITY

MPO
Organización Metropolitana de Planificación de Puerto Rico

1

Other Urbanized Areas Under 200,000 Population (UZA)

What is the Plan?

The 2050 Other Urbanized Areas Under 200,000 Population (UZA) Multimodal Long Range Transportation Plan (MLRTP) is an essential element of the transportation planning process and the key document identifying desired outcomes and priorities for transportation investments in Other Urbanized Areas.

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Why is the Plan Needed?

The **2050 UZA MLRTP** is a central and unifying document that summarizes goals, objectives, and performance measures. In the same way, it assesses current system performance, inventories future challenges and analyses needs. It also proposes investment strategies to be funded over the next 27 years.

It aims to improve the performance of the transportation in the UZA and move towards those goals.

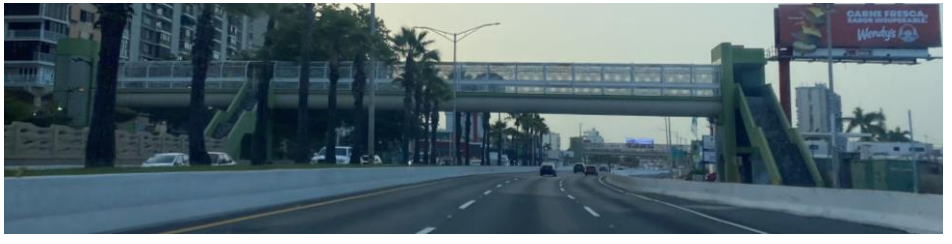
In alignment with the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, and Fixing America's Surface Transportation (FAST) Act, the planning process in Puerto Rico has strived to be a comprehensive framework for making transportation investment decisions in the Transportation Management Areas (TMA) and Island-wide. Currently the 2050 UZA MLRTP is ruled under the Bipartisan Infrastructure Law (BIL). The Department of Transportation and Public Works (DTPW) is the designated Metropolitan Planning Organization[1] (MPO) for all urbanized areas and Island-wide. As such, it is ultimately responsible for the compliance with the U.S. Department of Transportation (DOT) statutory requirements under the FAST-Act, and with the Rule Makings and Policy Guidance of the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA).

Once the 2050 UZA MLRTP is approved by the PRMPO and the Public Policy Committees, it will establish the planning framework for all transportation projects (including all modes) for the UZA under Puerto Rico's Transportation Planning Regions; and the five (5) smaller Transportation Regions[2] (TPRs) (Table 1.1).

Table 1.1: Municipalities within Other Urbanized Areas Classification and Under the TPRs

TPR	Municipalities within Other Urbanized Areas
East Region	Fajardo Urbanized Area
North Region	Arecibo Urbanized Area Florida-Barceloneta Urbanized Area
Southeast Region	Guayama Urbanized Area
South Region	Ponce Urbanized Area Juana Díaz Urbanized Area Yauco Urbanized Area
Southwest Region	Mayagüez Urbanized Area San Germán-Cabo Rojo Urbanized Area

Source: PRHTA, 2021



1. Metropolitan Planning Organization means the policy board of an organization created and designated to carry out the metropolitan transportation planning process, according to regulations (23 C.F.R. §450.104).
2. The definition of the MPO Regions is as established by the PRHTA. It is important to note that due to the recent data published for the 2020 Census related to population, the configuration of the Regions could be modified, as it is one of the factors considered to define the Regions.

What is Included in the Plan?

The Puerto Rico DTPW, acting as the PRMPO, elaborated the 2050 MLRTP consisting of two (2) documents for the Transportation Management Areas (TMAs) of San Juan and Aguadilla. Also, one (1) document for the Island-wide Transportation Plan, and one (1) document for Other Urbanized Regions of less than 200,000 inhabitants (includes the five (5) TPRs as required by Federal Regulations) (23 U.S.C. 134 and 135; 42 U.S.C. 7410 et. seq.; 49 U.S.C. 5303 and 5304). This document represents the **2050 UZA MLRTP.**

Table 1.2 shows the resources related to the framework from which the process for the development of revision for this Multimodal Long Range Transportation Plan is based on.

Table 1.2: Resources Supporting Long-Range Statewide and Metropolitan Transportation Plans

Resource	Description
23 C.F.R. 450	Planning Assistance and Standards
U.S. Code Title 49 Chapter 53	Transit
FTA Circular 8100.1D	Program Guidance for Metropolitan Planning and State Planning and Research Program Grants
Bipartisan Infrastructure Law Fact Sheet	Metropolitan, Statewide, and Non-Metropolitan Planning Metropolitan Planning

Source: Steer, 2023

How the Plan will be Used?

The 2050 UZA MLRTP is the guiding document for future investments in roads, transit services, bicycle and pedestrian facilities and related transportation services within the UZA Regions.

The Plan presents challenges and opportunities in infrastructure investments, transit, complete streets, and bicycle and pedestrian along a long-range period. This 2050 UZA MLRTP follows a performance-based planning process according to Federal Regulations with multimillion dollar investments until FY2050. It has a firm commitment with national goals of reducing fatalities, an unprecedent emphasis on pavement and bridges preservation and rehabilitation to upgrade conditions, improve freight mobility, and reduce congestion. Moreover, the 2050 UZA MLRTP foresees reducing congestion by improving public transit services and accessible facilities to most needed populations and with functional diversity.

Who is Responsible for The Plan?

The **Metropolitan Planning Organization (MPO)** is the regional organization responsible for transportation planning in UZA. In our case, PRHTA is the entity, within the DTPW, responsible for facilitating the transportation planning process for the Plan with effective public participation and outreach processes.

Organizational Context

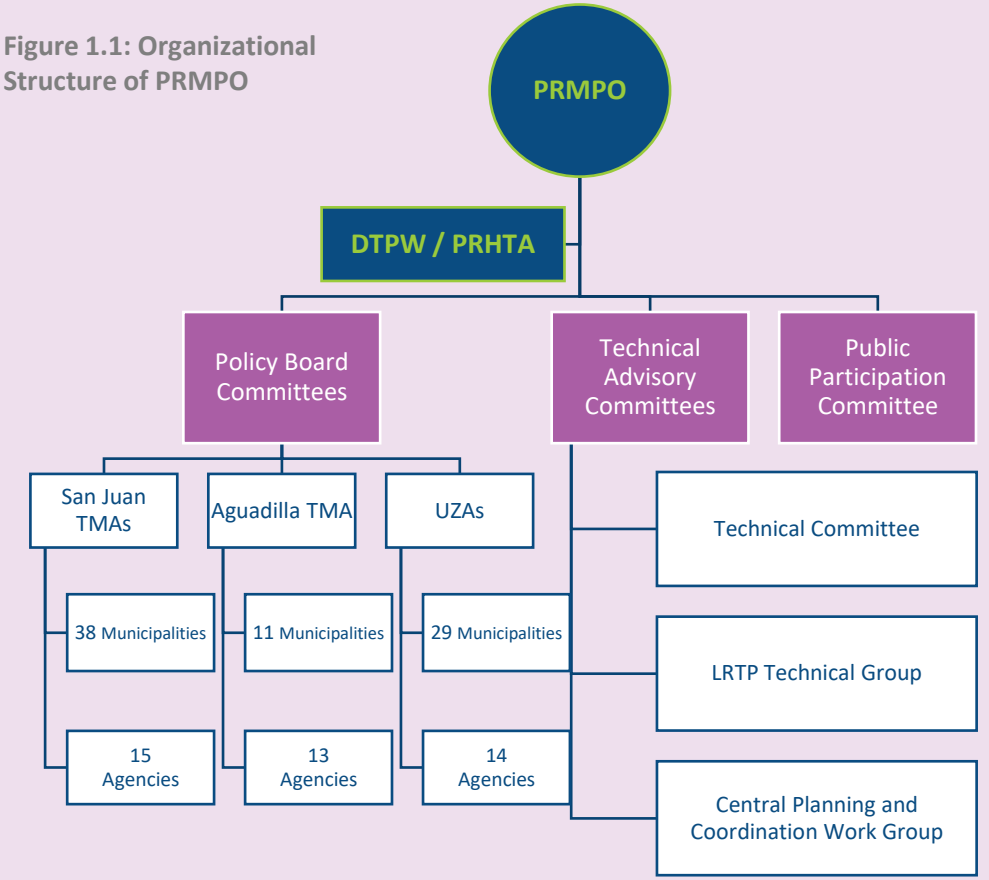
Puerto Rico Metropolitan Planning Organization (PRMPO)

The PRMPO is structured through three (3) Public Policy Committees representing the Aguadilla and San Juan TMAs, and Other Urbanized Areas Under 200,000 Population (UZA). Decisions are made by the Public Policy Committees regarding the projects and capital investments that will be using federal funds allocated for Puerto Rico's mass transit and highways as well as the vision, goals and objectives defined in the Plans. The members of the Public Policy Committees are comprised of the mayors of the municipalities and representatives of governmental agencies.

The PRMPO has a centralized structure to facilitate the administration and the metropolitan planning activities[3]. The Secretary of the DTPW is the president of the PRMPO. In coordination with other members, the Secretary promotes the development of an effective, integrated, and safe transportation system that enables economic growth and improves the well-being of its citizens.

The PRHTA is the grantee that receives the funding distributed by the Department of Transportation through the Federal Highways Administration and the Federal Transit Administration.

Figure 1.1: Organizational Structure of PRMPO



Source: Rules and Operating Procedures of Puerto Rico Metropolitan Planning Organization, 2018

3. rules-and-operating-procedures-prmpo-2018-september-14.pdf

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Disclaimer

The information presented and analyzed was developed mainly using the U.S. Census Bureau's American Community Survey 5-year estimates from the years analyzed, normally from 2016 to 2021. The COVID-19 pandemic had an impact on the quality of the data collected during 2020, compared to other years as the Census Bureau was forced to suspend data collection operations, especially in-person visits, and switch entirely to survey questionnaires that were not fully returned. This generates a smaller sample size and consequently a larger margin of error and less reliable data for the 2020 information. Therefore, this report needs to consider this data limitation for 2020.

Other Urbanized Areas Under 200,000 Population (UZA)

About Our Home

This chapter aims to provide a brief description of the Other Urbanized Areas (UZA's) socioeconomic characteristics to provide a better understanding of how the transportation sector is developed in each Transportation Planning Region. The chapter is divided into 6 main sections. The first describes the location and the geographical distribution of land, transportation authorities, and general elements of the territory. The second section describes and discusses sociodemographic data that is relevant to the Multimodal Long Range Transportation Plan (MLRTP). The third section describes the economy of the different UZAs, especially regarding its Gross Domestic Product (GDP), the main industries that compose this indicator, and the behavior of employment. The fourth section describes two events that have impacted people's livelihoods and consequently, the way in which transportation patterns behave: COVID-19 and the recent earthquakes. The fifth section depicts the land-use, and environmental sensitivity areas on each one of the UZAs. Finally, the sixth section shows the projections regarding Population and Employment.

Our Region: Location

Puerto Rico is a Caribbean Island that borders the Atlantic Ocean to the North and the Caribbean Sea to the South. It is located in the Caribbean Sea, east of the Dominican Republic, west of the Virgin Islands, and to the southeast of Florida. It constitutes the smallest of the Greater Antilles and is composed of an archipelago formed by the Main Island of Puerto Rico and several small islands: Vieques, Culebra, Mona, and numerous islets.

Figure 2.2 (on the next page) represents the location of Puerto Rico in the Caribbean.

Transportation Management Areas and Regions in Puerto Rico

Puerto Rico territory is mainly divided into 78 municipalities which are further divided into two (2) Transportation Management Areas (TMA) and five (5) Transportation Planning Regions (TPR). This totals seven (7) Transportation Regions under the Puerto Rico Metropolitan Planning Organization (MPO), which include:

TMAs

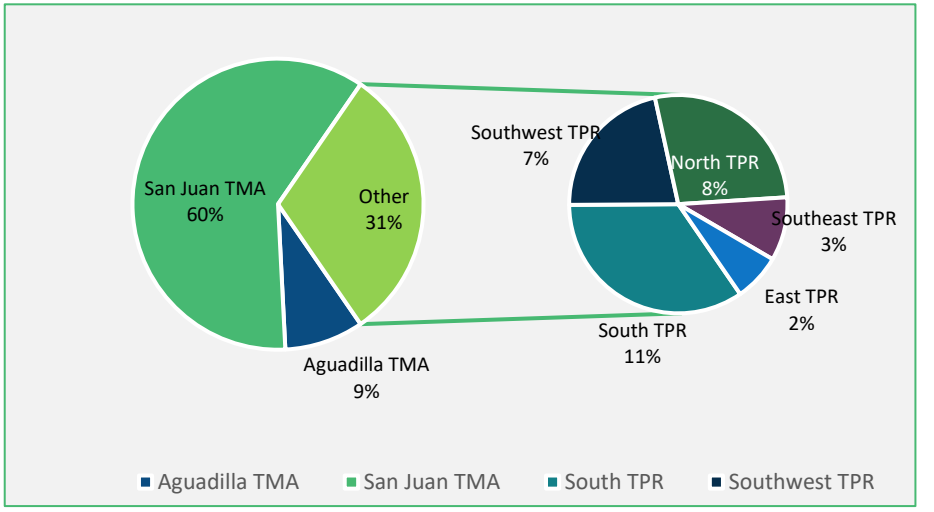
- San Juan; and
- Aguadilla

TPRs

- North (NTPR);
- East (ETPR);
- South (STPR);
- Southeast (SETPR); and
- Southwest (SWTPR).

Figure 2.1 shows the distribution of the population by the TMAs and TPRs. Also, highlights that the San Juan TMA hosts the largest share of residents, consisting of 60% of the population, while UZA regions total a 31% of the population share.

Figure 2.1: Puerto Rico Population Distribution by Transportation Management Areas and Transportation Planning Regions 2021



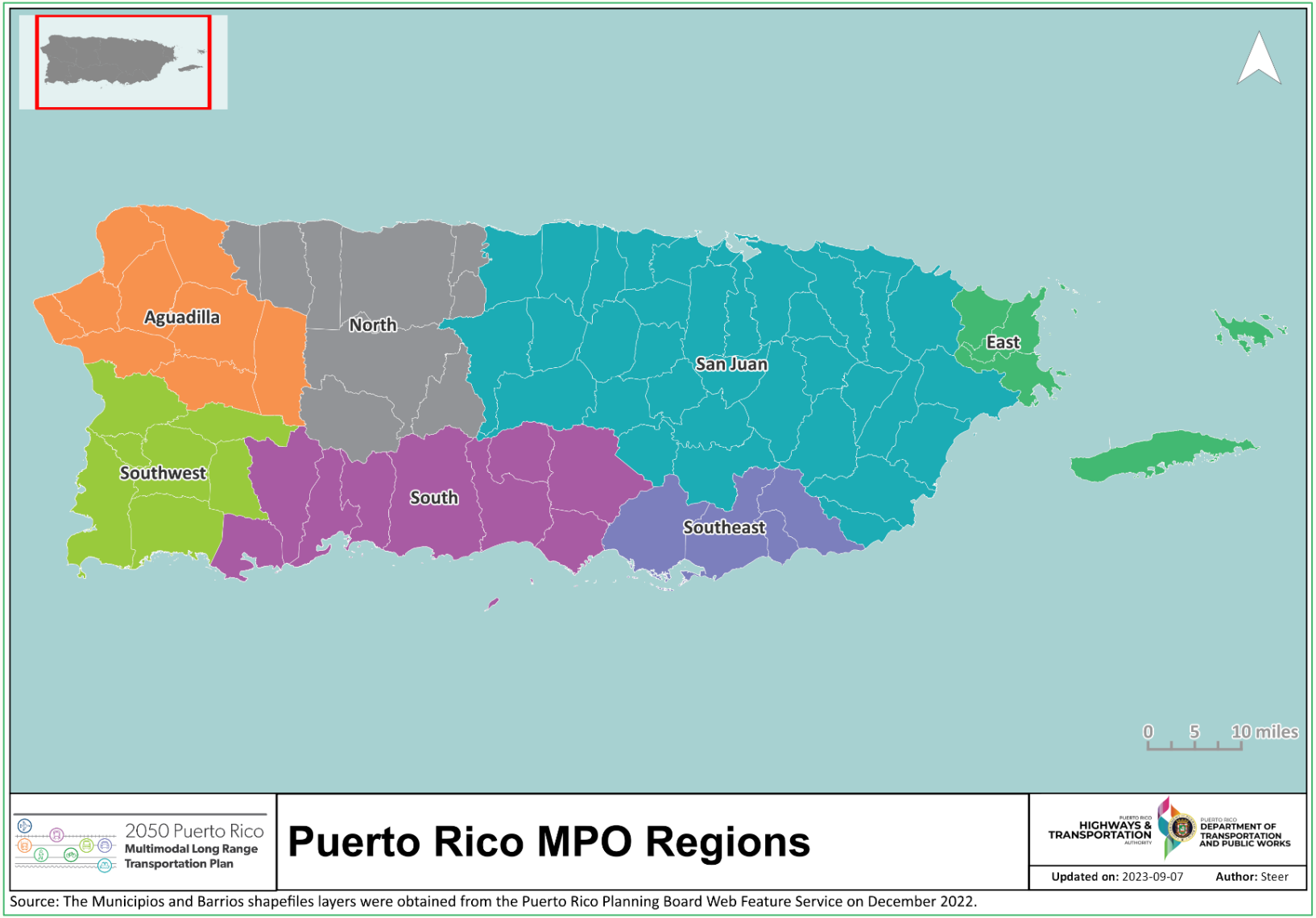
Source: U.S. Census Bureau, American Community Survey 2017-2021 5-Year Estimates

Figure 2.2: Puerto Rico Location

Source: OpenStreetMap, 2023. Retrieved from: osmdata.openstreetmap.de

Figure 2.3 shows the two (2) TMAs and five (5) TPRs, totaling seven (7) Transportation Regions under the Puerto Rico Metropolitan Planning Organization (MPO).

Figure 2.3: Transportation Management Areas and Transportation Planning Regions in Puerto Rico 2021



Source: The Municipios and Barrios shapefiles layers were obtained from the Puerto Rico Planning Board Web Feature Service on December 2022.

Transportation Planning Regions: Other Urbanized Areas

The TPR includes all the Other Urbanized Regions of less than 200,000 inhabitants. These areas are described below.

The NTPR is bounded to the east by the San Juan TMA Region, to the south by the STPR, and to the west by the Aguadilla TMA Region, as shown previously in Figure 2.3. A total of nine (9) municipalities are part of the NTPR as shown in Table 2.1.

The ETPR is located directly east of the San Juan TMA Region, as shown previously in Figure 2.3. A total of five (5) municipalities are part of ETPR, as can be seen in Table 2.1.

The STPR is located South of the NTPR and in between the Southwest and SETPRs, as shown previously in Figure 2.3. A total of nine (9) municipalities are part of STPR, as shown in Table 2.1.

The SETPR lies East of the STPR and South of the San Juan TMA Region, as shown previously in Figure 2.3. A total of four (4) municipalities are part of this transportation Region, as shown in Table 2.1.

The SWTPR lies South of the Aguadilla TMA Region and West of the STPR, as shown previously in Figure 2.3. A total of seven (7) municipalities are part of SWTPR, as shown in Table 2.1.

Table 2.1 lists the municipalities by TPRs regions.

The maps in page 11 and page 12 show the differences between regions. The largest regions (South TPR, North TPR, and Aguadilla TMA) in terms of population and land coverage are also the ones with the largest share of formal employment, after San Juan TMA. On the other hand, Southwest TPR, Southeast TPR, and East TPR, only comprise around 20% of land coverage and 12% of the population, and their share of formal employment is only around 10%[4].

Figure 2.4 and Figure 2.5 show how the population and employment trends are distributed geographically on the Island.

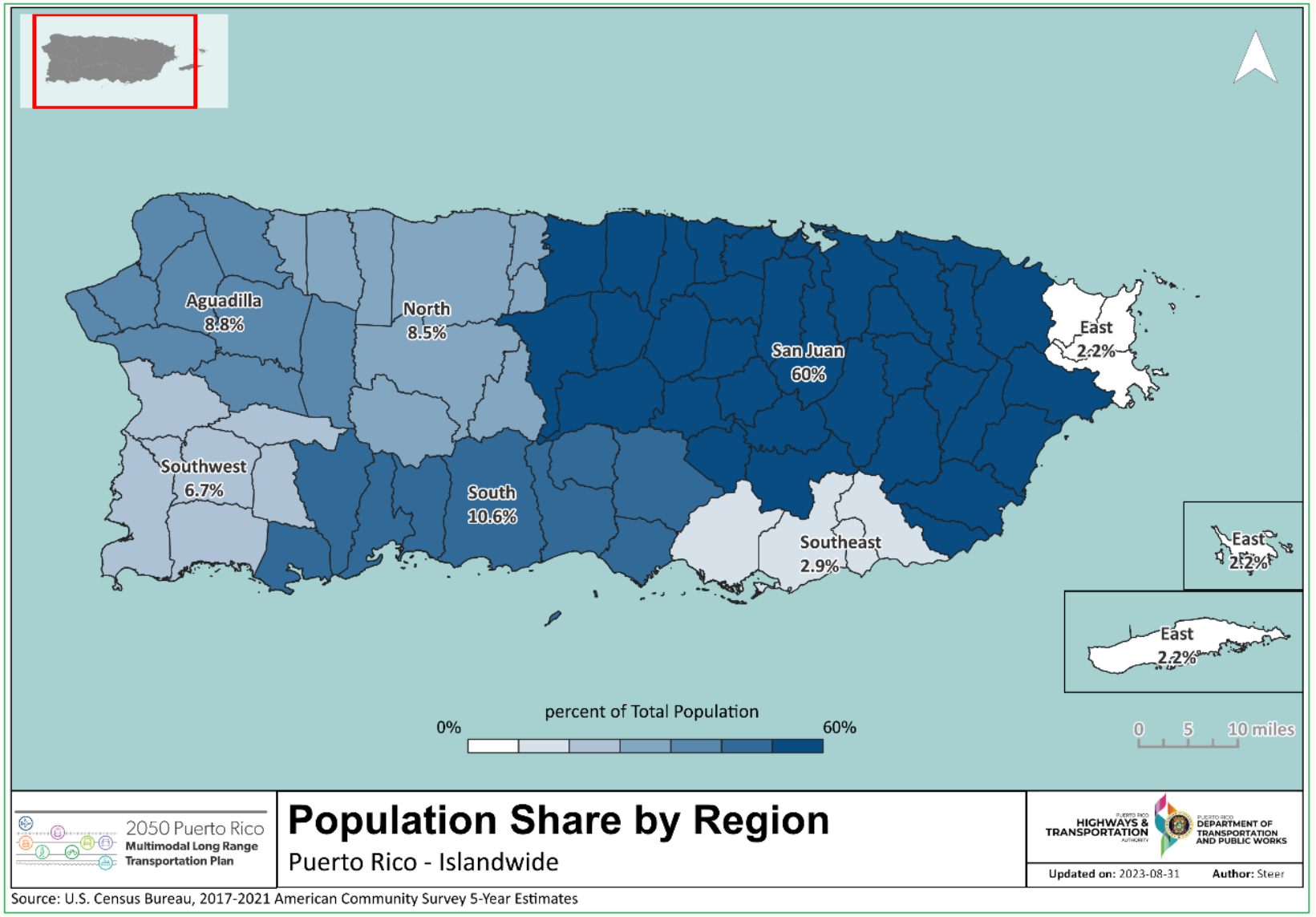
4.U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates.

Table 2.1: Population of Each Municipality in the TPRs, 2021

North TPR	Population 2021	South TPR	Population 2021	Southwest TPR	Population 2021	East TPR	Population 2021	Southeast TPR	Population 2021
Adjuntas	18,608	Coamo	35,268	Cabo Rojo	47,403	Ceiba	11,463	Arroyo	16,183
Arecibo	88,017	Guánica	14,297	Hormigueros	15,726	Culebra	1,293	Guayama	37,388
Barceloneta	22,836	Guayanilla	18,047	Lajas	23,407	Fajardo	32,336	Patillas	16,231
Camuy	32,885	Juana Díaz	46,704	Maricao	5,389	Luquillo	17,917	Salinas	26,208
Florida	11,725	Peñuelas	20,625	Mayagüez	74,146	Vieques	8,317		
Hatillo	38,739	Ponce	139,245	Sabana Grande	22,860				
Jayuya	14,887	Santa Isabel	20,530	San Germán	32,031				
Quebradillas	23,473	Villalba	22,431						
Utuado	28,585	Yauco	34,704						

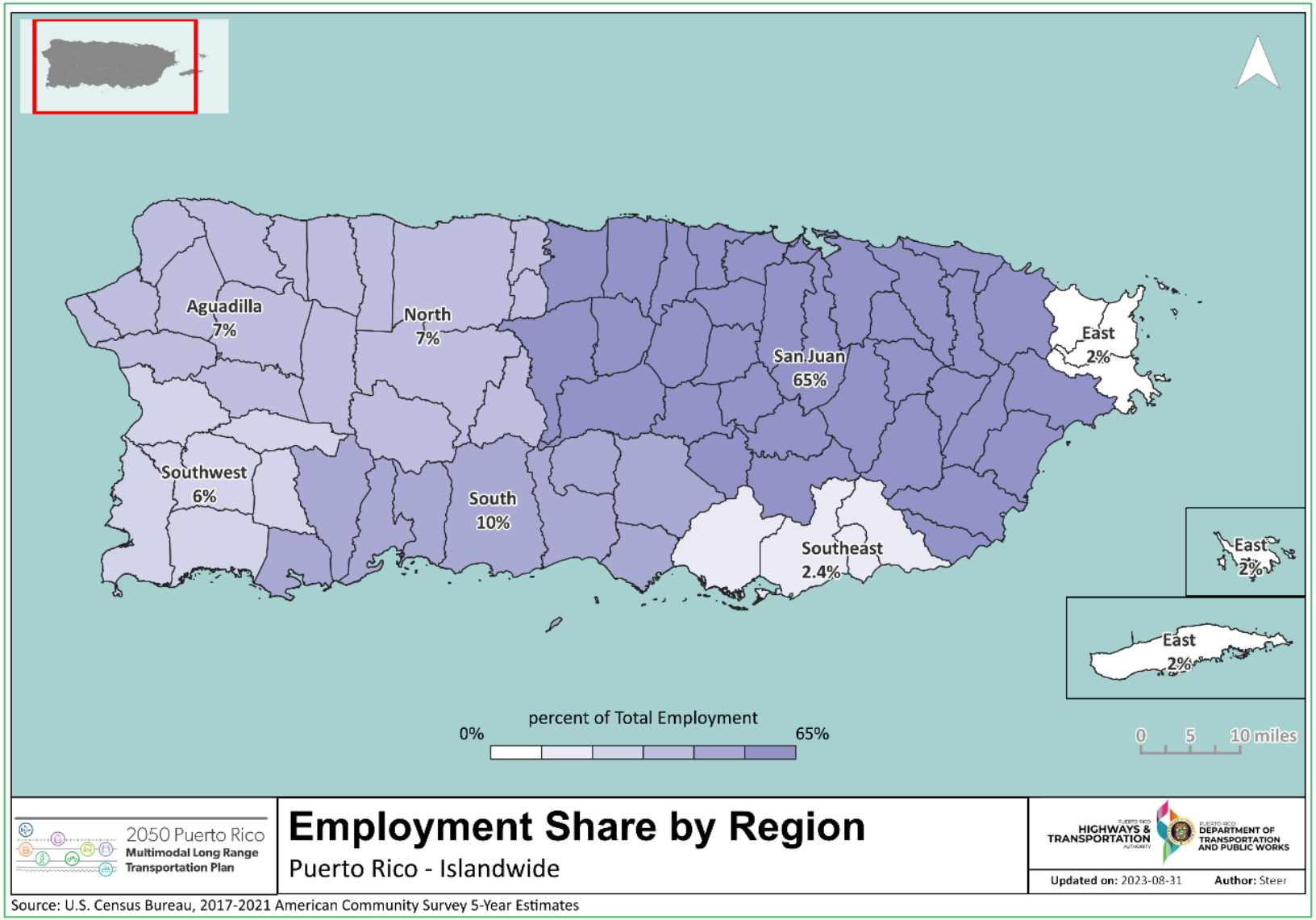
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.4: Population Share in Puerto Rico Regions



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.5: Employment in Puerto Rico Regions



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Our People: Sociodemographic Data

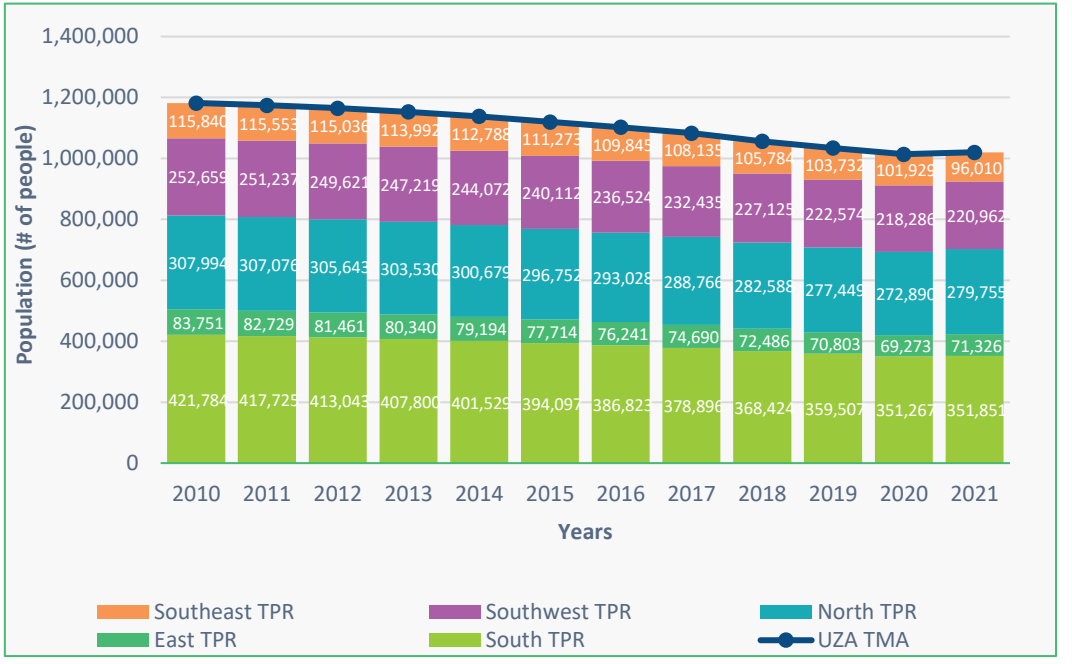
Current and historical sociodemographic data will allow for a better understanding of the people in terms of where they live, their age, household size, among other elements. Developing a disaggregated analysis by sex, race, and age allows a more holistic approach to understanding the different UZAs population and their livelihoods, as well as their potential needs to improve their quality of life.

Population

In general terms, the population across the different UZAs has presented the following trends and conclusions:

- Between 2010 and 2020, the population across all the UZAs decreased, with an overall average decrease of 14.3% as shown in Figure 2.6.
- Within these UZAs, the East TPR is the one that has presented the highest drop, with a -17.3% percent change when comparing its population between 2010 and 2020, i.e., around a 14,500-population loss in a decade.
- The population trend at South TPR was also noticeable, with a -16.7% percent change in population between 2010 and 2020, which represents around 70,000 fewer residents than in 2010.
- Between 2020 and 2021, the UZA presented a general population increase represented a 0.6% percent change in population.
- Within the UZAs, almost all presented a population increase in this period, except for Southeast TPR, which demonstrated a -5.8% percent change reduction in population. East TPR and North TPR showed the highest growth across this period, with a percent change of 3.0% and 2.5%, respectively.

Figure 2.6: Historic Population 2010-2021 per UZA

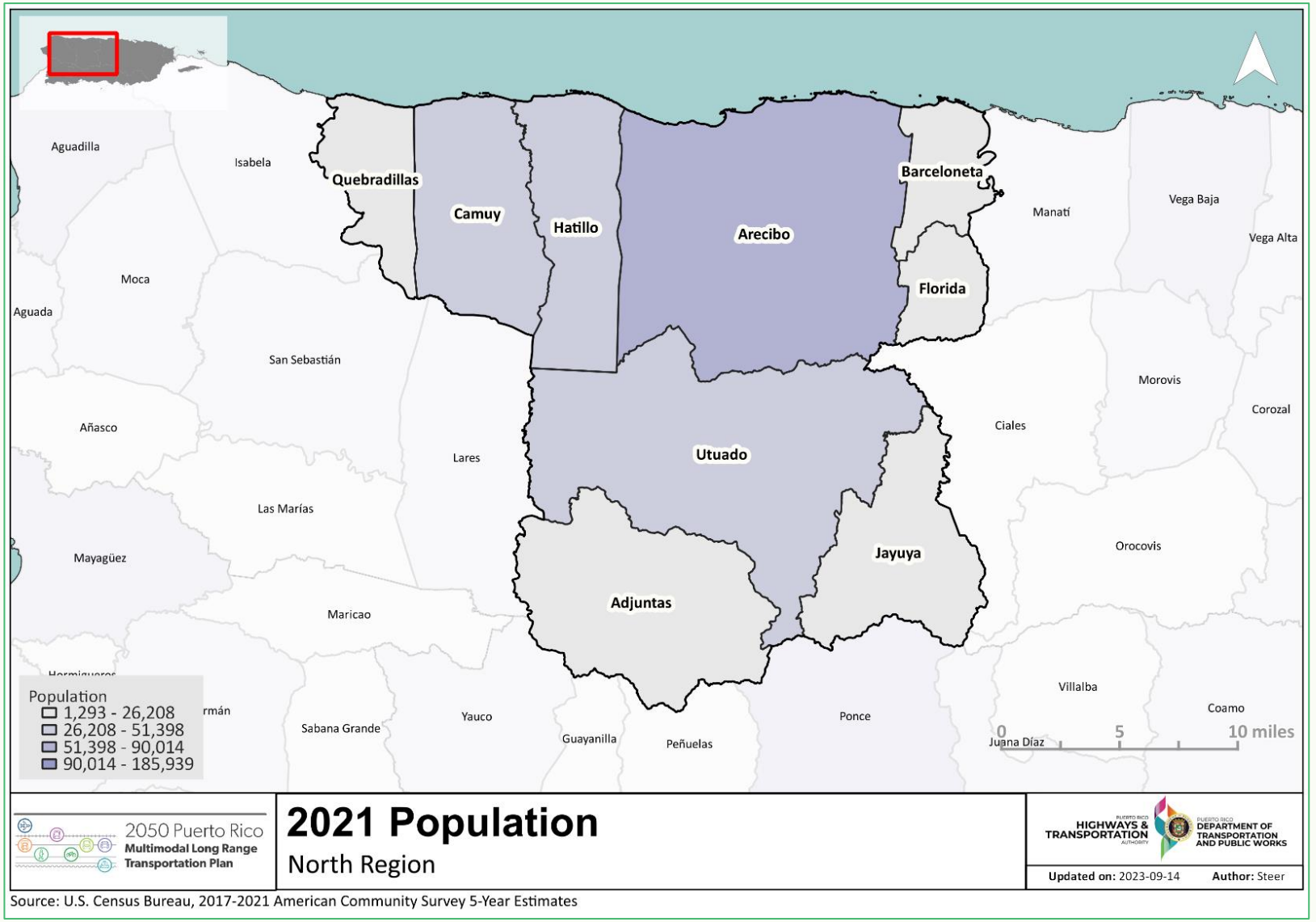


Source: U.S. Census Bureau, 2010 to 2021 American Community Survey 5-Year Estimates

The population distribution per UZA is presented in the following figures. Each one of them present a different configuration due to the heterogeneity of the regions and their municipalities.

Figure 2.7 presents the population distribution of North TPR and its inhabitants in 2021. In this region, Arecibo is the most populated municipality, with 31.5% of the total population, followed by Hatillo, Camuy, and Utuado, with 13.8%, 11.8%, and 10.2%, respectively, of the total population.

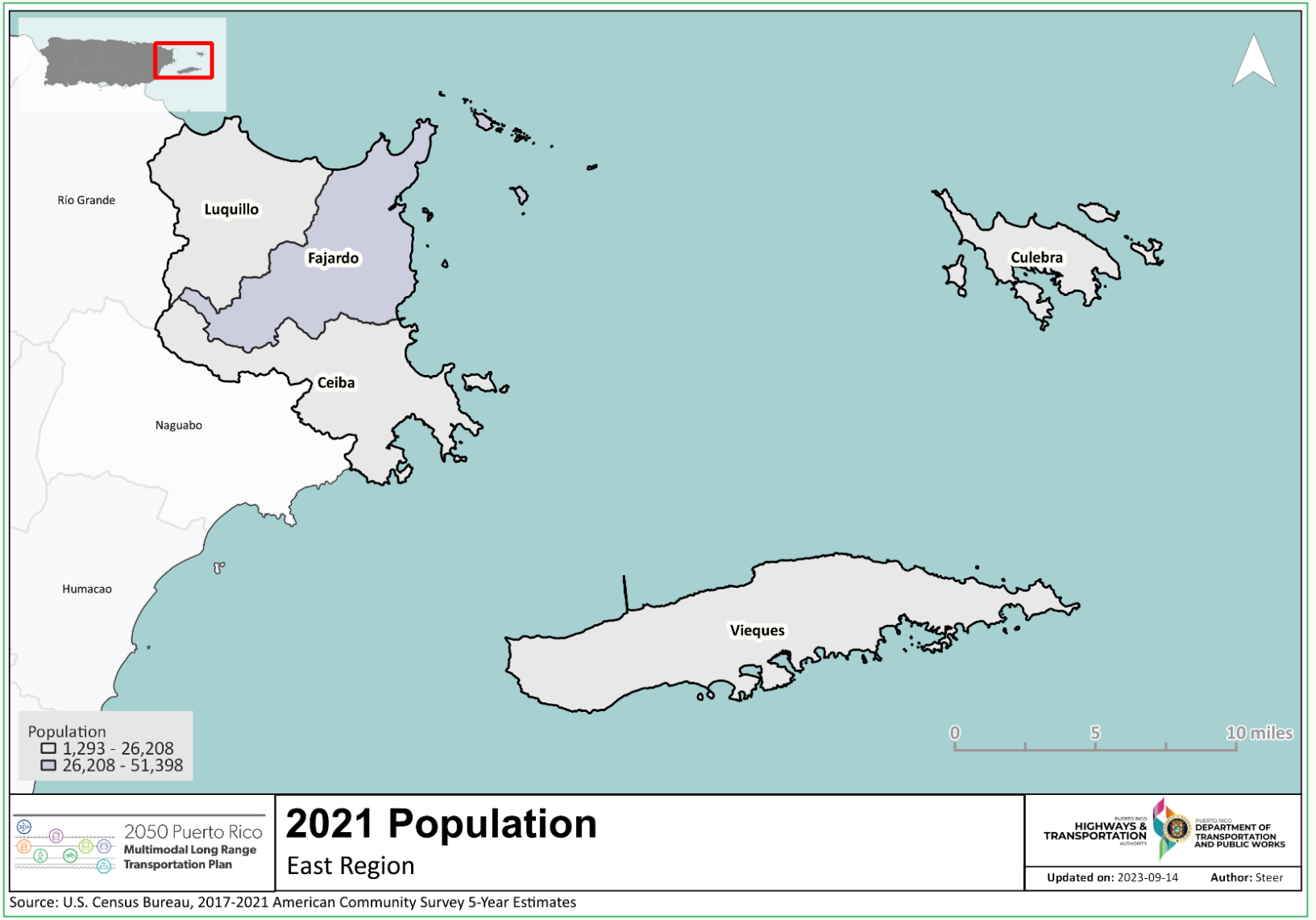
Figure 2.7: North TPR Population 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.8 shows the population distribution of East TPR and its 71,326 inhabitants in 2021. Most of the East TPR population is concentrated in Fajardo's Municipality, which centralizes almost 45.3% of the region's total population.

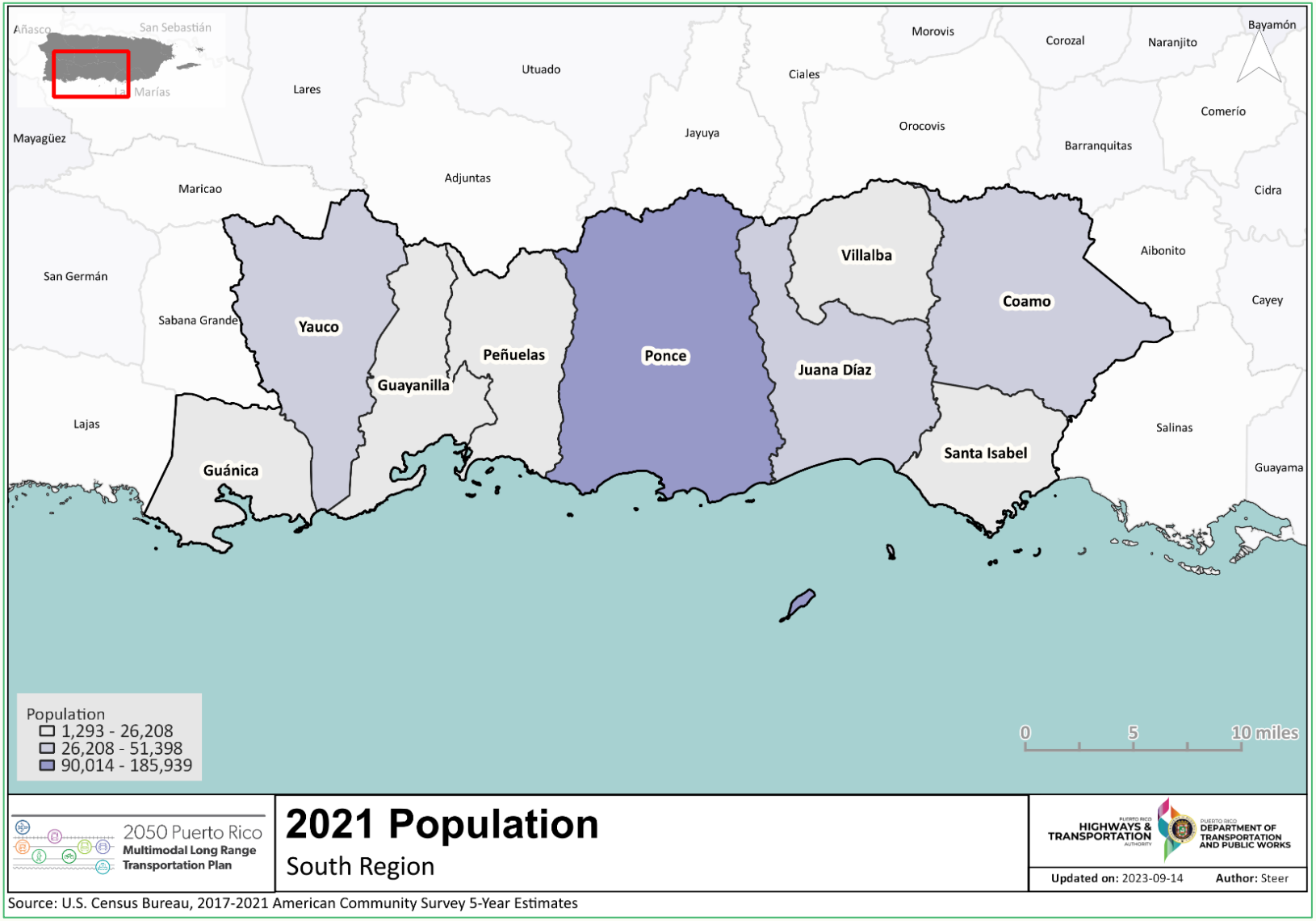
Figure 2.8: East TPR Population 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.9 presents the population distribution of South TPR and its inhabitants in 2021. As shown, the Municipality of Ponce has the largest population in South TPR with, approximately 39.6% of the region's population. Also, the municipalities of Juana Díaz, Yauco, and Coamo present relevant population clusters within the region.

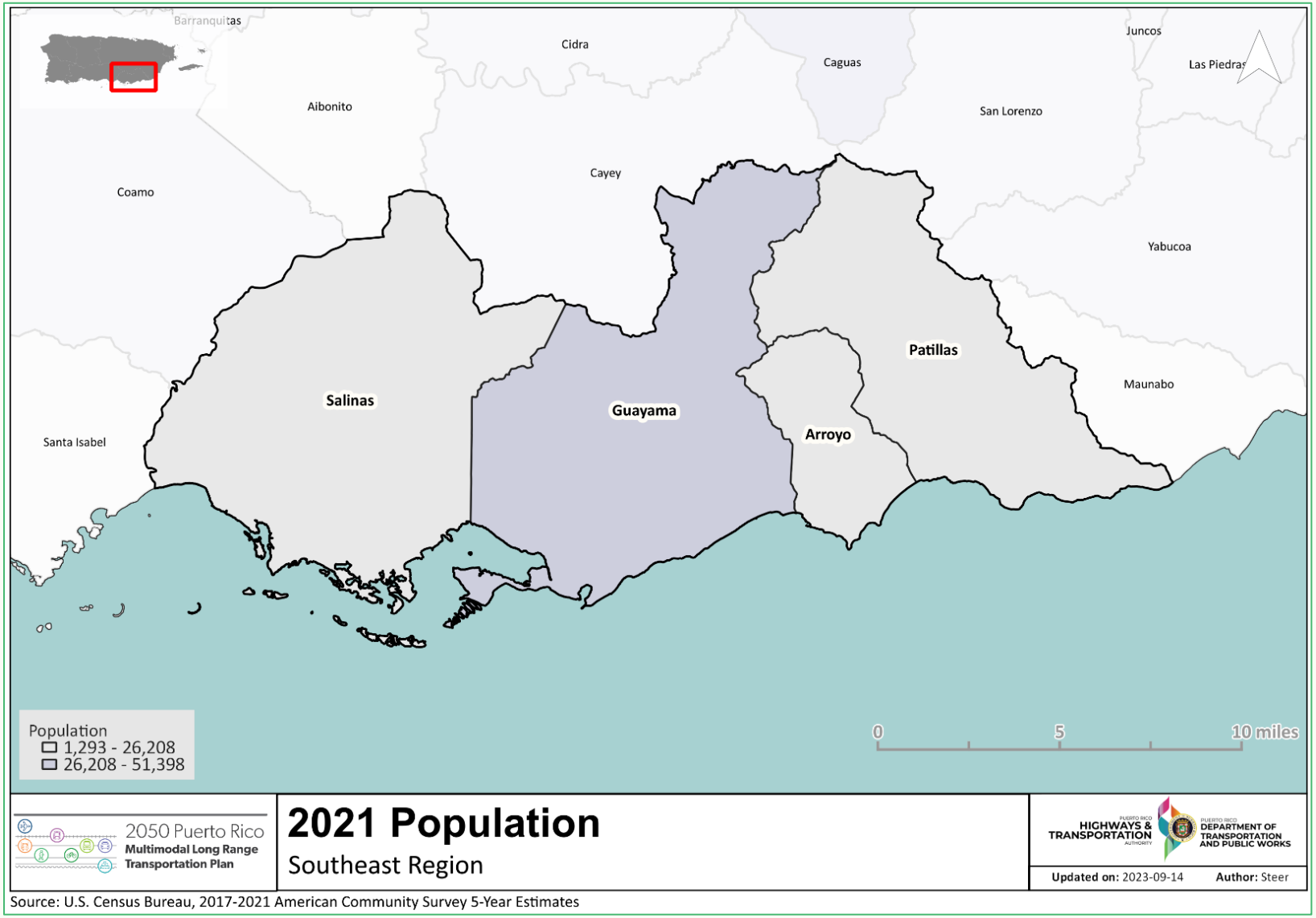
Figure 2.9: South TPR Population 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.10 presents the population distribution of Southeast TPR and its 96,010 inhabitants in 2021. Guayama is the most populated municipality in this region, with almost 40% of the total population, followed by Salinas (27.3%), Patillas (17%) and Arroyo (16.9%).

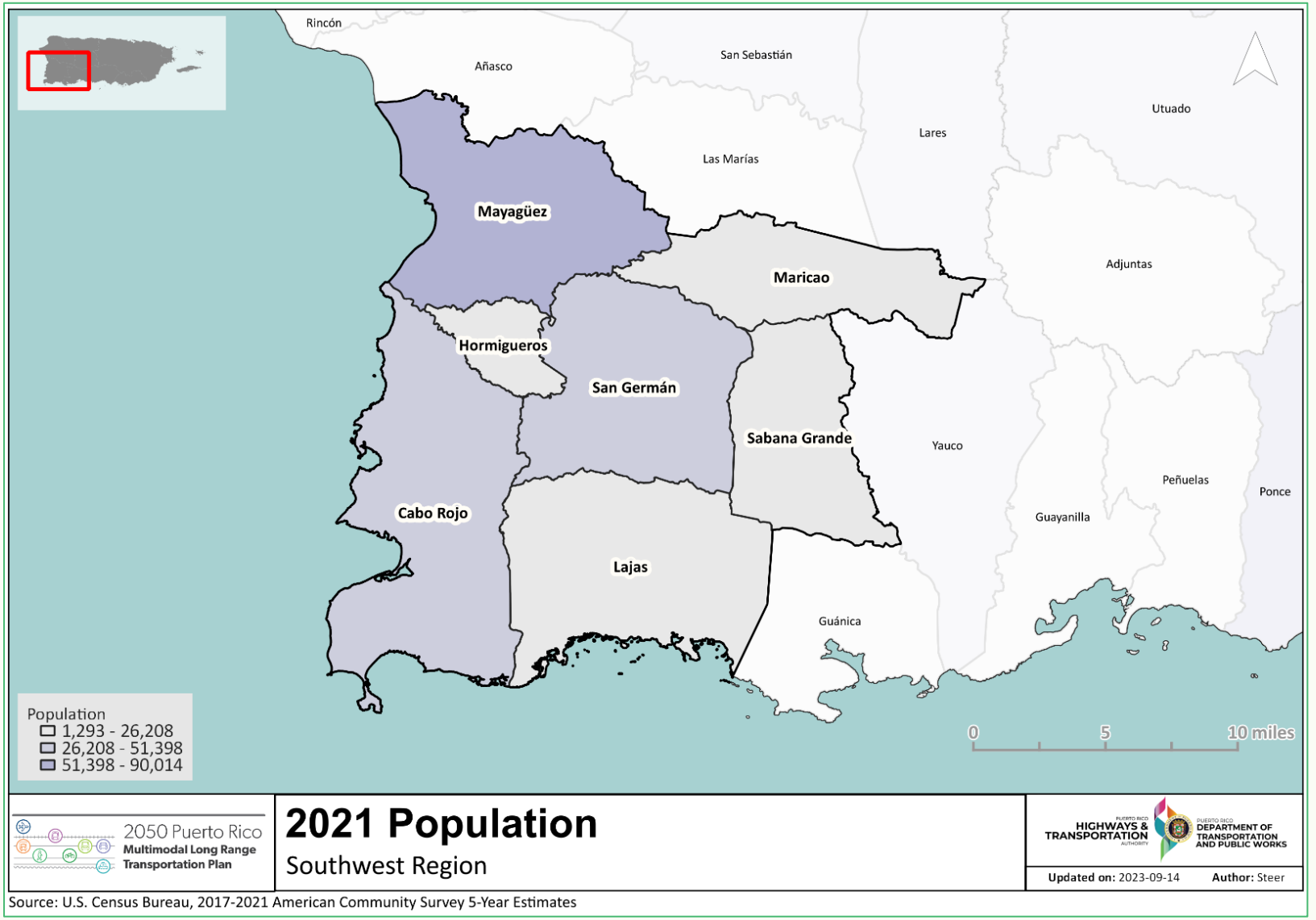
Figure 2.10: Southeast TPR Population 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.11 shows the population distribution of Southwest TPR and its inhabitants in 2021. Mayagüez is the most populated municipality in this region, with 33.6% of the total population, followed by Cabo Rojo and San Germán, with 21.5% and 14.5%, respectively, of the total population.

Figure 2.11: Southwest TPR Population 2021



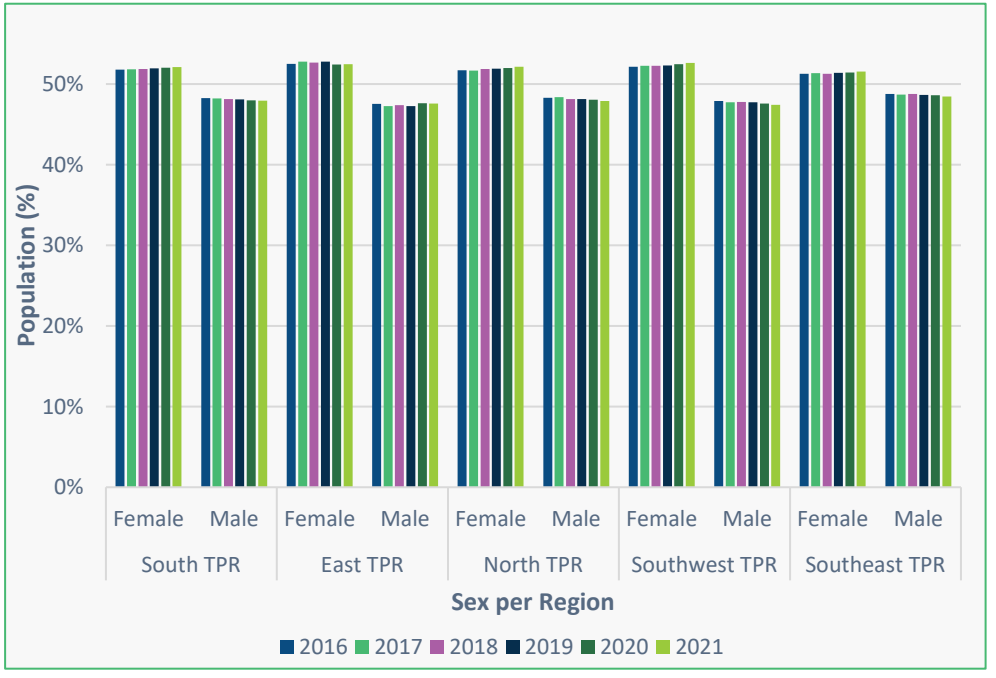
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Sex

Public policies and strategies need to have differentiated approaches for all genders and sexes. To do so, it is important to disaggregate data as much as possible so that all population groups are identified. This is why, the MLRTP identifies female and male population in each one of the UZA. Figure 2.12 shows the share of the female and male populations since 2016.

Since 2016, across all the UZAs, the distribution between females and males has been relatively similar, with a slightly larger female population through this period. It is worth noting that the South TPR is the only region that has constantly grown the female population since 2016. However, South TPR and the rest of the regions have shown an overall increase in the female population compared to 2016. In this same period, the male population has presented an overall decrease in all regions.

Figure 2.12: Population Distributed by Sex 2016-2021 per UZA.



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Race

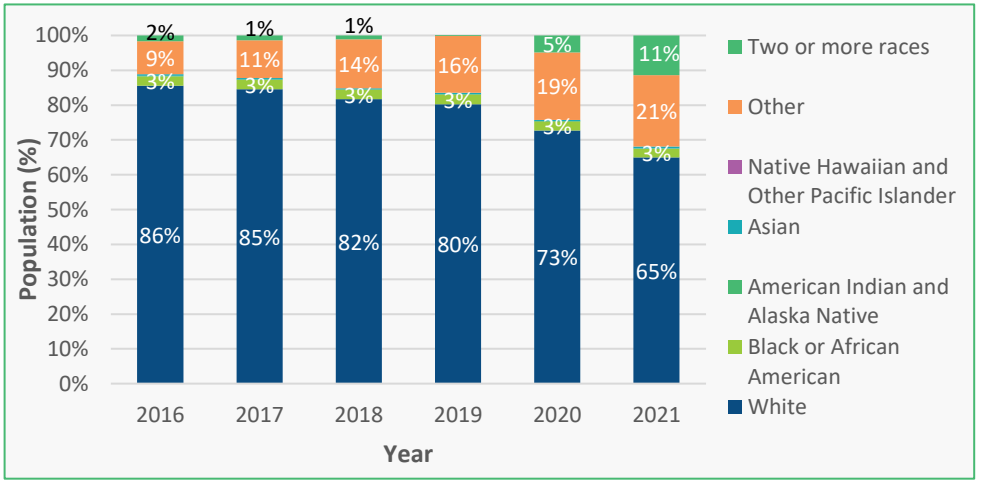
The Island of Puerto Rico has been a point of entry to the Caribbean and America in general. This means there is a great number of mixed races, the different regions of the island reflect this trend. The race distribution per UZA is presented below.

- North TPR

Figure 2.13 shows the races with which the inhabitants of North TPR have recognized themselves since 2016. The figure shows that, in this region, people predominantly recognize themselves as White. In 2019, 80% of the population declared to be identified as white, while 19% of the population considered themselves as "Other". However, this trend has changed slightly in recent years, with an increase in people who identify as "Other" or a blend of two or more races, consisting of 2021 almost 35% of the population.

It is worth noting that the black or African American race has remained constant at around 3% for most of the 2016 – 2021 analysis. The presence of other races, such as Asian, American Indian and Alaska Native, Native Hawaiian and Other Pacific Islanders is almost nonexistent.

Figure 2.13: Race Identification in North TPR 2016-2021



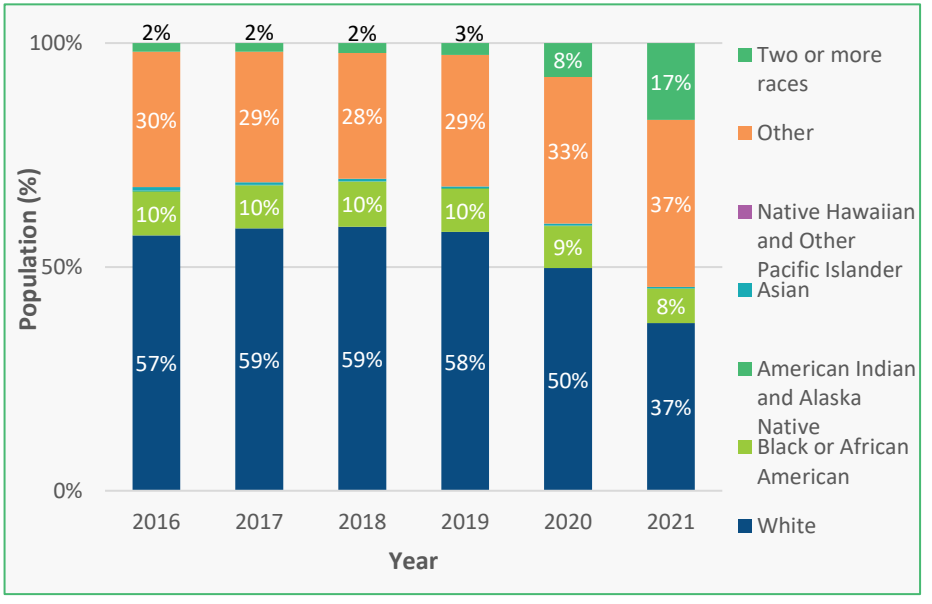
Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

- East TPR

Figure 2.14 shows the races with which the inhabitants of East TPR have recognized themselves since 2016. The figure shows that, in this region, most people recognize themselves as White, followed closely by "Other". In recent years, the trend of "Other" and a blend of two or more races has increased significantly; in 2021, 54% of the people of East TPR declared to be identified with one of these two ethnic groups, surpassing the proportion of inhabitants which considered themselves as White.

It is worth noting that the Black or African American race has remained constant for most of the 2016 – 2021 analysis. In the last two years, 2020 and 2021, the population of this ethnic group has suffered a slight decrease. The data suggest that this could be due to the fact that more of the population is identifying themselves as a mix of races.

Figure 2.14: Race Identification in East TPR 2016-2021[5]

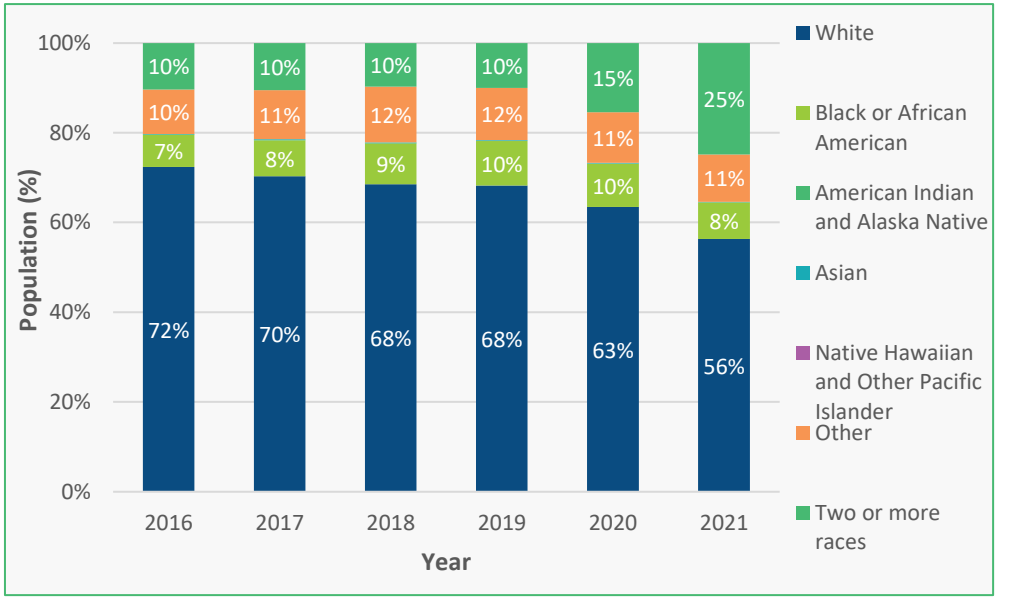


Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

- South TPR

Figure 2.15 show the races with which the inhabitants of South TPR have recognized themselves since 2016. The figure shows that, in this region, most people recognize themselves as white, followed by others and a mix of two or more races. In recent years, the trend of a blend of two or more races has increased significantly. In 2021, 25% of the people of South TPR declared to be identified with more than one race, the most significant proportion in the years of analysis.

Figure 2.15: Race Identification in South TPR 2016-2021



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

5. Only the values of the largest series are shown in here due to graph space.

- Southeast TPR

Figure 2.16 shows the races with which the inhabitants of Southeast TPR have recognized themselves since 2016. The figure shows that, in this region, people mostly recognize themselves as white, following by Black or African American. In 2021, 46% of the population declared to be identified as White, while 27% of the population considered themselves as Black or African American. In recent years there has been a slightly increase in people who identify as "Other" or a mix of two or more races.

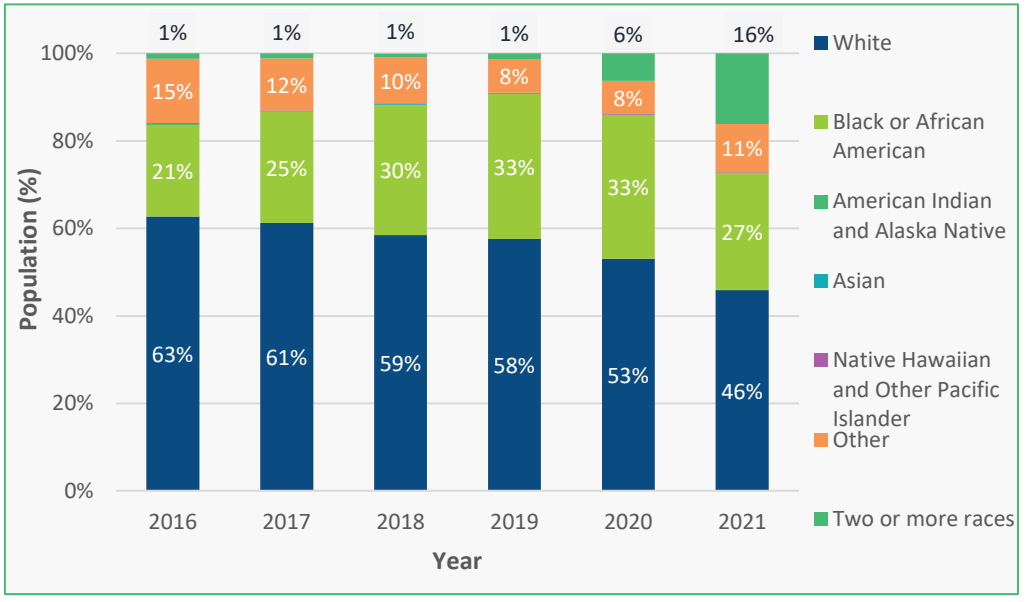
It is worth noting that there has not been presence of American Indian and Alaska Natives, Asians or Native Hawaiian and Other Pacific Islanders since 2016. Nevertheless, there was a large increase from two or more races, which was only 1% until 2020 at 6% and then in 2021 at 16%.

- Southwest TPR

Figure 2.17 shows the races with which the inhabitants of Southwest TPR have recognized themselves since 2016. The figure shows that, in this region, people predominantly recognize themselves as "Other". In 2019, 61% of the population declared to be identified as "Other", while 35% of the population considered themselves as White. However, this trend has changed slightly in recent years, with a slight increase in people who identify as White or a blend of two or more races in 2021.

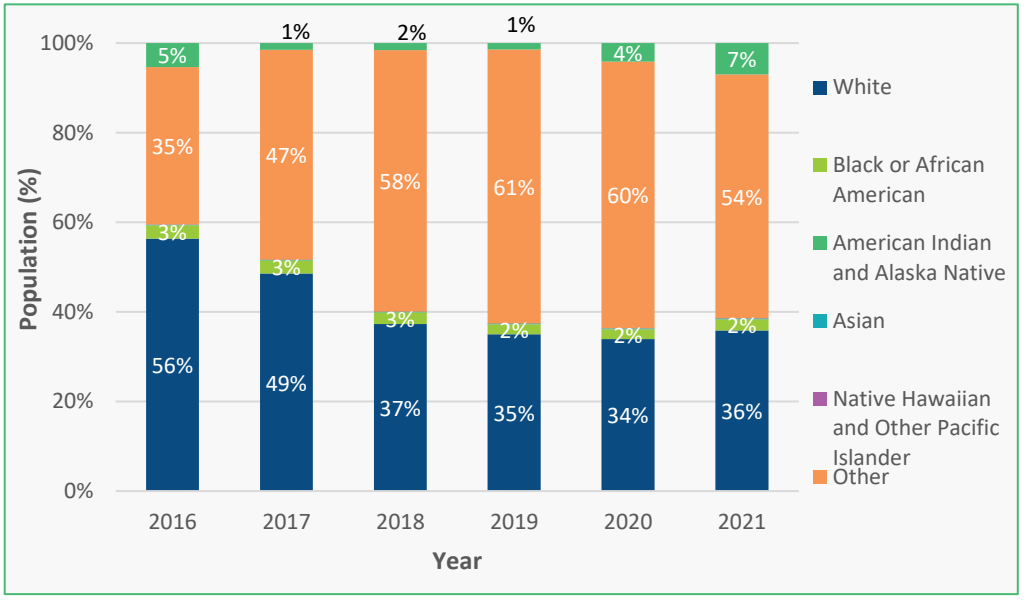
It is worth noting that the Black or African American race has remained constant at around 3% and 2% for most of the 2016 – 2021 analysis. The presence of other races, such as Asian, American Indian and Alaska Native, Native Hawaiian and Other Pacific Islanders is almost nonexistent.

Figure 2.16: Race Identification in Southeast TPR 2016-2021



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Figure 2.17: Race Identification in Southwest TPR 2016-2021



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Age Distribution

It is particularly important to look at population's age since there has been an aging trend in Puerto Rico for the last couple of years. In 2020 there were approximately 660,000 people in Puerto Rico considered as elderly (65 and older), which represented 20% of the Island's inhabitants. The median age in Puerto Rico, for 2021 was 43.1 years old, as stated by the ACS 5-years estimates.

Within the different UZAs these trends look a little different, the following figures show the median age trend and the age distribution in the different regions. Figure 2.18 shows the median age for each region in each year, showing a general increasing trend.

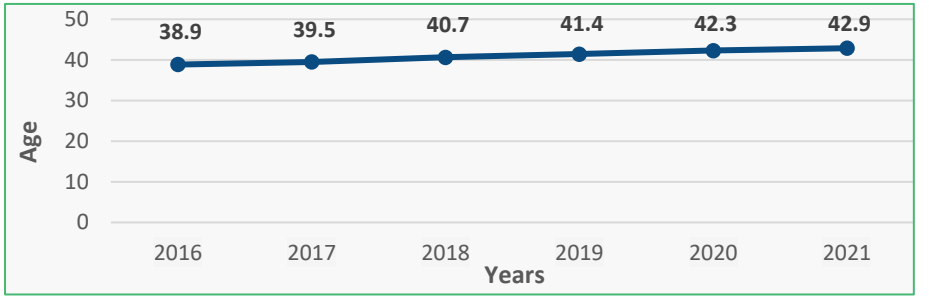
Figure 2.18: Median Age in UZA Regions Per Year

Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

- North TPR

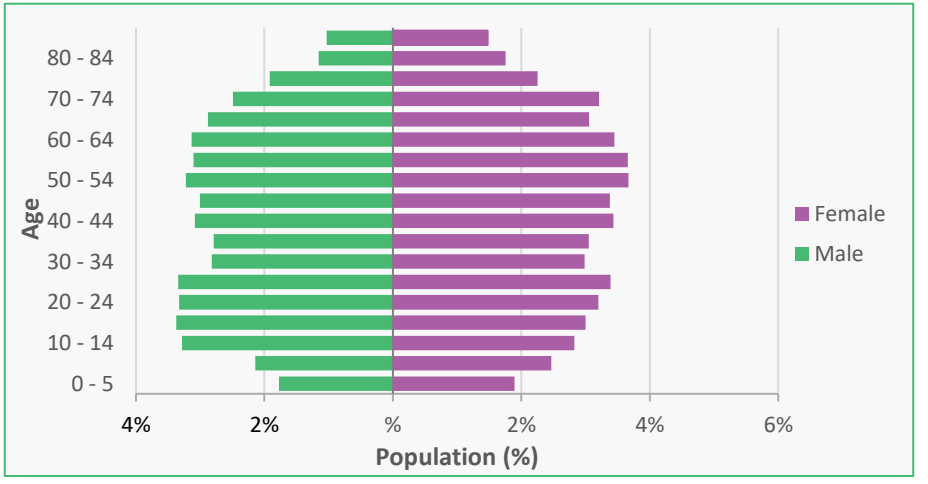
Figure 2.19 indicates that the median age for the North TPR in 2021 was 42.9. Figure 2.20 show that the age group between 50 and 54 years is the largest age group.

Figure 2.19: Median Age in North TPR Per Year



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

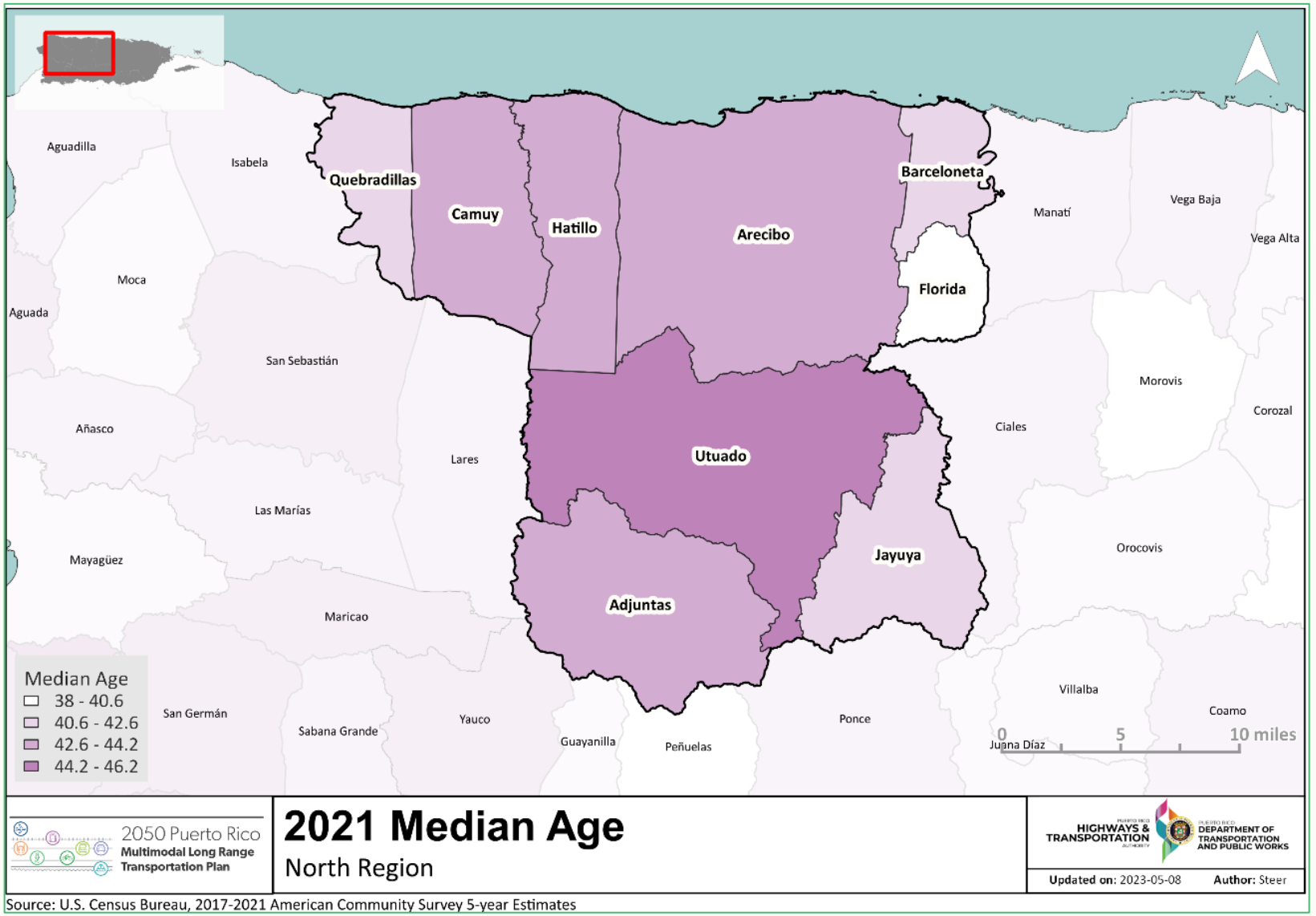
Figure 2.20: North TPR Age Distribution 2021



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Figure 2.21 indicates that the Municipality of Utuado (45.1 years) is the one with the highest median age, while the Municipality of Florida (40.6 years) is the one with the lowest median age.

Figure 2.21: North TPR Median Age Per Municipality 2021

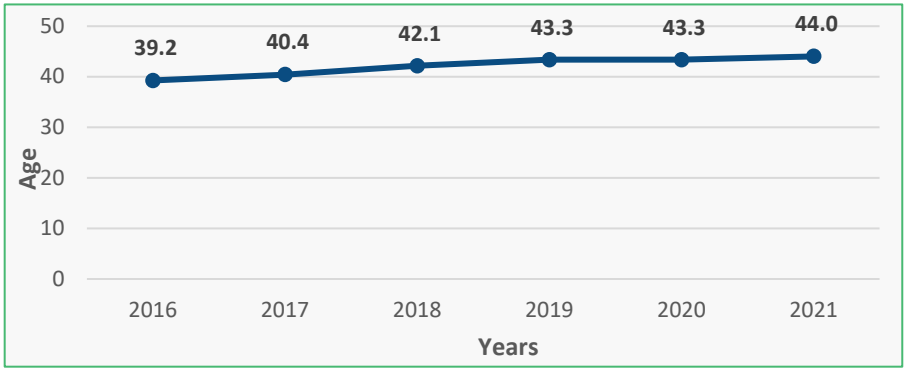


Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

- East TPR

Figure 2.22 shows that the median age for the last five (5) years in East TPR has been increasing and tends to go upwards. Since 2016, the median age of East TPR inhabitants has risen from 39.2 to 44.0.

Figure 2.22: Median Age in East TPR Per Year

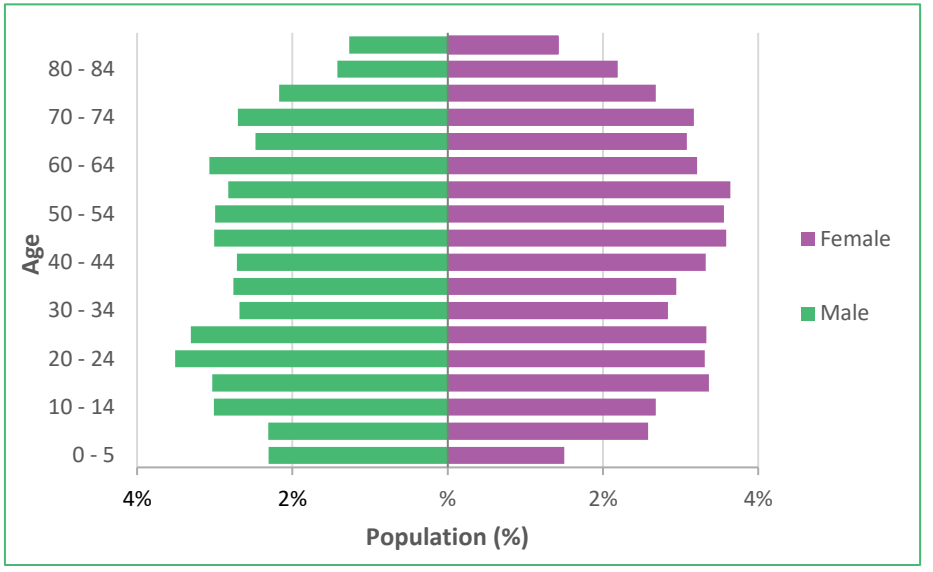


Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Figure 2.23 indicates that most people in East TPR are older than 40 years, confirming that the population is on the more senior side of the spectrum. It is worth noting the low proportion of males and females under 14 years, which indicates a trend of slower natality in recent years.

The population pyramid on Figure 2.23 shows a negative growth trend as there is population distribution towards older ages, rather than younger adults and children.

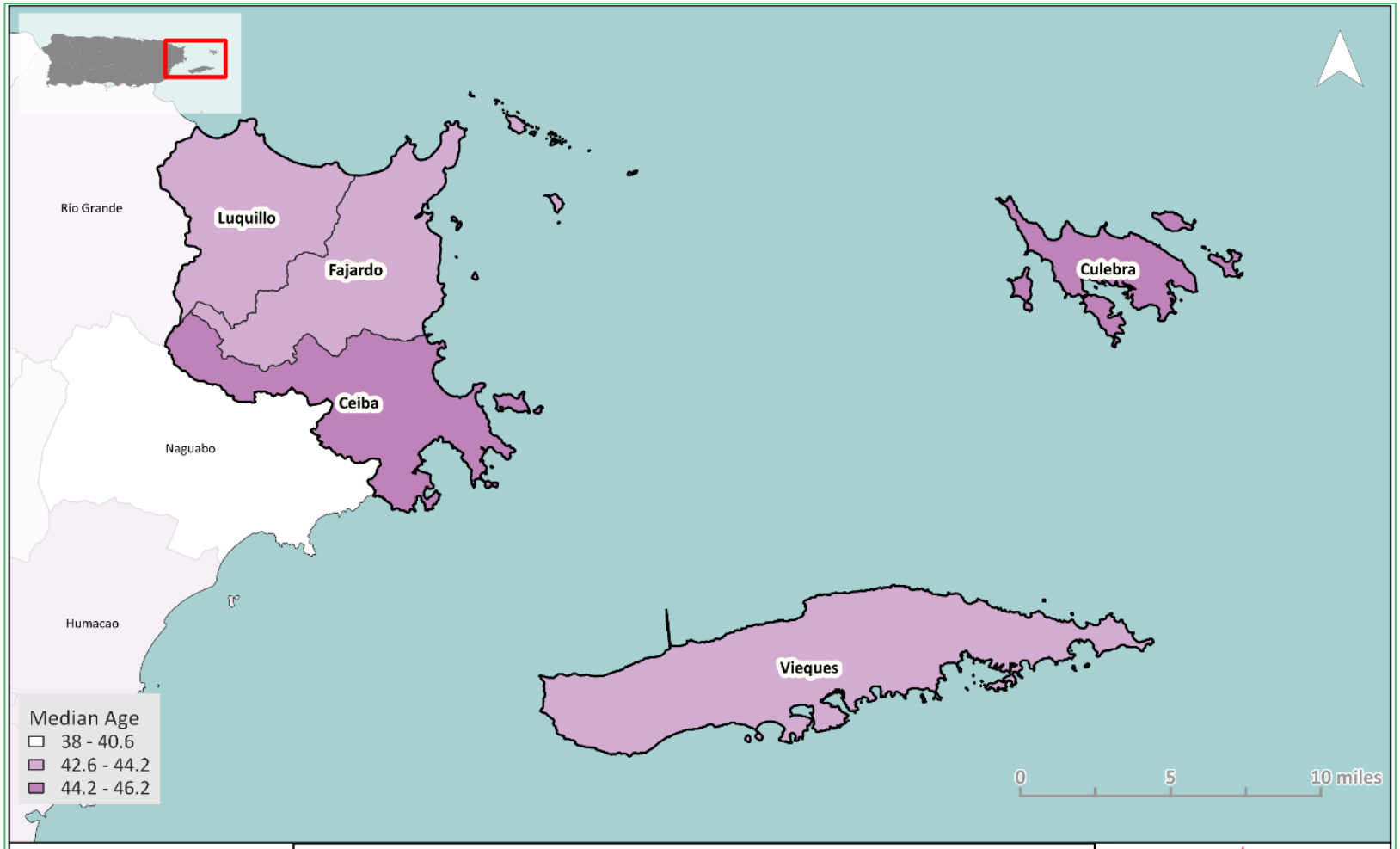
Figure 2.23: East TPR Age Distribution 2021



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Figure 2.24 shows the median age per municipality in the East TPR. In this region, the Municipalities of Culebra (45.1 years) and Ceiba (44.8 years) have on average, the oldest population. Luquillo municipality (43 years) has the youngest population, on average. This last indicates no substantial difference in age between the municipalities in the East TPR.

Figure 2.24: East TPR Median Age Per Municipality 2021

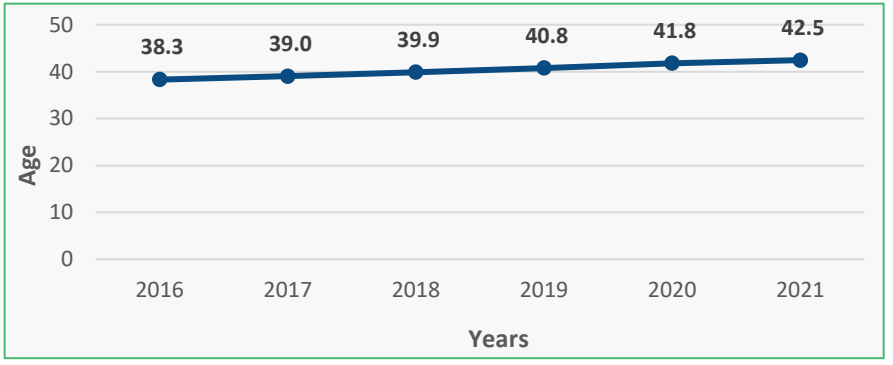


Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

- South TPR

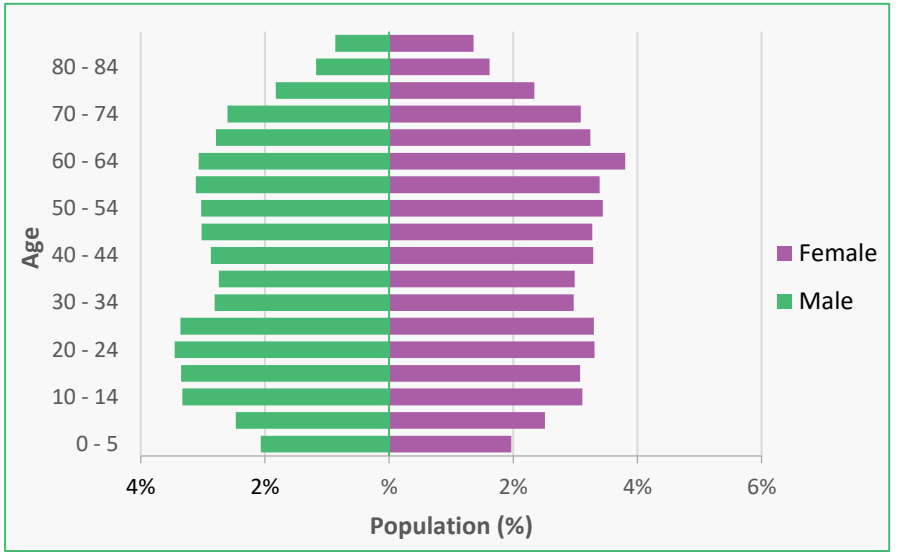
Figure 2.25 shows that the median age for the last five years has been increasing and tends to go upwards. Since 2016, the median age of South TPR inhabitants has risen from 38.3 to 42.5. Figure 2.26 indicates that most people in South TPR are older than 40 years, confirming that the population is on the more senior side of the spectrum.

Figure 2.25: Median Age in South TPR Per Year



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

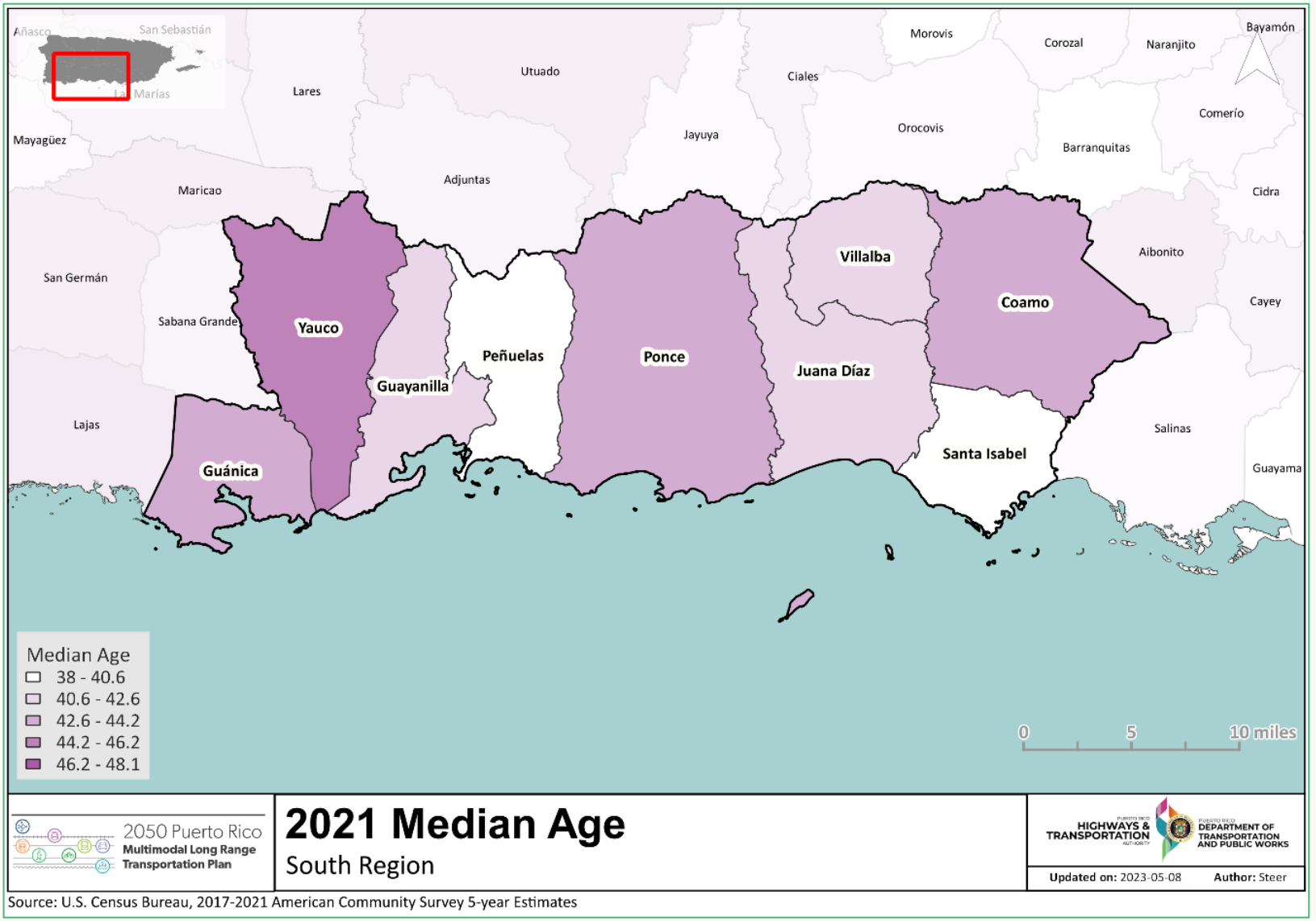
Figure 2.26: South TPR Age Distribution 2021



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Figure 2.27 shows the median age per municipality in the South TPR for 2021. This indicates that Yauco is the municipality with, on average, the oldest population, followed by Guánica, Ponce, and Coamo—meanwhile, Santa Isabel and Peñuelas possess, on average, the youngest population in the region.

Figure 2.27: South TPR Median Age Per Municipality 2021

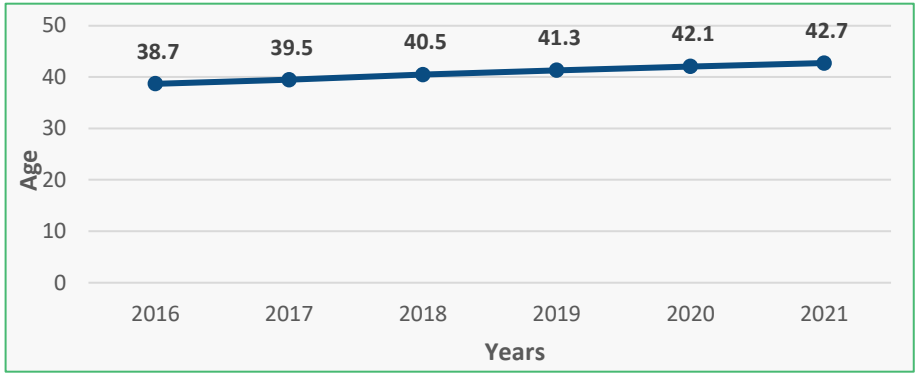


Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

- Southeast TPR

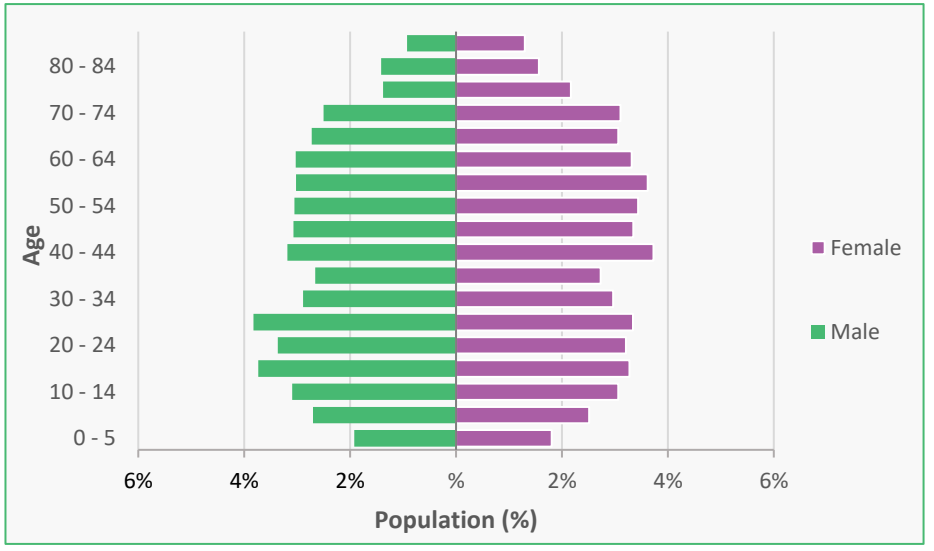
Figure 2.28 indicates that, for 2021, the median age in the Southeast TPR was 42.7 years. In Figure 2.29 it becomes evident that the group age between 25-29 in male, and 40-44 in female are the most frequent among Southeast TPR population.

Figure 2.28: Median Age in Southeast TPR Per Year



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

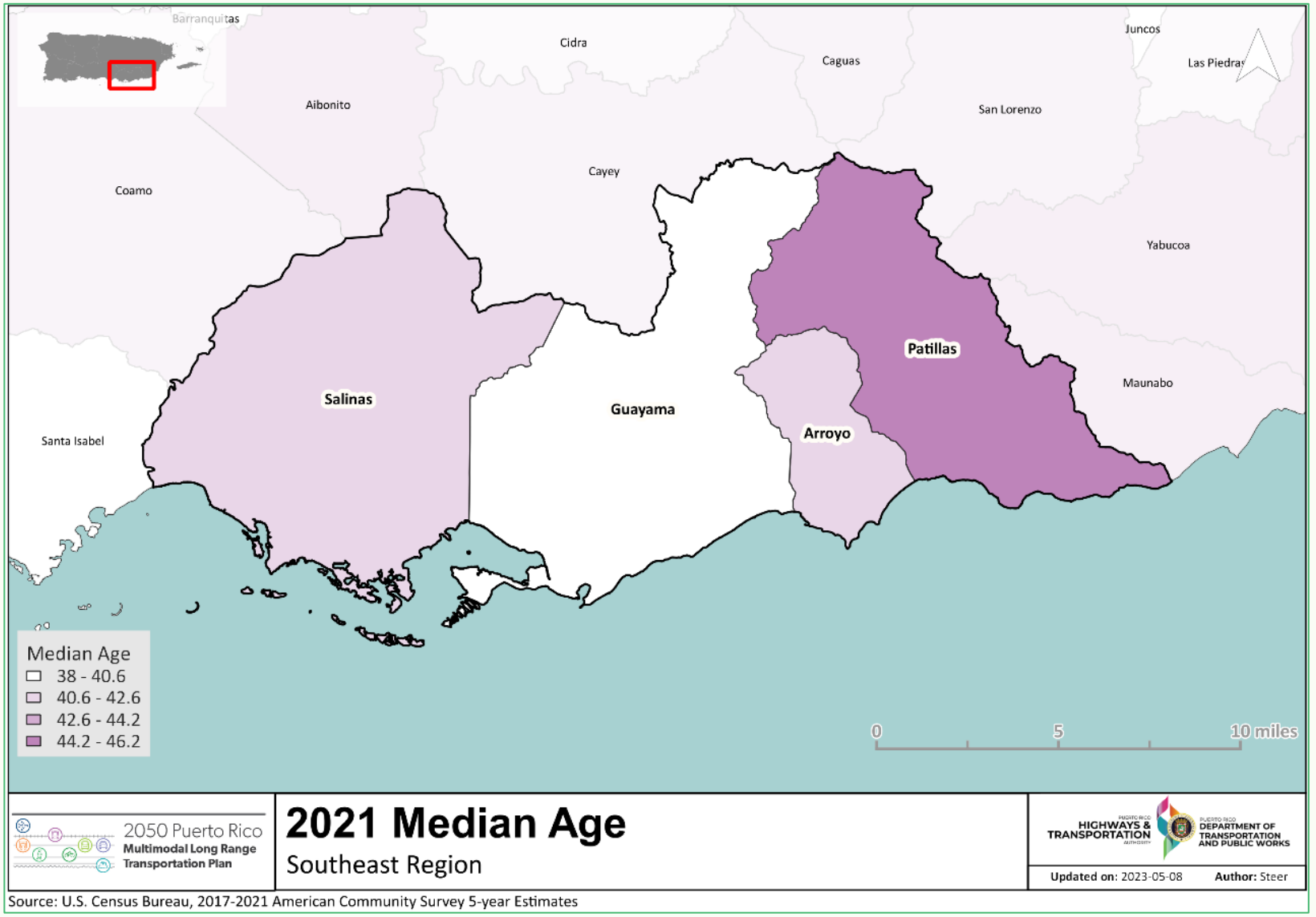
Figure 2.29: Southeast TPR Age Distribution 2021



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

According with Figure 2.30 the Municipality of Patillas (46.2 years) has the oldest population in the region.

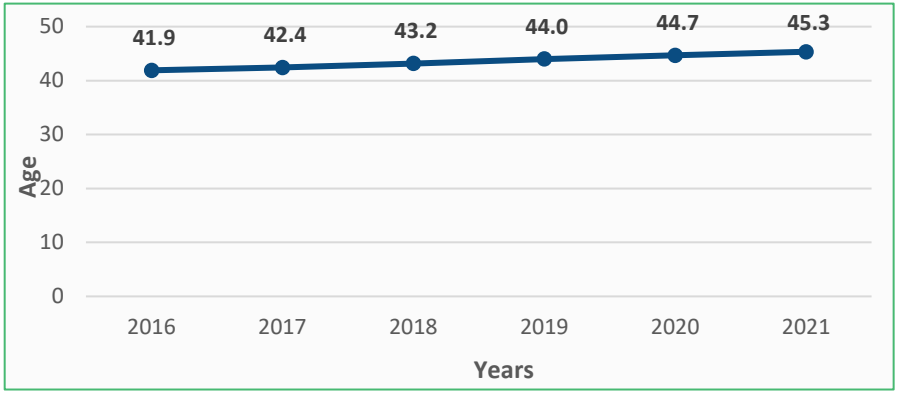
Figure 2.30: Southeast TPR Median Age Per Municipality 2021



- Southwest TPR

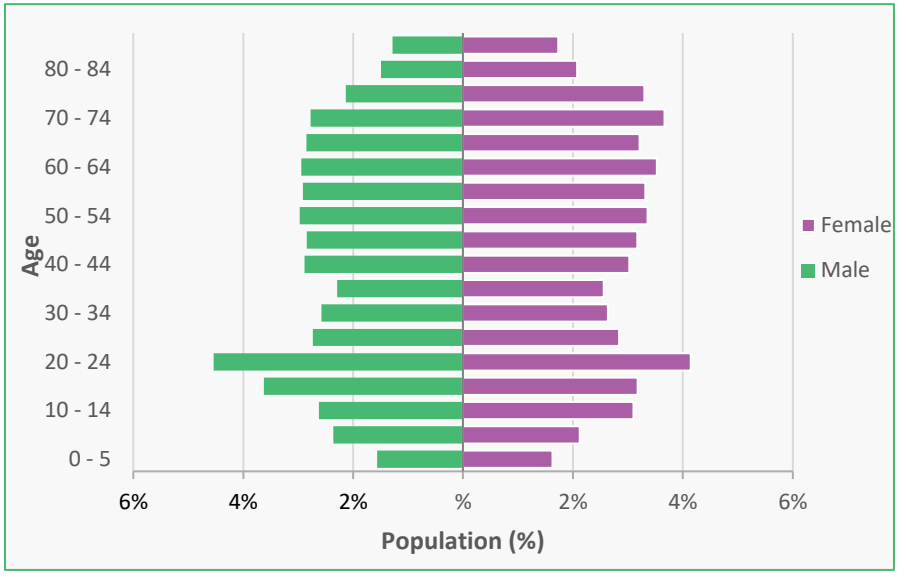
Figure 2.31 indicates that, for 2021, the median age in the Southwest TPR was 45.3 years. In Figure 2.32 it becomes evident that the group age between 20-24 is the most frequent among Southwest TPR population.

Figure 2.31: Median Age in Southwest TPR Per Year



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Figure 2.32: Southwest TPR Age Distribution 2021

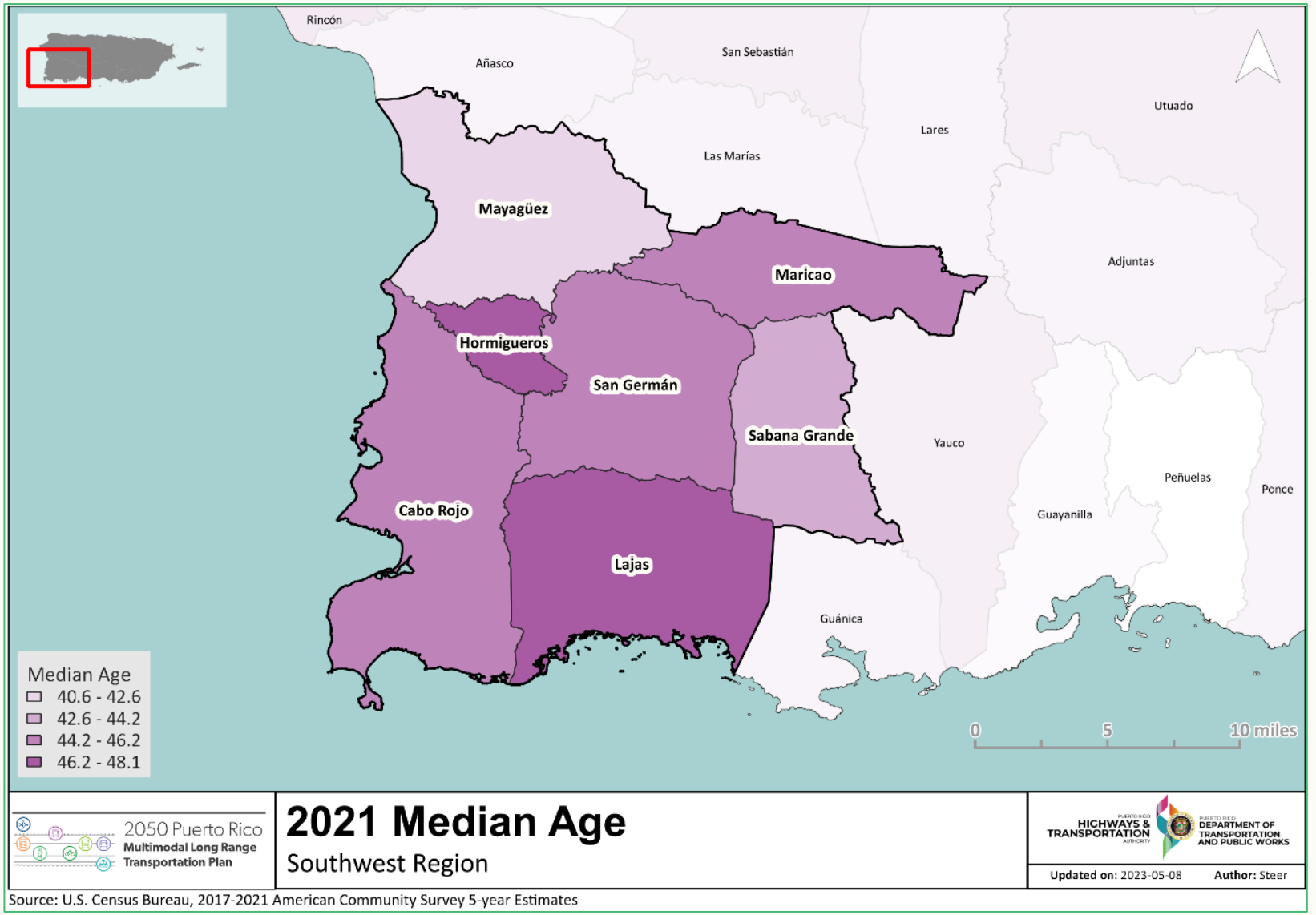


Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Figure 2.33 show that the municipalities of Hormigueros and Lajas have the oldest population, on average, in the region. In fact, Hormigueros (48.1 years) is the municipality with the highest population on average on the island.

In the Southwest TPRs, Mayagüez, is the municipality with the youngest population, on average (42.3 years).

Figure 2.33: Southwest TPR Median Age Per Municipality 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

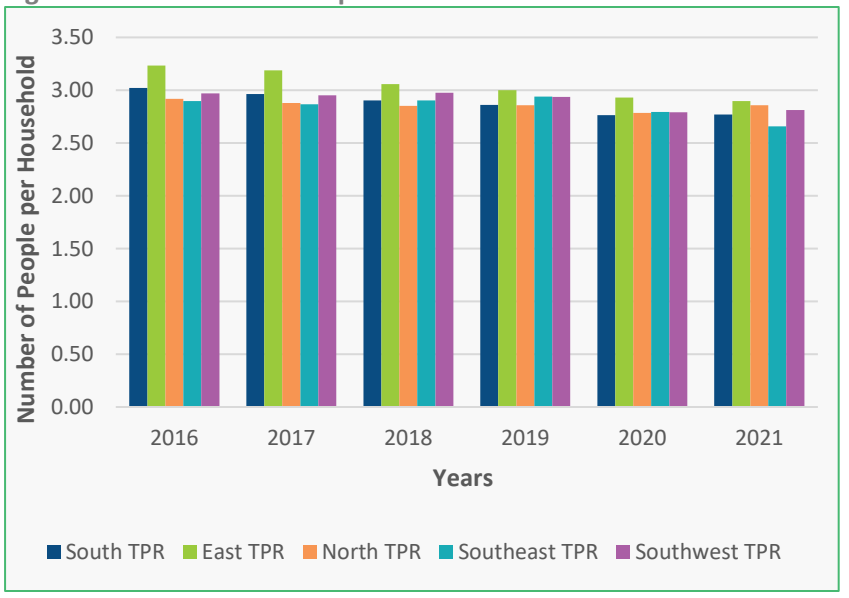
Housing

A household is defined by the Census as all the people who occupy a housing unit. Housing arrangements help outline people's livelihoods, their quality of live and living patterns. Household size also gives information about the type of goods and services that families consume and that will be required in the short and longer term.

Household Size

Puerto Rico's average household size in 2021 was approximately of 4.5 people, there has been a decreasing trend compared to 2016 when the average household size was 6.05 people. Each one of the UZAs have a different trend regarding household size, Figure 2.34 shows the number of people per household for the period 2016-2021 for each one of the UZA regions.

Figure 2.34: Number of People Per Household 2016-2021 Per UZA

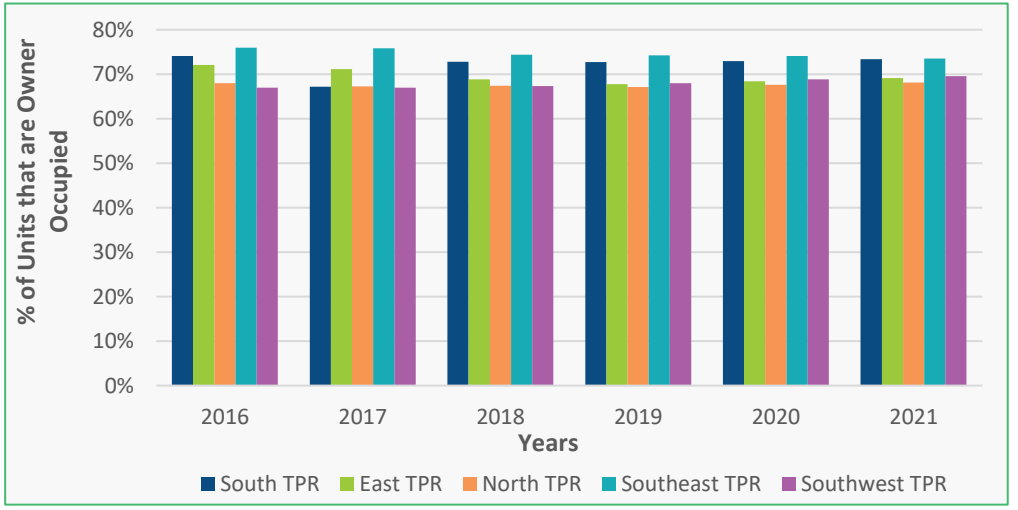


Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Similar to the island-wide trend, the UZA regions presented a decrease in average household size. The highest decrease was found in East TPR, where the average household size reduced from 3.23 in 2016 to 2.90 in 2021.

Figure 2.35 shows the tenancy profile in the UZA regions is relatively stable, between 68%-74%. The Southwest TPR has been the only one that has presented some tenancy growth passing from 67% to 70%. Meanwhile, East TPR has presented the biggest decrease in the same period, passing from 72% to 69%.

Figure 2.35: Tenancy Profile 2016-2021 Per UZA



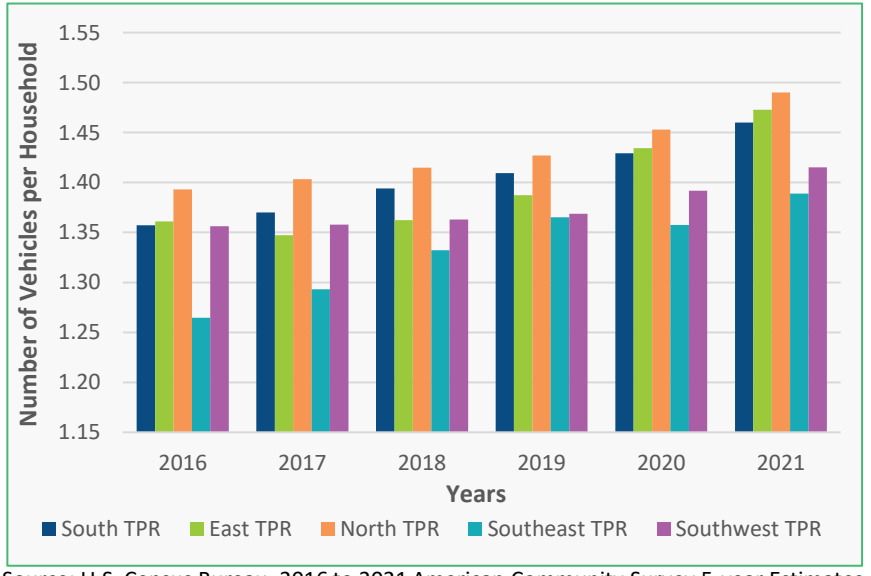
Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Vehicles per Household

Knowing the average number of vehicles per household can help analyse people's commuting patterns and their propensity to use public transport or other sustainable modes of transportation. In Puerto Rico, almost all households have one (1) or two (2) vehicles and a very low percentage of them have three (3) or more vehicles. Nevertheless, the average number of vehicles has been increasing from 2016 (1.39 vehicles per household) to 2021 where each household had an average of 1.50 vehicles.

Figure 2.36 show the trend of vehicles per household in the different UZA regions.

Figure 2.36: Number of Vehicles Per Household 2016-2021 Per UZA



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

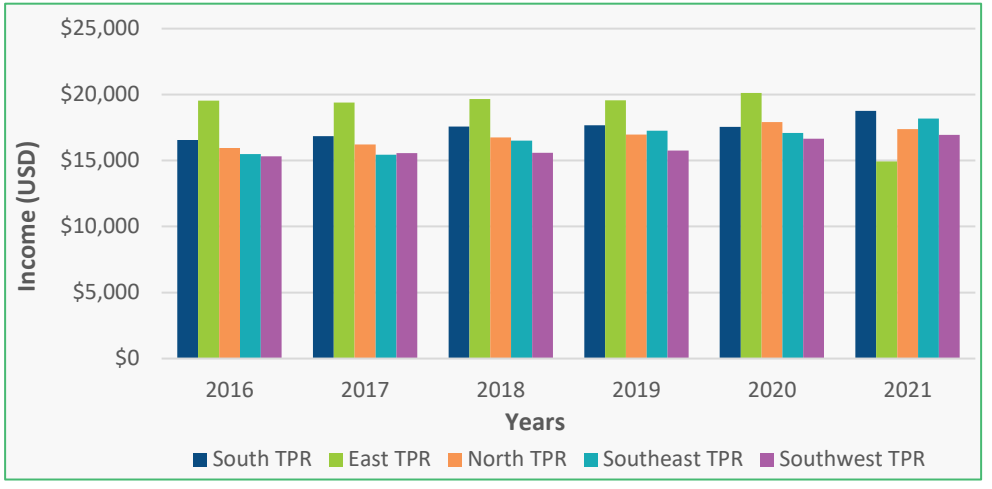
As well as the island-wide tendency, the number of vehicles per household in the UZA regions has presented a positive trend between 2016 and 2021, with an average increase of 7.4% in vehicles per household. The Southeast TPR showed the highest growth, almost 10%, compared to 2016, while the Southwest TPR presented the most modest with 4.34%.

Median Household Income

The median household income is one of the best indicators of how the economy in a region is behaving. This indicator, compared with the costs of living, will also help infer how the spending patterns of families and individuals will be on basic goods and services, considering that the type of expenses will depend on the income available. Puerto Rico's median household income has been increasing, from $19,606 in 2016 to $21,967 in 2021. The increase in median household income is a good economic indicator for the Island, as households are now able to spend more in goods and services. Nevertheless, this indicator should be analysed with caution and compared to the cost of living in a particular region to verify if people's purchasing capacity has effectively increased.

Figure 2.37 shows the household income trend in the different UZA regions.

Figure 2.37: Median Household Income 2016-2021 (current dollars) Per UZA



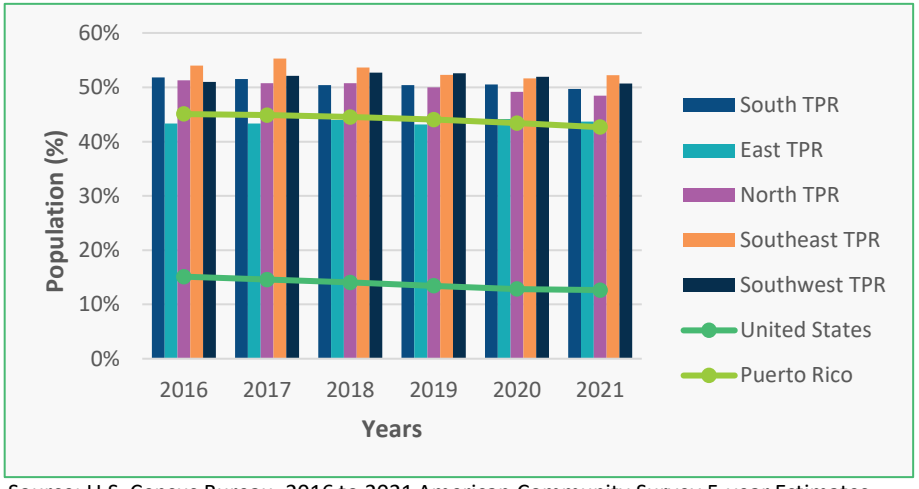
Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

The median household income across UZA regions in 2021 was $17,242, 21.5% less than the average income in Puerto Rico for the same year ($21,967). None of the UZA regions are on, or above, the island-wide average; however, between 2016 and 2021, there has been some relevant growth in regions like Southeast TPR (+17.3%) and South TPR (+13.3%). It is worth noting that East TPR has shown a considerable decrease in median household income of 23.5%.

Poverty

The poverty levels in Puerto Rico have been decreasing since 2016 and this has been a trend in all regions in Puerto Rico. Figure 2.38 shows the population that is below the poverty threshold established by the U.S. Census Bureau each year, according to household size and related children under 18 years. Figure 2.38 shows that population under the poverty level in all UZA is generally higher than that of Puerto Rico, except for the East Region in 2017. So, even though all the population in Puerto Rico tends to be less poor as time passes, UZA still represents the territories with the highest levels of poverty in the Island.

Figure 2.38 Poverty Levels in UZA, Puerto Rico and the U.S.



Source: U.S. Census Bureau, 2016 to 2021 American Community Survey 5-year Estimates

Our Economy: Gross Domestic Product (GDP)

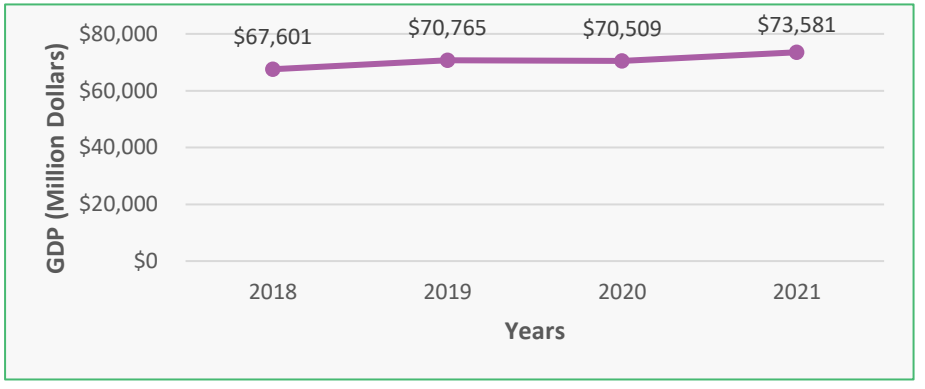
In terms of the Economy, it is important to review the historical data to understand the different trends in the Island. Economic performance has a big impact on sociodemographic trends in a specific region and can help forecast how different services will be provided in the short-, middle- and long-term. The GDP and employment trends will be discussed in this section.

Gross Domestic Product

Due to the limitations of the available data, only information at the Island-wide is presented in this section.

GDP is the world's most widely used macroeconomic indicator that reflects economic movement, as it is the most comprehensive measure of an economy's output of goods and services in a year. Over the last couple of years, GDP in Puerto Rico has had a general tendency to increase since 2018, as shown in Figure 2.39. At current prices for 2018 GDP was $67 billion, which continued to increase in 2019, a slight decrease in 2020, and then a final increase in 2021.

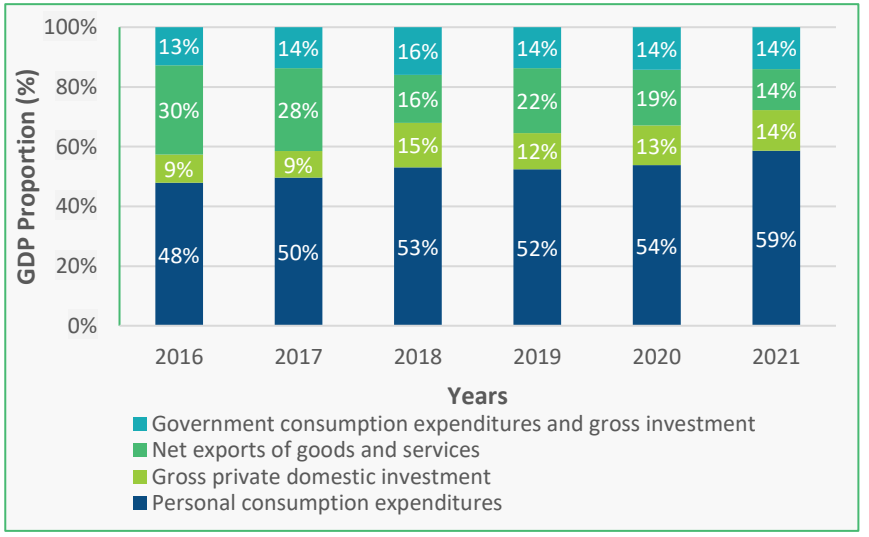
Figure 2.39: Puerto Rico GDP 2018-2021 in Millions of Current Dollars



Source: Economic Report to the Governor 2016 and 2021, Planning Board.
The graph uses the data from 2018-2021.

GDP is composed of i) personal consumption expenditures, ii) gross private domestic investment iii) net exports of goods and services, and iv) government consumption expenditures and gross investment. As Figure 2.40 shows, more than 50% of GDP is composed by the consumption of goods and services (shown by the series "personal consumption expenditures" in blue), which has been increasing throughout the years. In the same way, both net exports and government investment have been decreasing the share of GDP composition from 2016 to 2021.

Figure 2.40: GDP Composition 2016-2021

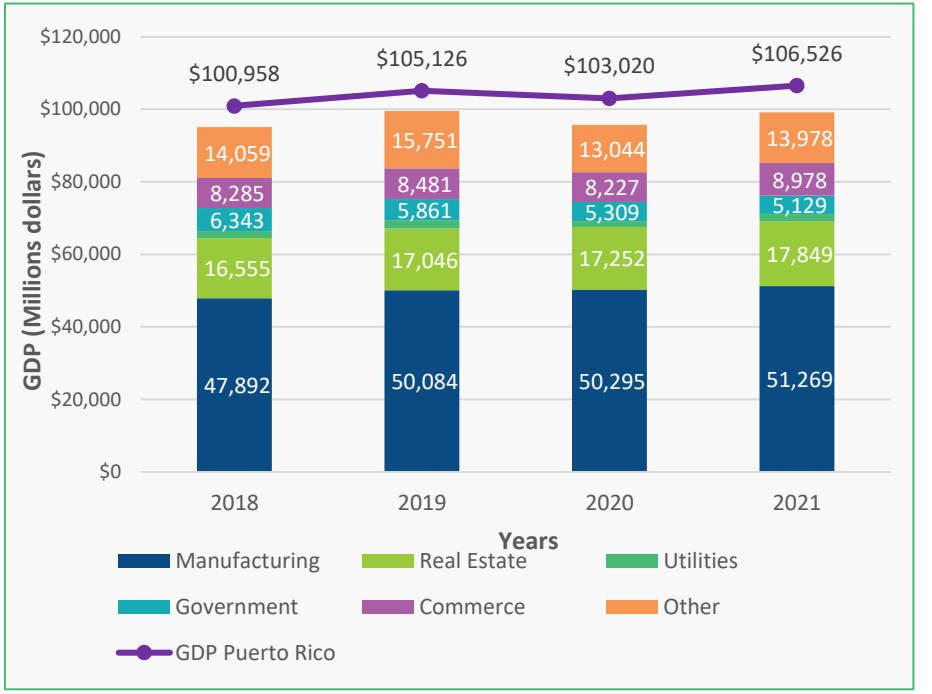


Source: Bureau of Economic Analysis, 2023

From the goods and services consumed, the five (5) industries that have a larger share of GDP are manufacturing, real estate, utilities, commerce, and government expenditures. In general, all industries increased in line with GDP, specially manufacturing that corresponds to 48.1% of the industrial sector in the Island.

In nominal terms, GDP totaled $106,526 million in 2021, reflecting an increase of $3,505 million or 3.4% compared to $103,020 million in 2020, as shown in Figure 2.41.

Figure 2.41: Puerto Rico GDP 2018-2021 in Millions of Current Dollars



Source: Economic Report to the Governor 2016 and 2021, Planning Board.
The graph uses the data from 2018-2021.

Agriculture, specifically, used to constitute the most significant source of economic activity of the Island. Bananas, coffee, oranges, roots, tobacco, and tubers constituted the main crops cultivated in the Island. However, in the 1960s the government geared the local economy toward a manufacturing and petrochemical industry, to improve the extreme poverty levels of the population[6]. This resulted in a constant and prolonged reduction of the agricultural output while benefiting the establishment of new manufacturing facilities. Until this date, it keeps being the case, since the manufacturing and large industrial sector constitutes a 48% of GDP.

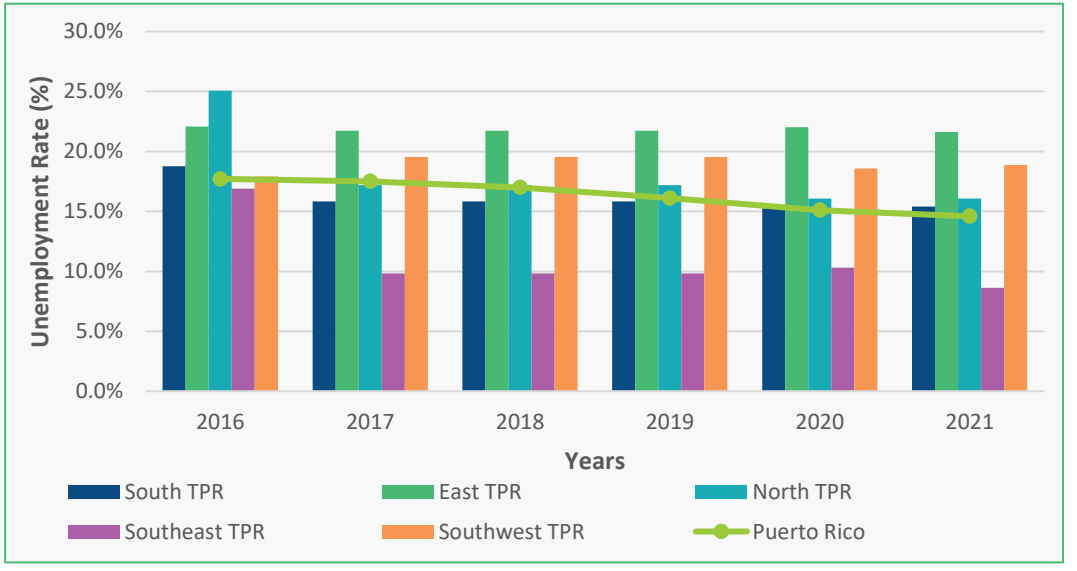
Nevertheless, a slow return of the agriculture industry is being observed, but this time with the advantage of modern agricultural practices, such as hydroponics, which help to maximize the use of available lands. As per data from the University of Puerto Rico in Mayagüez[7], the Island imports more than 80% of the food that is consumed. Bananas, coffee, plantains, mangos, and other high value specialty items such as mushrooms, lettuce, and tomatoes are currently the most consumed agricultural products. In addition, dairy production and other livestock products provide other streams of agricultural income, especially in the north-northwestern area of the Island.

Employment

According to the U.S. Data Census, American Community Survey for 2021, Puerto Rico had a labor force of 44.3%. There has been an Island-wide increasing trend in employment statistics, and a decreasing trend in unemployment rates from 2016 to 2021, as shown in Figure 2.42.

Between 2016 and 2021, most of the UZA regions have presented decreased trends regarding unemployment. In this period, regions such as the North TPR decreased their unemployment rate from 25.1% in 2016 to 16.1% in 2021 while increasing employment from 30.6% in 2016 to 33.5% in 2021. Meanwhile, in this same period, the Southwest TPR has slightly increased its unemployment from 17.9% in 2019 to 18.9% in 2021 but, in the same period, presented a slight increase in its employment from 30.4% in 2016 to 31.3% in 2021. This is shown in Figure 2.42.

Figure 2.42: Unemployment Rate 2016-2021 Per UZA



Source: U.S. Census Bureau, American Community Survey 2016 to 2021 5-Year Estimates

These employment and unemployment trends could vary from many factors, such as population growth and aging. However, the employment trends in the UZA regions suggest a slightly optimistic scenario in which most regions are decreasing their unemployment while increasing their employment.

6. Ruiz Toro, Juan (n.d). Puerto Rico's Operation Bootstrap. Modern Latin America Chapter 12. Strategies for Economic Development. Providence: Oxford University Press. Retrieved from: https://library.brown.edu/create/modernlatinamerica/chapters/chapter-12-strategies-for-economic-developmen/puerto-ricos-operation-bootstrap/#:~:text=By%201967%2C%20it%20estimated%20that,in%20less%20than%20twenty%20years. On September, 2023.
7. Mariam Ludim Rosa. 2020. La vulnerable seguridad alimentaria de la isla.

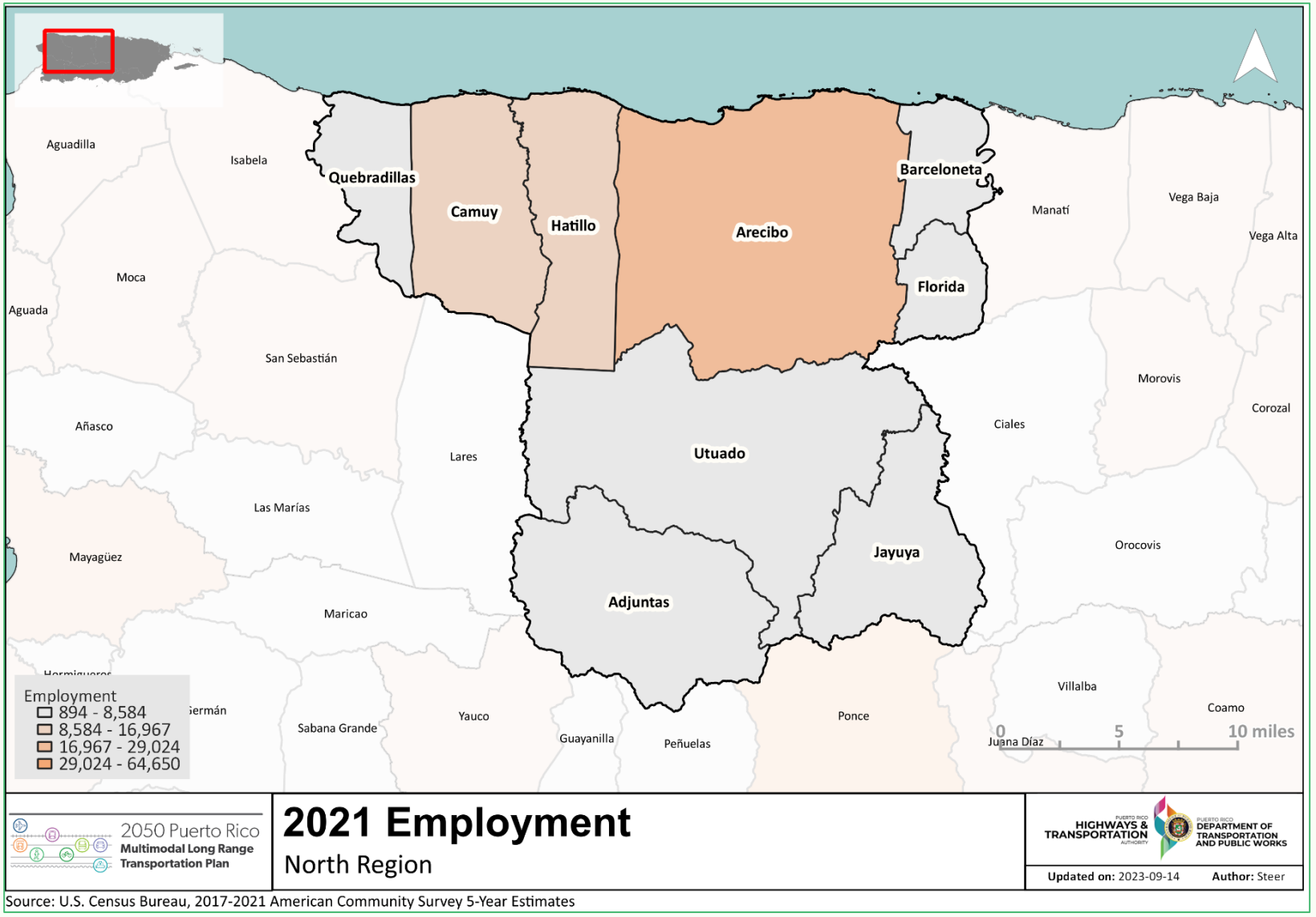
The following figures show the employment and unemployment numbers by municipality for each one of the UZA regions. A summary of the tendencies shown is shown below.

- **North TPR (Figure 2.43 and Figure 2.44):**
  - Municipalities with most employment: Arecibo, Hatillo, Camuy.
  - Municipalities with most unemployment: Adjuntas, Jayuya.
- **East TPR (Figure 2.45 and Figure 2.46):**
  - Municipalities with most employment: Fajardo.
  - Municipalities with most unemployment: Fajardo[8], Vieques.
- **South TPR (Figure 2.47 and Figure 2.48):**
  - Municipalities with most employment: Ponce, Juana Díaz.
  - Municipalities with most unemployment: Villalba, Yauco.
- **Southeast TPR (Figure 2.49 and Figure 2.50):**
  - Municipalities with most employment: Guayama.
  - Municipalities with most unemployment: Patillas, Salinas.
- **Southwest TPR (Figure 2.51 and Figure 2.52):**
  - Municipalities with most employment: Mayagüez, Cabo Rojo.
  - Municipalities with most unemployment: Lajas, Maricao.

It is important to highlight that an increase or decrease in unemployment does not signify a direct increase or decrease in employment in the same territory. The changes in employment trends tend to be related to the migration of people into and out of a territory, as well as the creation of new employment, among other variables.

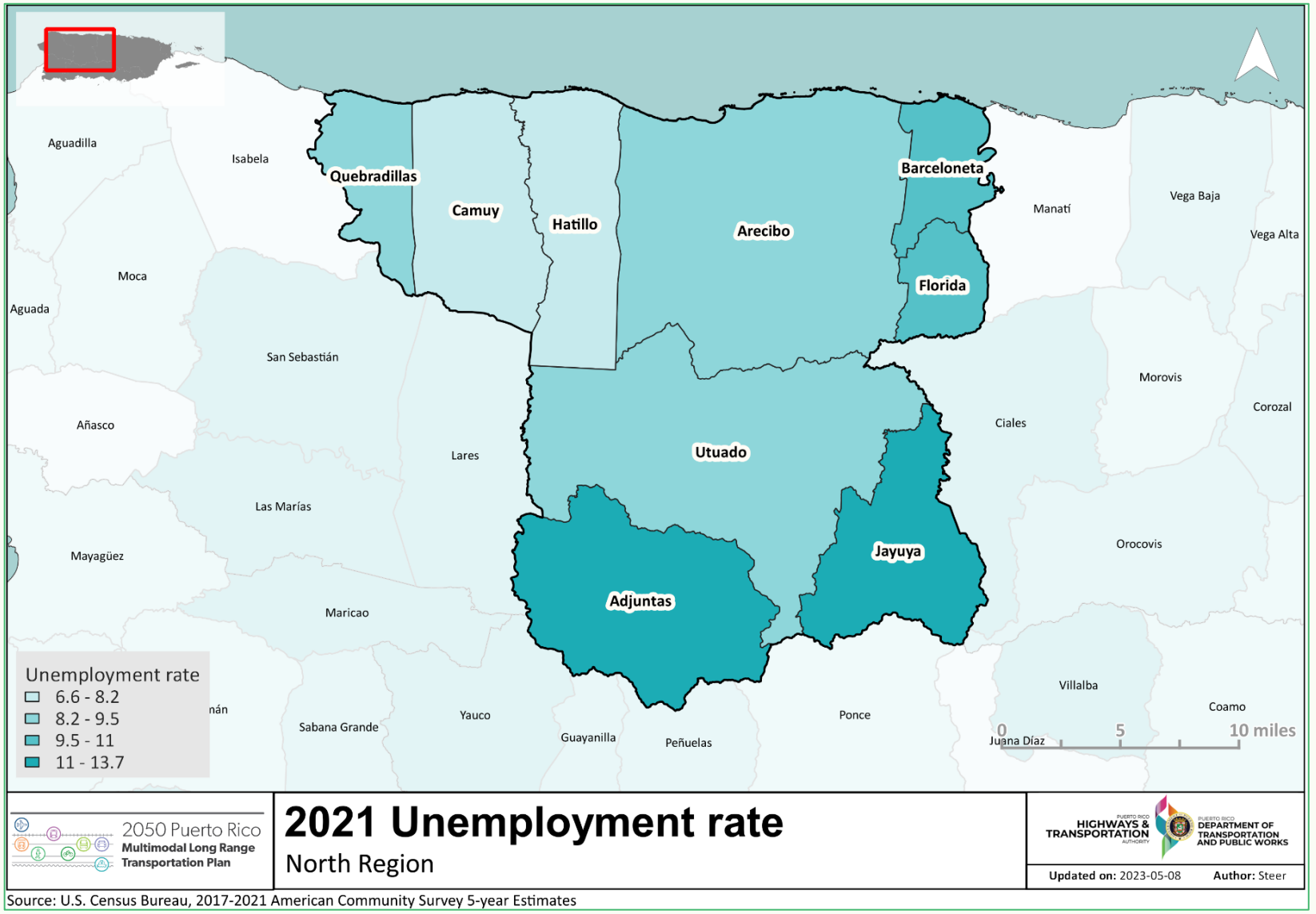
8. Fajardo is the municipality with both the most employment and unemployment because it has a bigger population tan the rest of the municipalities in the region.

Figure 2.43: North TPR Employment 2021



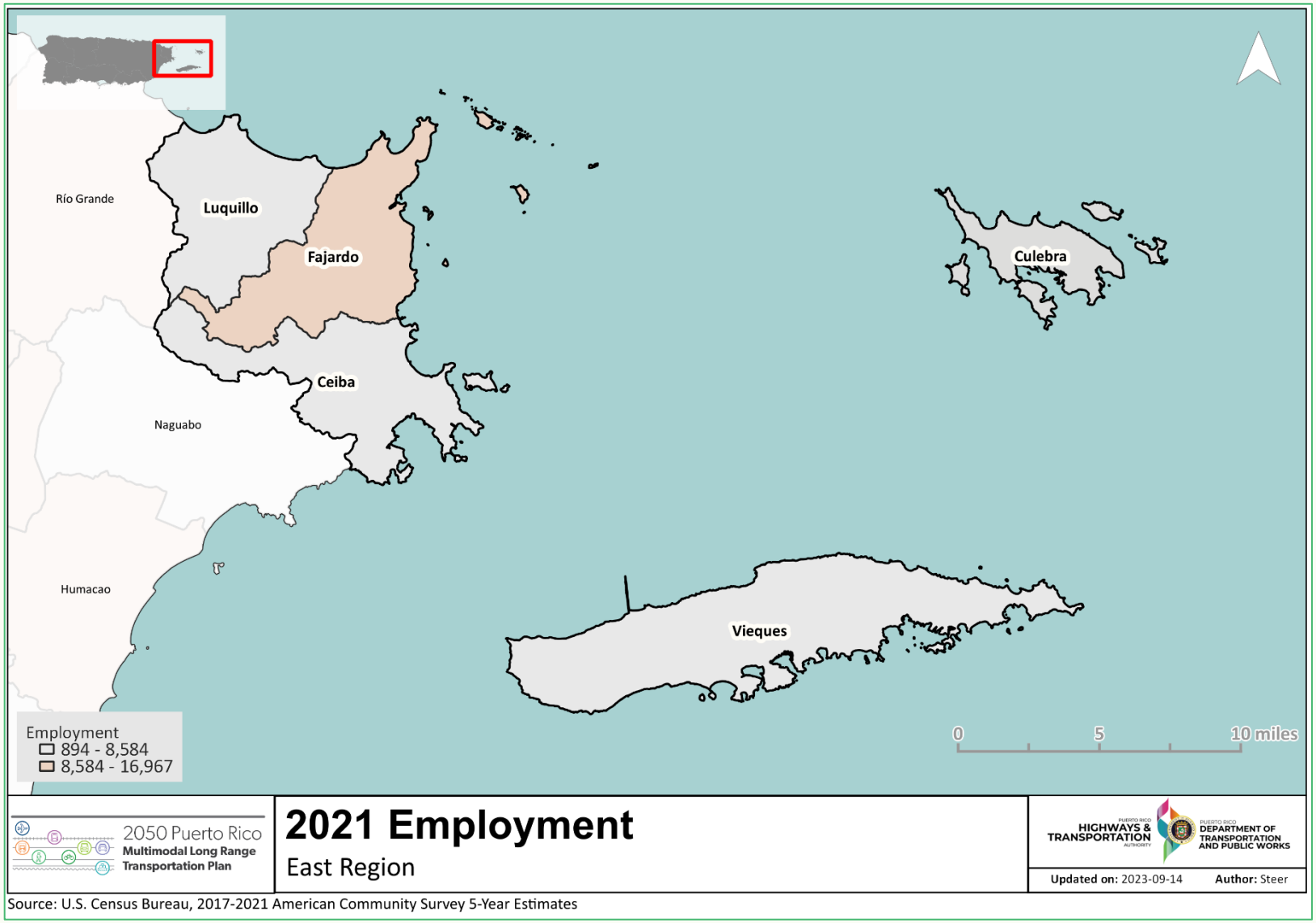
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.44: North TPR Unemployment Rate 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

Figure 2.45: East TPR Employment 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

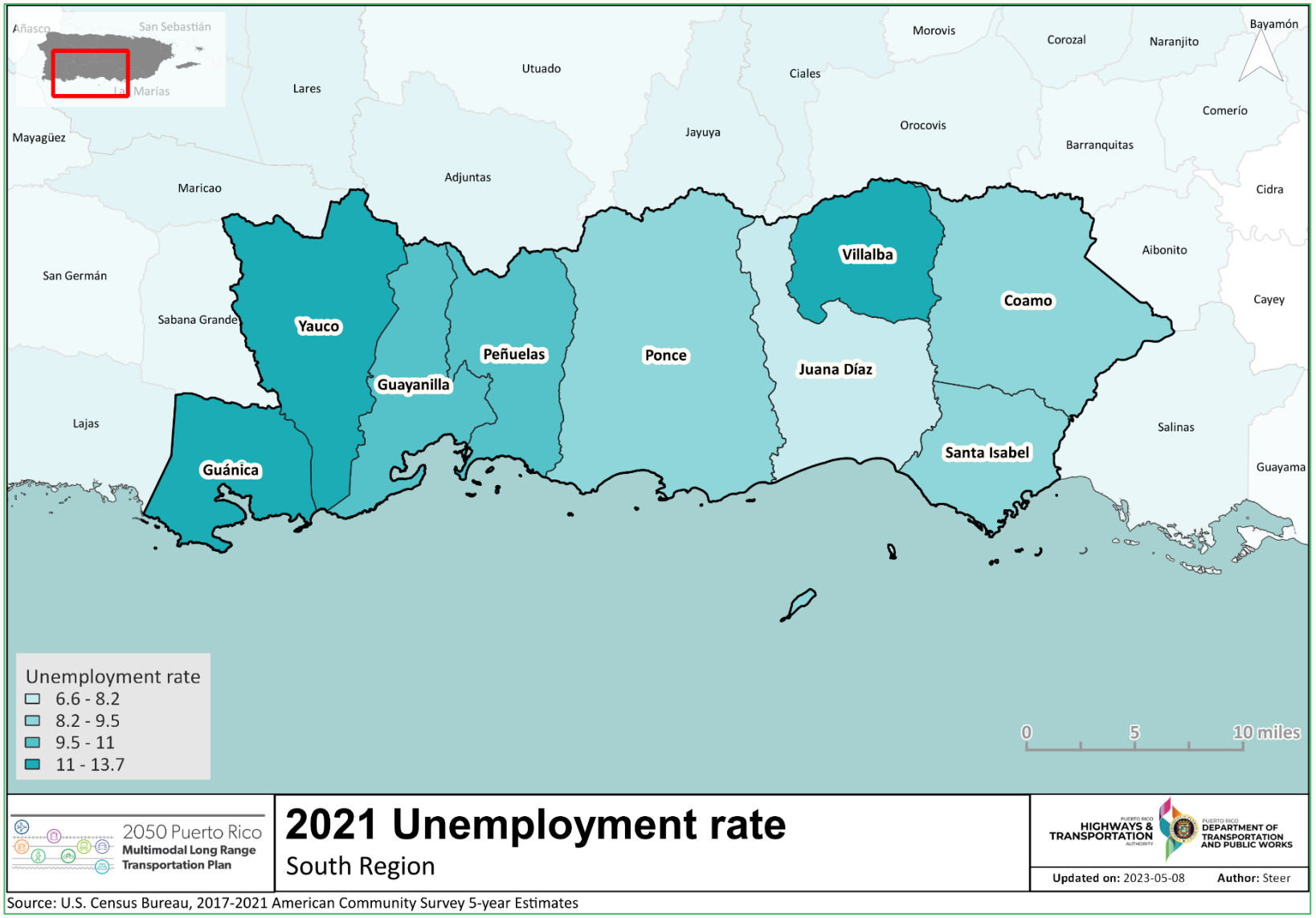
Figure 2.46: East TPR Unemployment Rate 2021

Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

Figure 2.47: South TPR Employment 2021

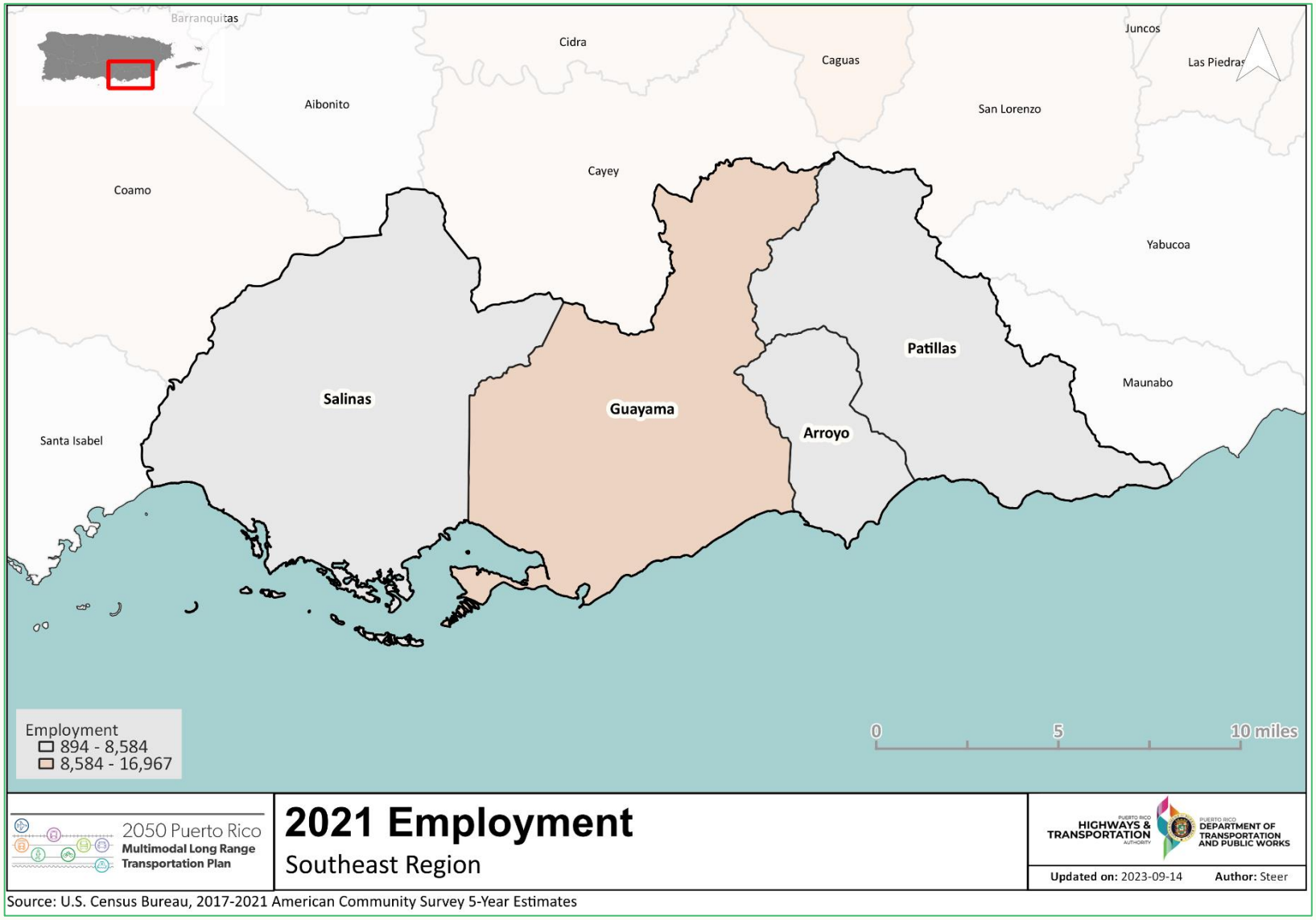
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.48: South TPR Unemployment Rate 2021



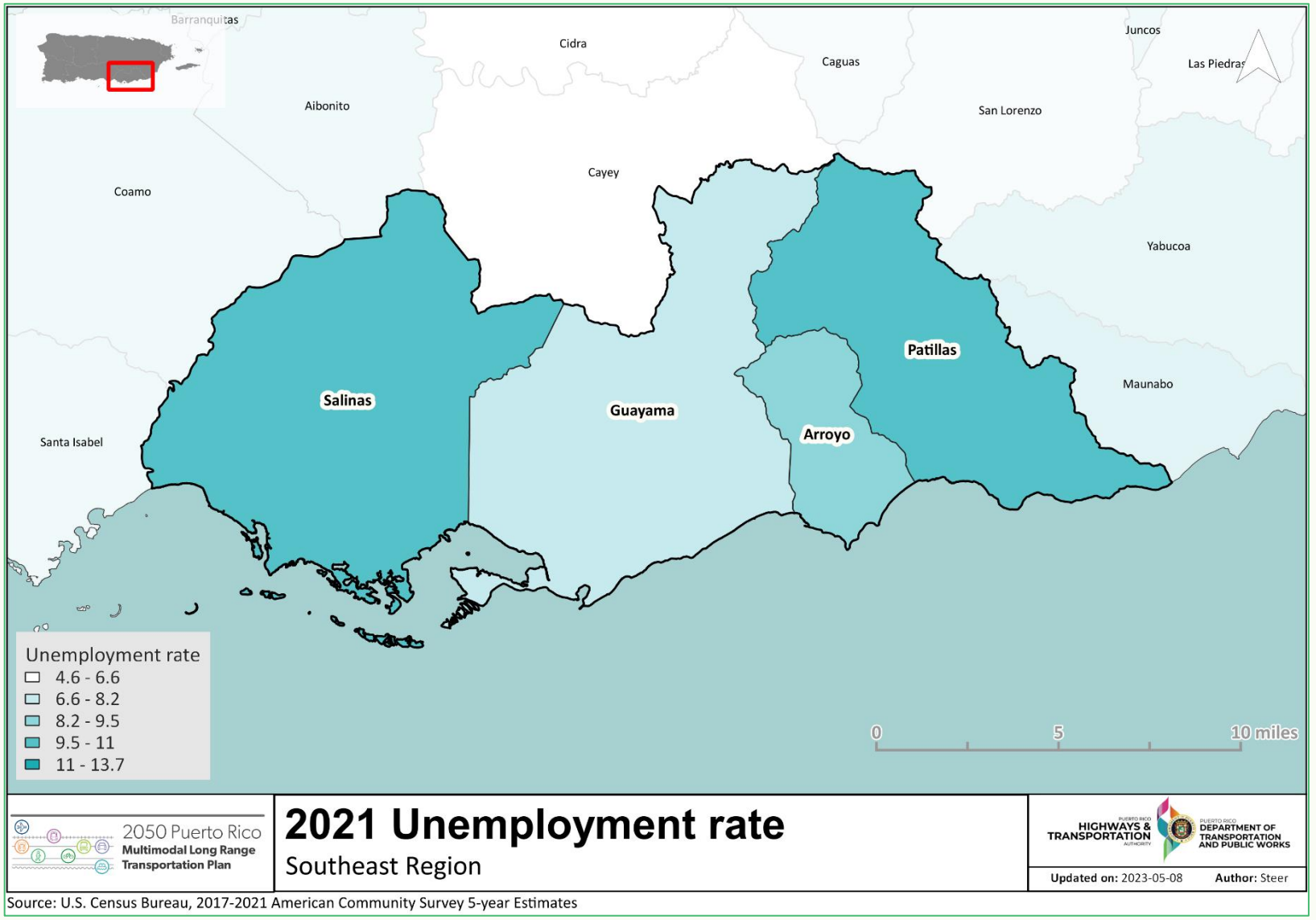
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

Figure 2.49: Southeast TPR Employment 2021



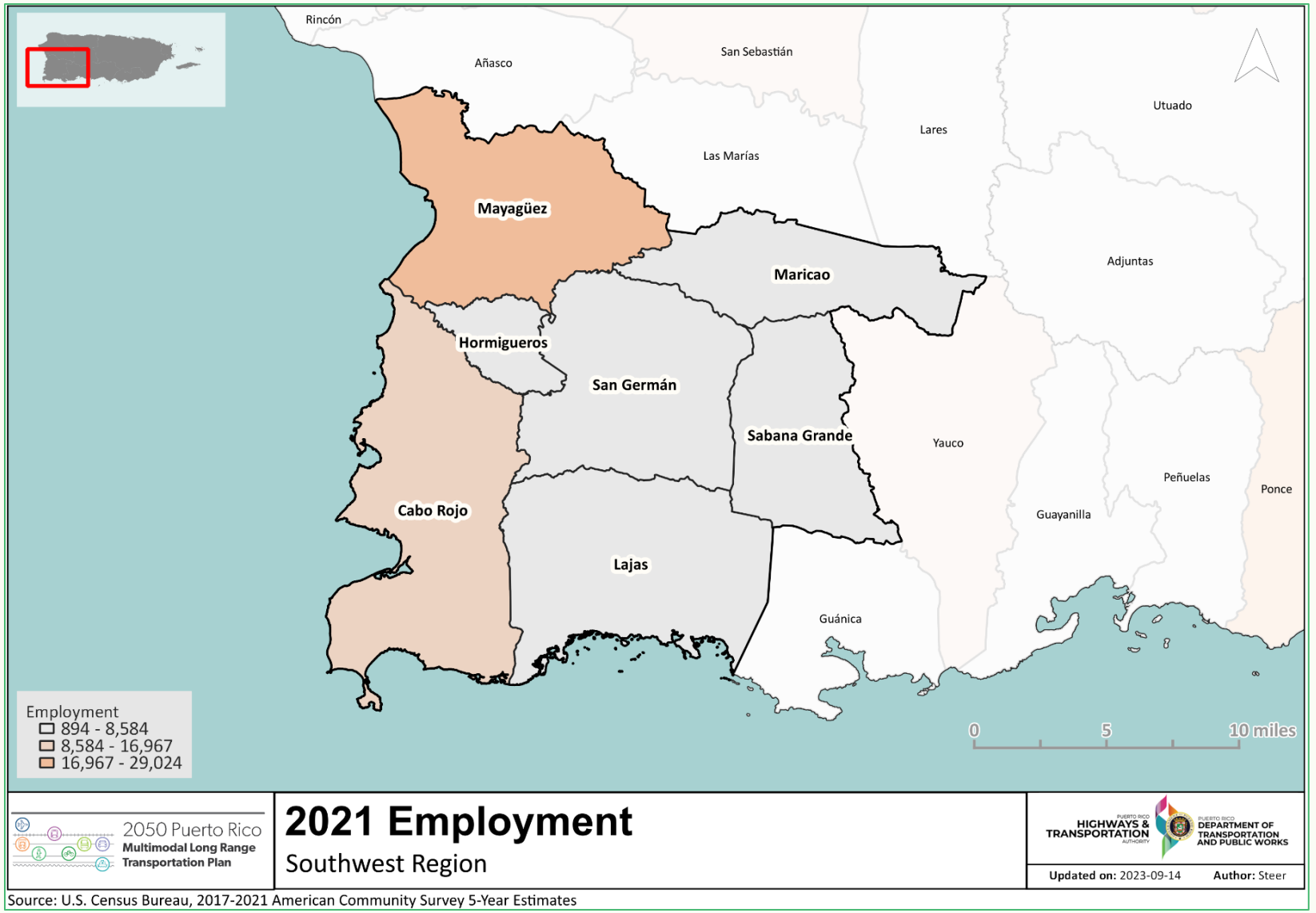
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.50: Southeast TPR Unemployment Rate 2021



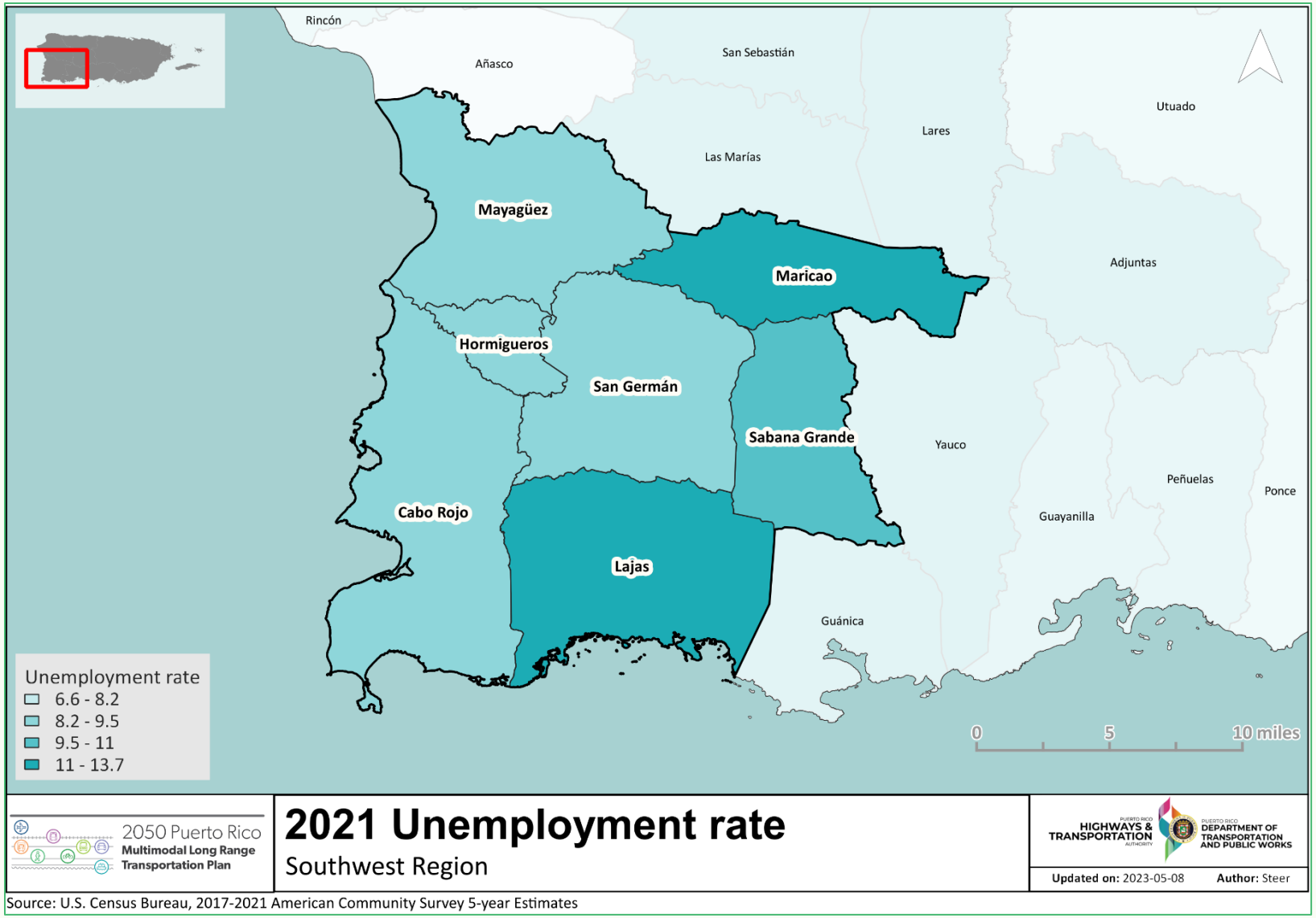
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

Figure 2.51: Southwest TPR Employment 2021



Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates

Figure 2.52: Southwest TPR Unemployment Rate 2021



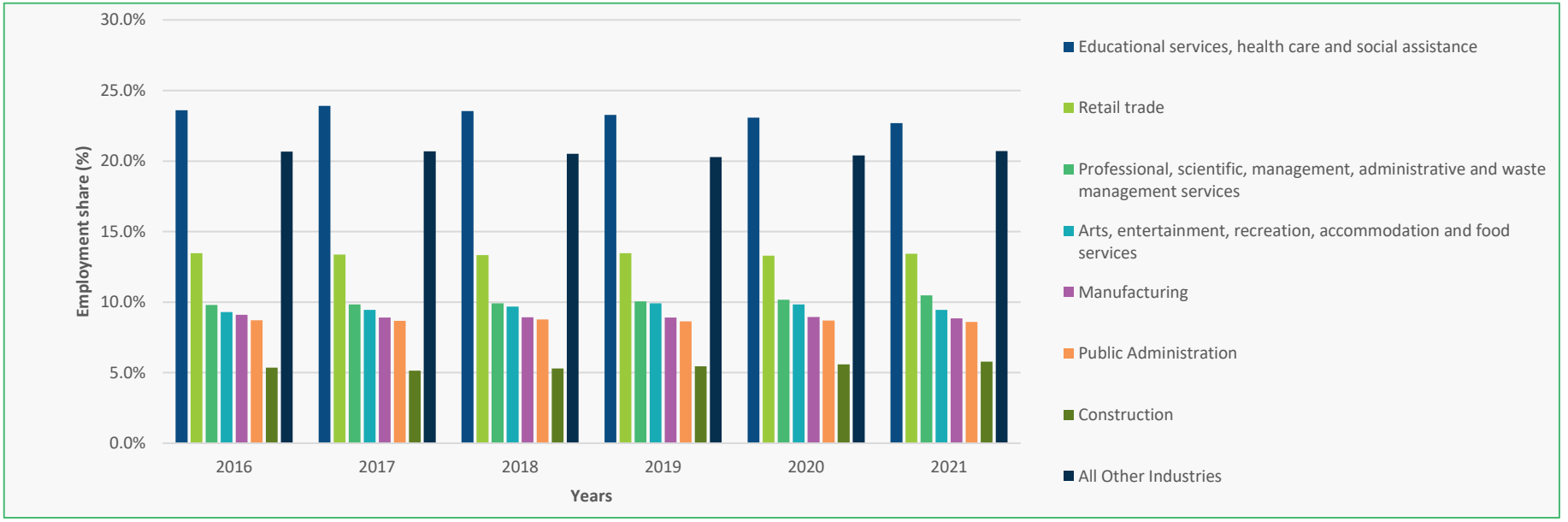
Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-year Estimates

As shown in Figure 2.53, two (2) main industries generate around 36% of employment in the Island, these are: Educational services, health care and social assistance; and Retail trade. These industries are followed by Professional, scientific, management, administrative, and waste management services; Arts, entertainment, recreation, accommodations, and food services; and Manufacturing.

As it was discussed, agriculture used to be the industry that generated a largest share of the GDP, as well as employment. Nevertheless, as of 2021, it is one of the smallest industries, generating the lowest share of employment (1.3%)[9].

The share of employment among industries also varies on each region. As shown in Figure 2.53 each region generates employment in different industries. The five (5) biggest employers are within the industries of: Educational services, health care and social assistance; Retail trade; Manufacturing; Public administration; and Arts, entertainment, recreation, accommodation and food services. The differences between regions responds to the geographic location of different industries. In general, all industries have a predominance of educational services, health care and social assistance, followed by retail trade. The graph shows the biggest industries in terms of employment share, and then groups all other industries that are very small and represent in the graph[10].

Figure 2.53: Puerto Rico Employment Share Per Industry 2021

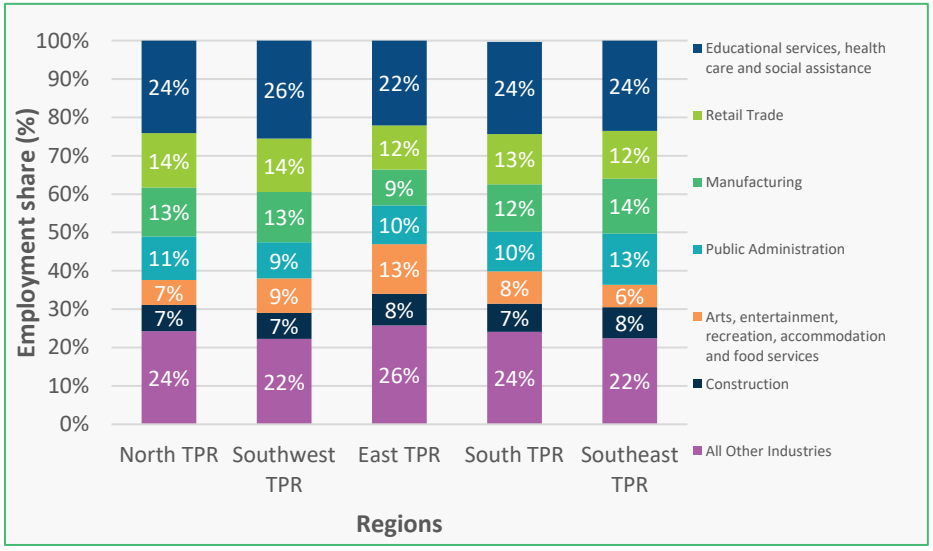


Source: U.S. Census Bureau, American Community Survey 2016 to 2021 5-Year Estimates

9. This number is very small to be shown in the graph. It is included as part of "Other".
10. All Other Industries includes: Agriculture, forestry, fishing hunting, and mining; Wholesale Trade; Transportation, warehousing, and utilities; Information; Finance, insurance, real estate, rental and leasing; Professional, scientific, management, administrative and waste management services; Other services, except public administration

As it is shown in Figure 2.54, UZA TPR follows the same trend as other regions where Educational services; health care and social assistance and Retail trade are the biggest employers. Nevertheless, the manufacturing has a larger share than other industries, probably due to the location of factories in the area.

Figure 2.54: Employment by Industry in Puerto Rico MPO Regions



Source: U.S. Census Bureau, American Community Survey 2016 to 2021 5-Year Estimates

Situations Affecting our Home

Due to the geographical location of Puerto Rico, the Island has been affected by major natural disasters, mainly hurricanes and earthquakes. Hurricane Irma and María in 2017 had a big impact in the Island's socio economic and demographic situations and were one of the main causes for Puerto Rico's current economic crisis represented by still high unemployment rates, and poverty rates. Then the earthquake swarm at the end of 2019 and beginning of 2020 created a more vulnerable situation for Puerto Ricans, followed by the COVID-19 pandemic. This chapter aims to describe the effects of certain natural events that explain the situations affecting the socio-demographics in the Island, specifically the earthquake swarm and the COVID-19 pandemic during 2020.

Natural Disasters

Due to the limitations of the available data, only information at the Island-wide is presented in this section. Puerto Rico lies in a tectonically active region where earthquakes have occurred for centuries. Earthquakes and tsunamis in Puerto Rico and adjacent islands are primarily driven by the convergence of the North American tectonic plate with the Caribbean tectonic plate, the section of the Earth's crust on which the islands are located. The rate these plates come together is about twenty millimeters a year. Puerto Rico's rocky island crust and its surrounding seafloor are located between the two tectonic plates mentioned before. The two plaques may move abruptly to relieve the stress, causing earthquakes[11].

After being hit by two hurricanes, María, and Irma in 2017, Puerto Rico was struck by an earthquake swarm (11 earthquakes magnitude 5 or greater) at the end of 2019 and the beginning of 2020[12]. This led Governor Wanda Vázquez to declare a state of emergency on January 7, 2020, to allocate funding to mitigate the effects of the earthquake.

11. U.S. Geological Survey. 2020. As Aftershocks Continue in Puerto Rico, USGS Supports Quake Recovery. Retrieved from https://www.usgs.gov/news/aftershocks-continue-puerto-rico-usgs-supports-quake-recovery.
12. Center for Disaster Philanthropy (December 2020). Puerto Rico Earthquakes. Retrieved from: https://disasterphilanthropy.org/disasters/puerto-rico-earthquakes/.

Table 2.2 presents the municipalities that were part of the state of emergency declaration[13]:

Table 2.2: Weekly New COVID-19 Cases in Puerto Rico

North TPR	East TPR	South TPR	Southeast TPR	Southwest TPR
Arecibo	No municipality was declared as part of the state of emergency.	Coamo	Salinas	Cabo Rojo
Adjuntas		Guánica		Hormigueros
Barceloneta		Guayanilla		Lajas
Jayuya		Juana Díaz		Maricao
Utuado		Peñuelas		Mayagüez
		Ponce		Sabana Grande
		Santa Isabel		San Germán
		Villalba		
		Yauco		

Source: Oficina Central de Recuperación, Reconstrucción y Resiliencia

After the event, about 3,000 homes were destroyed and 5,000 people had to refuge in public centers[14]. Public infrastructure was also impacted as it left residents on the Island without water and power for about a week. The earthquake also generated landslides that damaged roads and public transportation. Three regions (West, South, and Central) suffered the biggest infrastructure impacts in terms of roads, bridges, schools, and general properties that were damaged. Nevertheless, the whole Island suffered major electric and water shortages[15]. As of 2023, there are still various schools that have not been completely repaired or updated to comply with seismic standards.

The United States Federal Government, through FEMA, allocated more than $104 million dollars for disaster assistance to help fuel the recovery of Puerto Rico residents and businesses that suffered damage from the earthquake swarm[16].

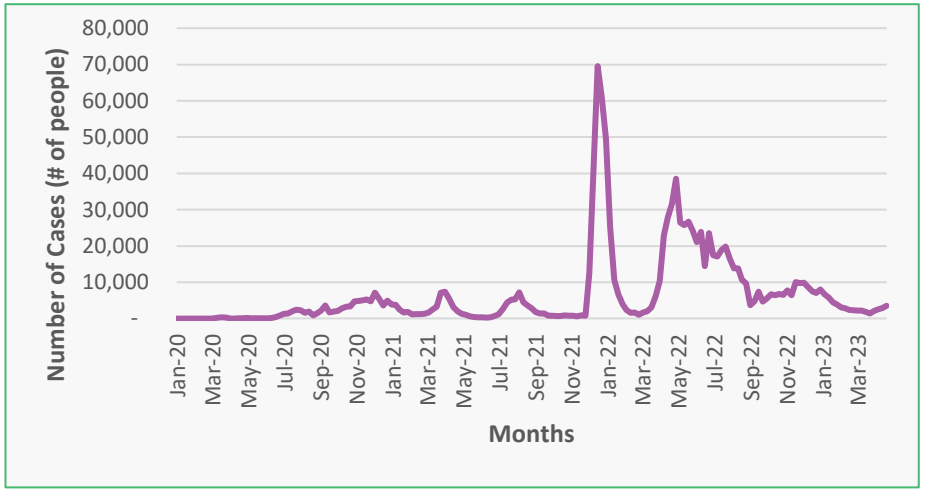
COVID-19

Months after the earthquake swarm, the COVID-19 virus appeared in the international scene. The COVID-19 pandemic affected Puerto Rico in similar ways as it did to other regions and countries around the world. In March 2020, Puerto Rico's administration declared the state of emergency due to the arrival of the virus to the Island[17]. The state of emergency included measures such as temperature check of all persons at all ports of entry, social distancing guidelines, lockdowns, quarantine, and curfews, some of the strictest and longest in the United States[18].

13. Oficina Central de Recuperación, reconstrucción y Resiliencia – COR3 (n.d). Respuesta a los Terremotos. Retrieved from https://recovery.pr.gov/es/respuesta-a-los-terremotos on September 26, 2023.
14. Agencia EFE (January, 2020). Cerca de 5,000 refugiados a casi una semana del terremoto del 7 de enero. Primera hora. Retrieved from: https://www.primerahora.com/noticias/puerto-rico/notas/cerca-de-5000-refugiados-a-casi-una-semana-del-terremoto-del-7-de-enero/.
15. Anónimo (January, 2020). Terremoto en Puerto Rico: Aprendiendo de las comunidades y apoyando su labor. Migrant Clinician. Retrieved from: https://www.migrantclinician.org/es/blog/2020/ene/terremoto-en-puerto-rico-aprendiendo-de-las-comunidades-y-apoyando-su-labor.html.
16. FEMA (March, 2021) La asistencia federal por desastre para los terremotos de Puerto Rico supera los $104 millones. Retrieved from: https://www.fema.gov/es/press-release/20210318/federal-disaster-assistance-puerto-rico-earthquakes-tops-104-million.
17. Atiles Osoria, Jose (2021). The COVID-19 Pandemic in Puerto Rico: Exceptionality, Corruption and State-Corporate Crimes. State Crime Journal, 2021, Vol. 10, No. 1, pp. 104-125. Retrieved from: https://www.jstor.org/stable/10.13169/statecrime.10.1.0104
18. Perez Semanaz, Sofia (November, 2020). The Impact of the Covid-19 Pandemic in Puerto Rico. American University Washington. Retrieved from: https://www.american.edu/cas/news/catalyst/covid-19-in-puerto-rico.cfm#:~:text=Puerto%20Rico%20has%20been%20hit,Ricans%20applied%20for%20unemployment%20benefits.

At the beginning of these measures, Puerto Rico recorded a small number of cases and had no reported deaths, which was better compared to other jurisdictions. Figure 2.55 shows the number of weekly cases reported in Puerto Rico until May 2023, when the COVID-19 was finalized as a public health emergency in the United States. As it shows, there was a peak of cases around January 2022 and that number declined in the later months.

Figure 2.55: Weekly New COVID-19 Cases in Puerto Rico



Source: Center for Disease Control and Prevention (CDC) COVID-19 Response

Some of the reasons why the virus did not widespread in the Island at the same rate as in other territories had to do with several measures and behaviors adopted by Puerto Ricans. Some of these reasons are:

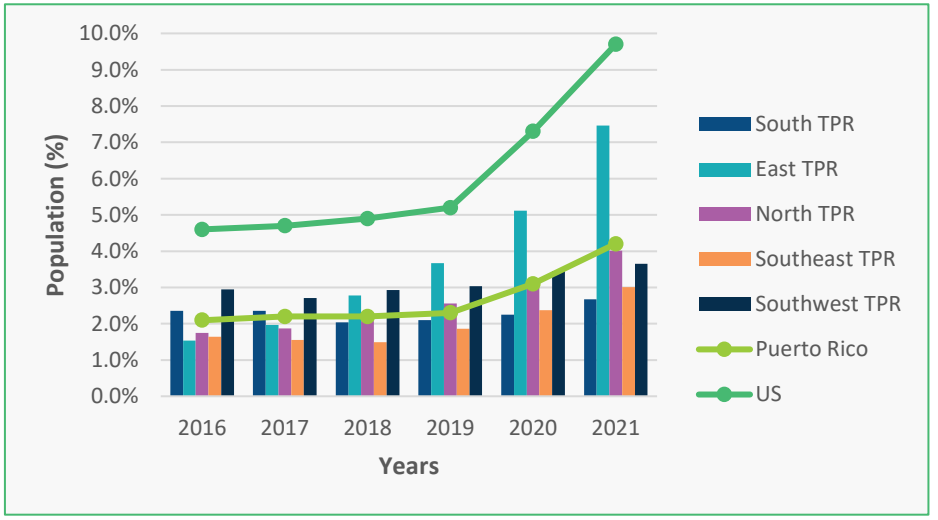
- Health care administrators in Puerto Rico are used to doing more with limited resources. In this case, Puerto Rico was provided with equal health care funding from the U.S. government which provided more resources that were executed in the most efficient way[19].
- The health care administrators in Puerto Rico are trained in public health which allowed them to manage health care facilities with a public health mindset that would provide the best results[20].
- The discussion around vaccines and masks was not politicized and were perceived as the fastest way to return to normal life[21].
- Poor urban infrastructure, lack of good and connected public transport and urban sprawl were a strength during the pandemic. For example, residents prefer driving as their mode of transportation, which facilitated physical distancing[22]. Nevertheless, it was also a weakness for the people that did not have any other option than public transit, which exposed them more to the virus.
- Effective working from home arrangements from different companies, as it was suggested on Executive Orders and international guidelines. This increase is in line with the trends in the U.S.

19. Bathija, P. & Resnick, J. (2022). Digging into the Reasons for Puerto Ricos's Successful COVID-19 Response. American Hospital Association. Retrieved from: https://www.aha.org/news/blog/2022-07-22-digging-reasons-puerto-ricos-successful-covid-19-response.
20. Bathija, P. & Resnick, J. (2022). Digging into the Reasons for Puerto Ricos's Successful COVID-19 Response. American Hospital Association. Retrieved from: https://www.aha.org/news/blog/2022-07-22-digging-reasons-puerto-ricos-successful-covid-19-response.
21. Bathija, P. & Resnick, J. (2022). Digging into the Reasons for Puerto Ricos's Successful COVID-19 Response. American Hospital Association. Retrieved from: https://www.aha.org/news/blog/2022-07-22-digging-reasons-puerto-ricos-successful-covid-19-response.
22. Perez Semanaz, Sofia (November, 2020). The Impact of the Covid-19 Pandemic in Puerto Rico. American University Washington. Retrieved from: https://www.american.edu/cas/news/catalyst/covid-19-in-puerto-rico.cfm#:~:text=Puerto%20Rico%20has%20been%20hit,Ricans%20applied%20for%20unemployment%20benefits.

Figure 2.56 shows the increase in the patterns of working from home. From 2016 to 2019 the percentage of people working from home did not exceed 2.5%. During 2020 this percentage increased to 3.1% and then 4.2% in 2021. This increase is in line with the trends in the U.S.

Considering that many companies and jobs have shifted towards a hybrid scheme, the percentage of population working from home might increase. This will most probably modify the travel patterns from and to work in the next couple of years.

Figure 2.56 Working from Home UZA, Puerto Rico and U.S. 2016-2021



Source: U.S. Census Bureau, American Community Survey 2016 to 2021 5-Year Estimates and 2010-2016 5-Year Estimates

Puerto Rico had been on an economic recession since 2010, which was increased by hurricanes, earthquakes and finally, the COVID -19 pandemic[23]. The decline on GNP, Gross National Product (GNP), employment rates and general population decline are the visible consequences of the economic crisis in the Island[24]. Even so, Puerto Rico's Economic Activity Index decreased from 122.1 in February 2020 to 110.1 in June 2020[25], more than 30,000 jobs were lost and around 1,400 businesses closed[26]. This has led experts to say that Puerto Rico's GNP will not be expected to grow in over the next five years[27].

The latter is more critical, considering the population in Puerto Rico is declining and aging, due in great part to the migration of people to mainland U.S. This situation leaves the Island with less population capable of working, which is translated in a productivity loss. Covid-19 as well as natural disasters occurring in the Island (hurricanes and earthquakes) have increased the occurrence of this migration out of the Island[28].

23. Government of Puerto Rico. Department of Labor and Human Resources (n.d.) Puerto Rico Economic Analysis Report 2020-2021. Retrieved from: https://www.dol.gov/sites/dolgov/files/eta/Performance/pdfs/annual_economic_reports/2021/PR%20Economic%20Analysis%20Report%20FY%202020-2021%20(00000002)%20en%20pdf.pdf.
24. Cheatham, A. & Roy, D. (2022). Puerto Rico: A U.S. Territory in Crisis. Council on Foreign Relations. Retrieved from: https://www.cfr.org/backgrounder/puerto-rico-us-territory-crisis.
25. Marxuach, Sergio (September 2021). The Threefold Challenge to the Puerto Rican Economy. Center for a New Economy. Retrieved from: https://www.cfr.org/backgrounder/puerto-rico-us-territory-crisis.
26. Associated Press (May 2021) Puerto Rico Groans Under COVID Pandemic as Health, Economy Suffer. VOA News. Retrieved from: https://www.voanews.com/a/usa_puerto-rico-groans-under-covid-pandemic-health-economy-suffer/6205345.html.
27. Hernandez-Padilla, JA & Mendez-Piñero MI. (September 2020). Economic Impact of the COVID-19 Pandemic in Puerto Rico. Proceedings of the 9th Annual World Conference of the Society for Industrial and Systems Engineering, 2020 SISE Virtual Conference. Retrieved from: http://ieworldconference.org/content/SISE2020/Papers/Hernandez-Padilla.pdf.
28. Cheatham, A. & Roy, D. (2022). Puerto Rico: A U.S. Territory in Crisis. Council on Foreign Relations. Retrieved from: https://www.cfr.org/backgrounder/puerto-rico-us-territory-crisis.

Our Environment: Land Use, Environmental Sensitive Area, and Natural Hazards

Land Use

Development and Urbanization

Puerto Rico's population has been on a steady decline during the past 20 years following economic recessions and as an effect of the hurricanes and earthquakes that have impacted the islands. The five (5) TPRs have experienced the effects of these events in their general and urban populations to varying degrees. The following list shows a brief description of these changes by region[29].

- **North TPR (Figure 2.57, Figure 2.58 and Figure 2.59):**

– The North region's population has been declining at a compound annual rate of 1.2% since 2010 up to 2020.

– The difference in the urban population share between the 2010 and 2020 was -1%. This difference is consistent with the general population decline, and minimal changes in urban and rural population.

- **East TPR (Figure 2.60, Figure 2.61 and Figure 2.62)**

– The East region's population has the smallest compound annual growth rate of all the regions with a compound annual rate of -1.9% decline since 2010.

– Despite having the largest population decrease, this region's urban population share increased from 89.2% in 2010 to 90.8% in 2020.

- **South TPR (Figure 2.63, Figure 2.64 and Figure 2.65):**

– The South region's population has the second lowest population compound annual growth rate of all regions with a -1.8% decline since 2010.

– The difference in the urban population share between the 2010 and 2020 was -3.5%. This difference is higher than the general population decline.

- **Southeast TPR (Figure 2.66, Figure 2.67 and Figure 2.68):**

– The Southeast region's population has the second largest compound annual growth rate with -1.3% since 2010.

– Although this region has one of the smallest population declines, it has the largest decrease in urban population share with an absolute difference of -11% between 2010 and 2020.

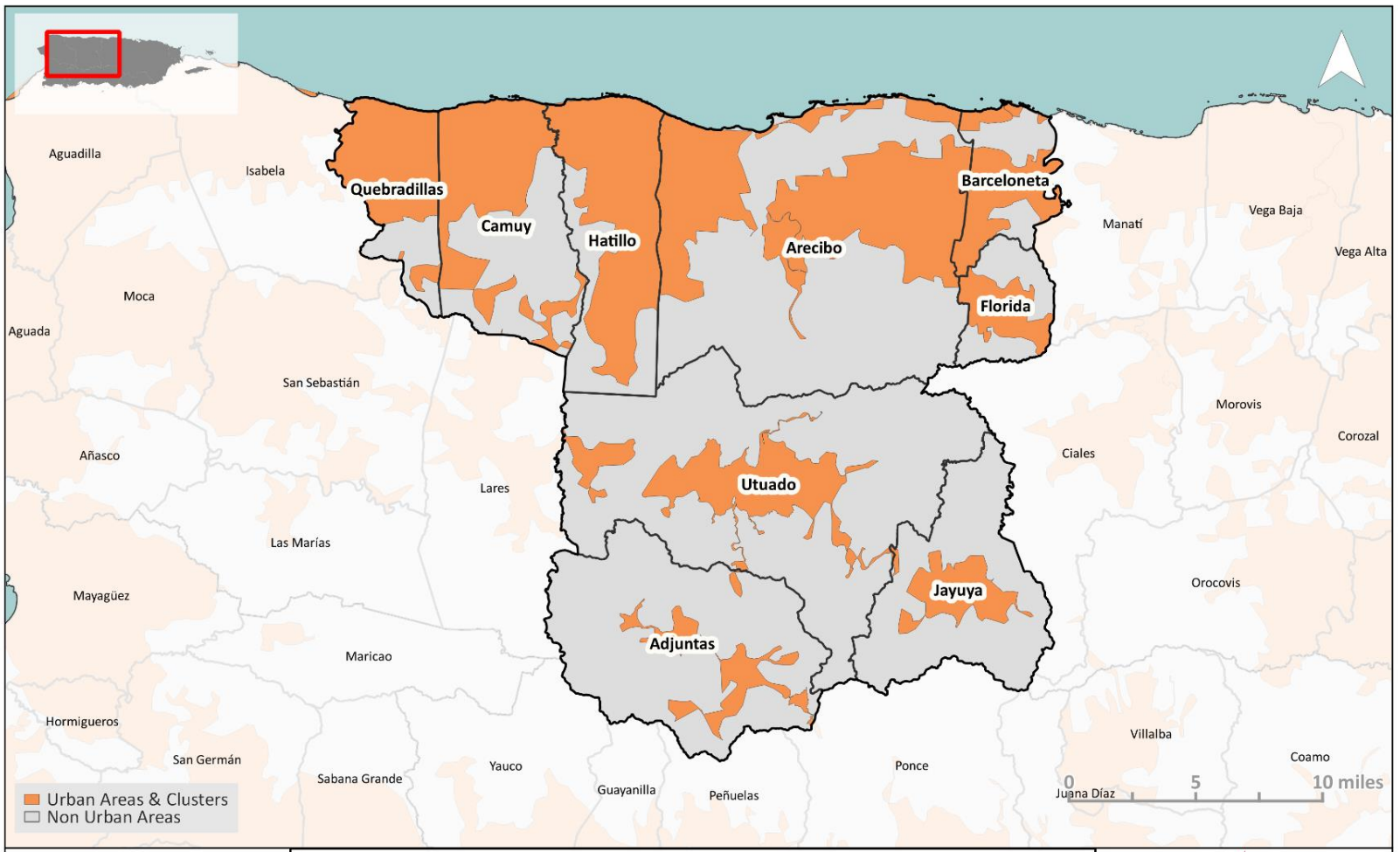
- **Southwest TPR (Figure 2.69, Figure 2.70 and Figure 2.71):**

– The Southwest region's population has been declining at a compound annual growth rate of -1.5% since 2010.

– The difference in the urban population share between the 2010 and 2020 was -3.8%. This difference is higher than the general population decline**.**

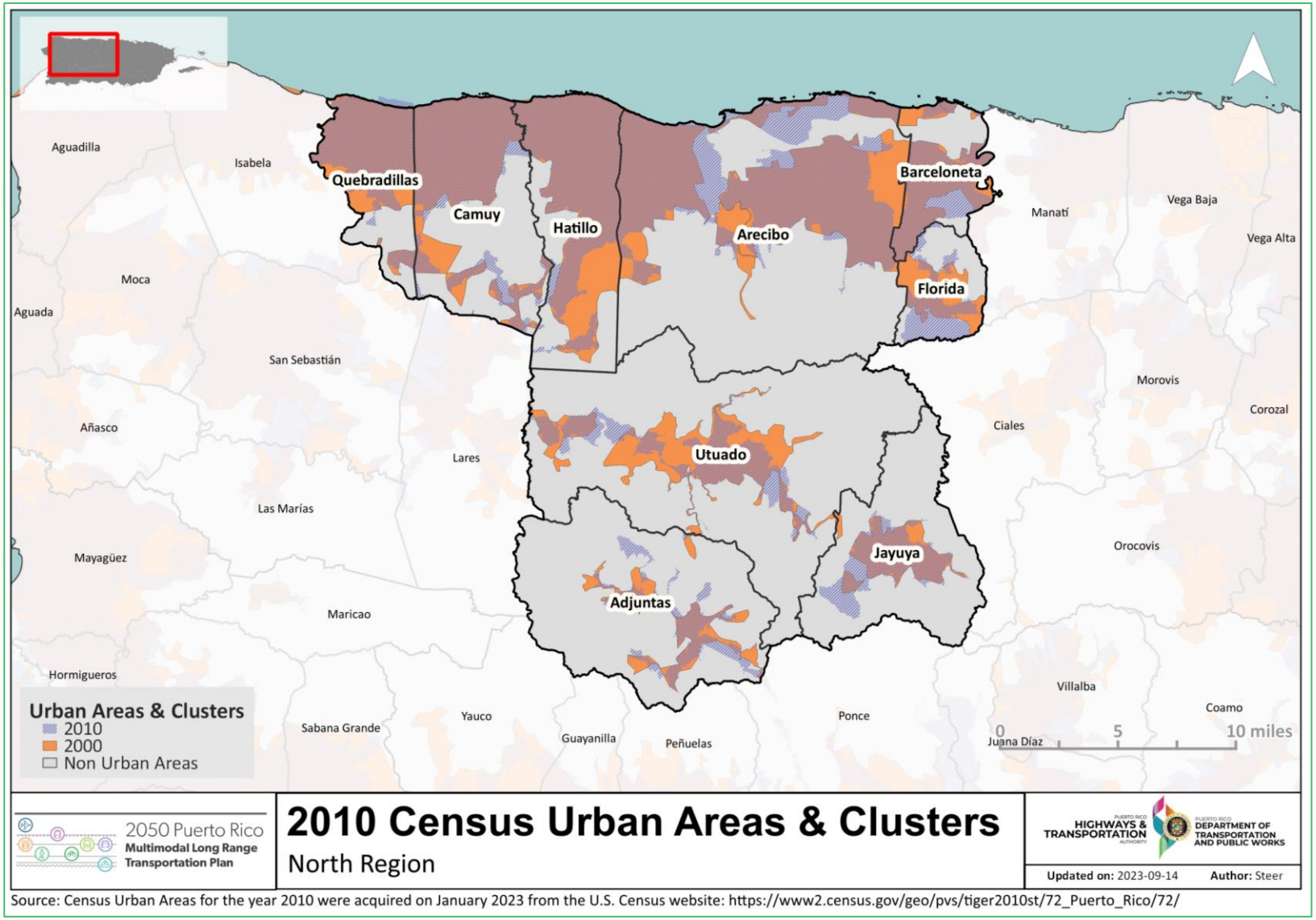
29. These calculations correspond to Compound Annual Growth Rate

Figure 2.57: UZAs 2000 Census Urban Areas and Clusters – North TPR



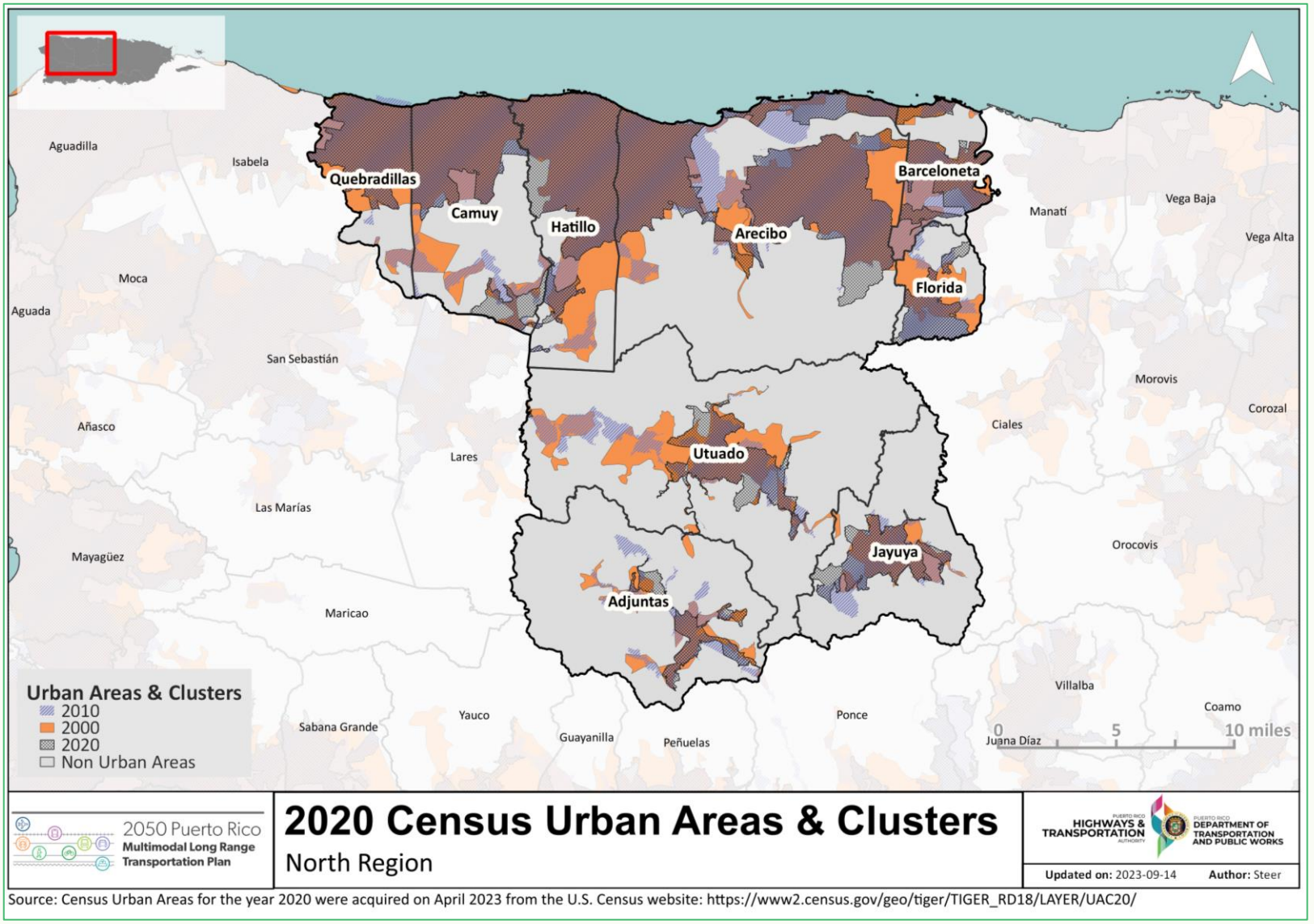
Source: Census Urban Areas for the year 2000 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/PREVGENZ/ua/ua00shp/ua99_d00_shp.zip

Figure 2.58: UZAs 2010 Census Urban Areas and Clusters – North TPR



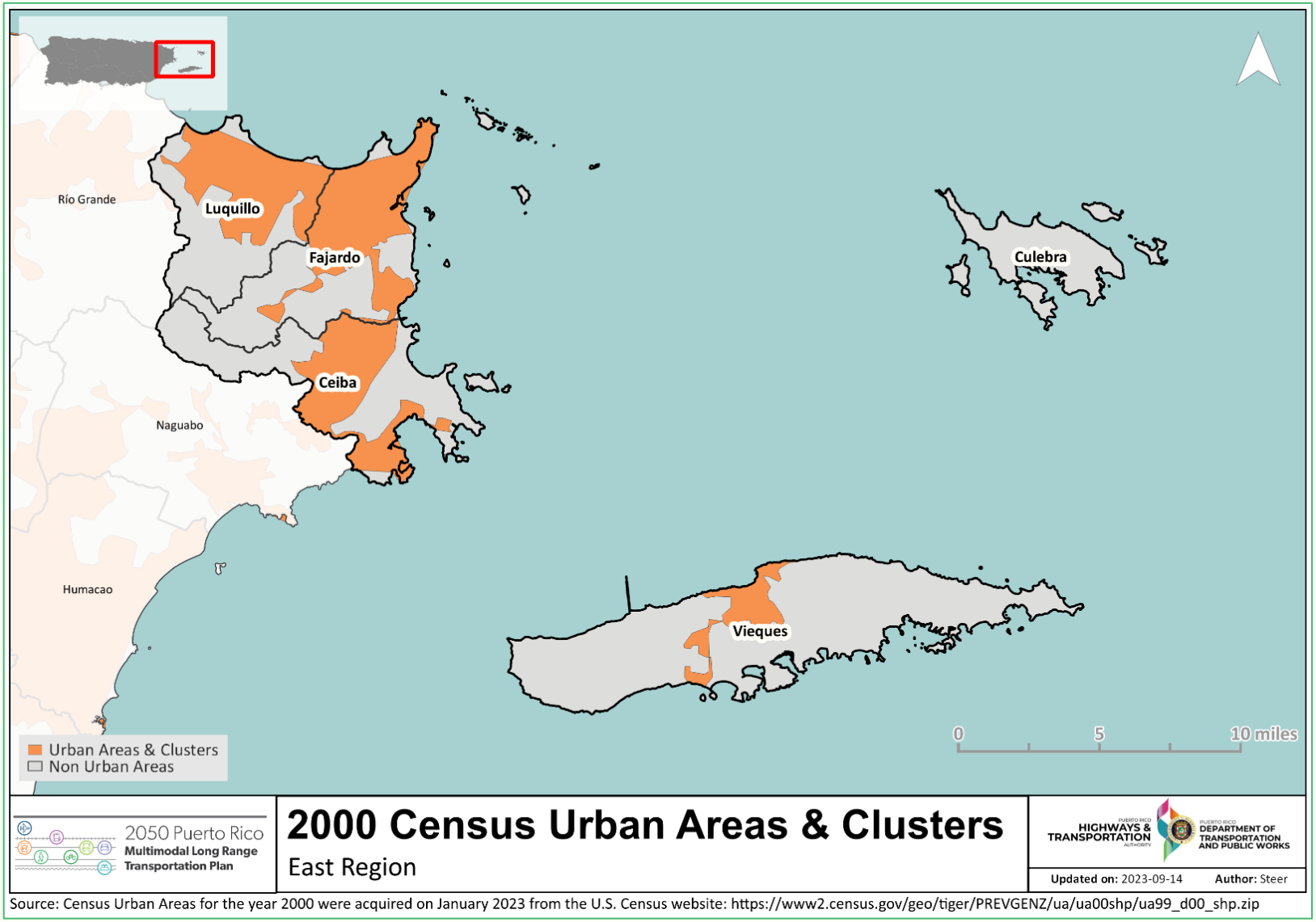
Source: Census Urban Areas for the year 2010 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/pvs/tiger2010st/72_Puerto_Rico/72/

Figure 2.59: UZAs 2020 Census Urban Areas and Clusters – North TPR



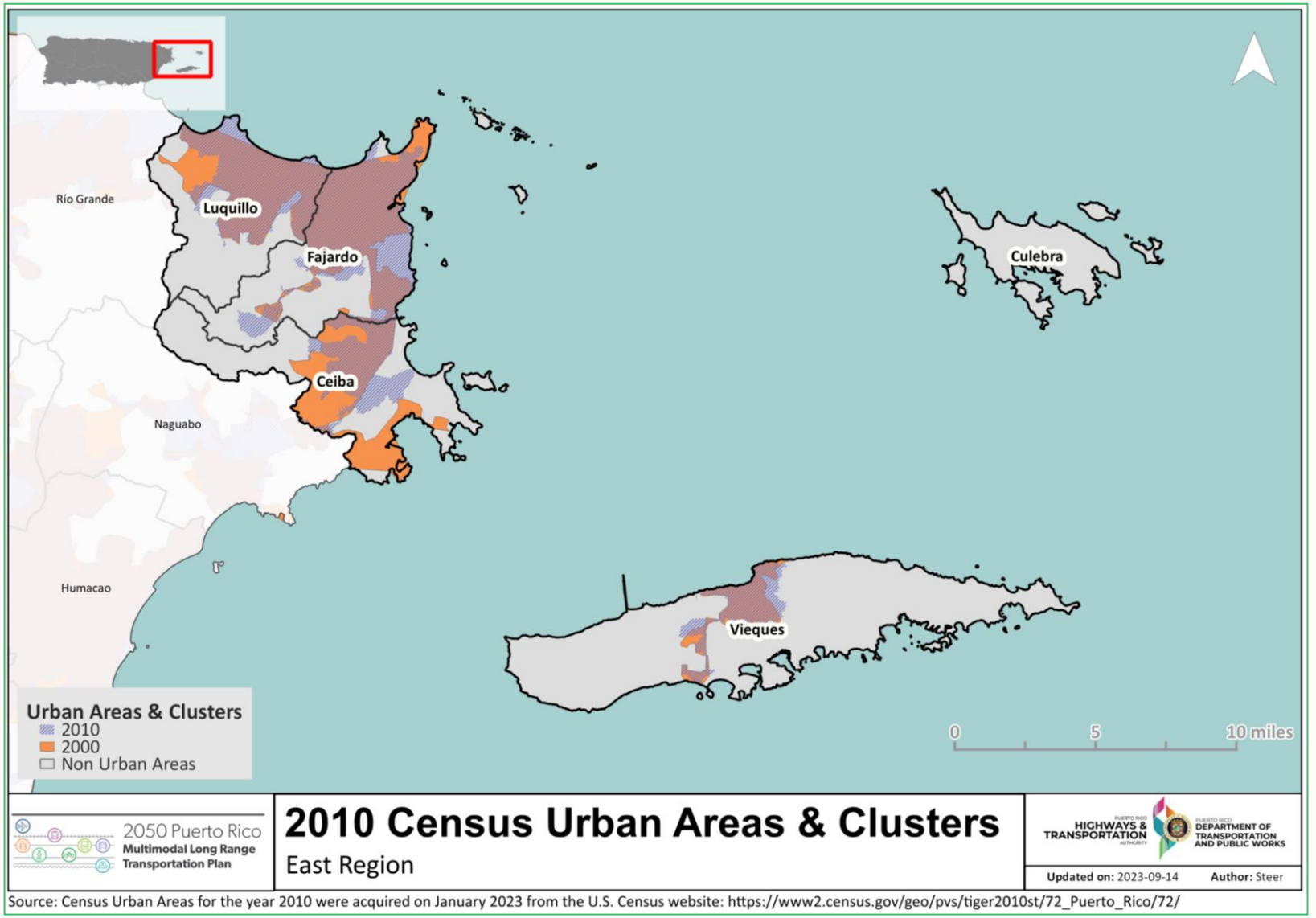
Source: Census Urban Areas for the year 2020 were acquired on April 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/TIGER_RD18/LAYER/UAC20/

Figure 2.60: UZAs 2000 Census Urban Areas and Clusters – East TPR



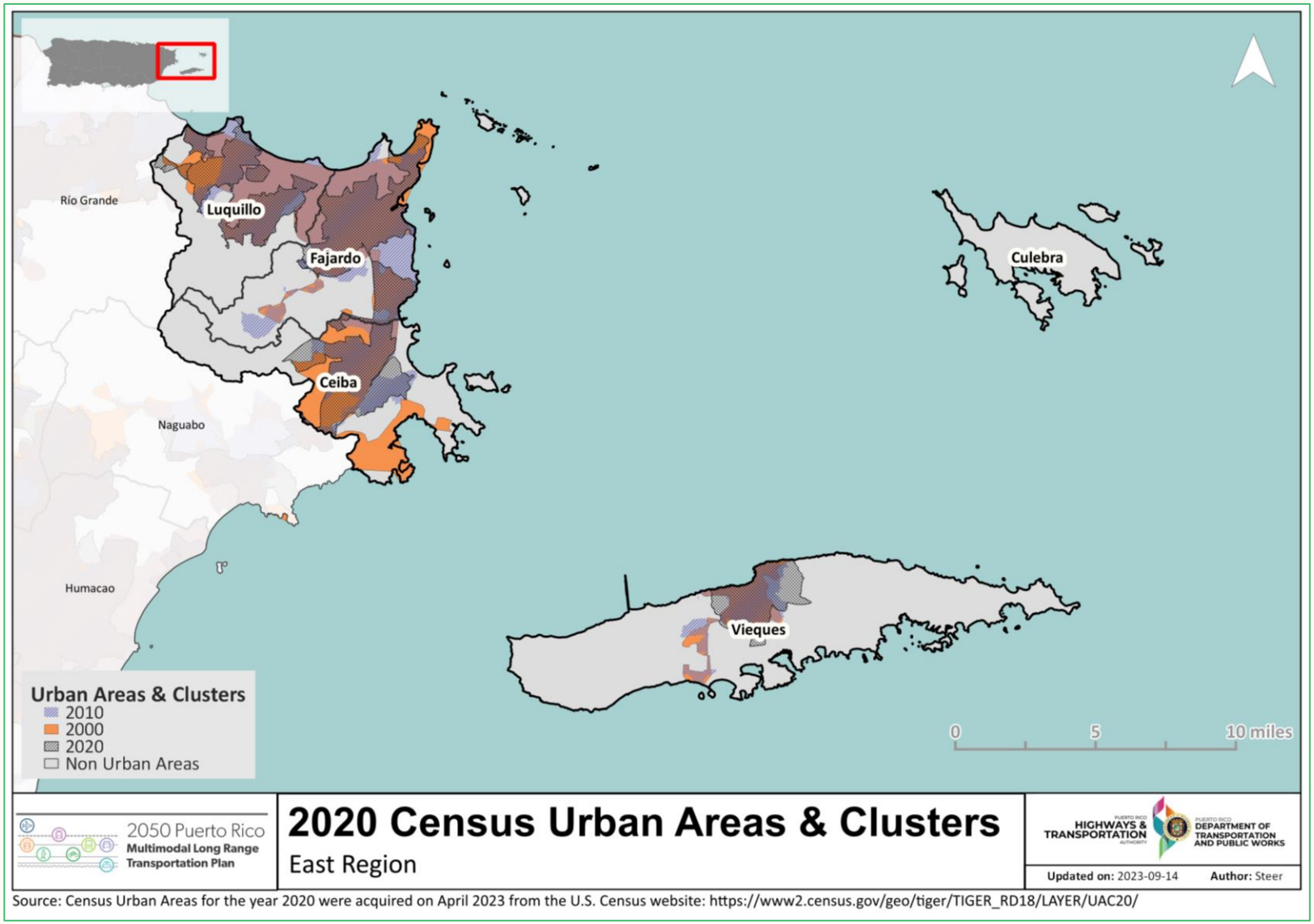
Source: Census Urban Areas for the year 2000 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/PREVGENZ/ua/ua00shp/ua99_d00_shp.zip

Figure 2.61: UZAs 2010 Census Urban Areas and Clusters – East TPR



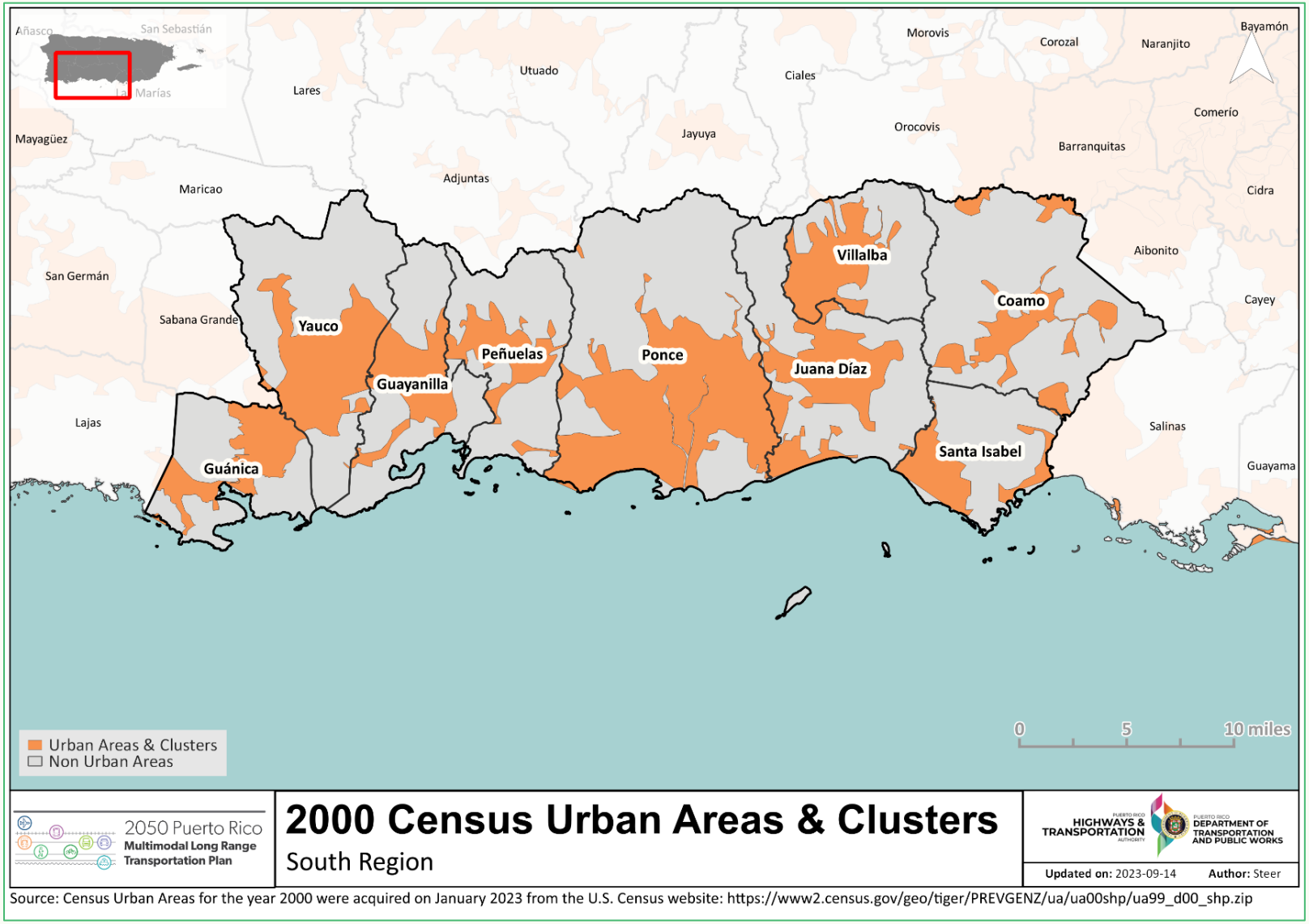
Source: Census Urban Areas for the year 2010 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/pvs/tiger2010st/72_Puerto_Rico/72/

Figure 2.62: UZAs 2020 Census Urban Areas and Clusters – East TPR



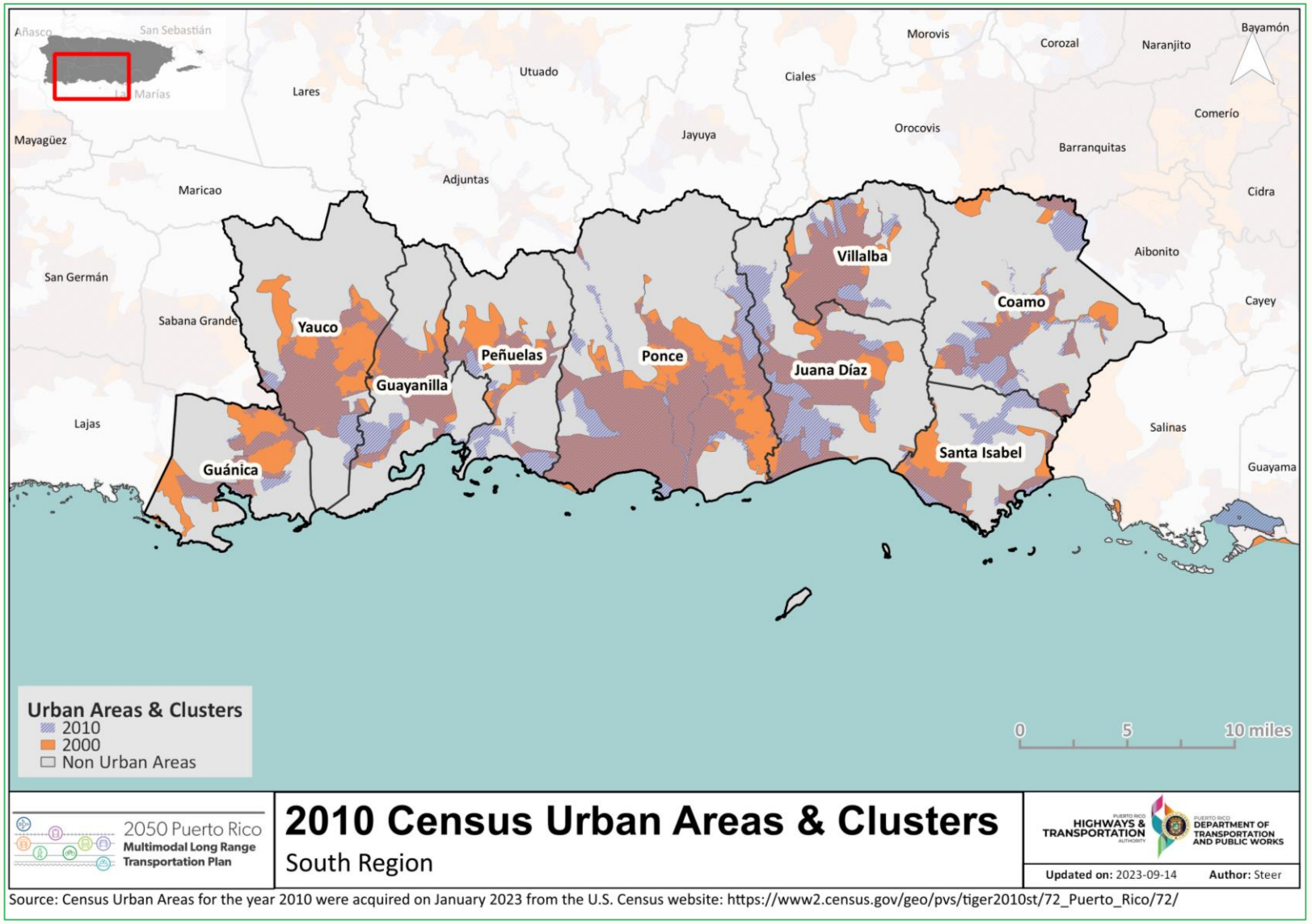
Source: Census Urban Areas for the year 2020 were acquired on April 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/TIGER_RD18/LAYER/UAC20/

Figure 2.63: UZAs 2000 Census Urban Areas and Clusters – South TPR



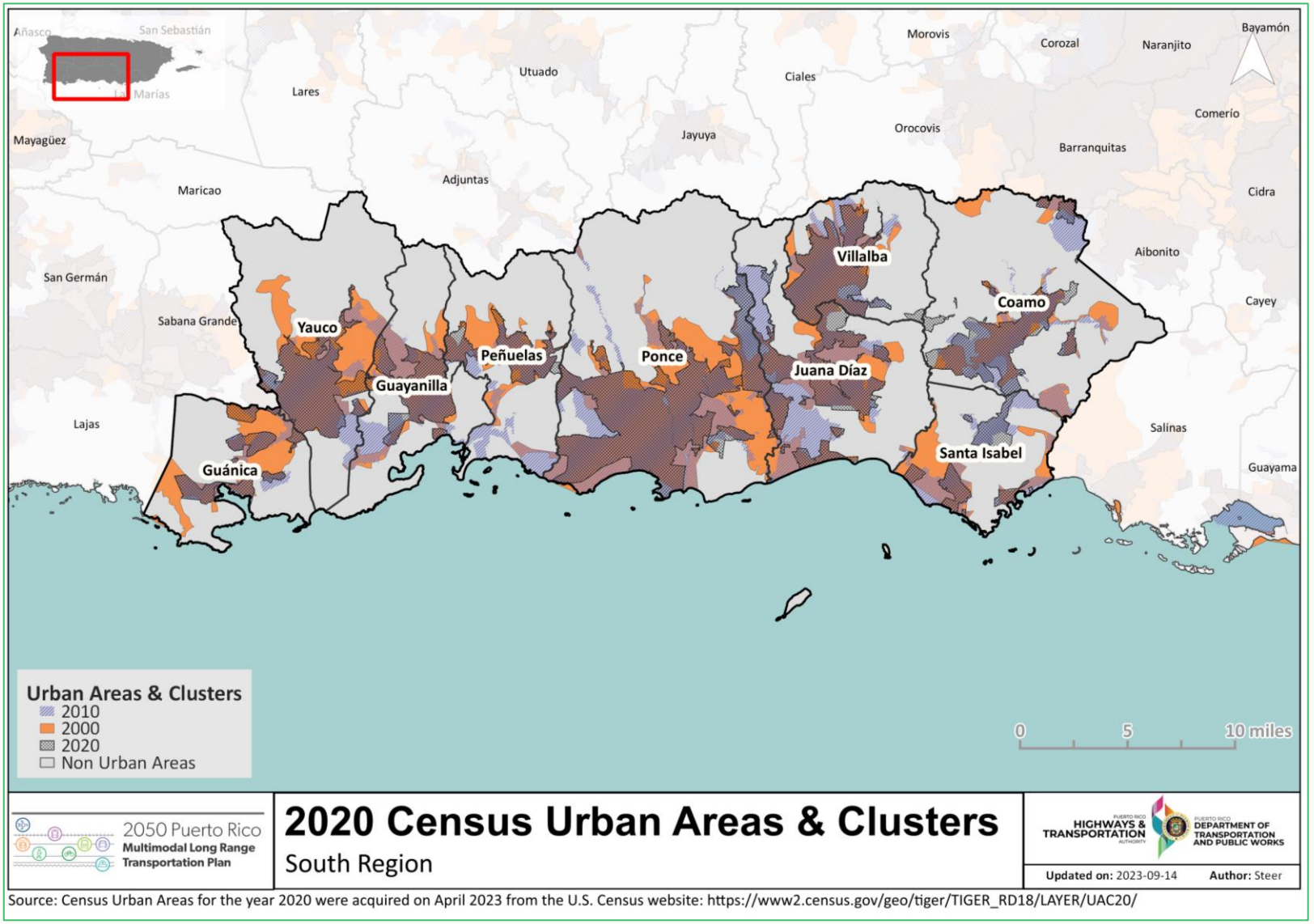
Source: Census Urban Areas for the year 2000 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/PREVGENZ/ua/ua00shp/ua99_d00_shp.zip

Figure 2.64: UZAs 2010 Census Urban Areas and Clusters – South TPR



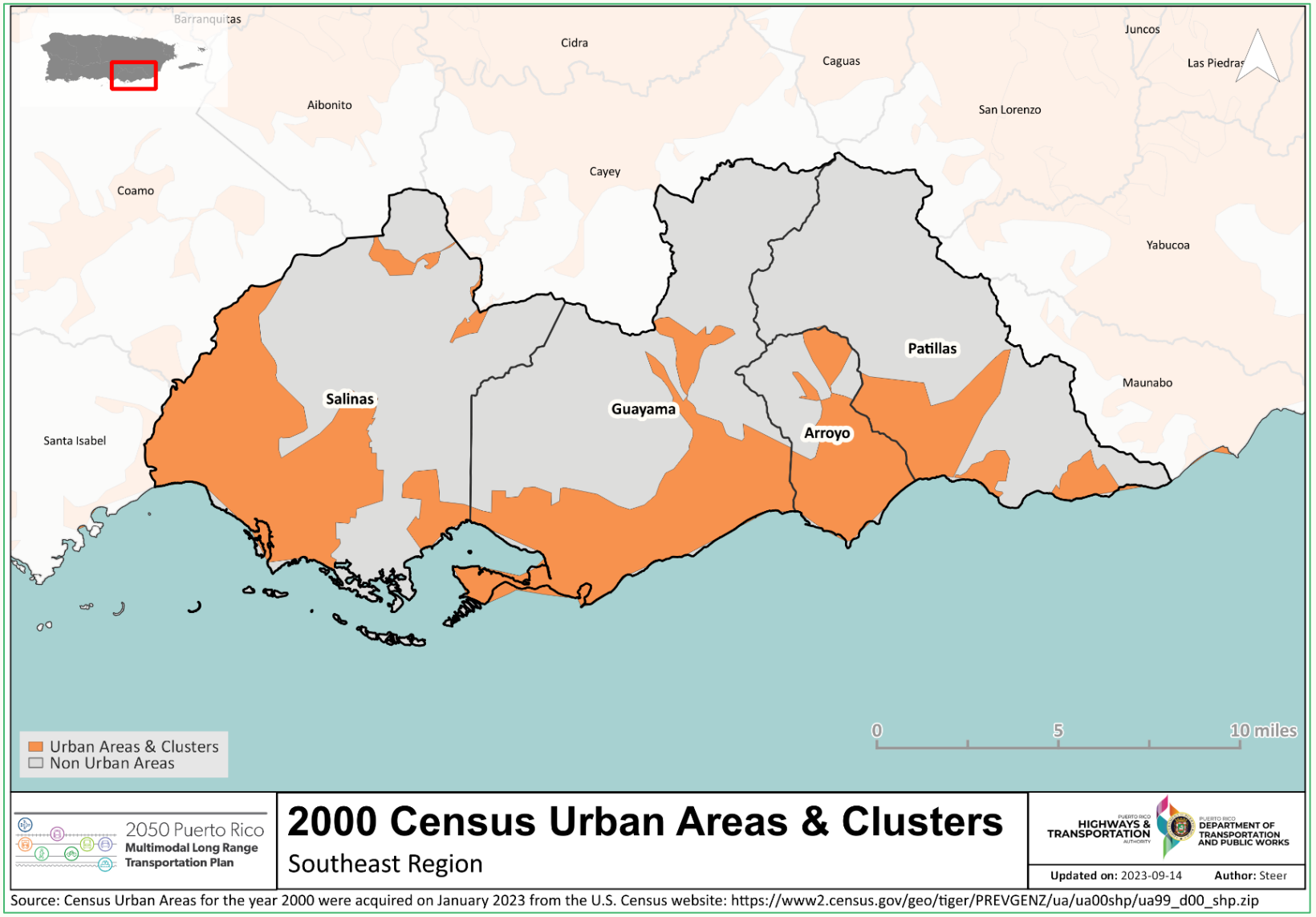
Source: Census Urban Areas for the year 2010 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/pvs/tiger2010st/72_Puerto_Rico/72/

Figure 2.65: UZAs 2020 Census Urban Areas and Clusters – South TPR



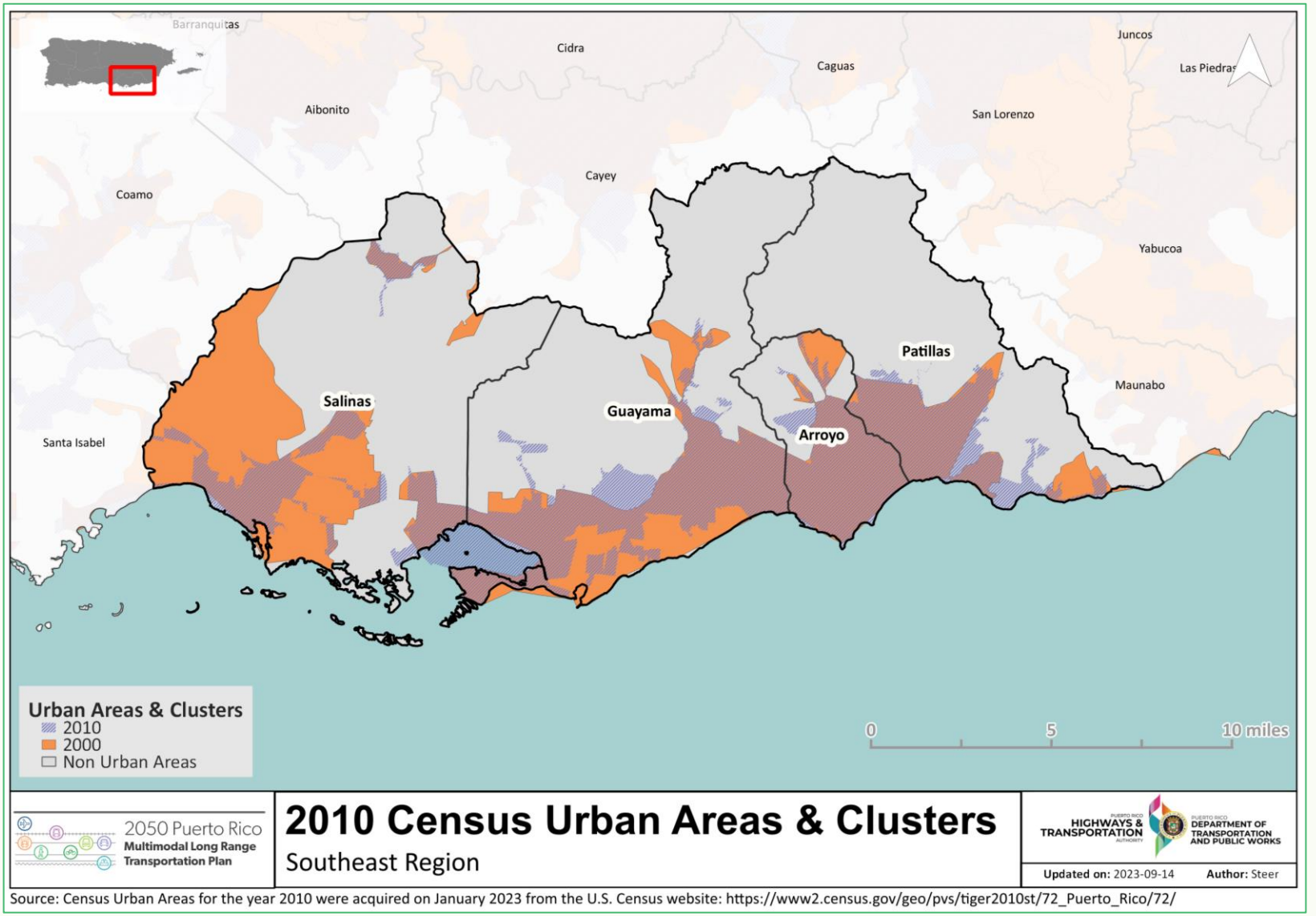
Source: Census Urban Areas for the year 2020 were acquired on April 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/TIGER_RD18/LAYER/UAC20/

Figure 2.66: UZAs 2000 Census Urban Areas and Clusters – Southeast TPR



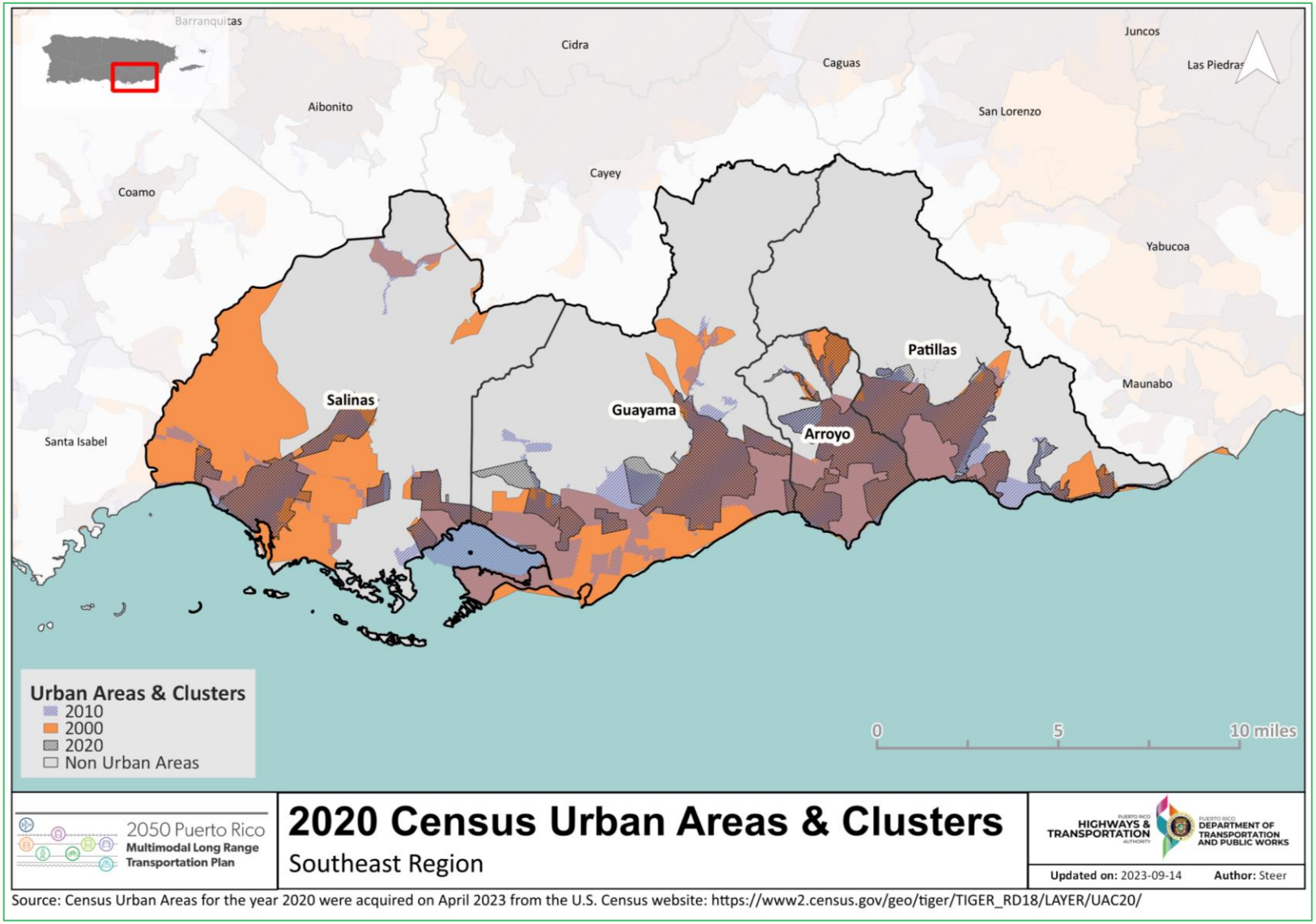
Source: Census Urban Areas for the year 2000 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/PREVGENZ/ua/ua00shp/ua99_d00_shp.zip

Figure 2.67: UZAs 2010 Census Urban Areas and Clusters – Southeast TPR



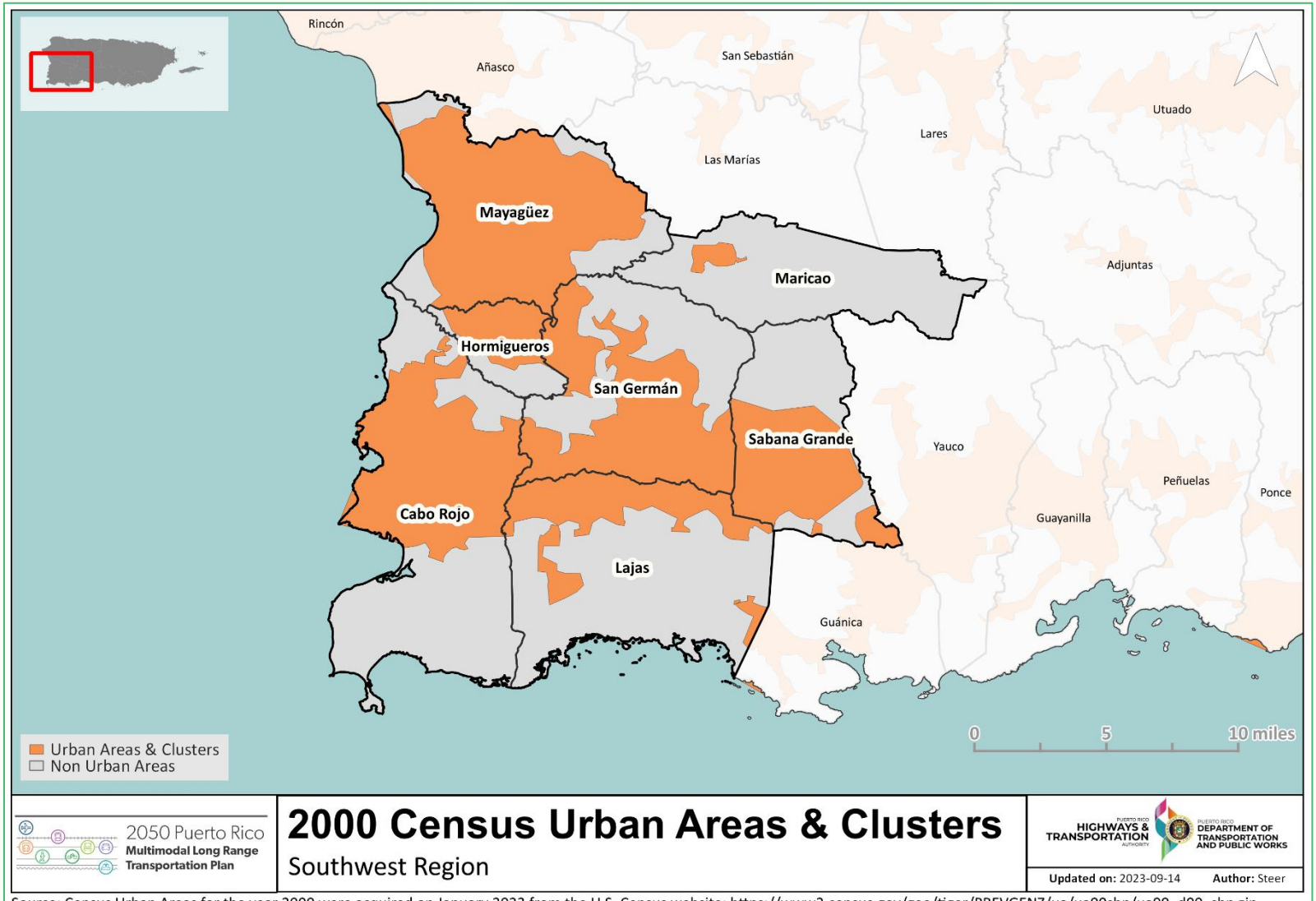
Source: Census Urban Areas for the year 2010 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/pvs/tiger2010st/72_Puerto_Rico/72/

Figure 2.68: UZAs 2020 Census Urban Areas and Clusters – Southeast TPR



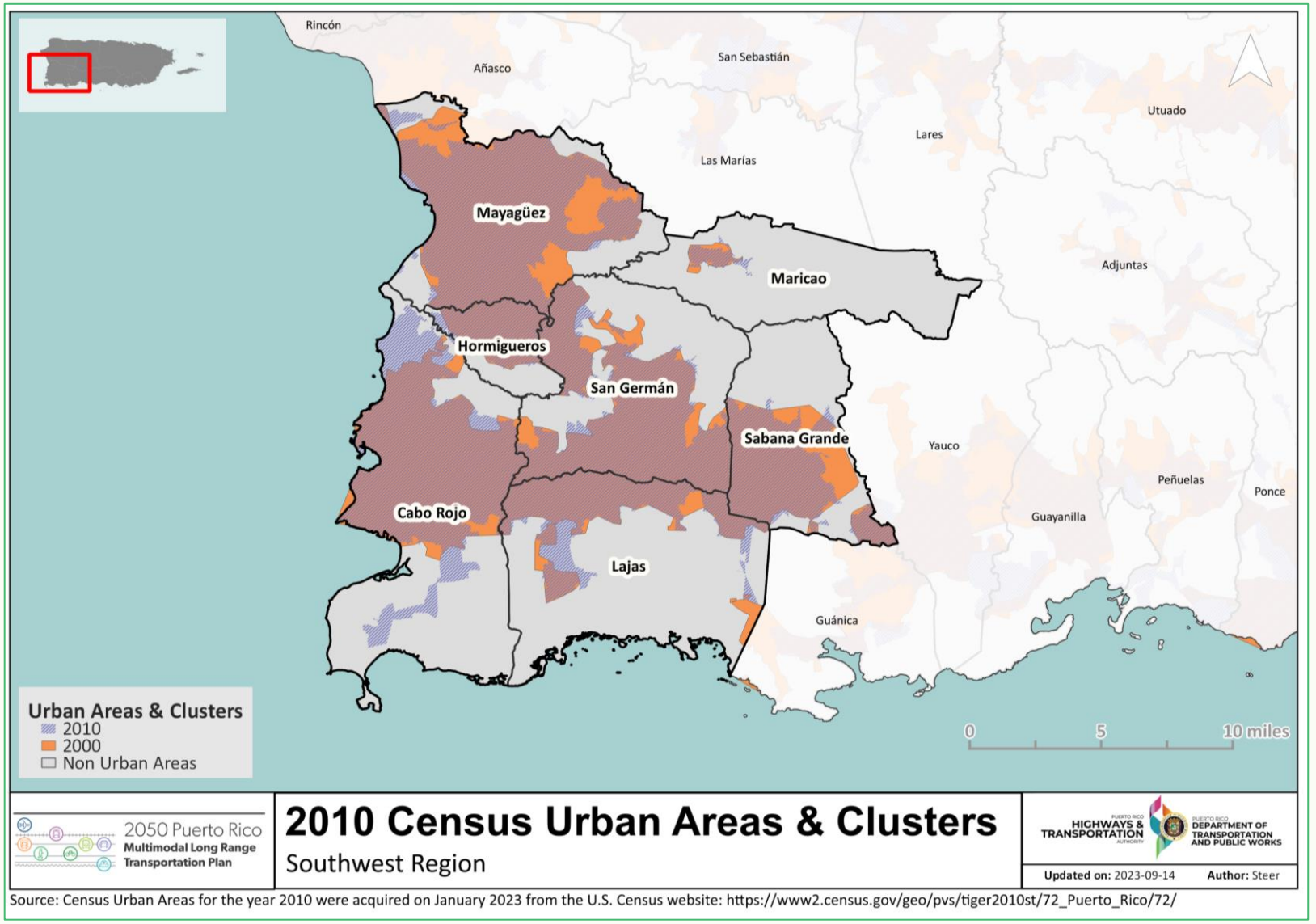
Source: Census Urban Areas for the year 2020 were acquired on April 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/TIGER_RD18/LAYER/UAC20/

Figure 2.69: UZAs 2000 Census Urban Areas and Clusters – Southwest TPR



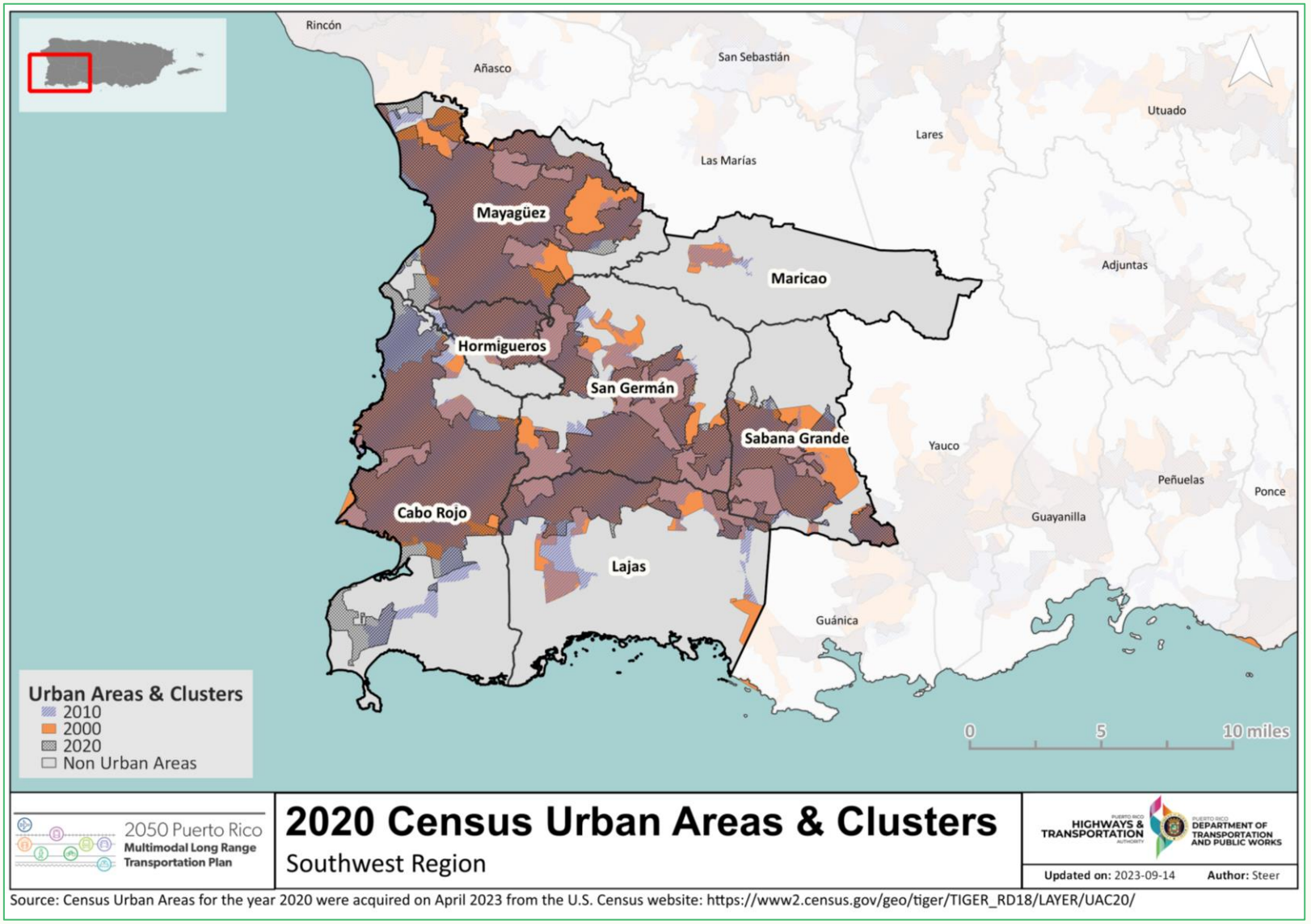
Source: Census Urban Areas for the year 2000 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/PREVGENZ/ua/ua00shp/ua99_d00_shp.zip

Figure 2.70: UZAs 2010 Census Urban Areas and Clusters – Southwest TPR



Source: Census Urban Areas for the year 2010 were acquired on January 2023 from the U.S. Census website: https://www2.census.gov/geo/pvs/tiger2010st/72_Puerto_Rico/72/

Figure 2.71: UZAs 2020 Census Urban Areas and Clusters – Southwest TPR



Source: Census Urban Areas for the year 2020 were acquired on April 2023 from the U.S. Census website: https://www2.census.gov/geo/tiger/TIGER_RD18/LAYER/UAC20/

Land Use Patterns

This section contains a summary of the Land Use Patterns for the Other Urbanized Areas. The Puerto Rico Planning Board approved the first Land Use Plan for Puerto Rico in 2015[30] with the objective of establishing the public policy on the management of land use that allows to maximize the potential of the Puerto Rican soil within a framework that guarantees the protection of natural resources and sustainable development. It is the framework that guides the public policy on land use for Puerto Rico. It is important to mention that this plan has not been updated since its initial approval.

The Land Use Plan established a new territorial regional structure based on functional areas. This structure intents to understand and attend how the municipalities are interconnected considering its interrelation, mobility, dependencies, complementarity, and influences among social, economic, and industrial aspects, apart from the shared geographical characteristics.

There are various municipalities that are part of the UZAs Region and correspond to different Functional Areas; an overview is provided below, as well as the key elements regarding the land use patterns in each region.

- **North TPR (Figure 2.72):**

  - The main urban areas of this region are Barceloneta, Florida, and Arecibo, being the latest the principal activity Center.
  - Environmentally sensitive areas and reserves, mountains, important wetlands, state forest and karst formations are some of the natural resources by which the development is emerging.
  - This region also has important agricultural soils, forest, and mountains, especially through Jayuya, Adjuntas and Utuado.
  - The highest mountain on the Island, Cerro Punta, located in Jayuya. The Cambalache Forest, a natural reserve, lies between the municipalities of Barceloneta and Arecibo.
  - Functional areas:
    - Arecibo Functional Area: Arecibo, Hatillo, Camuy, Quebradillas, and Utuado.
    - Manatí Functional Area: Barceloneta, and Florida.
    - Ponce Functional Area: Adjuntas, and Jayuya.

30. Note that the Puerto Rico Land Use Plan has not been updated since its initial approval in 2015.

- **East TPR (Figure 2.73):**

  - Presents a high degree of variability in the environmental settings as a function of the location within the Region, ranging from the coastal plains and mountainous parts.

  - Monte Pirata, located in Vieques is the highest part of both Islands, with an elevation of approximately 923 feet above the sea level.

  - It has a character of its own since Culebra and Vieques are Islands. They are separated by the Vieques Passage. This means that there is no terrestrial connection between these municipalities and the main Island. Transportation between both areas can only be made either by air or maritime means of transportation.

  - The most important and recognizable natural systems of this region are El Yunque National Forest and the Northeast Ecological Corridor Natural Reserve.

  - Functional areas:
    - Fajardo Functional Area: Luquillo, Fajardo, Ceiba, Vieques, and Culebra.

- **South TPR (Figure 2.74):**

  - The Guánica's Dry Forest is an example of the natural resources that can be found in this Region. This one-of-a-kind forest is located mainly between the municipalities of Guánica, Guayanilla, Yauco and represents the most arid zone in the Island. Is designated as a Natural Reserve by the PR Planning Board.

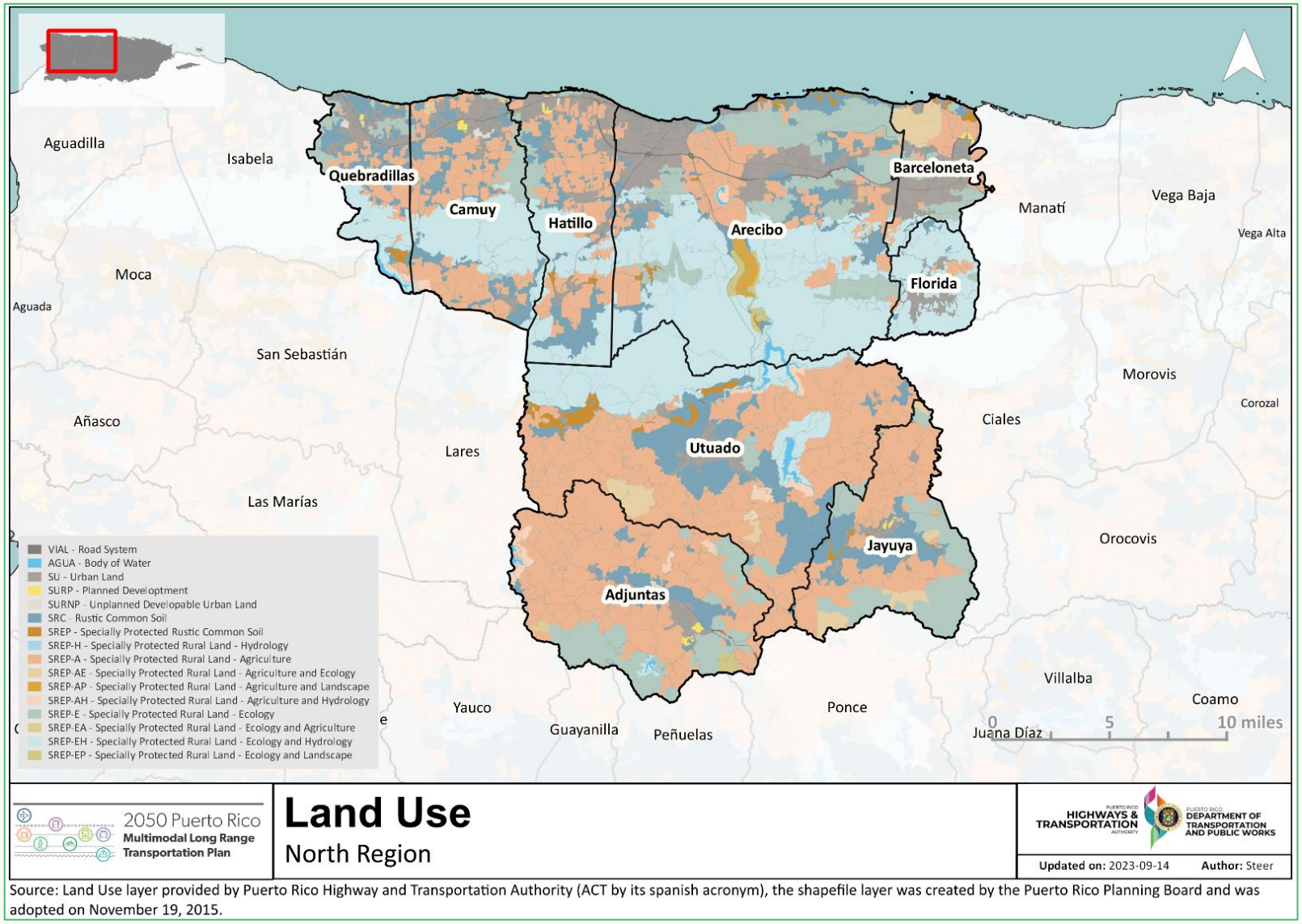
  - Major cultural centers like the Ponce Art Museum, hospitals, shopping centers such as Plaza del Caribe, important judicial courts and regions, governmental offices, hotels, universities such as the University of Puerto Rico, Ponce campus, Ponce Catholic University Main Campus, including the School of Law, Tibes Taíno Indians Ceremonial Ground, and the Hacienda Buenavista generate the principal travelling in the Ponce UA and the STPR.

  - Functional areas:
    - Ponce Functional Area: Coamo, Guánica, Guyanilla, Juana Díaz, Peñuelas, Ponce, Santa Isabel, Villalba, and Yauco. Manatí Functional Area: Barceloneta, and Florida.

- **Southeast TPR (Figure 2.75):**
  - There are numerous forests, water resources and protected soils available in the SETPR. Río Grande de Patillas is the biggest river in the Region. The Jobos Bay National Reserve, located between the municipalities of Guayama and Salinas, is one of the most important estuaries in the Island.
  - The Guayama municipality, as the principal activity center, carries the most significant role in the economic development in the area. La Casa de los Pastelillos, Charco Azul, The Carite Forest and the Jobos Bay National Reserve are also important touristic venues.
  - The main facilities of the SETPR are the judicial courts, including the "Guayama Judicial Region", shopping centers like the Guayama Mall, government offices, hospitals, and the Aguirre Thermoelectrical Central in Salinas, one of the principal energy generators in the Island.
  - Functional areas:
    - Guayama Functional Area: Salinas, Guayama, Arroyo, and Patillas.

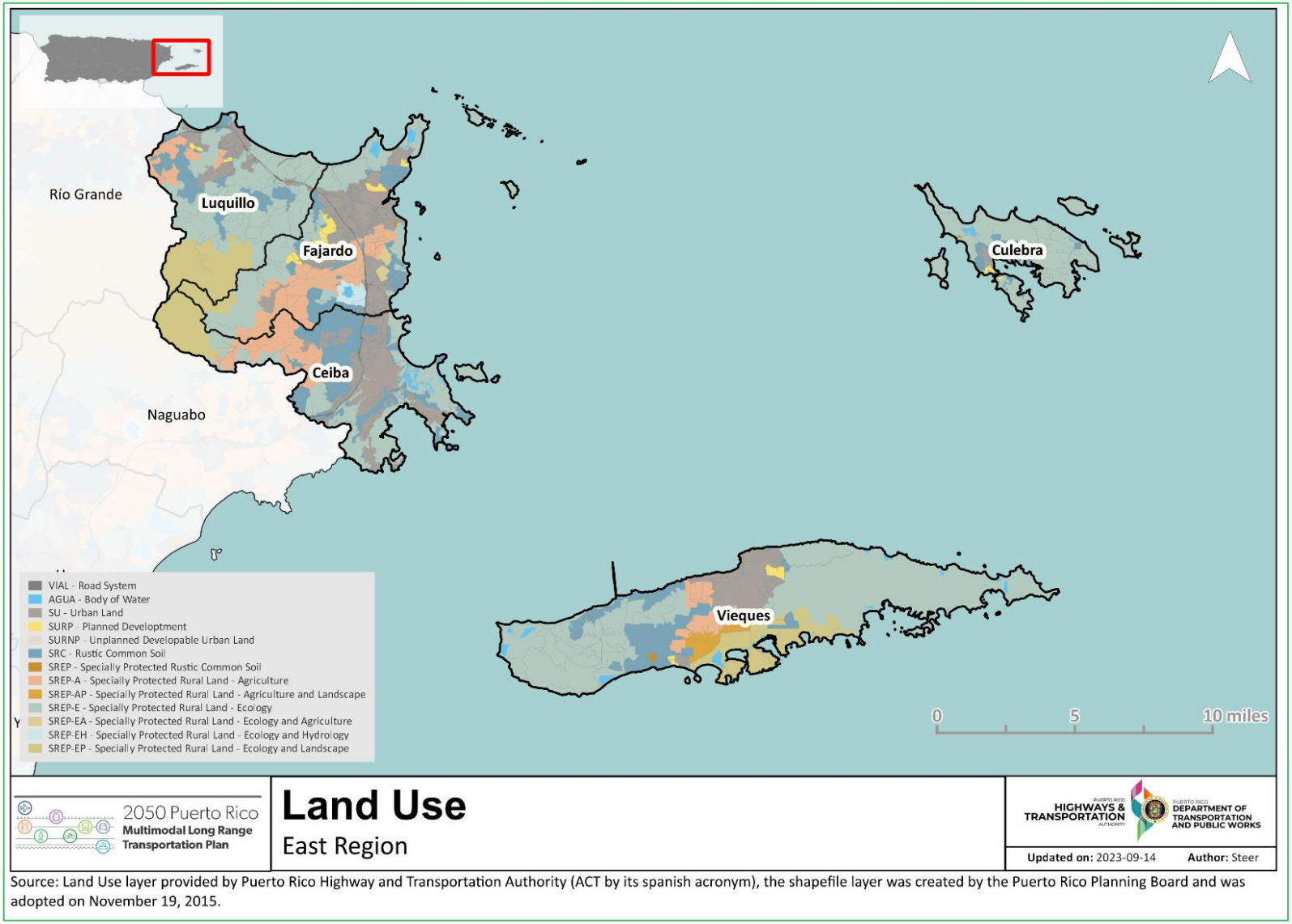
- **Southwest TPR (Figure 2.76):**
  - The SWTPR shelters great extensions of protected agricultural soil, natural reserves, forests and water resources. The Lajas Valley, comprehending primarily the Lajas, Cabo Rojo and Guánica municipalities, is one of the most important coastal basins in the Island. The Guanajibo Valley, covering the municipalities of Cabo Rojo, Hormigueros and San Germán, serves as an important link between the west coast agricultural reserves.
  - The Puerto Rico's karstic zone, comprehended also in some parts of the Cabo Rojo and San Germán municipalities, appears as a direct example of how natural environment guides urban development.
  - SWTPR is also a central focus of commercial activity, tourism and travel generators, with the municipality of Mayagüez as the principal activity center.
  - Functional areas:
    - Mayagüez Functional Area: Mayagüez, Hormigueros, Lajas, Sabana Grande, Cabo Rojo, Maricao, and San Germán

Figure 2.72: Land Use Patterns – North TPR



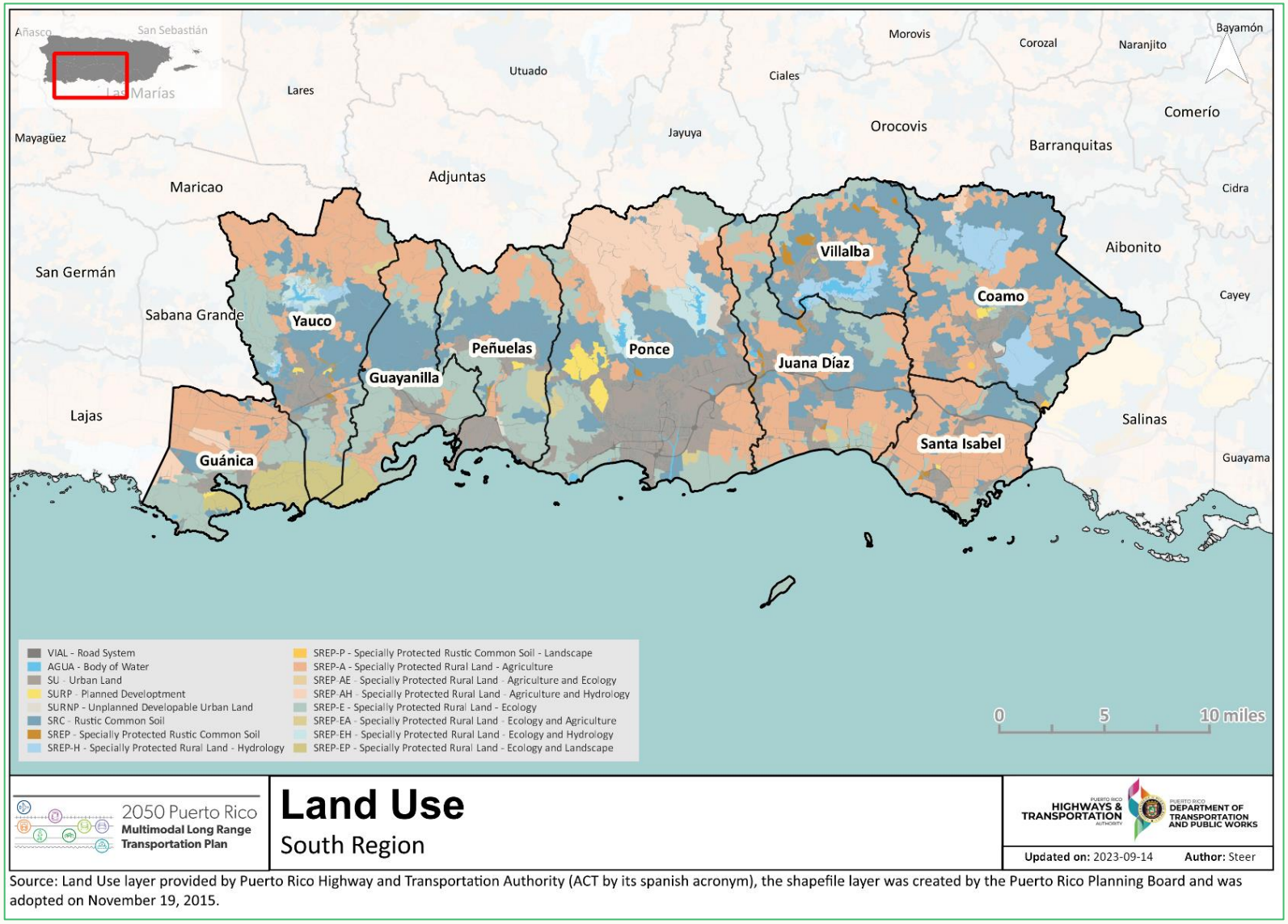
Source: Land Use layer provided by Puerto Rico Highway and Transportation Authority (ACT by its spanish acronym), the shapefile layer was created by the Puerto Rico Planning Board and was adopted on November 19, 2015.

Figure 2.73 Land Use Patterns – East TPR



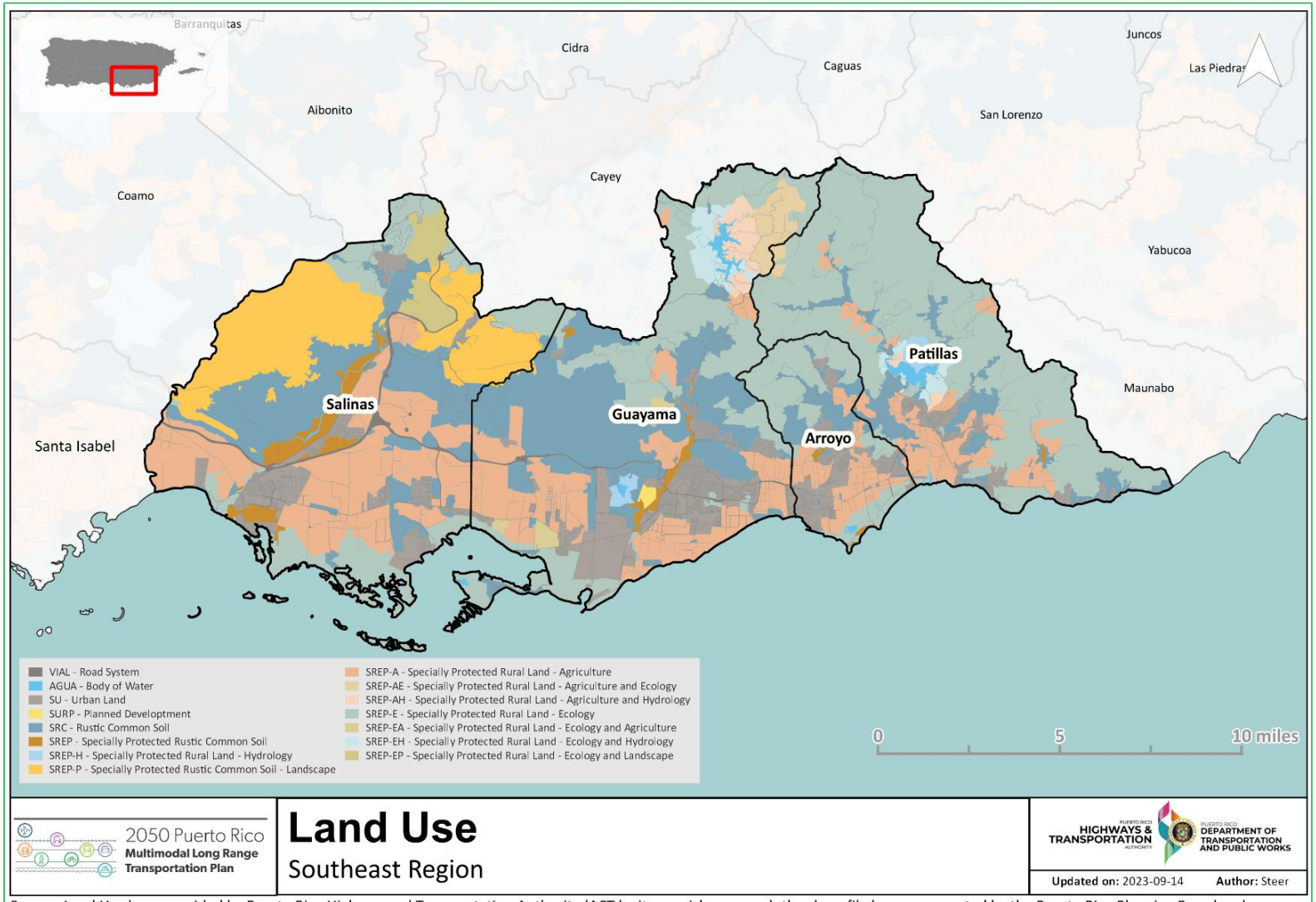
Source: Land Use layer provided by Puerto Rico Highway and Transportation Authority (ACT by its spanish acronym), the shapefile layer was created by the Puerto Rico Planning Board and was adopted on November 19, 2015.

Figure 2.74: Land Use Patterns – South TPR



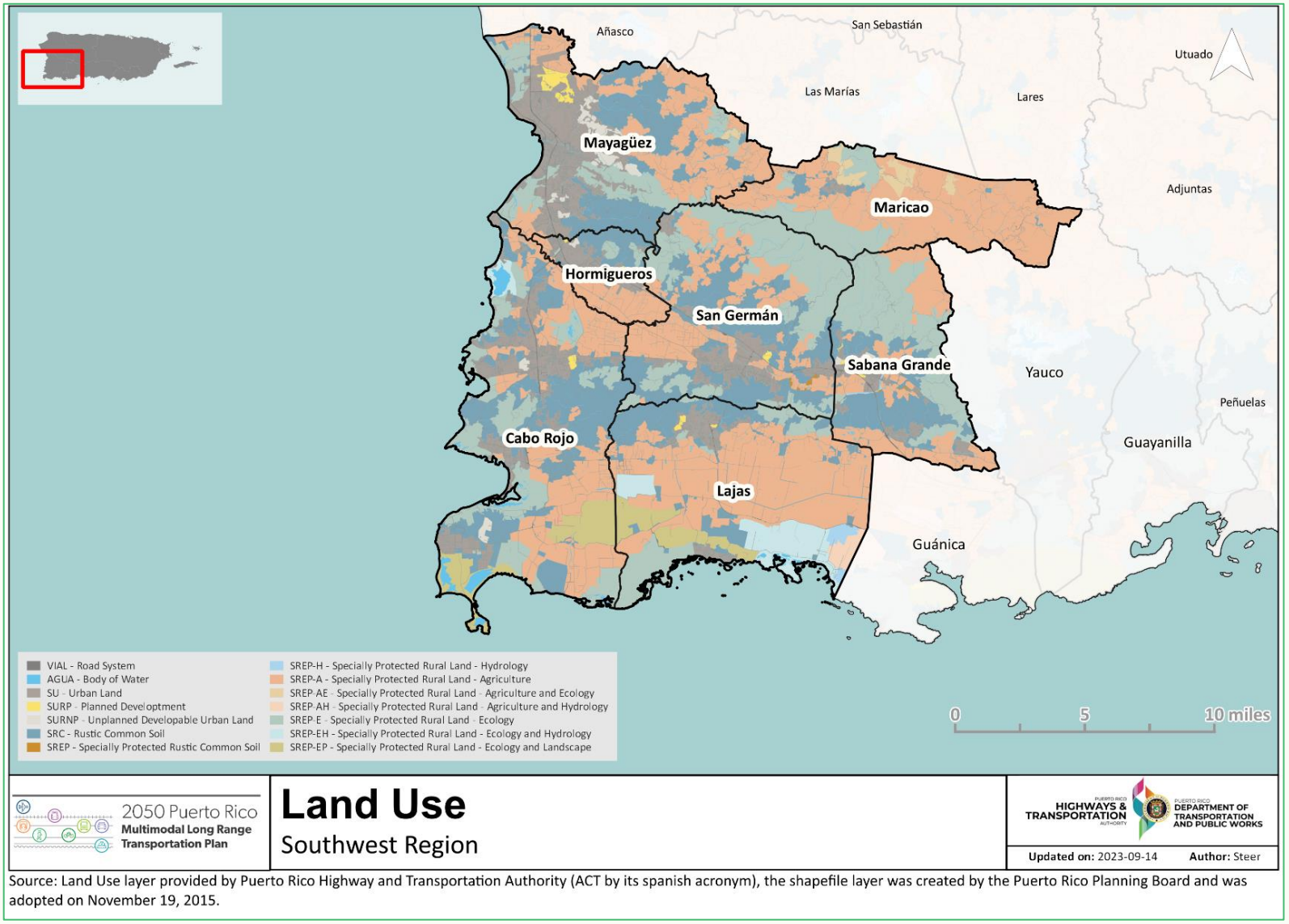
Source: Land Use layer provided by Puerto Rico Highway and Transportation Authority (ACT by its spanish acronym), the shapefile layer was created by the Puerto Rico Planning Board and was adopted on November 19, 2015.

Figure 2.75: Land Use Patterns – Southeast TPR



Source: Land Use layer provided by Puerto Rico Highway and Transportation Authority (ACT by its spanish acronym), the shapefile layer was created by the Puerto Rico Planning Board and was adopted on November 19, 2015.

Figure 2.76: Land Use Patterns – Southwest TPR



Source: Land Use layer provided by Puerto Rico Highway and Transportation Authority (ACT by its spanish acronym), the shapefile layer was created by the Puerto Rico Planning Board and was adopted on November 19, 2015.

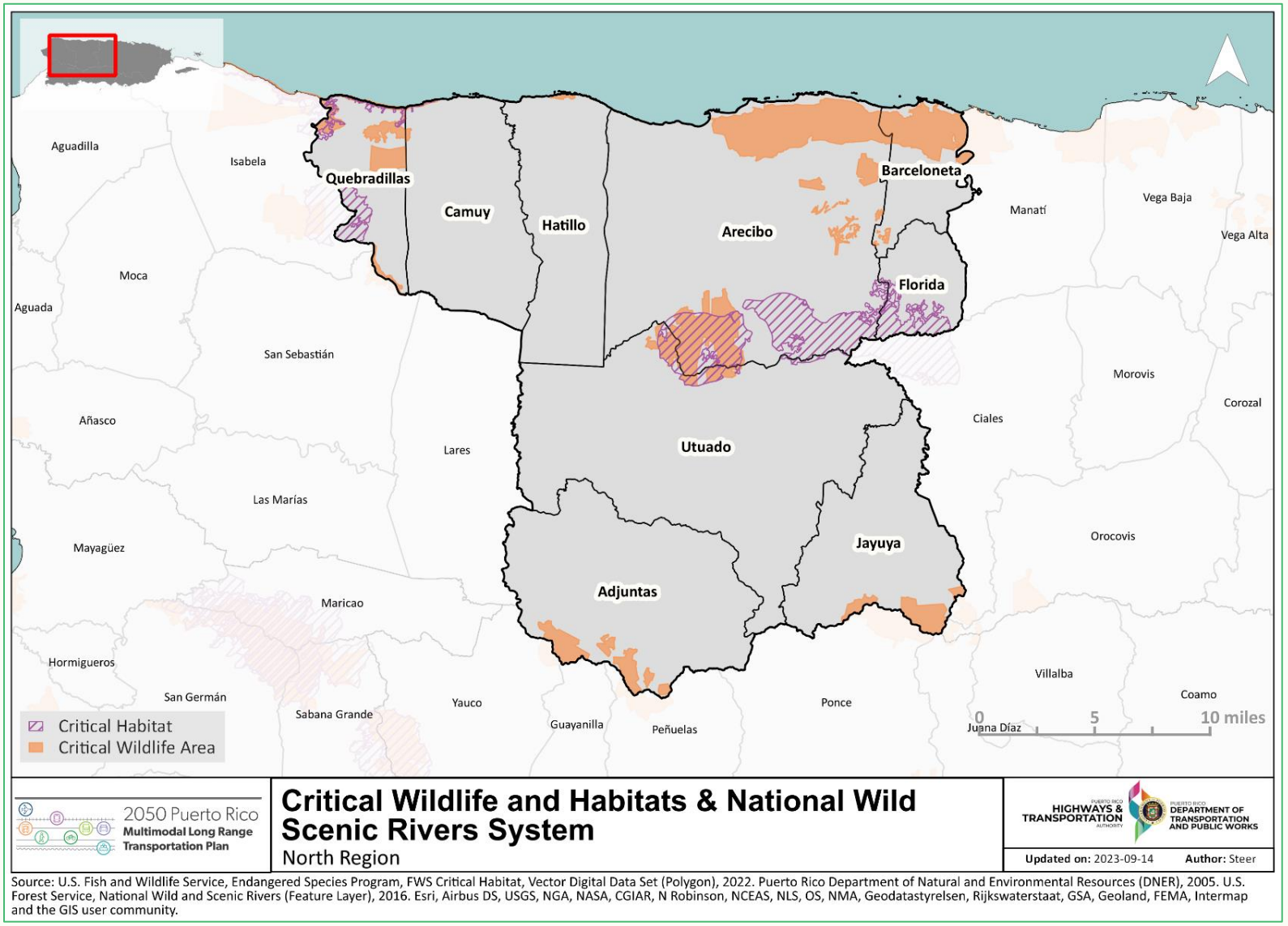
Environmental Sensitivity Area

This section discusses the current natural resources situation in UZA. Topics discussed include coastal plains, water resources, forests, protected areas, among other natural and environmental resources of the island and their status. Furthermore, this section addresses the natural hazards that the island faces due to its geographic location and how resilience is part of the management and preparation for these events.

Puerto Rico has environmental resources ranging from rain forests to dry forests coexisting in this space is a function. It is the orographic nature of the rainfall distribution; where the humidity carried by the trade winds incoming from the northeast as well as storm systems that move in a westbound direction are intercepted in the northern parts of the Island. This causes the noticeable dryer conditions of the south and southwest part of the Island. In fact, the north side of the central mountainous divide known as Cordillera Central shows an annual rainfall intensity close to one hundred inches while the southwest region (which is the driest one) corresponding intensity is of approximately thirty inches. The higher rainfall intensity areas are associated with higher ground elevations of the central mountainous system, while the driest ones are located within coastal zones that exhibit lower elevations in the south part of the Island.

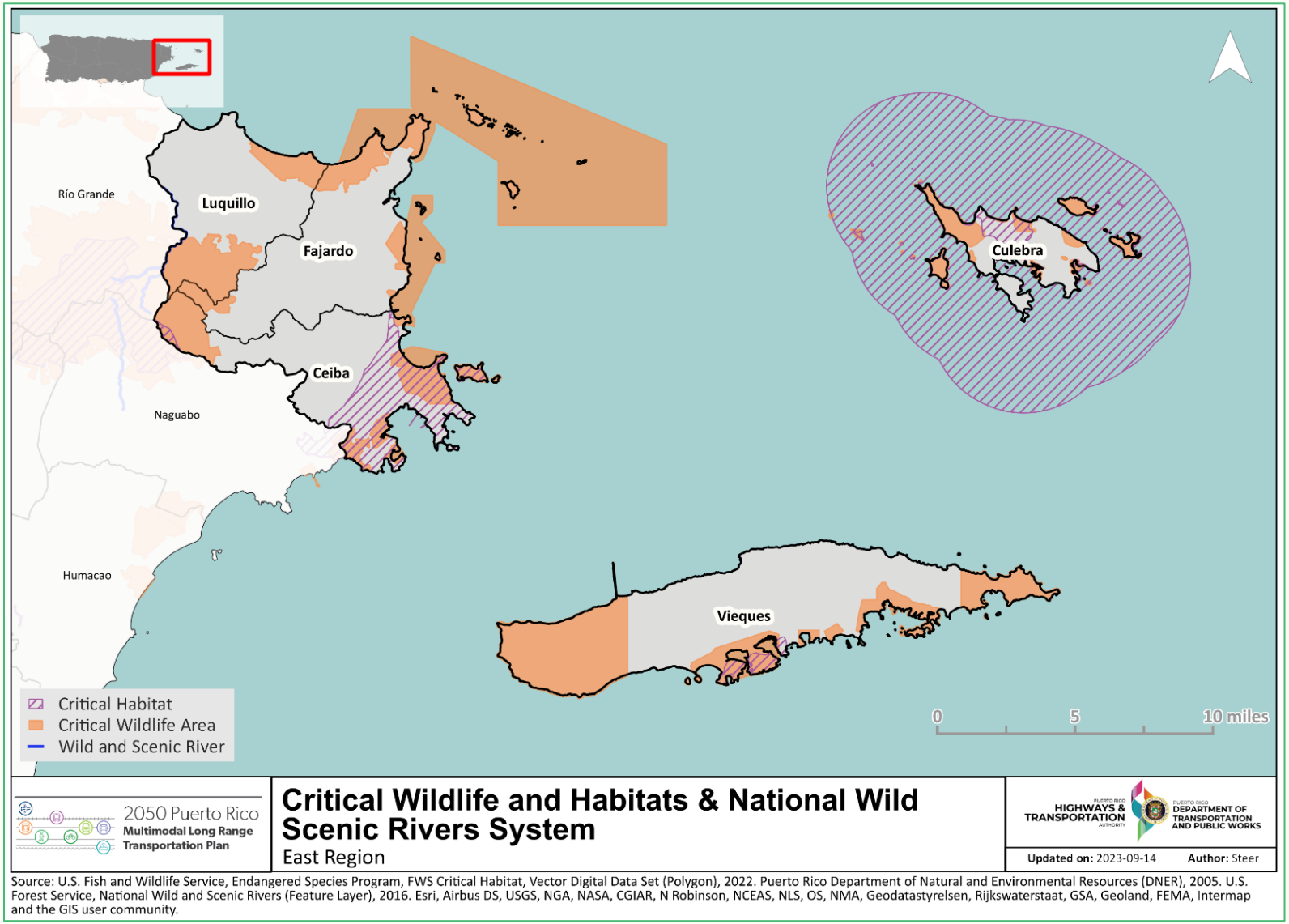
Despite having a limited geographical expansion, the UZA TMA has a diverse set of natural eco-systems. Because of the variations in the topography, rainfall patterns result in the establishment of flora and fauna ecosystems with unique characteristics, some of which are endemic to Puerto Rico. Therefore, many of them are catalogued under the United States Fish and Wildlife Service (USFWS) Critical Habitat Designation or the Puerto Rico Department of Natural and Environmental Resources (DRNER) Critical Wildlife to achieve the conservation of these species and their natural habitat. Refer to Figure 2.77 to Figure 2.81.

Figure 2.77: Critical Wildlife and Habitats and National Wild Scenic River Systems – North TPR



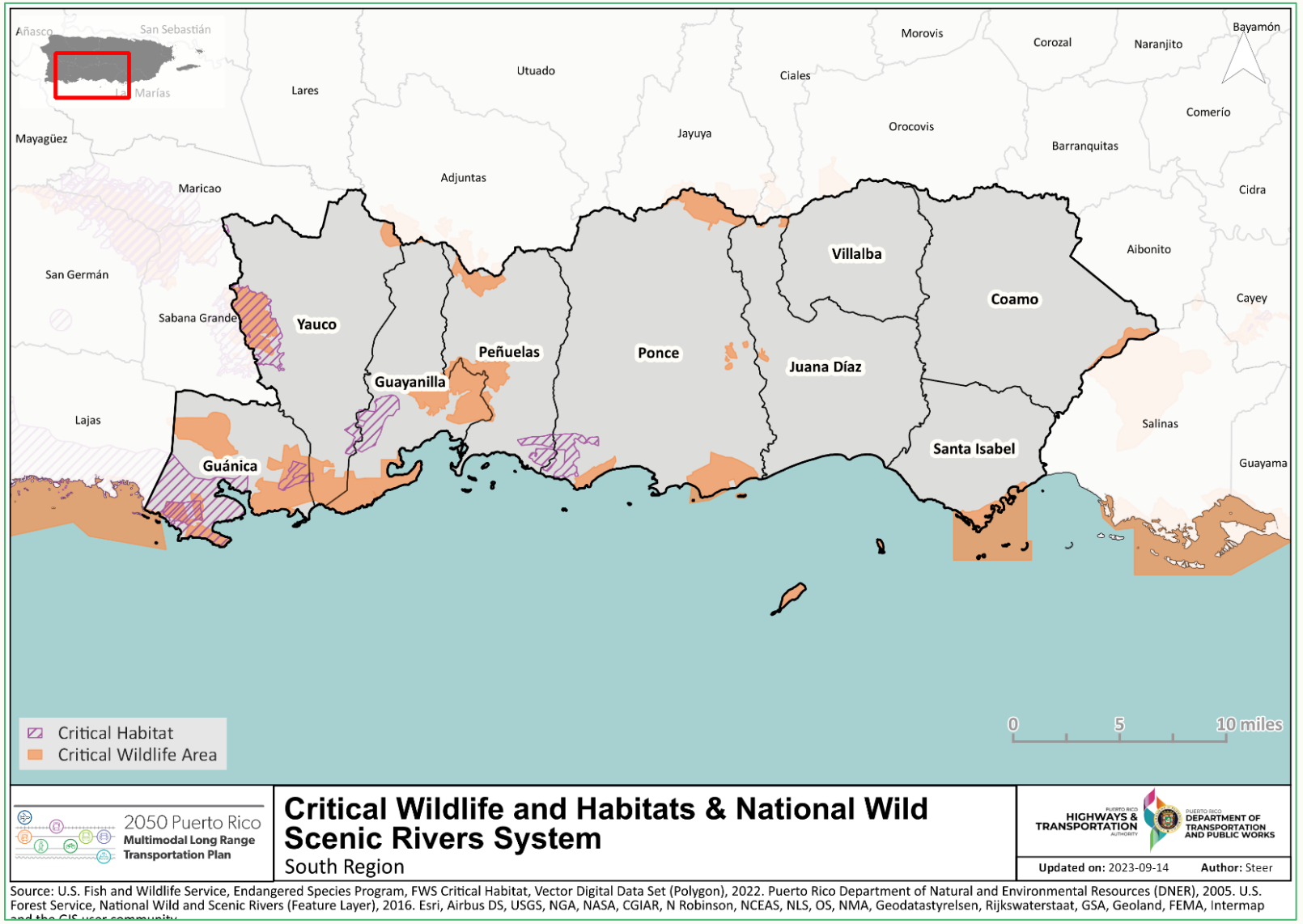
Source: U.S. Fish and Wildlife Service, Endangered Species Program, FWS Critical Habitat, Vector Digital Data Set (Polygon), 2022. Puerto Rico Department of Natural and Environmental Resources (DNER), 2005. U.S. Forest Service, National Wild and Scenic Rivers (Feature Layer), 2016. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.78 Critical Wildlife and Habitats and National Wild Scenic River Systems – East TPR



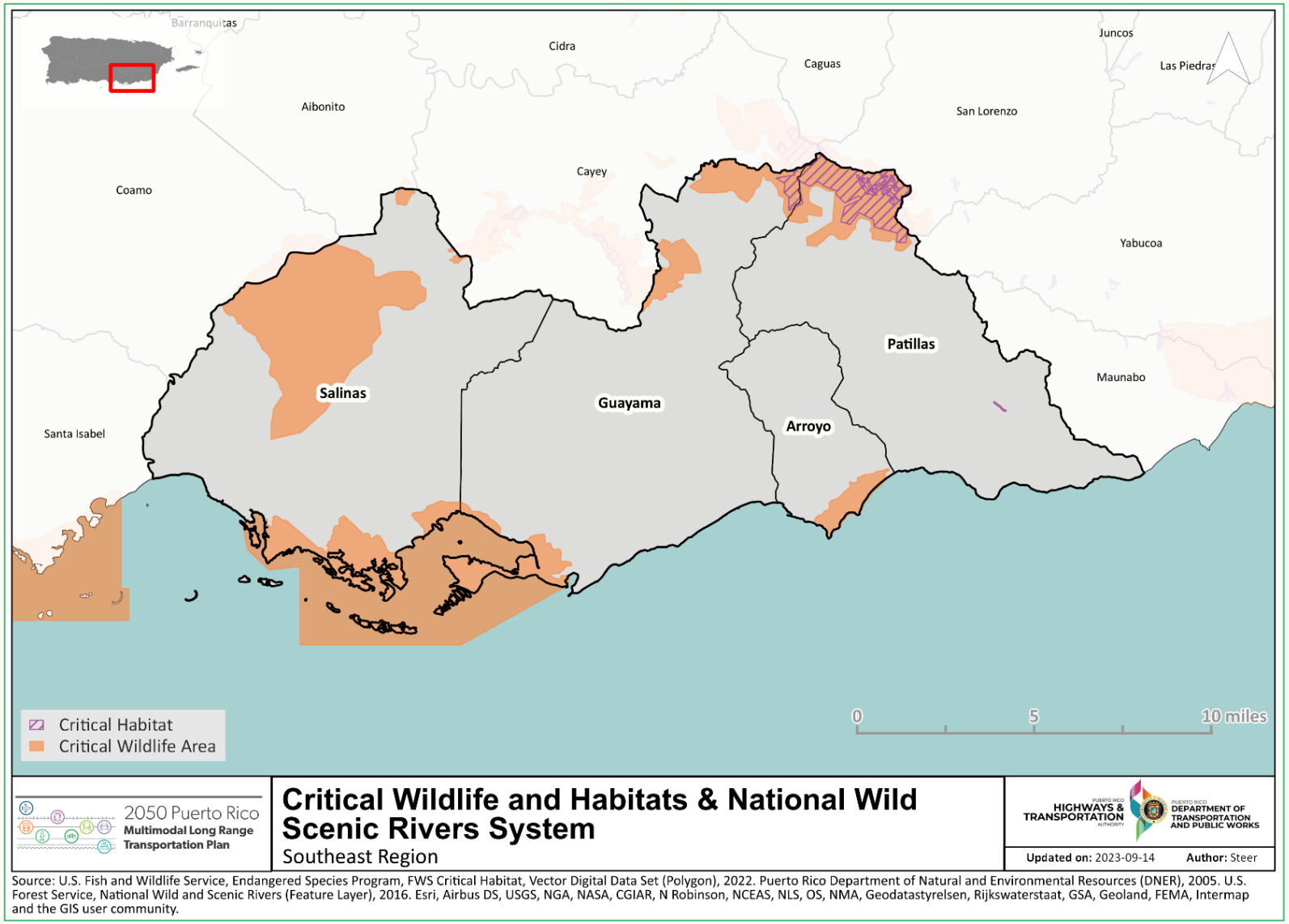
Source: U.S. Fish and Wildlife Service, Endangered Species Program, FWS Critical Habitat, Vector Digital Data Set (Polygon), 2022. Puerto Rico Department of Natural and Environmental Resources (DNER), 2005. U.S. Forest Service, National Wild and Scenic Rivers (Feature Layer), 2016. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.79 Critical Wildlife and Habitats and National Wild Scenic River Systems – South TPR



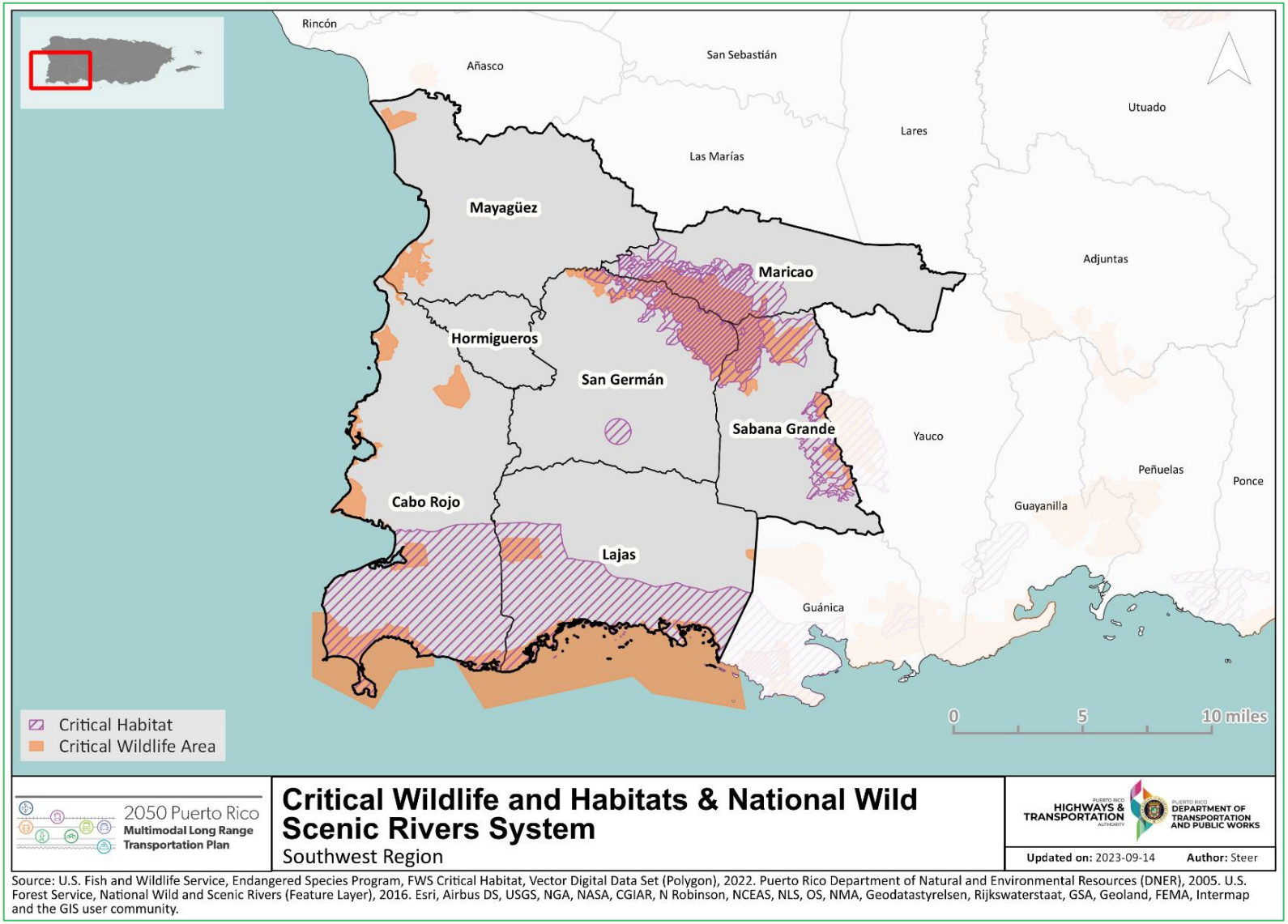
Source: U.S. Fish and Wildlife Service, Endangered Species Program, FWS Critical Habitat, Vector Digital Data Set (Polygon), 2022. Puerto Rico Department of Natural and Environmental Resources (DNER), 2005. U.S. Forest Service, National Wild and Scenic Rivers (Feature Layer), 2016. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

Figure 2.80 Critical Wildlife and Habitats and National Wild Scenic River Systems – Southeast TPR



Source: U.S. Fish and Wildlife Service, Endangered Species Program, FWS Critical Habitat, Vector Digital Data Set (Polygon), 2022. Puerto Rico Department of Natural and Environmental Resources (DNER), 2005. U.S. Forest Service, National Wild and Scenic Rivers (Feature Layer), 2016. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.81 Critical Wildlife and Habitats and National Wild Scenic River Systems – Southwest TPR



Source: U.S. Fish and Wildlife Service, Endangered Species Program, FWS Critical Habitat, Vector Digital Data Set (Polygon), 2022. Puerto Rico Department of Natural and Environmental Resources (DNER), 2005. U.S. Forest Service, National Wild and Scenic Rivers (Feature Layer), 2016. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Coastal Plains

The second most common physiographic province of Puerto Rico is composed by the alluvial coastal plains that get formed from the erosion of the interior mountainous. Therefore, it shows mostly low elevations and are made up by sediments. The north plains extend from the northwestern corner of the Island up to the Río Grande de Loíza, in the northeastern corner, while the south plans extend from Ponce to Guayama. Across these areas is possible to find environmental resources such as agricultural valleys, beaches, dry forest reserves, lagoons, mangrove forests, and wetlands.

Close to the coastal plains band, a significant and regulatorily protected karts system[31] is found, as shown in Figure 2.80 to Figure 2.84. This area is formed by limestone rocks and is characterized by large-scale processes of breaking down and dissolution of rock. Due to this characteristic, waters enter rapidly to the aquifers, and therefore are susceptible to groundwater contamination, which constitutes a reason for its sensitivity and protection. A second broad karstic region is observed in the southwestern area, between Ponce and Cabo Rojo. However, this area is not as developed as the previous one in terms of karstic features.

In general, this Region exhibits ground elevations that generally increase from the north to south. Therefore, lower elevations are observed along the coastal plains facing the Atlantic Ocean. It is possible to observe a high degree of variability in the environmental settings as a function of the location within the Region, ranging from the coastal plains and mountainous parts.

Outcroppings (mogotes) of limestone are scattered through the mountainous volcanic region in the center of the Island. Cave systems (like the Camuy Caves) as well as river valleys are common features of this area. The erosion of the limestone often leaves large sinkholes in the surface.

- **North TPR (Figure 2.82)**

– This region exhibits ground elevations that generally increase from the north to south.

– Lower elevations are observed along the coastal plains facing the Atlantic Ocean.

– Elevations along these areas range between 0 to 278 feet above the means sea level.

– This area is bounded to the south by the karst formations corridor that generally runs from west to east with elevations generally ranging from 278 to 602 feet above the mean sea level.

– In terms of physiographic features, this region shares the three (3) provinces identified in Puerto Rico which are: alluvial coastal plains, the karst, and the central mountainous interior[32].

– The coastal plains of this Region are known for the extensive presence of cattle farms, in particular the municipalities of Camuy, Hatillo and Arecibo.

31. More information about the Karst or karstic formation in this region can be found in the 2045 Long Range Transportation for Puerto Rico.
32. U.S. Geological Survey. 1996. Atlas of Groundwater Resources in Puerto Rico and the U.S. Virgin Islands, Report 94-4198.

- **East TPR (Figure 2.83)**

– The ETRP presents a high degree of variability in the environmental settings as a function of the location within the region, ranging from the coastal plains and mountainous parts.

– Ground elevations of the mainland part of this region range from 0 to 87 feet above the mean sea level at the north, east and south borders. The highest elevations of the Region are observed toward the west side, within the premises of the El Yunque National Forest, in a range between 602 and 1,330 feet above the mean sea level.

– The Islands of Culebra and Vieques, exhibit ground elevations ranging from 0 feet above the means sea level along their coasts to higher elevations mostly toward their center parts.

- **South TPR (Figure 2.84)**

– The northern parts of the STPR are characterized by high elevations (ranging from 1,000 to 1,330 feet above the mean sea level feet) while the lowest ones (ranging from 0 to 87 feet above the mean sea level) are located toward the southern part of the Region which is in a coastal zone facing the Caribbean Sea.

– In terms of physiographic features, most of the area is located within alluvial coastal plains with some intrusions of the central mountainous interior[33].

- **Southeast TPR (Figure 2.85)**

– In general, this Region exhibits ground elevations that generally increase from the south to the north. Therefore, lower elevations are observed along the coastal plains facing the Caribbean Sea.

– In terms of physiographic features, most of the area is located within alluvial coastal plains with some intrusions of the central mountainous interior.

– Mean annual rainfall in this Region ranges from approximately less than 30 up to approximately 60 inches per year in the coastal plains to up to more than 100 inches per year in the mountainous areas close to the Municipalities of Arroyo and Patillas.

- **Southwest TPR (Figure 2.86)**

– The northeastern parts of the SWTPR are characterized by high elevations (ranging from 1,000 to 1,330 feet above the mean sea level feet) while the lowest ones (ranging from 0 to 602 feet above the mean sea level) are located toward the west and southern parts of the Region.

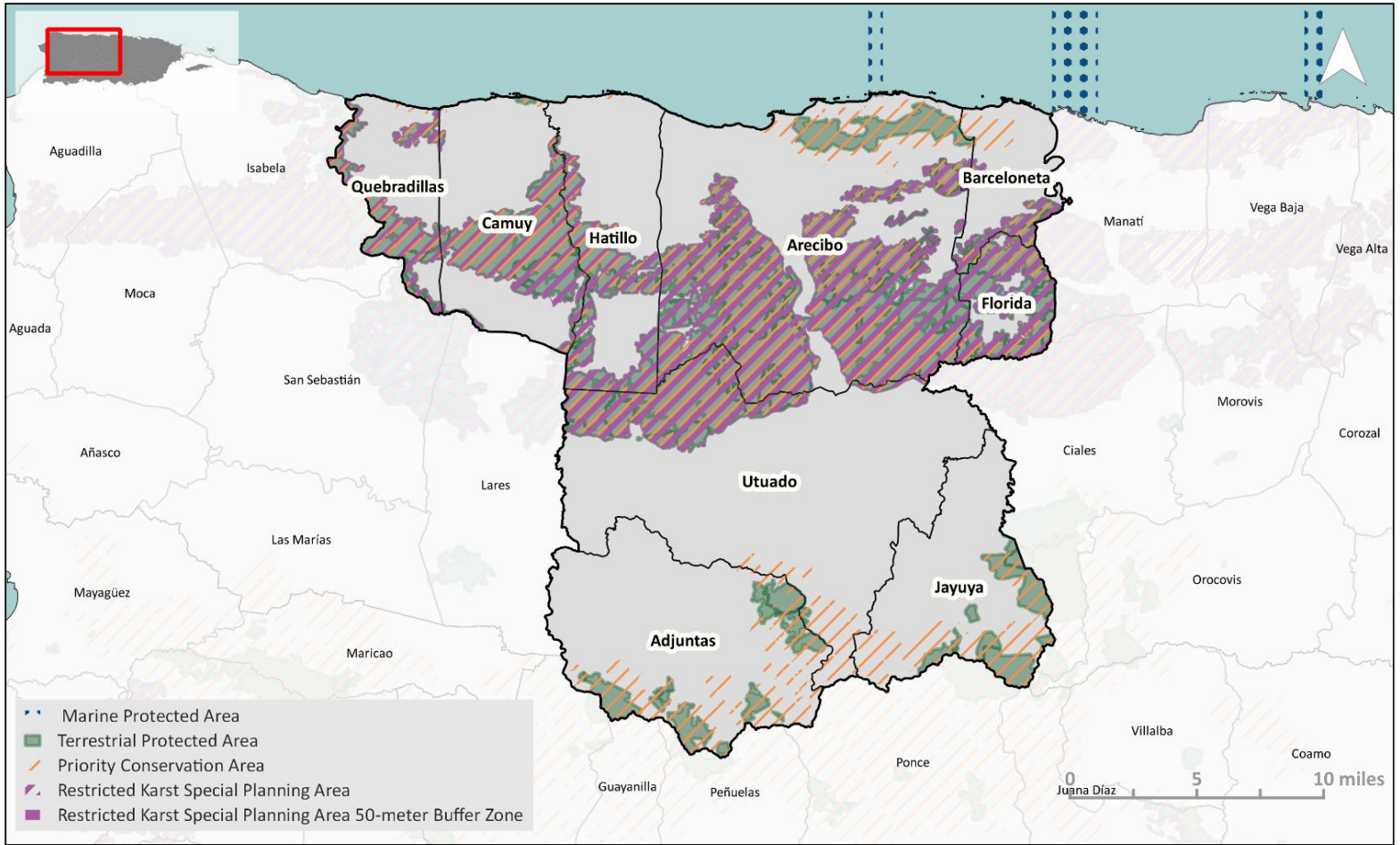
– In terms of physiographic features, most of the area is located within intrusions of the central mountainous interior and some small patches of alluvial coastal plains.

– Mean annual rainfall in this Region ranges from approximately 100 inches per year in the northeastern highest elevations to less than 30 inches per year near the south coast.

– This part of the Region shares the same characteristic of the SWTPR, since it is the result of the orographic effect caused by the Cordillera Central mountainous system that retains most of the humidity carried by the winds in the northern part of the Island.

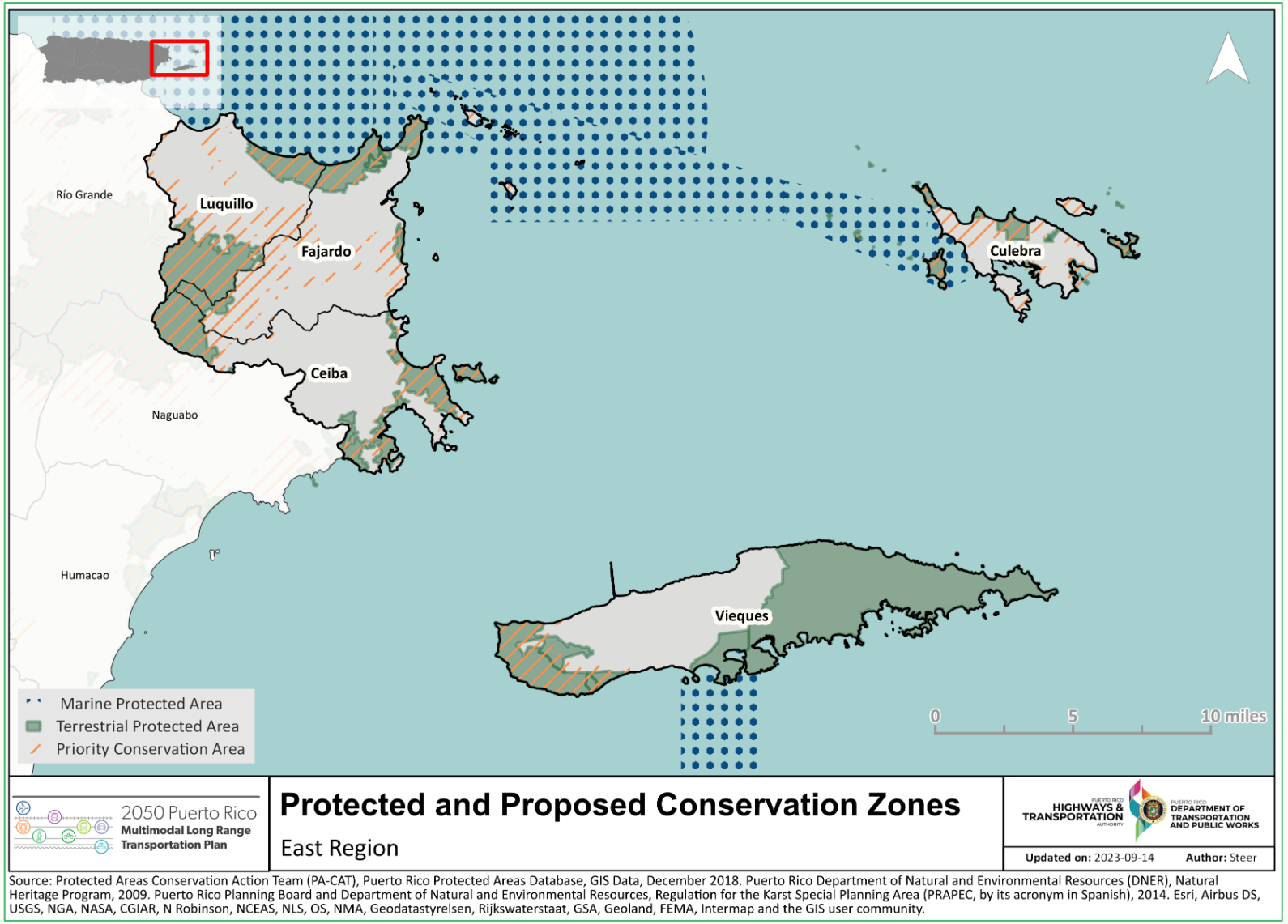
33. (U.S. Geological Service, Atlas of Ground-Water Resources in Puerto Rico, and the U.S. Virgin Islands, 1994).

Figure 2.82: Protected and Proposed Conservation Zones – North TPR



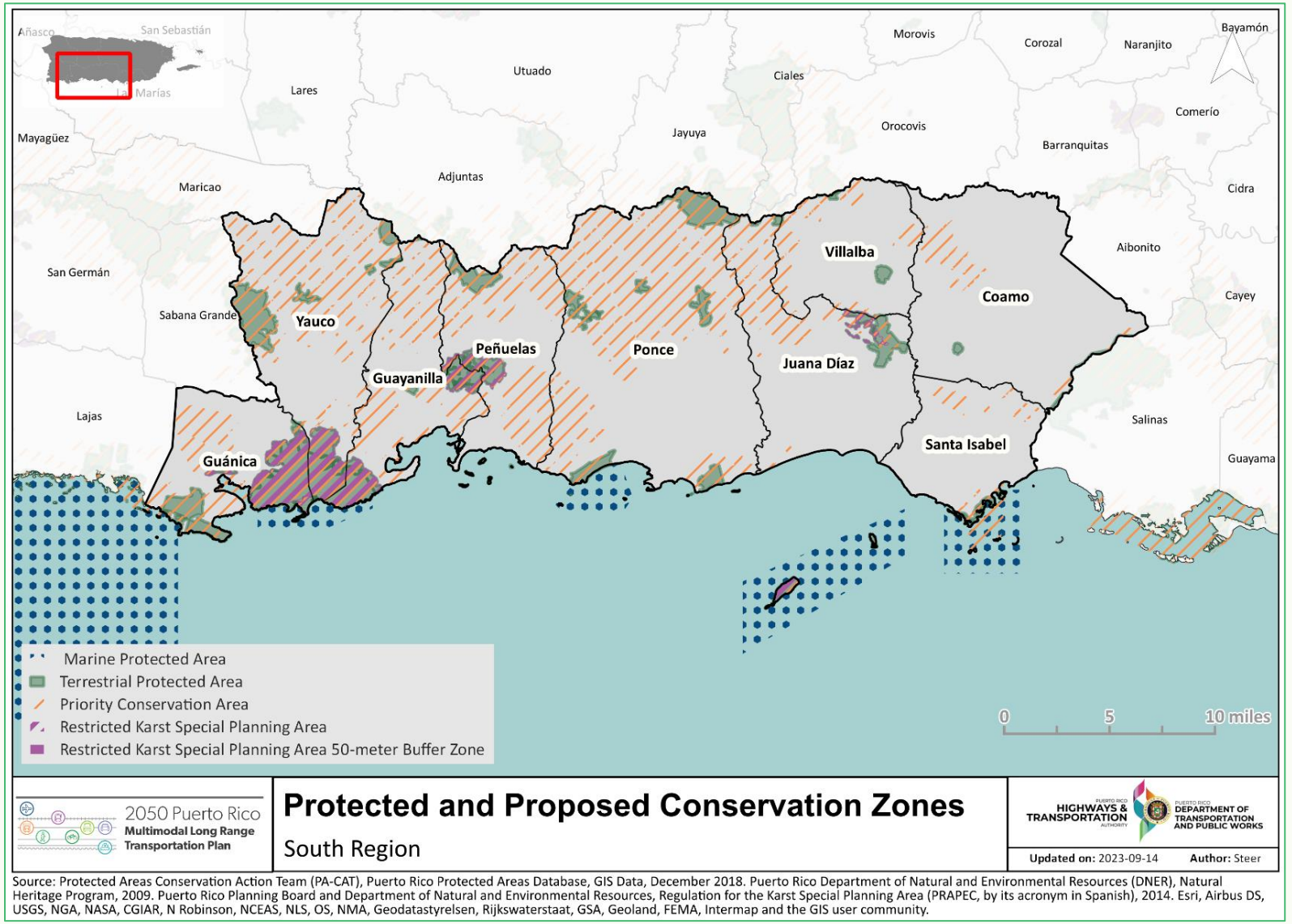
Source: Protected Areas Conservation Action Team (PA-CAT), Puerto Rico Protected Areas Database, GIS Data, December 2018. Puerto Rico Department of Natural and Environmental Resources (DNER), Natural Heritage Program, 2009. Puerto Rico Planning Board and Department of Natural and Environmental Resources, Regulation for the Karst Special Planning Area (PRAPEC, by its acronym in Spanish), 2014. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.83 Protected and Proposed Conservation Zones – East TPR



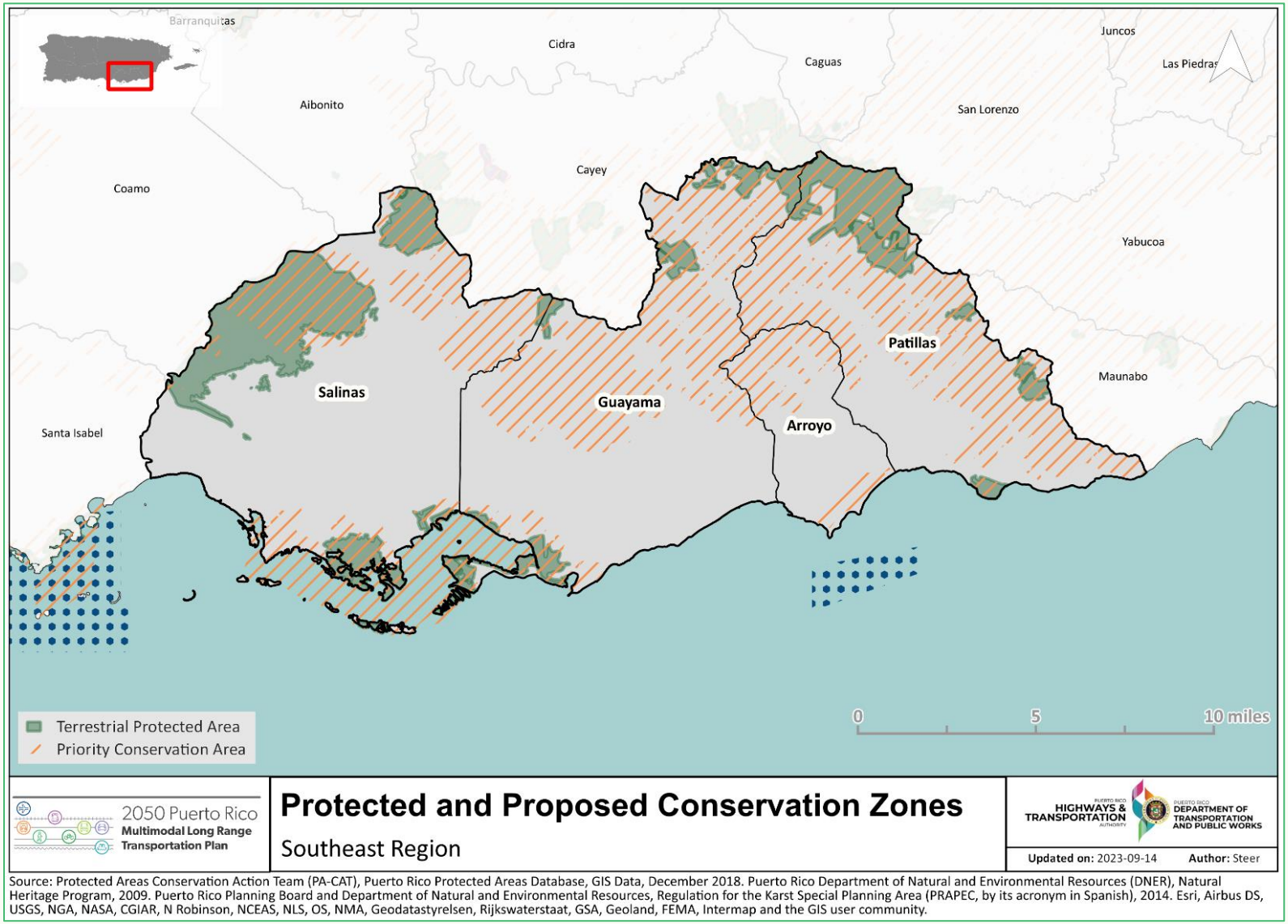
Source: Protected Areas Conservation Action Team (PA-CAT), Puerto Rico Protected Areas Database, GIS Data, December 2018. Puerto Rico Department of Natural and Environmental Resources (DNER), Natural Heritage Program, 2009. Puerto Rico Planning Board and Department of Natural and Environmental Resources, Regulation for the Karst Special Planning Area (PRAPEC, by its acronym in Spanish), 2014. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.84 Protected and Proposed Conservation Zones – South TPR



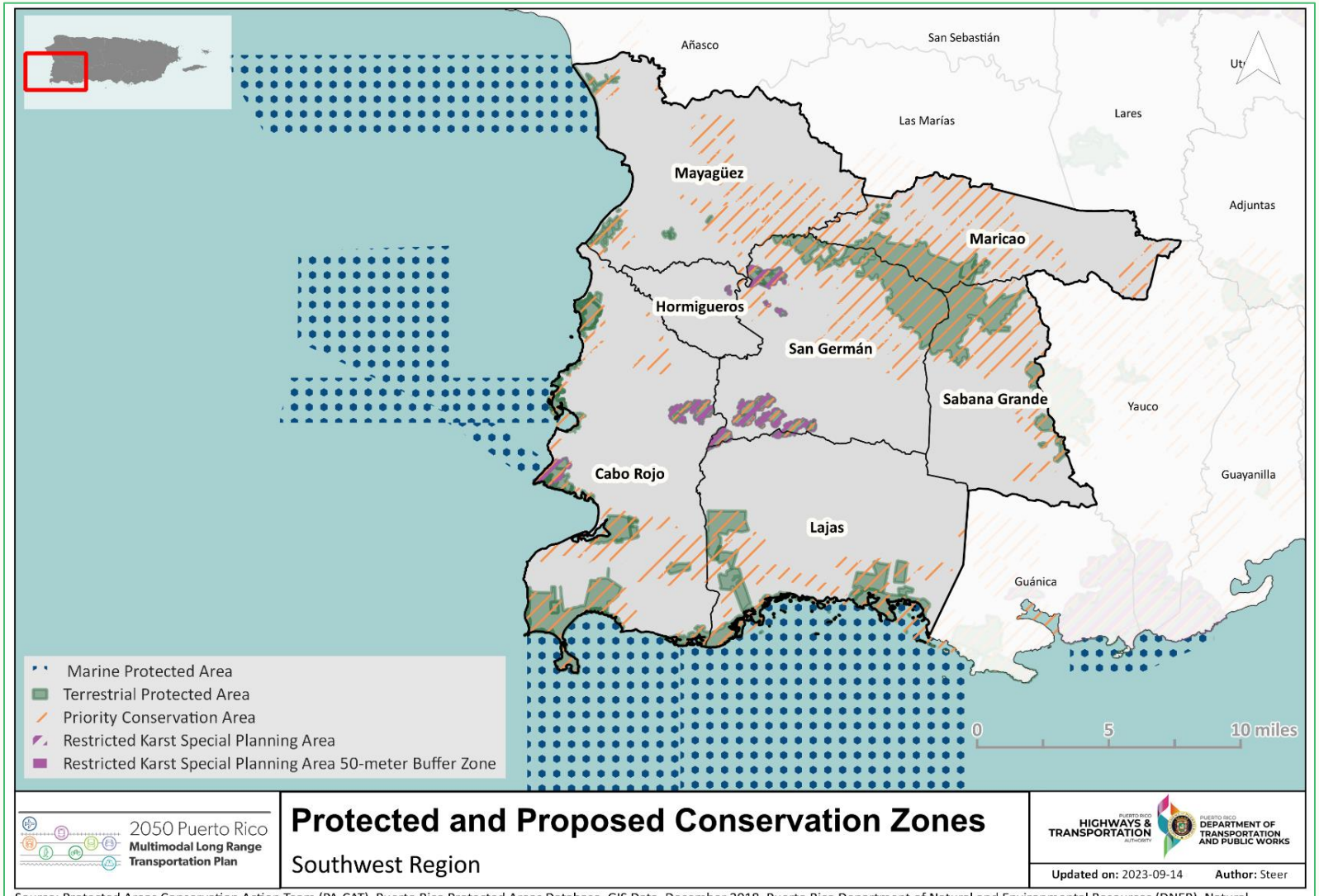
Source: Protected Areas Conservation Action Team (PA-CAT), Puerto Rico Protected Areas Database, GIS Data, December 2018. Puerto Rico Department of Natural and Environmental Resources (DNER), Natural Heritage Program, 2009. Puerto Rico Planning Board and Department of Natural and Environmental Resources, Regulation for the Karst Special Planning Area (PRAPEC, by its acronym in Spanish), 2014. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.85 Protected and Proposed Conservation Zones – Southeast TPR



Source: Protected Areas Conservation Action Team (PA-CAT), Puerto Rico Protected Areas Database, GIS Data, December 2018. Puerto Rico Department of Natural and Environmental Resources (DNER), Natural Heritage Program, 2009. Puerto Rico Planning Board and Department of Natural and Environmental Resources, Regulation for the Karst Special Planning Area (PRAPEC, by its acronym in Spanish), 2014. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.86 Protected and Proposed Conservation Zones – Southwest TPR



Source: Protected Areas Conservation Action Team (PA-CAT), Puerto Rico Protected Areas Database, GIS Data, December 2018. Puerto Rico Department of Natural and Environmental Resources (DNER), Natural Heritage Program, 2009. Puerto Rico Planning Board and Department of Natural and Environmental Resources, Regulation for the Karst Special Planning Area (PRAPEC, by its acronym in Spanish), 2014. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Mountains

The mountainous interior of Puerto Rico and its offshore islands are composed mainly of a mixture of volcanic and sedimentary rocks. It covers approximately a 60% of its entire surface. The Central Mountains range (Cordillera Central is the main mountain range in Puerto Rico and crosses the island from west to east and divides the island into northern and southern coastal plains. In the UZA TPR it runs eastward from Maricao, in the central eastern region of Puerto Rico and on to the outskirts of the Sierra de Cayey. Sierra de Cayey is an extension of Cordillera Central that begins in the town of Cayey. The Sierra de Cayey "extension" branches out into two lower ranges: Sierra Guardarraya and Cuchillas de Panduras which run eastward to Yabucoa and Patillas respectively.

There is an additional Cordillera Central eastern branch, Sierra de Luquillo, which runs northeastwardly from Gurabo to Fajardo and includes several high peaks, including Toro Hill, at 3,524 ft. (1,074 m), El Yunque at 3,494 ft. (1,065 m) and El Pico Oeste at 3,446 ft. (1,056 m). El Yunque forest is the only Tropical Forest Reserve under the jurisdiction of the U.S. Forest Service.

Important environmental resources located within this Region are agricultural lands, caves, extensive forestland, landslide prone slope areas, and springs. Extensive tropical vegetation and fauna are observed in most of the rural areas of this Region. These natural assets from the mountainous interior of Puerto Rico, as well as other assets like scenic, archaeological, cultural recreational and historic can be enjoyed by users of the Panoramic Route, which crosses the Island from west to east along the Central Mountain range.

Forest and Wildlife Preserves

The mountainous ranges of Puerto Rico with their abundant rainfall and exuberant flora and fauna species host several state forests reserves. Perhaps, the most known as El Yunque Caribbean National Forest that comprises approximately 28,000 acres of land and is nested in the Sierra de Luquillo Mountain range. However, it is an area under preservation since 1876, when the Spanish crown set it aside for preservation. Even with this government protection, the area is being pressured in the past by attempts from private entities to develop nearby areas. These development efforts which may have resulted in negative impacts to the protected species that live within the forest efforts have been controlled by both the local and federal government agencies with the establishment of special zoning and planning requirement applicable to projects in municipalities that surround this forest.

In contrast to the mountainous forest system, the Guánica Dry Forest and the Cabo Rojo Wildlife Refuge are examples of important reserves located in the southwest corner of the Island, in south coastal plains. Many of these are protected areas under the Protected Areas Conservation Action Team (PA-CAT) or proposed for conservation by the DNER through the Priority Conservation Areas. Some examples are Tres Picachos Commonwealth Forest, Río Camuy Cave System, Caguana Indigenous Ceremonial Park, Vieques National Wildlife Refuge, among other protected areas.

Future planned developments with the potential to negatively affect these preserved and unique natural resources shall be carefully analysed to assess and eliminate them to the extent possible. Established environmental regulations are enforced locally by the Permits Management Office (OGPe for its acronym in Spanish) and the Department of Natural and Environmental Resources (DNER) to protect these resources. At a federal level agency such as the U.S. Fish and Wildlife Service (USFWS) and the U.S. Environmental Protection Agency (EPA) work on the protection of those environmental resources. Regarding to transportation improvement projects, new and future ones will be required to consider avoidance, minimization, and mitigation of any identified environmental impact. The MPO, through the PRHTA, supports the coordination with federal and Commonwealth agencies to promote a consultation process.

A description of the forest and wildlife preserve for each region is below:

- **North TPR (Figure 2.87)**

  – The most important coastal natural reserve of this Region is Caño Tiburones, located in the municipality of Arecibo. Currently is protected by the Puerto Rico Department of Natural and Environmental Resources (DRNA).

  – Another protected coastal system of the Region is the Natural Reserve of Cueva del Indio, in the municipality of Arecibo.

  – The Río Abajo State Forest is also located in this municipality, while Bosque del Pueblo is in the municipality of Adjuntas.

  – Bosque del Pueblo, in the municipality of Adjuntas, presents a particular case since the local organization Casa del Pueblo, signed an agreement with the DNER to administer this forest that has become a model for other communities to follow.

- **East TPR (Figure 2.88)**

  – Some natural reserves and state forests systems are observed within this Region, varying from the coastal dry systems to wet ones located in the mountainous area of the Region.

  – The most important and recognizable natural systems of this Region are El Yunque National Forest and the Northeast Ecological Corridor Natural Reserve.

  – The Ceiba State Forest as well as the Natural Protected Area of Medio Mundo and Daguao are also nested in this Region.

  – Vieques is a municipality exhibiting characteristics of its own and hosts the National Wildlife Refuge El Buey and the Natural Reserve of the Vieques bioluminescent bay.

  – The natural resources from Culebra include the Luis Peña Canal Natural Reserve and the Culebra National Wildlife Refuge.

- **South TPR (Figure 2.89)**

  – The north part of this Region lies inside a subtropical moist forest (that represents 58.4% of the entire surface area of the Island). Most of the environmentally sensitive areas are in coastal areas.

  – The most emblematic forest system within this Region is the Guánica Dry Forest and covers an area of approximately 10,000 acres.

  – Additional forest and/or natural reserves located within this Region are:

    - El Convento Natural Reserve (Peñuelas), Punta Cucharas Natural Reserve and the Punta Cabullón Natural Protected Area (Ponce), Punta Petrona Natural Reserve and Punta Pozuelo Natural Protected Area (Santa Isabel), Susua State Forest (Yauco).

- **Southeast TPR (Figure 2.90)**

  – The Carite State Forest is one of the most important forest systems in the region. This forest is managed by the Puerto Rico DNER and offers to the public camping areas as well as the Patillas Lagoon for aquatic activities.

  – The coastal area most relevant natural systems are the Natural Reserve of the Jobos Bay Estuary, the Natural Reserve of Tourmaline Coral Reef and the Aguirre State Forest.

  – The Natural Reserve of Punta Viento Wetlands is observed to the eastern part of this Region, in the municipality of Patillas.

- **Southwest TPR (Figure 2.89)**

– The Natural Reserve of Cerro Las Mesas, located in the municipality of Mayagüez, as well as Natural Reserve of Maricao, both located in the municipality of Maricao; are examples of Subtropical Wet forests.

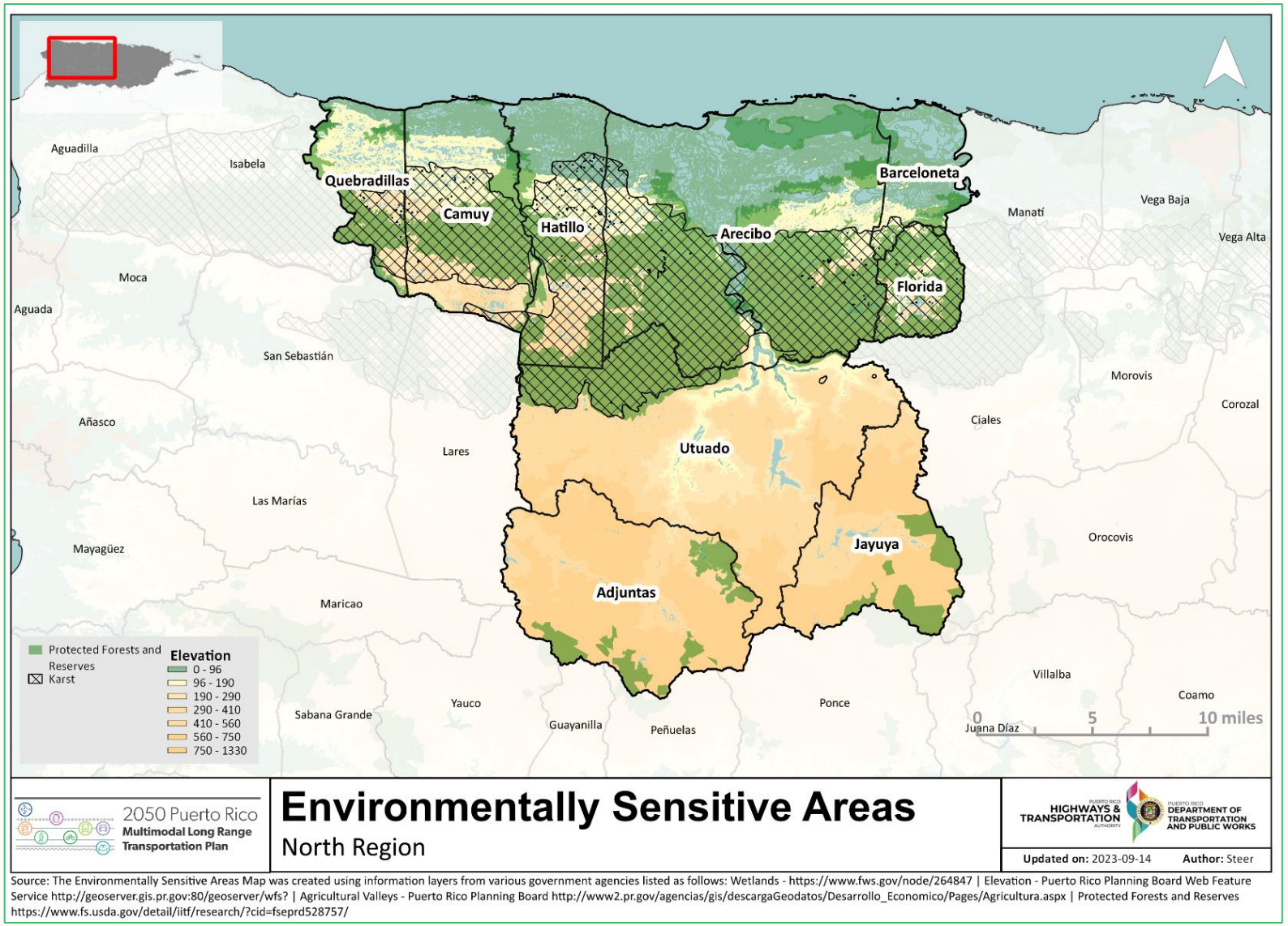
– Most of the natural reserves adapted to dry climate conditions are in the Municipality of Cabo Rojo:

    - Sierra Alta Natural Reserve, Conuco Protected Natural Area, Joyuda Lagoon Natural Reserve, Punta Guaniquilla Natural Reserve, the Cabo Rojo National Wildlife Refuge, the Laguna Cartagena National Wildlife Refuge, and the Boquerón Sate Forest.

– La Parguera Natural Reserve located in the Municipality of Lajas constitute a unique natural resource since within its boundaries is observed the bioluminescent Lajas bay.

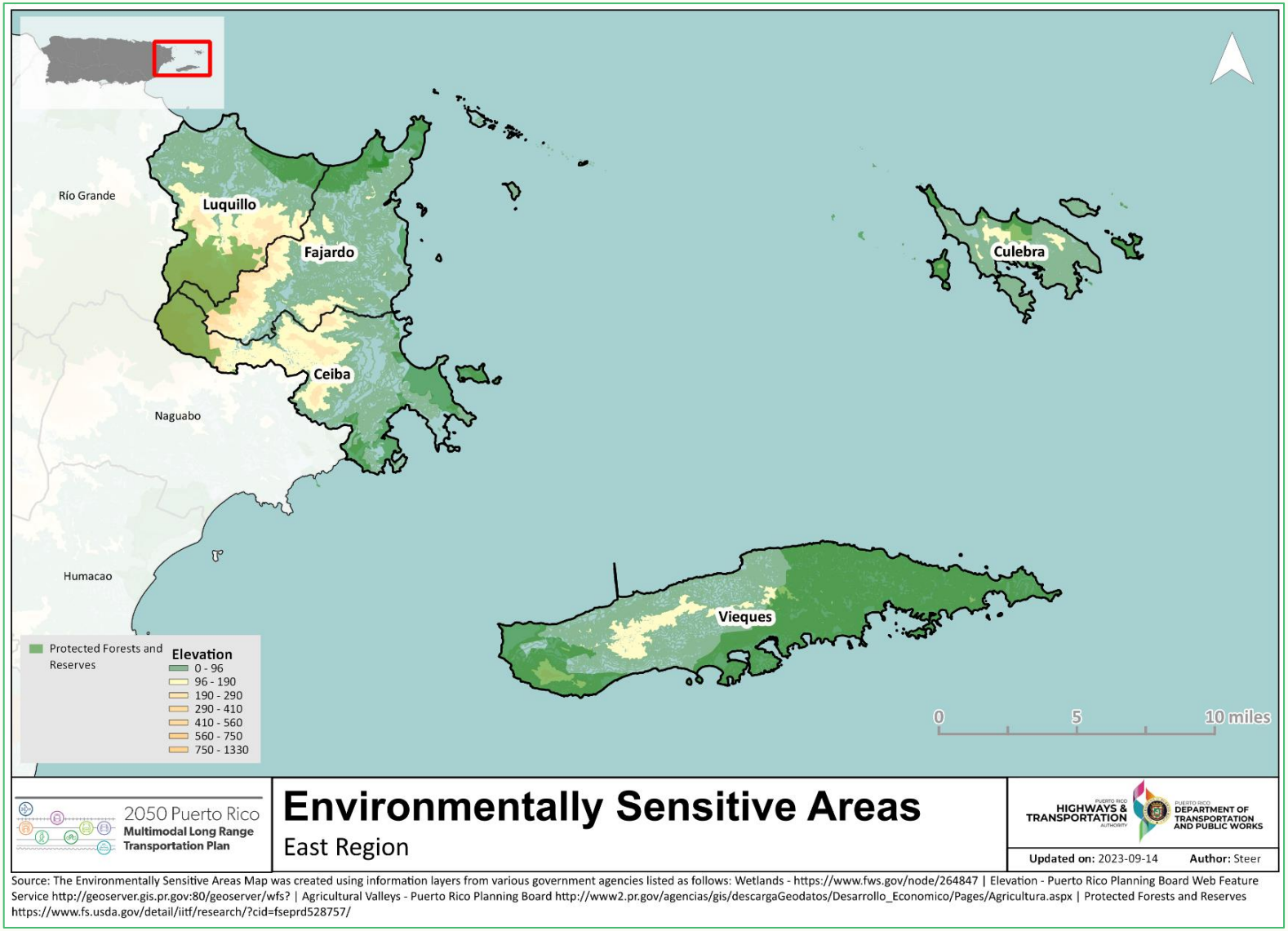
– The most important among the Reserves in this area is the Cabo Rojo Wildlife Refuge.

Figure 2.87: Environmentally Sensitive Areas - North TPR



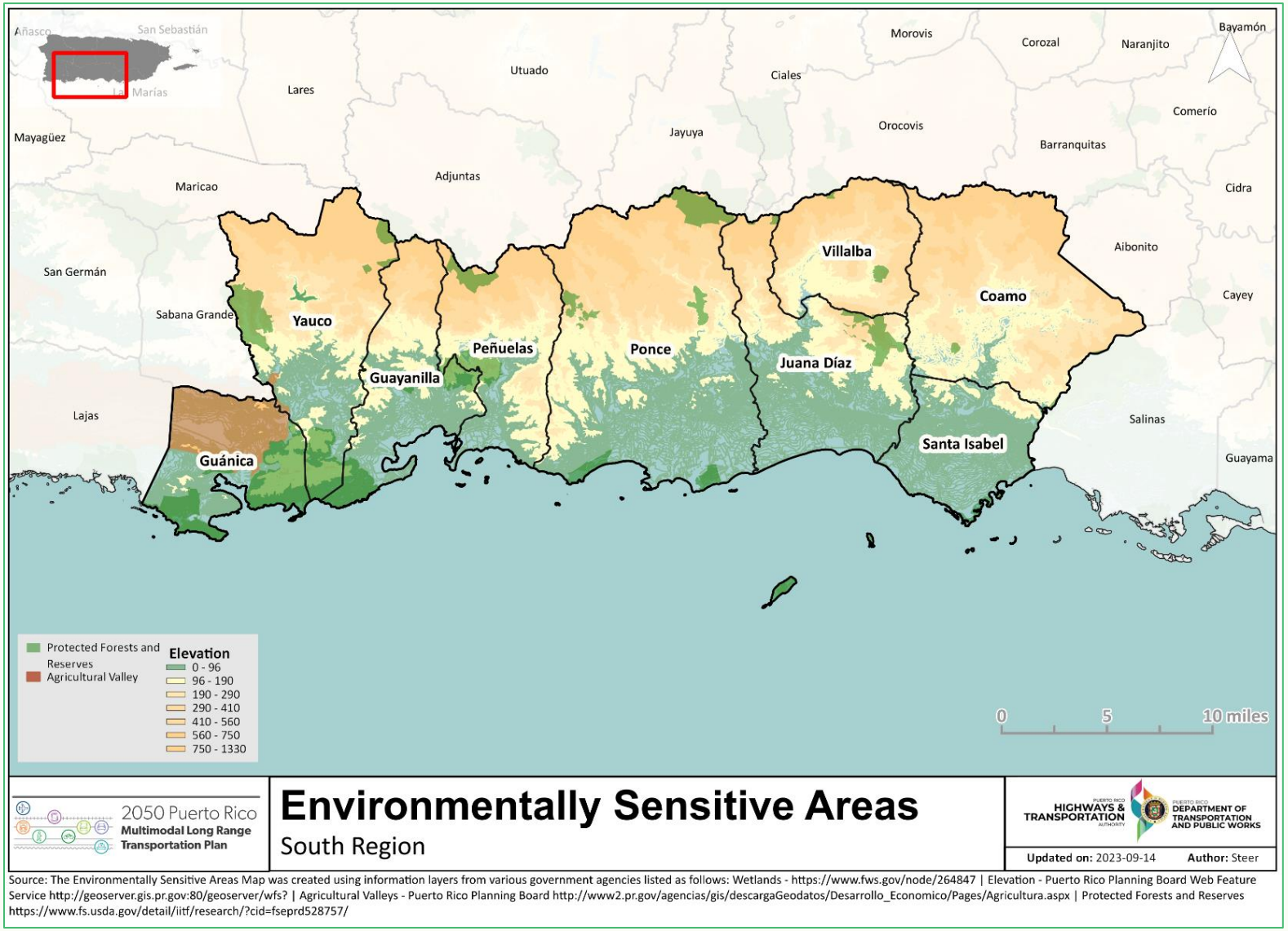
Source: The Environmentally Sensitive Areas Map was created using information layers from various government agencies listed as follows: Wetlands - https://www.fws.gov/node/264847 | Elevation - Puerto Rico Planning Board Web Feature Service http://geoserver.gis.pr.gov:80/geoserver/wfs? | Agricultural Valleys - Puerto Rico Planning Board http://www2.pr.gov/agencias/gis/descargaGeodatos/Desarrollo_Economico/Pages/Agricultura.aspx | Protected Forests and Reserves https://www.fs.usda.gov/detail/iitf/research/?cid=fseprd528757/

Figure 2.88: Environmentally Sensitive Areas - East TPR



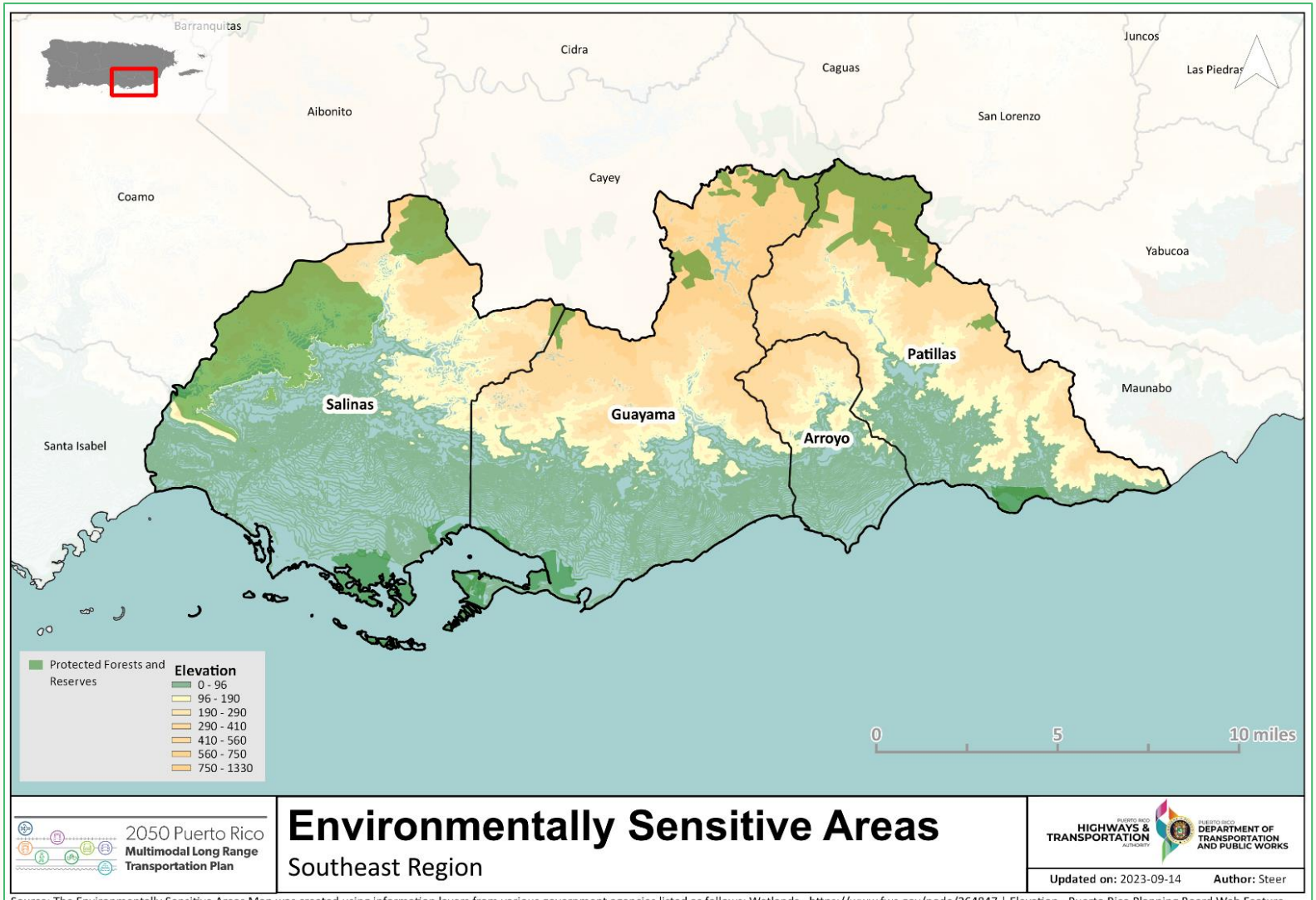
Source: The Environmentally Sensitive Areas Map was created using information layers from various government agencies listed as follows: Wetlands - https://www.fws.gov/node/264847 | Elevation - Puerto Rico Planning Board Web Feature Service http://geoserver.gis.pr.gov:80/geoserver/wfs? | Agricultural Valleys - Puerto Rico Planning Board http://www2.pr.gov/agencias/gis/descargaGeodatos/Desarrollo_Economico/Pages/Agricultura.aspx | Protected Forests and Reserves https://www.fs.usda.gov/detail/iitf/research/?cid=fseprd528757/

Figure 2.89: Environmentally Sensitive Areas - South TPR



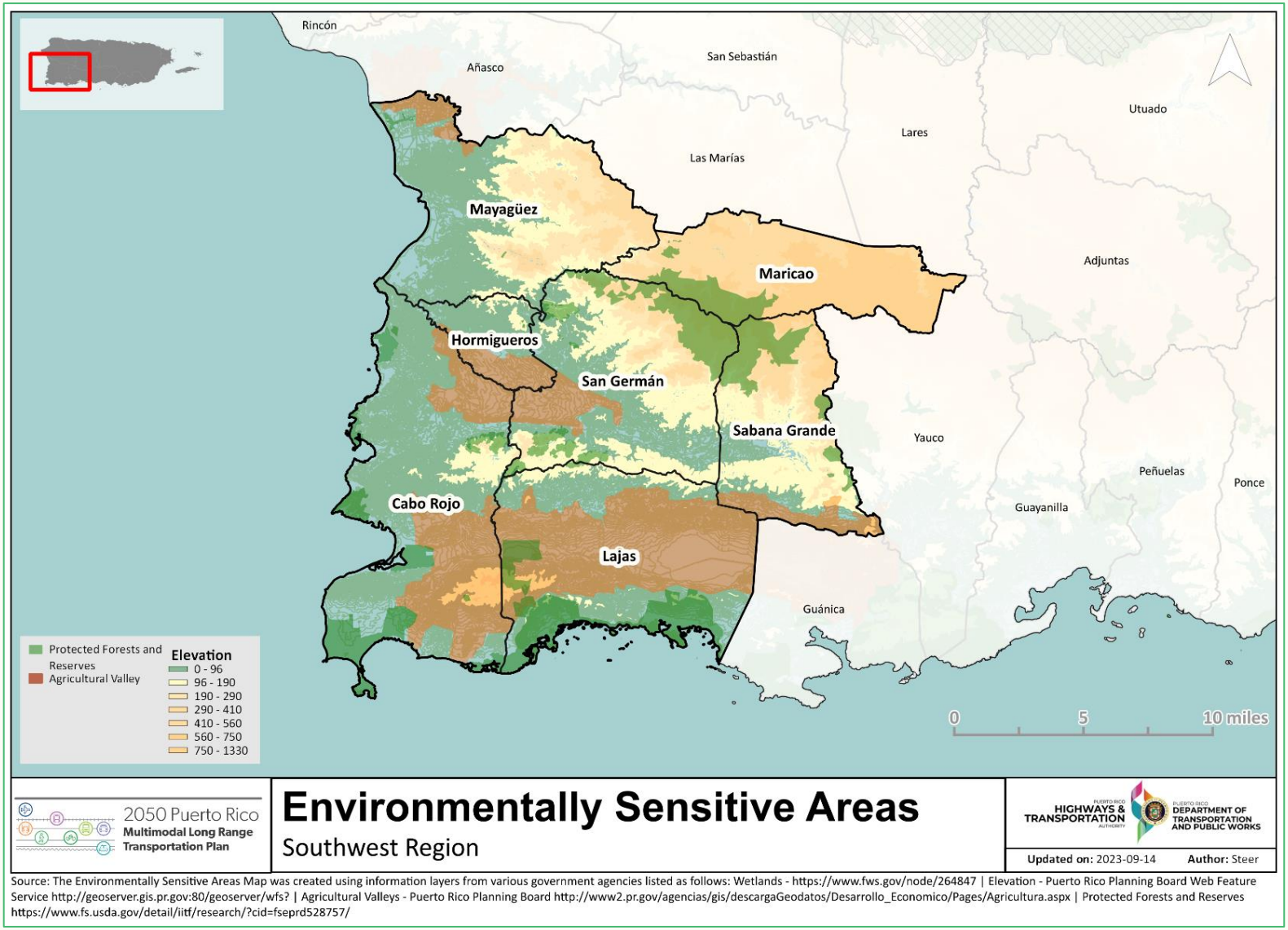
Source: The Environmentally Sensitive Areas Map was created using information layers from various government agencies listed as follows: Wetlands - https://www.fws.gov/node/264847 | Elevation - Puerto Rico Planning Board Web Feature Service http://geoserver.gis.pr.gov:80/geoserver/wfs? | Agricultural Valleys - Puerto Rico Planning Board http://www2.pr.gov/agencias/gis/descargaGeodatos/Desarrollo_Economico/Pages/Agricultura.aspx | Protected Forests and Reserves https://www.fs.usda.gov/detail/iitf/research/?cid=fseprd528757/

Figure 2.90: Environmentally Sensitive Areas - Southeast TPR



Source: The Environmentally Sensitive Areas Map was created using information layers from various government agencies listed as follows: Wetlands - https://www.fws.gov/node/264847 | Elevation - Puerto Rico Planning Board Web Feature Service http://geoserver.gis.pr.gov:80/geoserver/wfs? | Agricultural Valleys - Puerto Rico Planning Board http://www2.pr.gov/agencias/gis/descargaGeodatos/Desarrollo_Economico/Pages/Agricultura.aspx | Protected Forests and Reserves https://www.fs.usda.gov/detail/iitf/research/?cid=fseprd528757/

Figure 2.91: Environmentally Sensitive Areas - Southwest TPR



Source: The Environmentally Sensitive Areas Map was created using information layers from various government agencies listed as follows: Wetlands - https://www.fws.gov/node/264847 | Elevation - Puerto Rico Planning Board Web Feature Service http://geoserver.gis.pr.gov:80/geoserver/wfs? | Agricultural Valleys - Puerto Rico Planning Board http://www2.pr.gov/agencias/gis/descargaGeodatos/Desarrollo_Economico/Pages/Agricultura.aspx | Protected Forests and Reserves https://www.fs.usda.gov/detail/iitf/research/?cid=fseprd528757/

Water Resources

The UZAs have a vast variety of water resources which are an important part of the Island's natural resources, including creeks, rivers, wetlands[34], lagoons, and groundwater, etc. Artificial reservoirs have also been developed to produce energy, to serve as water supply for consumption, flood control and recreation. Most of these sites have a biodiversity of fauna and flora as well as ecological importance. These important resources are protected by local and federal regulations. Identifying these water bodies is essential, and databases such as the USFWS National Wetlands Inventory and the National Wild and Scenic Rivers System provide a visual representation of them. Below is a description of the water resources for each region.

- **North TPR (Figure 2.92)**

  – The most significant rivers with permanent water flow in this area are Río Grande de Arecibo river and Río Grande de Manatí river. The Río Grande de Arecibo river constitutes the source of water of the locally known as the Super aqueduct, a source of potable water capable of supplying part of the demand of the San Juan Metropolitan Area as well as many municipalities located along the path of the distribution pipe. As result of its geological characteristics, groundwater for public, agricultural, and industrial uses are notable for the coastal portion of this Region.

  – Other important hydrological sources that lie within this TPR are Río Guajataca's basin, crossing Camuy and Quebradillas, Río Camuy's basin, crossing Camuy and Hatillo and the Caño Tiburones Coastal Area between Arecibo and Barceloneta.

- **East TPR (Figure 2.93)**

  – The most significant ones with permanent water flow in this area are Río Mameyes, Río Sabana, Río Fajardo and Río Daguao. Both Río Mameyes and Daguao originate in the premises of El Yunque National Forest and discharge into the Atlantic Ocean.

  – With respect to the Islands of Vieques and Culebra, they lack the presence of permanent flow streams. All the streams are intermittent and cannot be used as a source of potable water for their population. To solve this condition, the Puerto Rico Aqueduct and Sewer Authority (PRASA) built an underwater pipe that conveys water from the municipality of Naguabo to the Islands.

- **South TPR (Figure 2.94)**

  – The most significant rivers with permanent water flow in this area are Río Cañas, Río Cerillos, Río Descalabrado, and Río Jacaguas. All of them drain toward the Caribbean Sea.

  – The area is underlying by an alluvial aquifer which provides adequate conditions for the construction of an extensive network of wells which have been used for potable and irrigation purposes.

- **Southeast TPR (Figure 2.95)**

  – In terms of hydrologic features, except for the Descalabrado and Jueyes rivers, which have permanent flow, the network of creeks, and rivers are intermittent streams. This explains the presence of what used to be a system of irrigation channels used for agricultural purposes but is not being used for such purposes.

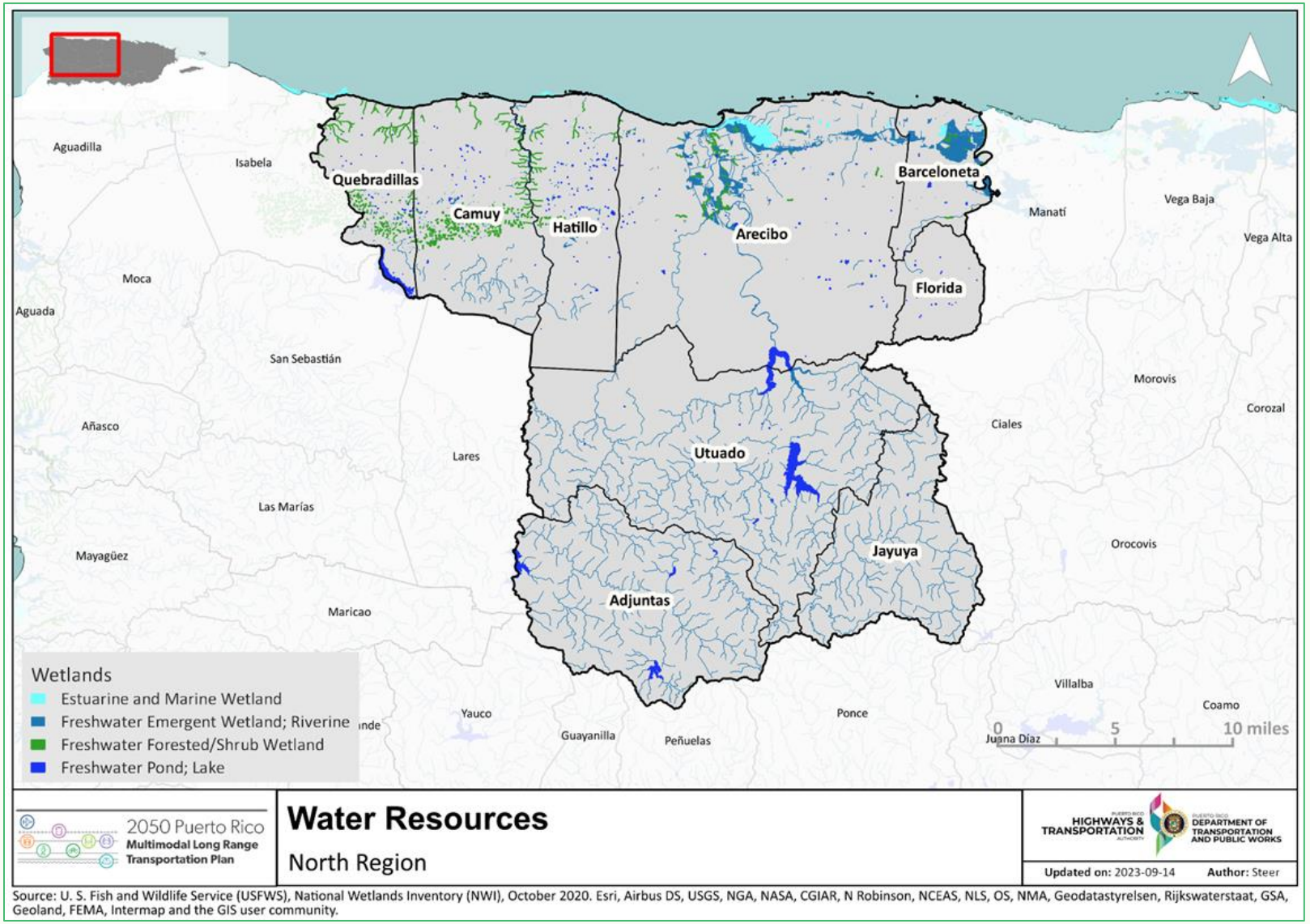
- **Southwest TPR (Figure 2.96)**

  – The most significant rivers with permanent water flow in this area are: Quebrada Grande and Río Loco. An extensive irrigation system has been provided for the area, mostly for agricultural uses.

  – According to the USGS, the ground water uses in the Cabo Rojo and Lajas Region is limited due to the presence of high concentrations of dissolved solids, which make it unsuitable for most uses. Sources of potable water of the Region are located mostly within the northwest part of this Region.

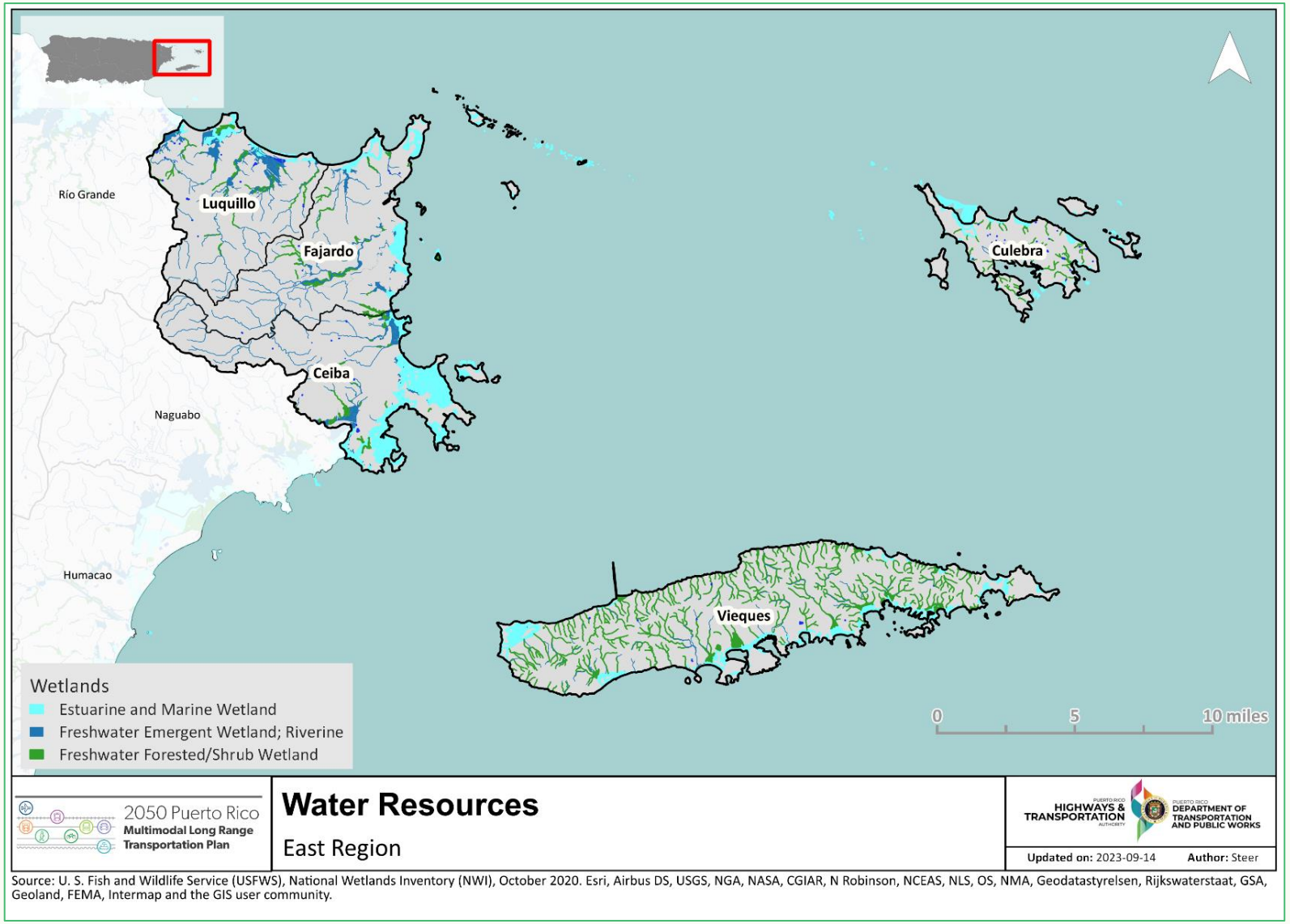
34. According to the U.S. EPA, wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season.

Figure 2.92: North TPR Water Resources



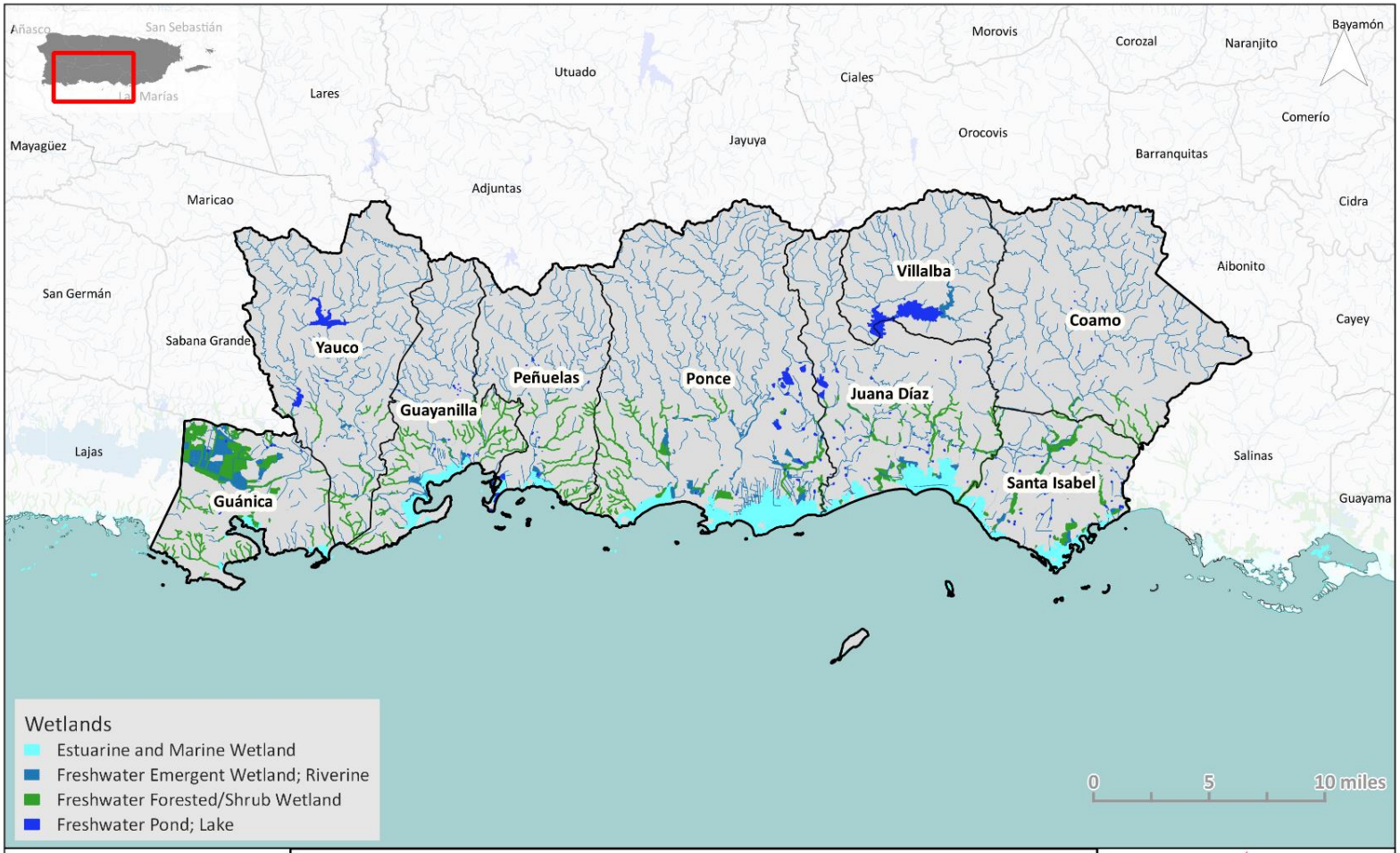
Source: U. S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI), October 2020. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.93: East TPR Water Resources



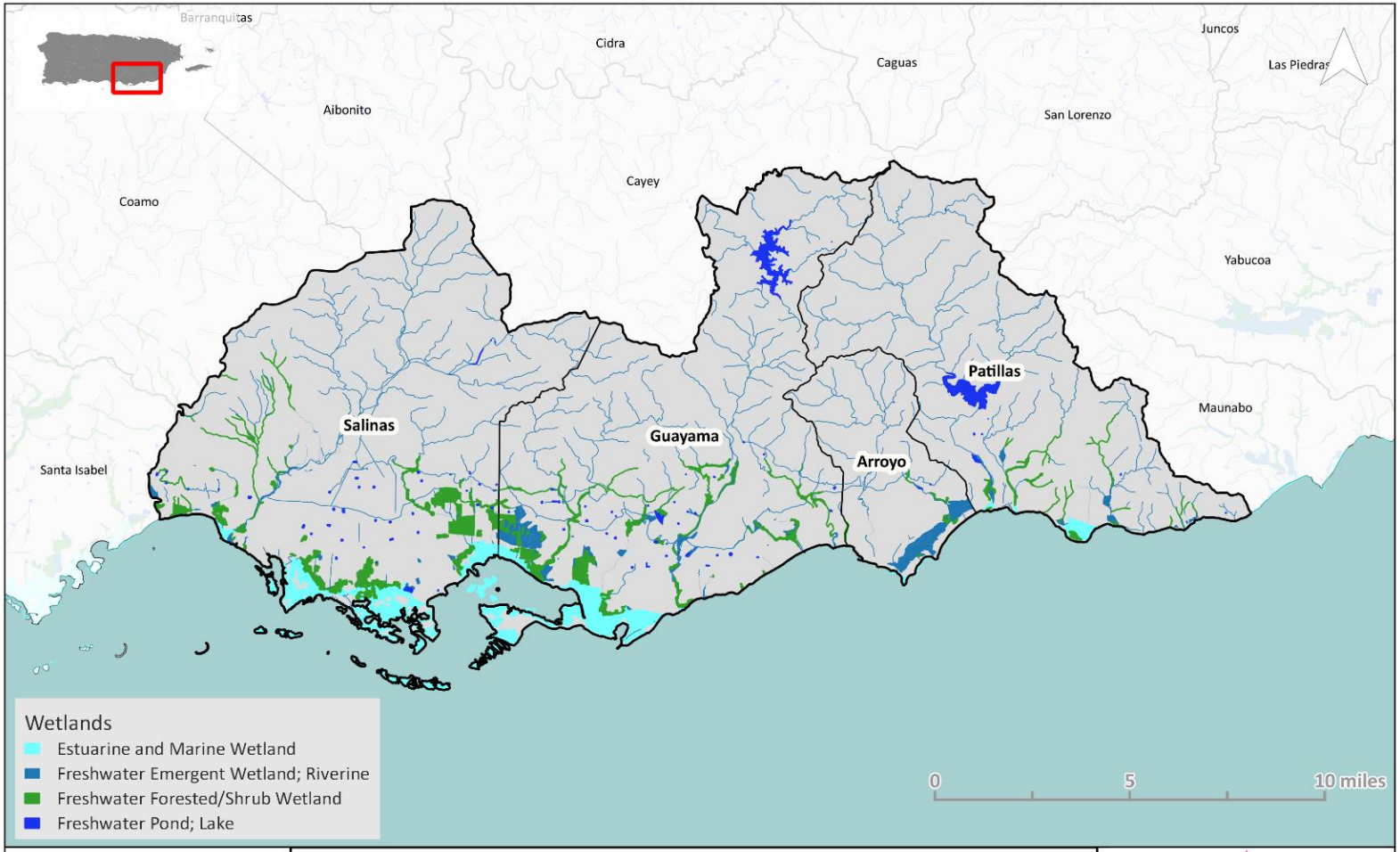
Source: U. S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI), October 2020. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.94: South TPR Water Resources



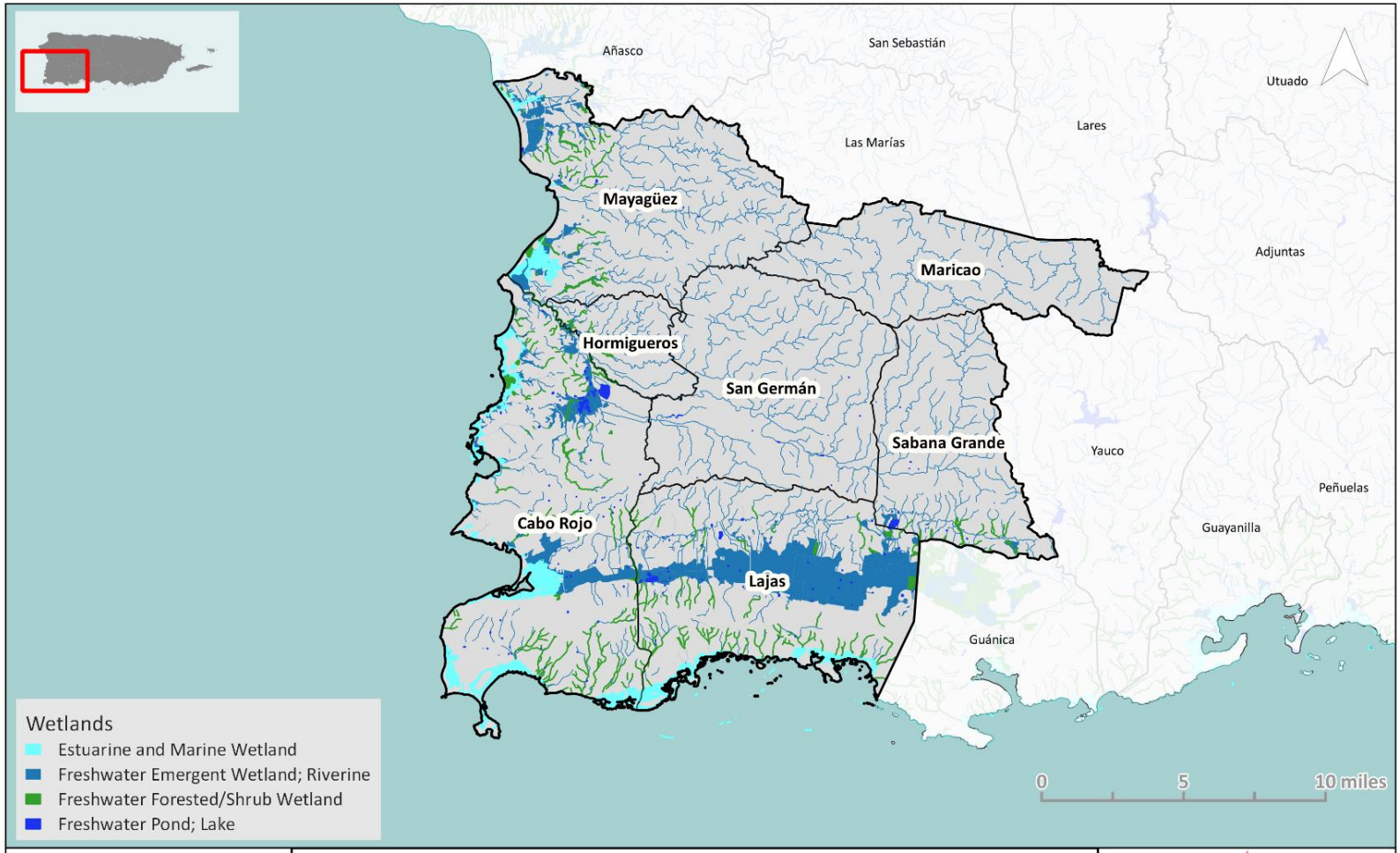
Source: U. S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI), October 2020. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.95: Southeast TPR Water Resources



Source: U. S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI), October 2020. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.96: Southwest TPR Water Resources



Source: U. S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI), October 2020. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Natural Hazards

The above-mentioned Island environmental resources, as all countries in the world, are subject to natural hazards that should be considered in any comprehensive planning effort. The following sections discuss the region's characteristics in the context of natural hazards.

The island of Puerto Rico is subject to numerous threats from natural hazards, including hurricanes, landslides, earthquakes, coastal and inland flooding, and freshwater scarcity, among other[35]. These hazards must be taken into consideration when planning, designing, or constructing projects to prepare, mitigate, and adapt to these risks.

Hurricanes

Hurricanes are one of the most frequent natural hazards that Caribbean islands are prone to encounter. The frequency of storms and their intensity could increase with climate change[36]. Tropical storms and hurricanes have become more intense during the past 20 years. Although warming oceans provide these storms with more potential energy, scientists are not sure whether the recent intensification reflects a long-term trend. Nevertheless, hurricane wind speeds and rainfall rates are likely to increase as the climate continues to warm[37]. Hurricanes can also induce erosion, collision, flooding, and over wash in the transportation infrastructure. Hurricanes impacts are certainly an important consideration as they affect the island's natural resources such as coral reefs, coastal flooding, water resources, and ecosystems as well as direct or indirect effects on the economy, infrastructure, and people's health and safety.

Earthquakes

Puerto Rico lies in a tectonically active region where earthquakes have occurred for centuries. Earthquakes and tsunamis in Puerto Rico and adjacent islands are primarily driven by the convergence of the North American tectonic plate with the Caribbean tectonic plate, the section of the Earth's crust on which the islands are located. The rate these plates come together is about 20 millimeters a year. Puerto Rico's rocky island crust and its surrounding seafloor are squeezed between these tectonic plates. The rocks are naturally full of fractures and faults. Some of these faults may move abruptly to relieve the stress, causing earthquakes[38].

A magnitude 4.7 earthquake began an earthquake sequence in southwest Puerto Rico on December 28, 2019. A magnitude 6.4 mainshock struck on Jan. 7, and by mid-March 2020 the sequence has produced more than 300 earthquakes greater than magnitude 3, a scale that people can feel, and at times the quakes have come in quick succession. These earthquakes sequences are occurring offshore of southwest Puerto Rico in a deformation zone, or an area where rocks are strained, bounded by the Punta Montalva Fault on land and the Guayanilla Canyon offshore. Earthquake locations and other data show that several fault structures have been active in this sequence. Even when the most likely scenario is that the aftershocks will become less frequent over time, with no earthquake larger than a magnitude 6, aftershocks are almost a certainty and expected to continue for years. This sequence of events continues been tracked by scientists at the Puerto Rico Seismic Network and the USGS National Earthquake Information Center in Golden, Colorado, which monitors a network of earthquake sensors in the U.S. and overseas and provides scientifically verified earthquake information worldwide. It is essential to prepare for this condition since aftershocks, and the resulting damage from earthquakes directly influence the island's environment.

35. U.S. Geological Survey. Puerto Rico Natural Hazards. usgs.gov
36. U.S. Geological Survey. Puerto Rico Natural Hazards: Hurricanes. usgs.gov
37. Environmental Protection Agency. 2016. What Climate Change Means for Puerto Rico.
38. U.S. Geological Survey. 2020. As Aftershocks Continue in Puerto Rico, USGS Supports Quake Recovery. Retrieved from https://www.usgs.gov/news/aftershocks-continue-puerto-rico-usgs-supports-quake-recovery

Flooding

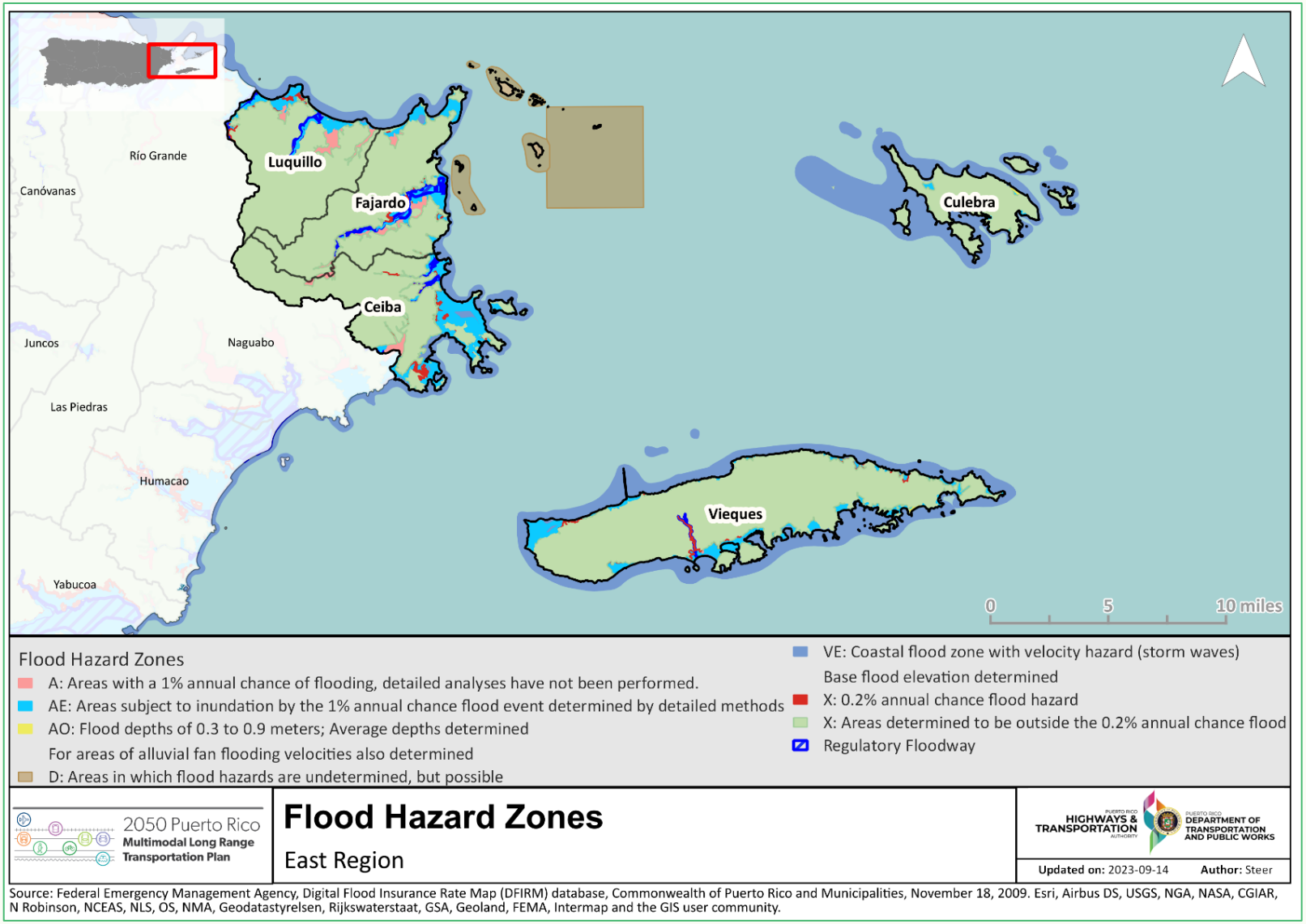
Flooding is when water overflows onto land or coast that were normally dry and is one of the most common natural-weather events. Flooding can happen during heavy rains, when rivers overflow, when ocean waves come on the shore, among other events. Flooding may be only a few inches of water, or it may cover a house to the rooftop. Floods that happen very quickly are called flash floods. Floods can cause power outages, disrupt transportation, damage buildings, and trigger landslides[39]. Natural events affecting Puerto Rico led to coastal and inland flooding. As a result, flood zones maps have been developed in the last couple of years (starting on 2019) by the Federal Emergency Management Office (FEMA) to help identify areas prone to flooding and prepare for effects. Areas sensitive or susceptible to flooding in Puerto Rico are shown in Figure 2.97 to 2.101.

39. Federal Emergency Management Agency. Puerto Rico Flood Map.

Figure 2.97: North TPR Flooding Zones

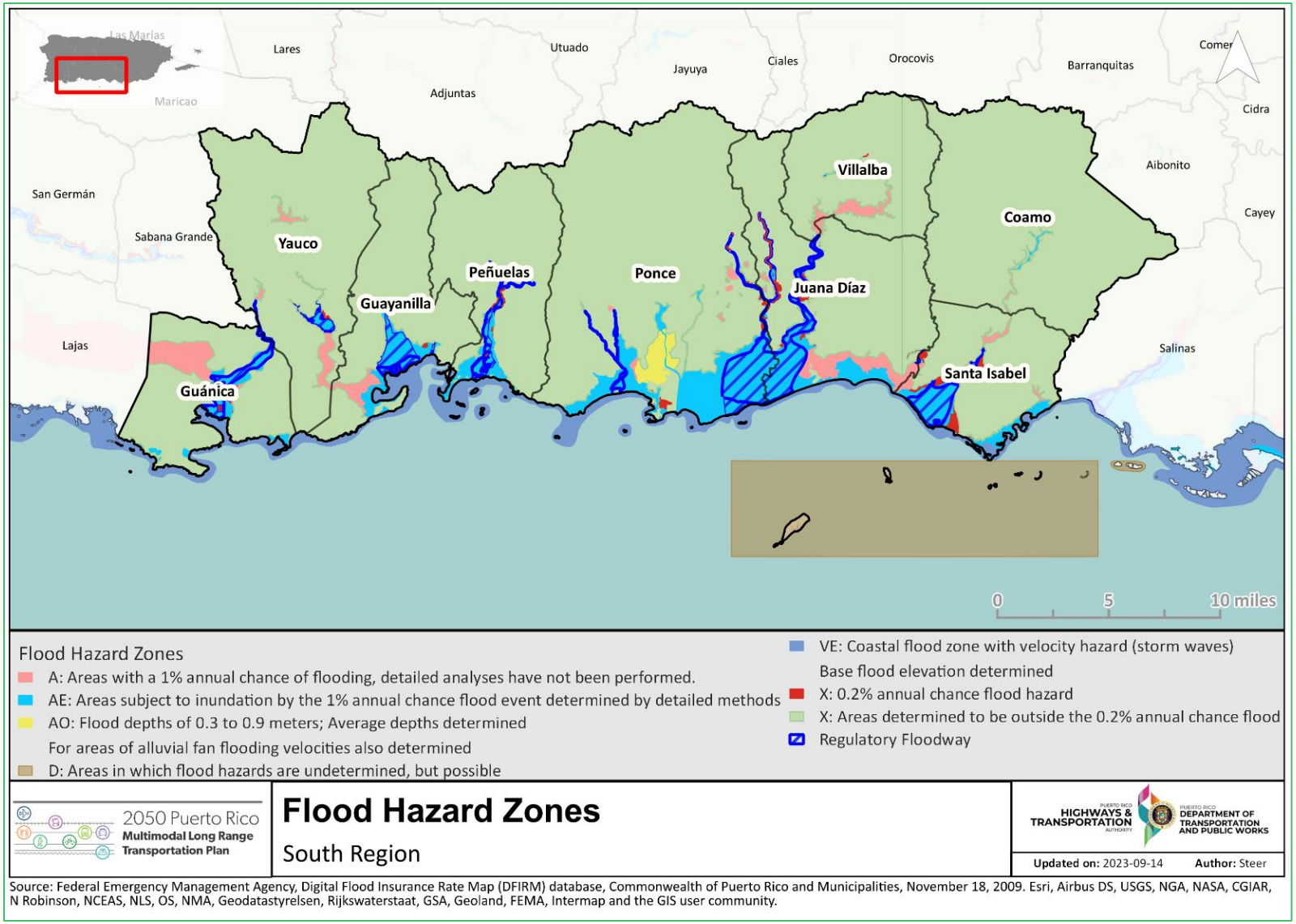
Source: Federal Emergency Management Agency, Digital Flood Insurance Rate Map (DFIRM) database, Commonwealth of Puerto Rico and Municipalities, November 18, 2009. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.98: East TPR Flooding Zones



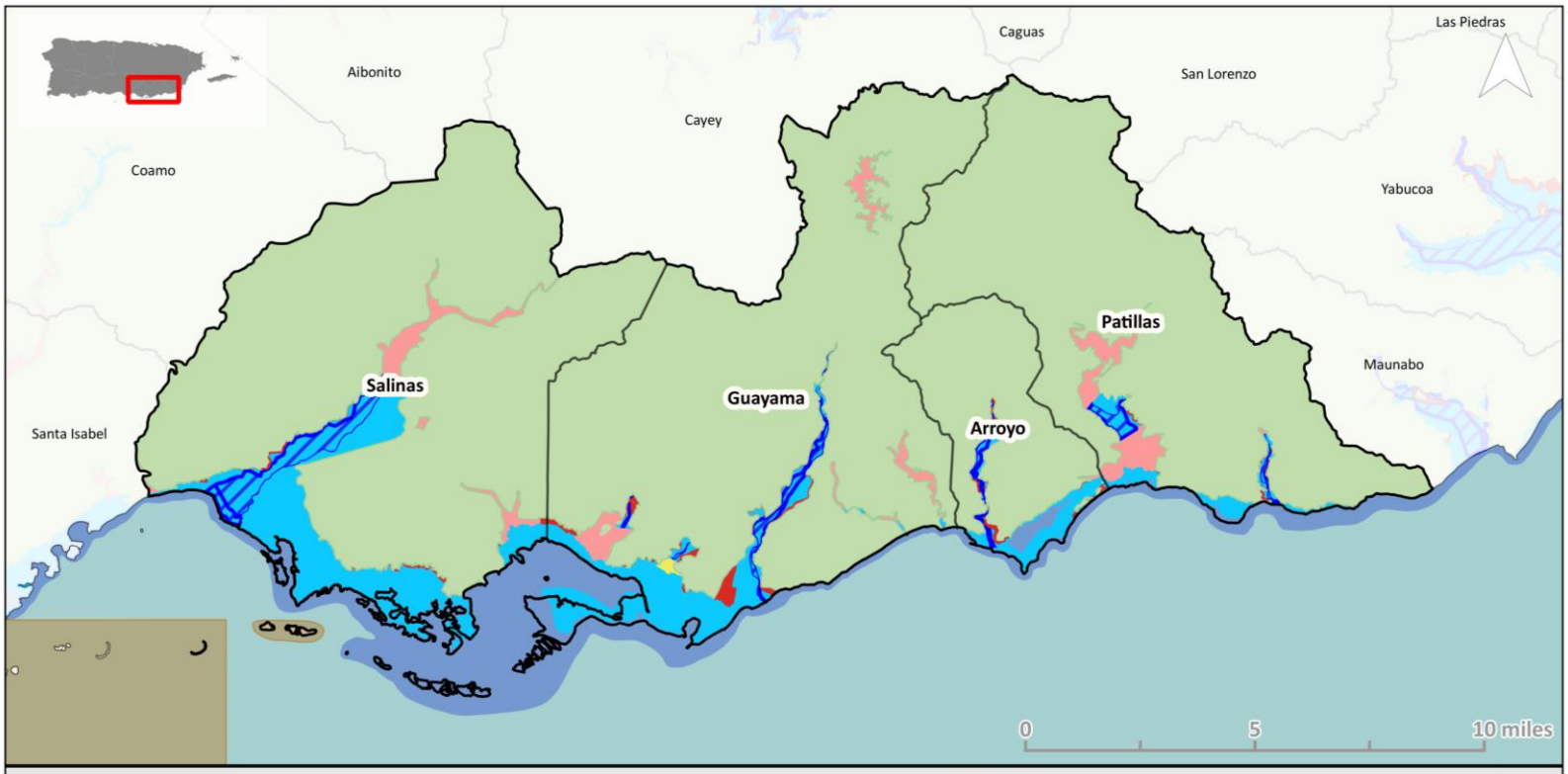
Source: Federal Emergency Management Agency, Digital Flood Insurance Rate Map (DFIRM) database, Commonwealth of Puerto Rico and Municipalities, November 18, 2009. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.99: South TPR Flooding Zones



Source: Federal Emergency Management Agency, Digital Flood Insurance Rate Map (DFIRM) database, Commonwealth of Puerto Rico and Municipalities, November 18, 2009. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.100: Southeast TPR Flooding Zones



Flood Hazard Zones

- A: Areas with a 1% annual chance of flooding, detailed analyses have not been performed.
- AE: Areas subject to inundation by the 1% annual chance flood event determined by detailed methods
- AO: Flood depths of 0.3 to 0.9 meters; Average depths determined
  For areas of alluvial fan flooding velocities also determined
- D: Areas in which flood hazards are undetermined, but possible
- VE: Coastal flood zone with velocity hazard (storm waves)
  Base flood elevation determined
- X: 0.2% annual chance flood hazard
- X: Areas determined to be outside the 0.2% annual chance flood
- Regulatory Floodway

2050 Puerto Rico Multimodal Long Range Transportation Plan

Flood Hazard Zones

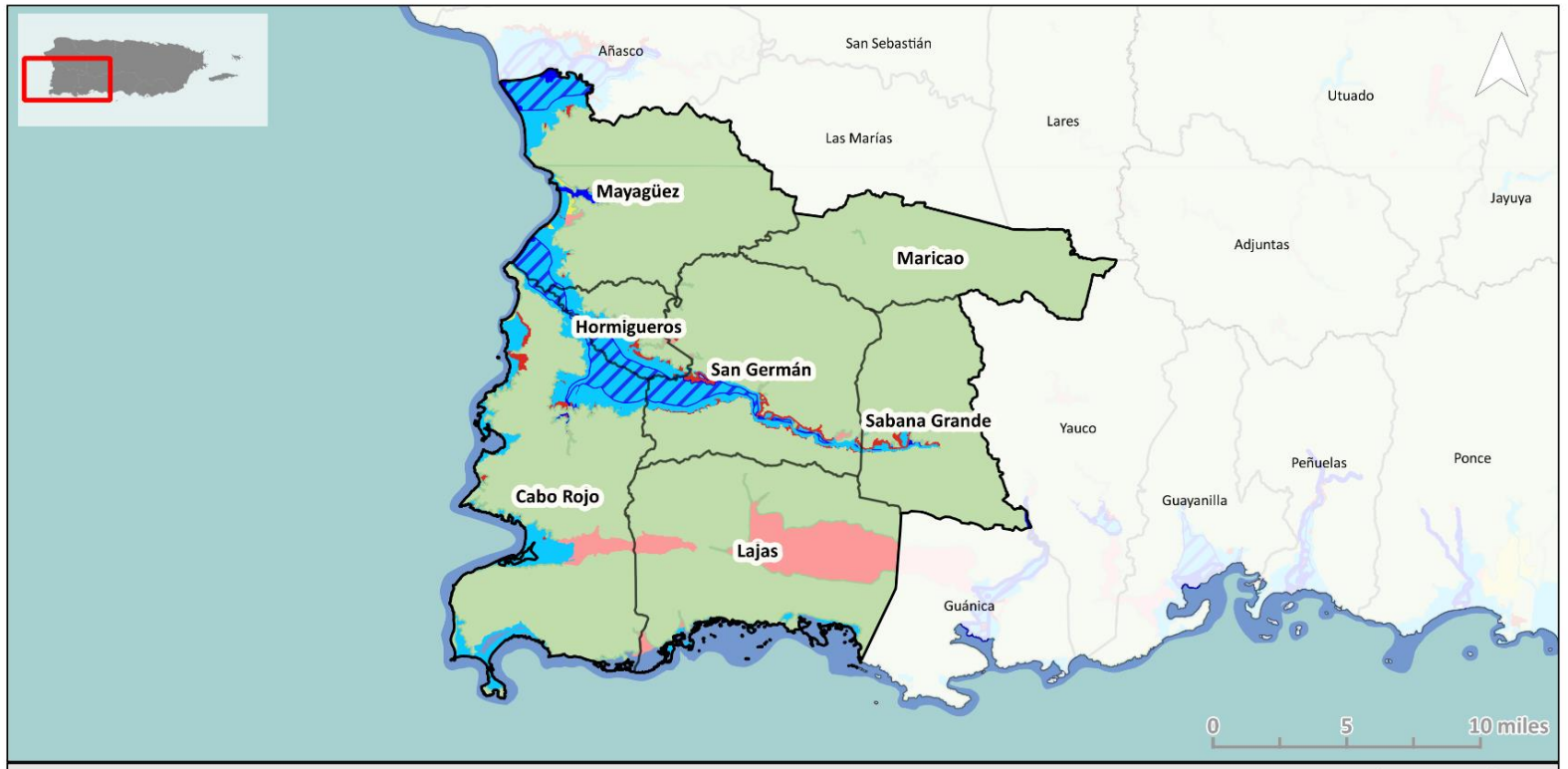
Southeast Region

Puerto Rico Highways & Transportation Authority — Puerto Rico Department of Transportation and Public Works

Updated on: 2023-09-14 **Author:** Steer

Source: Federal Emergency Management Agency, Digital Flood Insurance Rate Map (DFIRM) database, Commonwealth of Puerto Rico and Municipalities, November 18, 2009. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Figure 2.101: Southwest TPR Flooding Zones



Source: Federal Emergency Management Agency, Digital Flood Insurance Rate Map (DFIRM) database, Commonwealth of Puerto Rico and Municipalities, November 18, 2009. Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community.

Climate Change

Puerto Rico's climate is changing. The Commonwealth has warmed by more than one-degree Fahrenheit since the mid-20th century, and the surrounding waters have warmed by two degrees since 1901. The sea is rising about an inch every 15 years, and heavy rainstorms are becoming more severe. In the coming decades, rising temperatures are likely to increase storm damages, significantly harm coral reefs, and increase the frequency of unpleasantly hot days[40]. Climate change impacts all of Puerto Rico's natural resources, and therefore the Puerto Rico Climate Change Mitigation, Adaptation, and Resilience Law (Law No. 33 of 2019) was implemented. Some of the most affected resources are:

- **Water Resources:** Although heavy rainstorms may become more common, total rainfall is likely to decrease in the Caribbean region. Warmer temperatures also reduce the amount of water available because they increase the rate at which water evaporates (or transpires) into the air from soils, plants, and surface waters. With less rain and drier soils, the island may face an increased risk of drought.

- **Coral Reefs and Ocean Acidification:** Warming waters are likely to harm most coral reefs. The widespread loss of coral is due to warming and increasing acidity of coastal waters.

- **Ecosystems:** Warmer temperatures and changes in rainfall could expand, shrink, or shift the ranges of various plants and animals in Puerto Rico's forests, depending on the conditions that each species requires.

- **Agriculture:** Higher temperatures are likely to interfere with agricultural productivity in Puerto Rico as it affects soils, livestock, and water resources.

- **Infrastructure:** Heavy rainstorms and flooding may affect the infrastructure in the Island preventing it from providing the desired services[41]. For example, the services in terms of public transit may be affected, as well the delivery of goods in the Island.

Governments of territories around the world have issued public policies and actions to increase resilience and sustainability to face climate change as well as natural resources scarcity. Under Law 33 of 2019, mentioned above, every project in Puerto Rico must be resilient by considering all natural hazards and to proactively address climate-related risks. Nature-based solutions are sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience[42]. These solutions integrate natural features and processes into efforts to face climate change, reduce flood risk, improve water quality, protect coastal assets, restore, and protect wetlands, stabilize shorelines, reduce urban heat, add recreational spaces, among others. There are several tools that can be implemented for agencies actions to be resilient. To increase resilience with nature-based solutions, agencies must collaborate, plan, and implement nature-based solutions and make the use of resilience as a widespread practice.

40. Environmental Protection Agency. 2016. What Climate Change Means for Puerto Rico.
41. Puerto Rico Climate Change Council (PRCC). 2022. Puerto Rico's State of the Climate 2014-2021: Assessing Puerto Rico's Social-Ecological Vulnerabilities in a Changing Climate. Puerto Rico Coastal Zone Management Program, Department of Natural and Environmental Resources, NOAA Office of Ocean and Coastal Resource Management. San Juan, PR.
42. Federal Emergency Management Agency. 2021. Building Community Resilience with Nature-Based Solutions.

Our Future: Growth

This chapter was built based on the information from the U.S. Census Bureau 2010, 2020 Decennial Redistricting Data for the population analysis and from the Local Area Unemployment Statistics 2010-2022 for the employment analysis.

The population forecasts used as a reference the projected rate of population change published by the United Nations Data Portal in 2022 by the Population Division. The population and employment changes are all calculated as a percent change between the years mentioned. Whenever another calculation is being made it will be clarified.

The employment forecasts were developed by applying a historic rate of growth for the first three (3) years of the projection to account for recent growth in employment. This process considers the federal funds for economic recovery after the Hurricane Maria and the COVID-19 pandemic. These forecasts estimate that after the next 3 years the population aging will have a stronger influence over employment rate and will result in a long-term reduction.

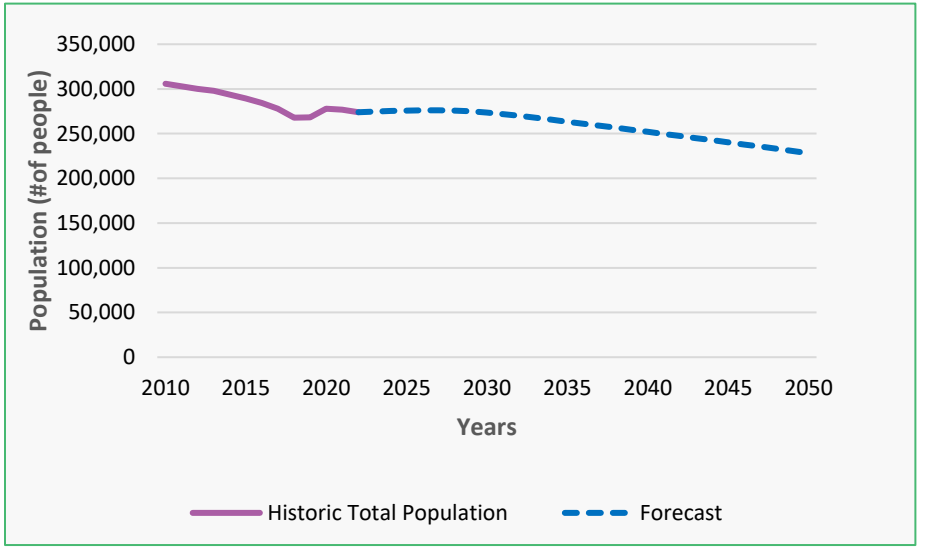
North TPR

Population Growth

The population in the North TPR represents almost 8% of Puerto Rico's population. In general, this region has experienced a population loss, represented by a percent change of 9.2% when comparing from 2010 to 2020. During the last decade, all the municipalities experienced a population loss, being Utuado the municipality with the most significant loss at -14.7%.

The population forecast for the North Region estimates that in the next 30 years the population will decrease by almost 18, reaching 228,083 people in 2050. This trend is shown in Figure 2.102.

Figure 2.102: North TPR Population Forecast 2050



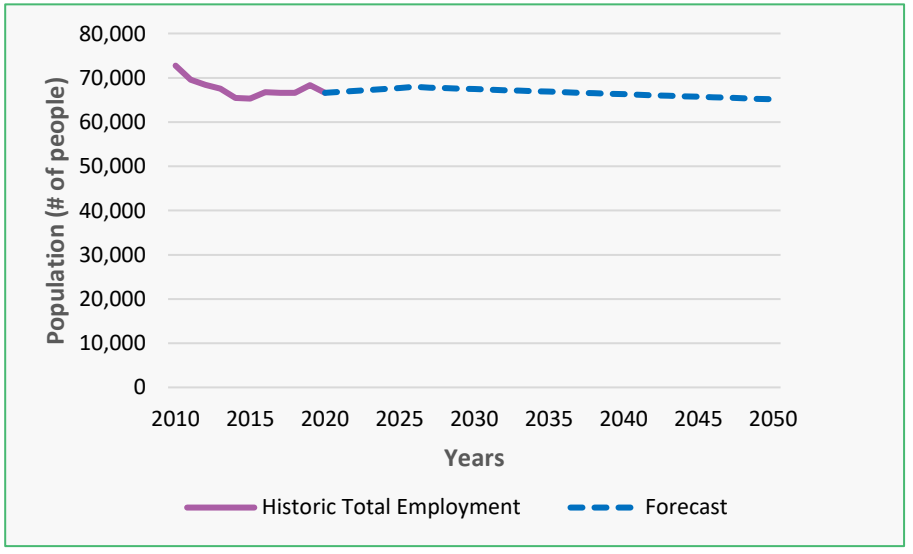
Source: U.S. Census Bureau, UN Population Division Data & Advantage estimates

Employment Growth

In terms of employment, the North Region exhibited an employment growth from 2010 to 2022 in all the municipalities, except for Adjuntas (-2.2%). The highest employment growth was exhibited by Barceloneta (17.9%). The overall employment increase was 8.4%.

As shown in Figure 2.103 the employment forecast for the region estimates a decrease of around (-2.2%) from 2020 to 2050. Even though there is still a decrease in the employment estimates, this region has the least pronounced loss in the next 30 years.

Figure 2.103: North TPR Employment Forecast 2050



Sources: Local Area Unemployment Statistics (LAUS) 2010 – 2022 & Advantage estimates

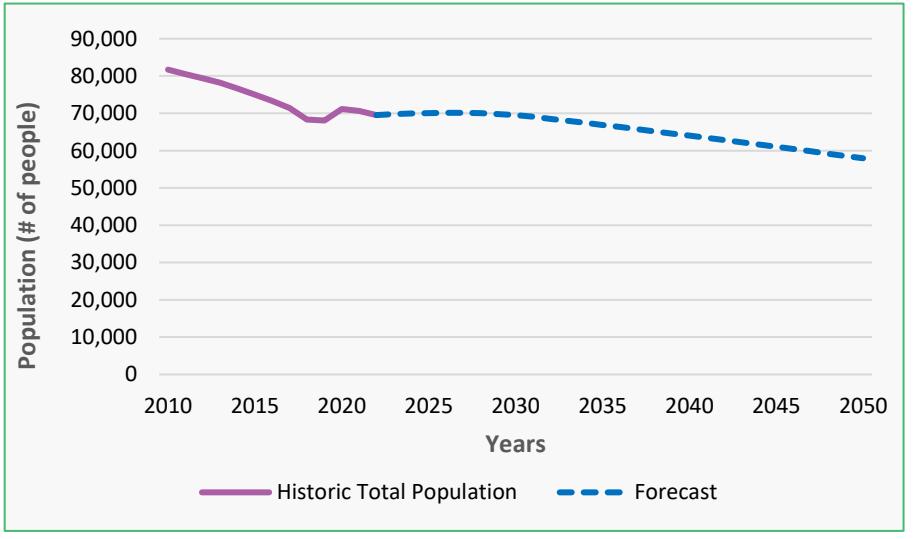
East TPR

Population Growth

The East Region is the smallest of Puerto Rico, representing around 3% of the island's total population. This region experienced a population loss from 2010 to 2020 by 12.9%. The population loss was the case for all the municipalities, with the most significant decline in Ceiba with -17% loss.

The population forecast estimates that by 2050 there will be around 58,000 people living in the region, which signifies an 18.6% overall decrease from 2020 until 2050.

Figure 2.104: East TPR Population Forecast 2050



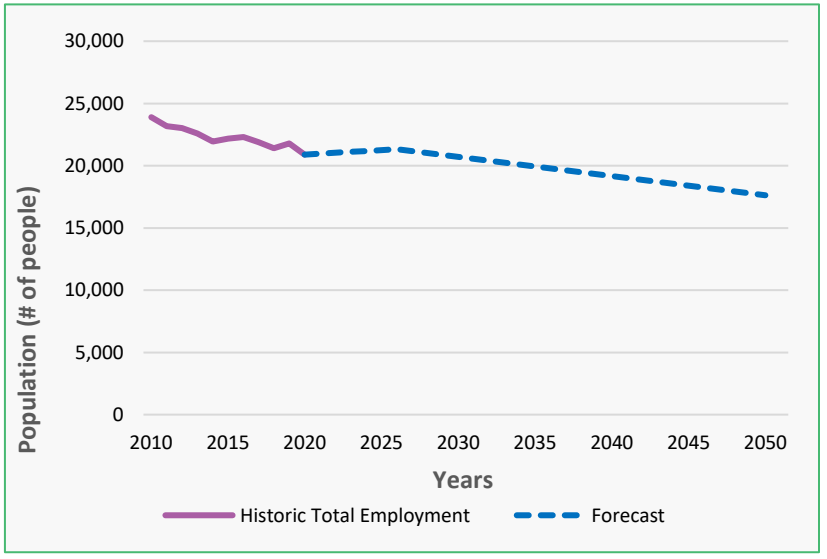
Sources: U.S. Census Bureau 2010, 2020 DEC Redistricting Data, UN Population Division Data & Advantage estimates

Employment Growth

From 2010, the East region employment trends have experienced a mix of growth and contraction. In general, the employment only grew by 0.7% from 2010 to 2022. This number represents higher growth rates such as the one from the municipality of Culebra which grew by 31.9% and a very pronounced decrease in the municipality of Vieques by 7.7%.

The employment forecast estimates that by 2050 employment will be around 18,000 which means a decrease by almost 15.6% as shown in Figure 2.105.

Figure 2.105: East TPR Employment Forecast 2050



Sources: Local Area Unemployment Statistics (LAUS) 2010 – 2022 & Advantage estimates

South TPR

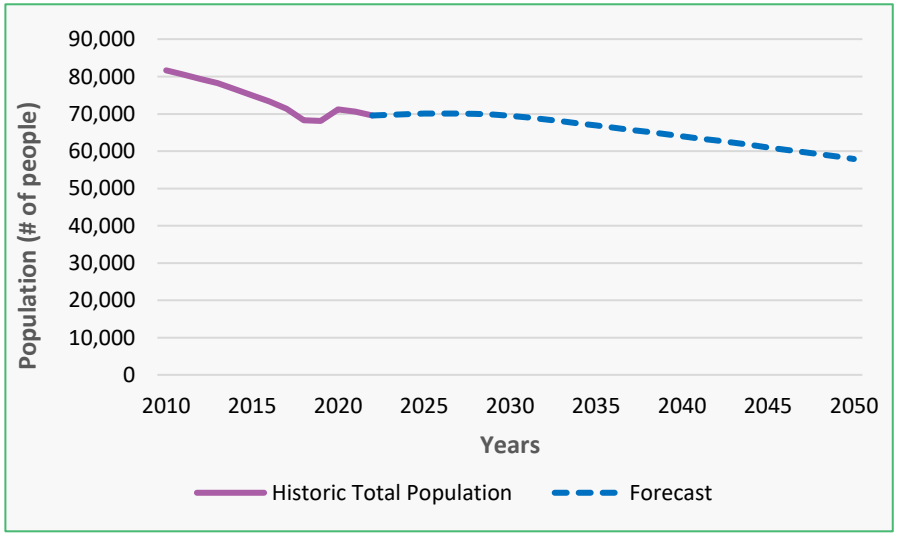
Population Growth

The South Region represents around 11% of the Island's total population. From 2010 to 2020 the region experienced a general population loss of -16.2%. All the municipalities exhibited a population loss, the most pronounced loss was in Guánica with -29% and the least pronounced was Juana Díaz with an -8.3% loss.

As shown in Figure 2.94, the largest population loss was in 2020 after the severed earthquakes in the municipality of Guánica that left many residential and non-residential structures uninhabitable. This was one of the main reasons for population migration in the region.

The population forecast estimates a -19.3% population decrease in the next 30 years. The population will reach 279,548 people in 2050.

Figure 2.106: South TPR Population Forecast 2050



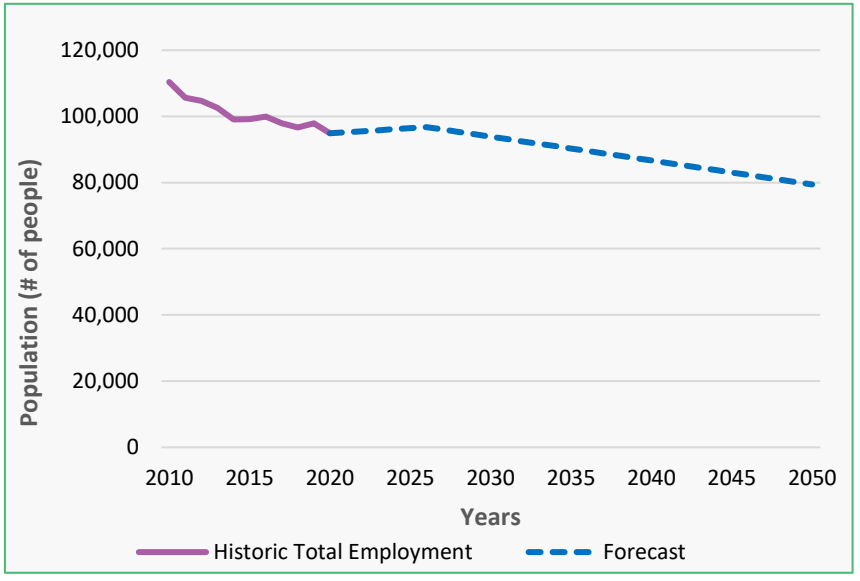
Sources: U.S. Census Bureau 2010, 2020 DEC Redistricting Data, UN Population Division Data & Advantage estimates

Employment Growth

In the South TPR there was an employment decrease of -14.1% from 2010 to 2020. Only three municipalities experienced employment growth from 2010'2022 during this period: Coamo (-8.6%), Juana Díaz (-11.8%), and Villalba (-1.3%). All other municipalities experienced a general decline in employment compared to the share in 2010.

The employment forecast estimates a 16.3% decrease in employment in the course of the next 30 years. Employment for the South Region in 2050 is expected to be around 80,000.

Figure 2.107: South TPR Employment Forecast 2050



Sources: Local Area Unemployment Statistics (LAUS) 2010 – 2022 & Advantage estimates

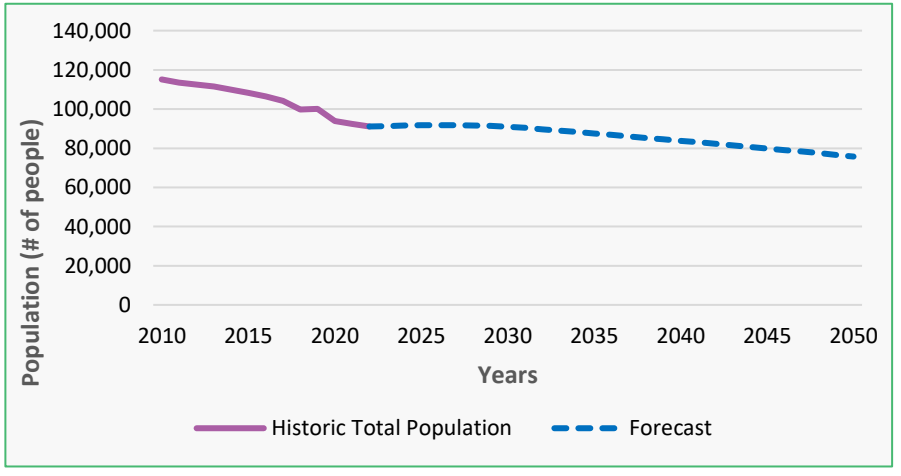
Southeast TPR

Population Growth

The Southeast region is the second smallest region in the Island, as its population represents almost 3% of the island's total population. This region experienced a population loss of 18.3% from 2010 to 2020. In general, all municipalities exhibited a population loss, especially Guayama with 19.3%.

The population forecast estimates that the population will continue to decrease by 19.3% in the next 30 years. By 2050 population will reach around 75,000 people, starting with around 93,000 in 2020.

Figure 2.108: Southeast TPR Population Forecast 2050



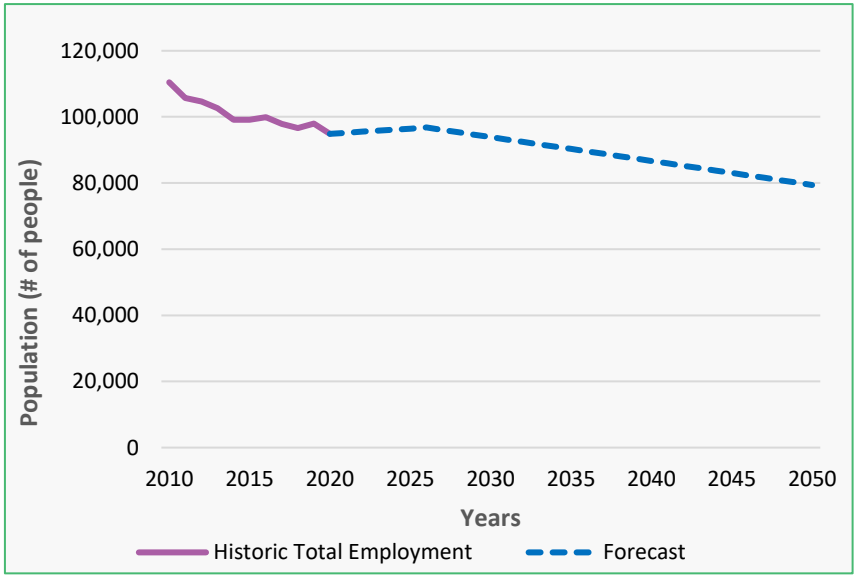
Sources: U.S. Census Bureau 2010, 2020 DEC Redistricting Data, UN Population Division Data & Advantage estimates

Employment Growth

The employment trends in the Southeast region are different from what is observed in other regions. In general, employment did not exhibit any growth, it decreased by -4.4% from 2010 to 2022. The most pronounced decrease was exhibited in Patillas (-9.5%) The only municipality that showed an employment increase was Salinas by 0.5%, which seems very small compared to what happens in other municipalities.

The employment forecast estimates an overall decrease of almost 26% from 2020 to 2050. Employment is expected to reach around 17,000 in 2050, as shown in Figure 2.99.

Figure 2.109: Southeast TPR Employment Forecast 2050



Source: U.S. Census Bureau, UN Population Division Data & Advantage estimates

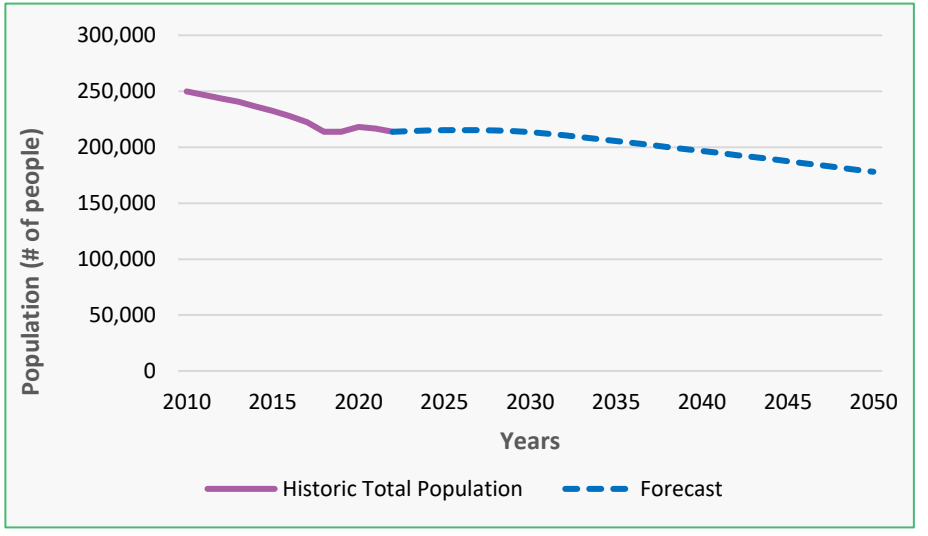
Southwest TPR

Population Growth

The Southwest region represents almost 75 of the island's total population and exhibited a 12.7% loss of its population from 2010 to 2020. The municipality with the most significant decline was Mayagüez with a 17.7% population loss.

The population forecast estimates that by 2050 there will be around 178,000 people in the region, which translates into a 18.4% decline.

Figure 2.110: Southwest TPR Population Forecast 2050



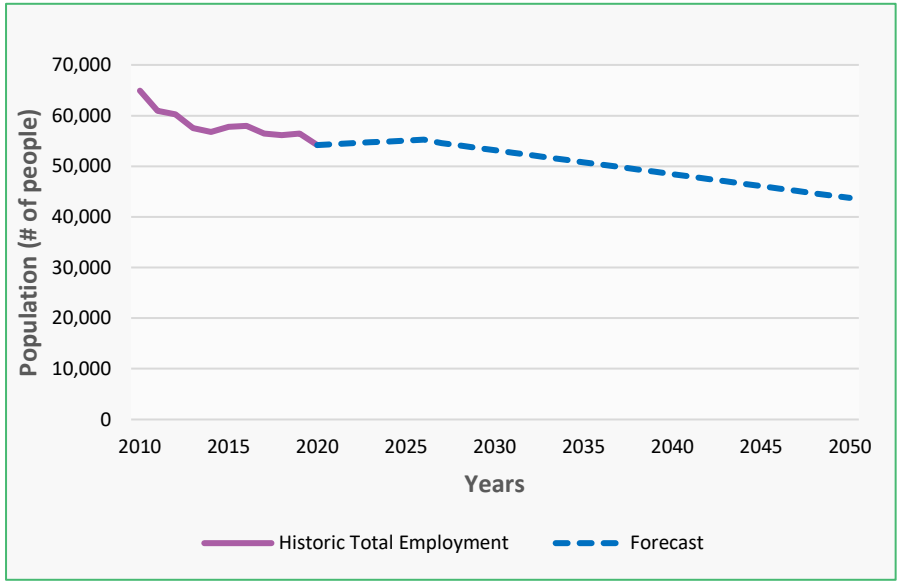
Sources: U.S. Census Bureau 2010, 2020 DEC Redistricting Data, UN Population Division Data & Advantage estimates

Employment Growth

The Southwest region employment shows a contraction compared to 2010, with an overall decline of 16.6%. This is contrary than in other regions where employment tended to increase in 2022, as all municipalities exhibit a decrease, especially Lajas with a 22.2% decline.

Figure 2.111 shows employment forecast estimates that the employment will be around 44,000 on 2050 which represents a 19.3% decrease over the next 30 years.

Figure 2.111: Southwest TPR Employment Forecast 2050



Sources: Local Area Unemployment Statistics (LAUS) 2010 – 2022 & Advantage estimates

Our Challenges and Opportunities

Safety

Even when there was a reduction of fatalities from 2016 to 2020 there are some issues like alcohol-impaired driving and pedestrian fatalities that have represented a large proportion of traffic fatalities in Puerto Rico (two-thirds of total traffic fatalities). Road users' behavior is the biggest problem and the hardest to change. See Highway Safety Plan[43] for more details.

Aging Infrastructure

The pavement and bridges in Puerto Rico included under the National Highway System (NHS) are below National averages, nonetheless, the percentages of Poor NHS bridge area and Poor interstate lane miles have decrease significantly in recent years. The PRHTA is forecasted to meet its interstate pavement objectives within 10 years while maintaining its NHS bridges that are presently better than the target standards[44]. For more information see the Puerto Rico Transportation Assets Management Plan.

Traffic Congestion

Puerto Rico has more vehicle miles travel than any other smaller state in the US, with 13,762 millions of VMT[45]. The average commute time to work on the Island is 27.1 minutes, which is longer than average US commute time at 26.9 minutes. Additionally, data indicates that about 3.5% of the workforce in Puerto Rico have commutes exceeding 90 minutes[46].

The Aguadilla TMA does not have a transit system, further compounding the congestion problem, giving residents and commuters less options to switch commuting modes. Addressing congestion requires adding programs and policies that attend this issue, public transit, active transportation, parking, and carpooling. See the Long-Range Multimodal Plan Travel Survey and TDM Report for more details.

43. Puerto Rico Traffic Safety Commission (2021). Puerto Rico Highway Safety Plan FY2022. Retrieved directly from https://www.nhtsa.gov/sites/nhtsa.gov/files/2021-10/PR%20FFY2022%20HSP-Final%20Revision%2008052021.pdf on September 26, 2023.
44. Puerto Rico Highways and Transportation Authority (2022). Puerto Rico Transportation Asset Management Plan 2032. Retrieved directly from https://act.dtop.pr.gov/wp-content/uploads/2023/04/2022-12-29-BIL-Compliant-TAMP-2032.pdf on September 26, 2023
45. Puerto Rico Highways and Transportation Authority (2022). Puerto Rico Transportation Asset Management Plan 2032. Retrieved directly from https://act.dtop.pr.gov/wp-content/uploads/2023/04/2022-12-29-BIL-Compliant-TAMP-2032.pdf on September 26, 2023
46. Data USA (n.d) Data USA: Puerto Rico. Retrieved directly from: https://datausa.io/profile/geo/puerto-rico#housing on September 26, 2023.

Shared Mobility

Shared Mobility applications, which connect automobiles and passengers, as well as e-scooters and e-bicycles, can provide less priced, more flexible, and on-demand transportation options, which can impact vehicle ownership trends. This emerging trend needs the adoption of new regulations to ensure riders' safety and to govern the design and operation of these services.

Active Transportation and Micromobility

Enhanced bicycle connections, safer streets and active transportation overall provide a variety of advantages and transportation options. Walking and cycling provide possibilities to enhance physically and mental health by increasing movement and spending time outside, also helps to reduce obesity, among other health problems. By removing barrier caused by a vehicle, people become more in touch with their communities. It also benefits low-income and minority populations, since people in those communities are less likely to possess a private car, and hazardous streets may make active transportation difficult[47].

Climate Change and Extreme Weather

2Climate change and extreme weather events are always a constant challenge to the transportation infrastructure. The Island of Puerto Rico is yearly threatened by the possibility of hurricanes, extreme flooding, and earthquakes. The environmental effects created by these threats requires a system that is more resilient to these trends. See the "Ley de Mitigación, Adaptación y Resiliencia al Cambio Climático de Puerto Rico", Law 33, May 22, 2019.

Energy Transformation and Electric Vehicles

Energy transformation including the transition to electric vehicles and all the infrastructure required. In Puerto Rico there is a low number of Electric Vehicle (EV) ownership, reaching a little over 3,000 vehicles. Currently the PRHTA is working to advance the National Electric Vehicle Infrastructure (NEVI) Program. At this time, the PR-2, PR-52, PR-22 has been designated as alternative fuel corridors in the UZA, this corridor was submitted as "corridor pending"[48].

The electric infrastructure was severely damaged after the hurricanes Irma and María. Even when LUMA Energy[49] has plans to reconstruct and update the power grid, it is estimated that it will take years to be completed. Because of this, it is important to strategize in those first years of the EV infrastructure deployments. Refer to the Puerto Rico Electric Vehicle Infrastructure Deployment Plan under the National Electric Vehicle Infrastructure Formula Program for more details.

Connected Vehicles and ITS Technologies

Connected cars and Intelligent Transportation System (ITS) are new technologies that, via their capabilities and performance, will encourage a decrease in accidents. The adoption of connected vehicles in Puerto Rico is not as advanced as that of ITS technologies. However, because these technologies are part of the Puerto Rico Regional ITS Architecture, the Puerto Rico Highway Safety Improvement Program (HSIP0will assist their development[50]. See Highway Safety Improvement Program (HSIP) for more details.

Public Transportation Challenges

PRITA is a newer organization that is still in its early stages. The organizational structure still has gaps in terms of assets transferring and responsibilities for PRITA to have full ownership of the Agency.

The culture in Puerto Rico is that we travel by car, and each house has more than one (1) car. The challenge how to persuade individuals to switch modes and view public transportation as a viable option for everyone.

47. U.S. Department of Transportation (2015). Active Transportation. Retrieved from https://www.transportation.gov/mission/health/active-transportation on September 26, 2023
48. As defined by the Puerto Rico Electric Vehicle (EV) Infrastructure Deployment Plan under the National Electric Vehicle Infrastructure (NEVI) Formula Program a corridor pending indicates that a corridor lacks adequate alternative fuel infrastructure to accommodate alternative fuel vehicles.
49. Power company responsible for power distribution and power transmission in Puerto Rico
50. State DOT (2022). Highway Safety Improvement Program. 2022 Annual Report. Retrieved from https://highways.dot.gov/sites/fhwa.dot.gov/files/2023-08/PR-HSIP-2022.pdf on September 26, 2023

3

Other Urbanized Areas Under 200,000 Population (UZA)

About Our Transportation System

This chapter aims to briefly describe the Urbanized Areas Under 200,000 Population's (UZA) current transportation conditions and characteristics, to better understand how the transportation sector has evolved in the Region. The chapter is divided into six (6) main sections. The first one describes active transport which includes bicycle, pedestrian and micromobility modes. The second one describes the different transit options offered in the regions and their organizational structure. The third one describes the roadway system in the regions. The fourth and fifth sections describe the airports and seaports in the regions. The sixth section describes the freight's current conditions and its components in the regions.

In recent years, transportation alternatives in the UZAs have become crucial in terms of economic development, environmental preservation, and health considerations. Worldwide tendencies are directing their focus to (1) a less motor vehicle use mindset, (2) encouraging bicycle-pedestrian modes of transportation, and (3) combining available transportation alternatives.

The Puerto Rico Department of Transportation and Public Works (DTPW) and the Highway and Transportation Authority (PRHTA) have adopted goals and objectives to plan and develop a multi-modal transportation system.

This multi-modal transportation system integrates all transportation modes to improve the mobility and access conditions. It also aims to create a more livable urban environment and a more efficient transportation system, including the use of non-motorized modes.

Active Transport

Bicycle and Pedestrian

The Comprehensive Bicycle and Pedestrian Plan for Puerto Rico was adopted by the Public Policy Committee of the Puerto Rico Metropolitan Planning Organizations (MPO) on September 18, 2018. It was developed as the policy document to guide state and local efforts to improve access and mobility conditions. This plan was developed by the DTPW and the PRHTA.

Said policy document is set to guide state and local efforts to improve access and mobility conditions and develop new pedestrian and cyclist facilities. The plan sets out as part of their objectives: i) to promote and increase the use of cycling and walking as alternative modes of transportation, and ii) to enable the physical integration of urban centers through a cycling and walking network that improves accessibility. The plan evaluates the existing conditions for both the pedestrian and cycling infrastructure.

The plan aims, among other things, at developing new pedestrian and cyclist facilities to improve the quality of life of our communities. Figure 3.1 to Figure 3.5 shows the UZA Regions' proposed cyclist network for 2050 as presented in the Comprehensive Bicycle and Pedestrian Plan for Puerto Rico. It considers the roads that are primarily used for these activities as well as the extensive deployment of new infrastructure in regions with low levels of bicycle and pedestrian activity.

As part of the Plan, the pedestrian conditions in the Regions were evaluated and the UZA Regions had scores ranging from 24 to 34 points out of 100. The pedestrian evaluation considered nine (9) categories: pedestrian facilities, conflicts with pedestrian facilities, crosswalks, maintenance, path size, buffer, aesthetics, and shade. The scores were distributed within the Regions as follows:

- North region: 34.
- East region: 30.
- South region: 24.
- Southeast region: 28.
- Southwest region: 24.

The main reason for this low score was the lack of ramps for wheelchairs and strollers on the sidewalks. Table 3.1, and Figure 3.1 to Figure 3.5 show the roads used the most for walking in the different municipalities within the UZA Regions.

The roads that are mostly used for walking are widespread in the regions' municipalities are:

Table 3.1: Roads Most Used for Walking in UZAs

Region	Municipality	Road Used for Walking			
North	**Quebradillas**	PR-481	Municipal Street	PR-2	PR-333
South	**Ponce**	Las Américas Ave.	Miramar Ave.	Federal Ave.	PR-5139
		Glenview Ave	A Street	El Monte Street	PR-139
		G Street	H Street	I Street	
	Coamo	PR-14,	PR-150	PR-153	PR-545
	Guayanilla	PR-127			
	Yauco	PR-127	PR-333		
	Juana Díaz	PR-510	PR-149	Footpath	
	Guánica	PR-324			
Southeast	**Arroyo**	Calle Cangrejos			
Southwest	**Mayagüez**	PR-380	PR-108	PR-64	PR-106
		PR-2	PR-65	Cataluña Street	Valle Sur Street
		PR-2R	Tolosa Street	Andalucía Street	Balboa Street.
		Pablo Alemar Street	Luis Castellón Street	Julio Bouliz Street	Roberto Cole Street
		Ricardo Sequinot Street	Manuel Maymon Street	Pablino Trinta Street	
	Lajas	PR-305			
	Cabo Rojo	PR-205	PR-301	PR-101	

Source: Comprehensive Bicycle and Pedestrian Plan for Puerto Rico, 2018

For bicycle conditions, the plan developed a Bicycle Infrastructure Facilities Evaluation that considers the following elements: bicycle facilities, safety, conflicts, maintenance, speed limit, traffic volume, space available, aesthetics, and shade.

Based on this evaluation, the facilities in the South and Southwest regions received the lowest scores in the Bicycle Infrastructure Facilities Evaluation: 46 and 45 out of 100 points, respectively. The bicycle facility in the South region is located in Ponce and is called Parque Lineal Río Portugués y Parque Lineal Bucaná. The highest score was for available space. The bicycle facility in the Southwest Region is located in Mayagüez and is called Parque Lineal Río Mayagüez. The highest score was for maintenance. None of these facilities was scored on speed limit or traffic volume because the facility is not adjacent to vehicle traffic.

The Plan also evaluated the Cycling Potential Index (CPI) for the UZA Regions to provide an objective, evidence-based method of assessing the underlying potential for cycling in a specific location. It considered hilliness, socio-demographics, and trip length. In general, the places with the highest potential for cycling are around the coast and in the conglomeration of major municipalities.

The UZAs have different levels of CPI considering they have a different mix of the variables to calculate it. The most used roads for cycling in the UZA Regions are as follows:

- The East TPR has low potential according to the CPI, only the municipalities of Luquillo and Fajardo have a higher potential. Vieques and Culebra have the least potential, probably due to low demographics. This could be improved if the use of bicycles was more attractive to tourists.
- In the North TPR there is a higher potential in the Coast of Arecibo and in Barceloneta.
- In the South TPR there is a potential in almost all municipalities, especially Ponce, Juana Díaz, and Santa Isabel.
- The Southeast TPR has some potential, especially on the coast, from Salinas to some parts of Patillas.
- In the Southwest TPR there is potential in the municipalities located to the west, especially Mayagüez and Cabo Rojo. The lowest potential is in the municipalities of Lajas and San Germán.

The roads that are most used for cycling are distributed along the municipalities in each region. These are:

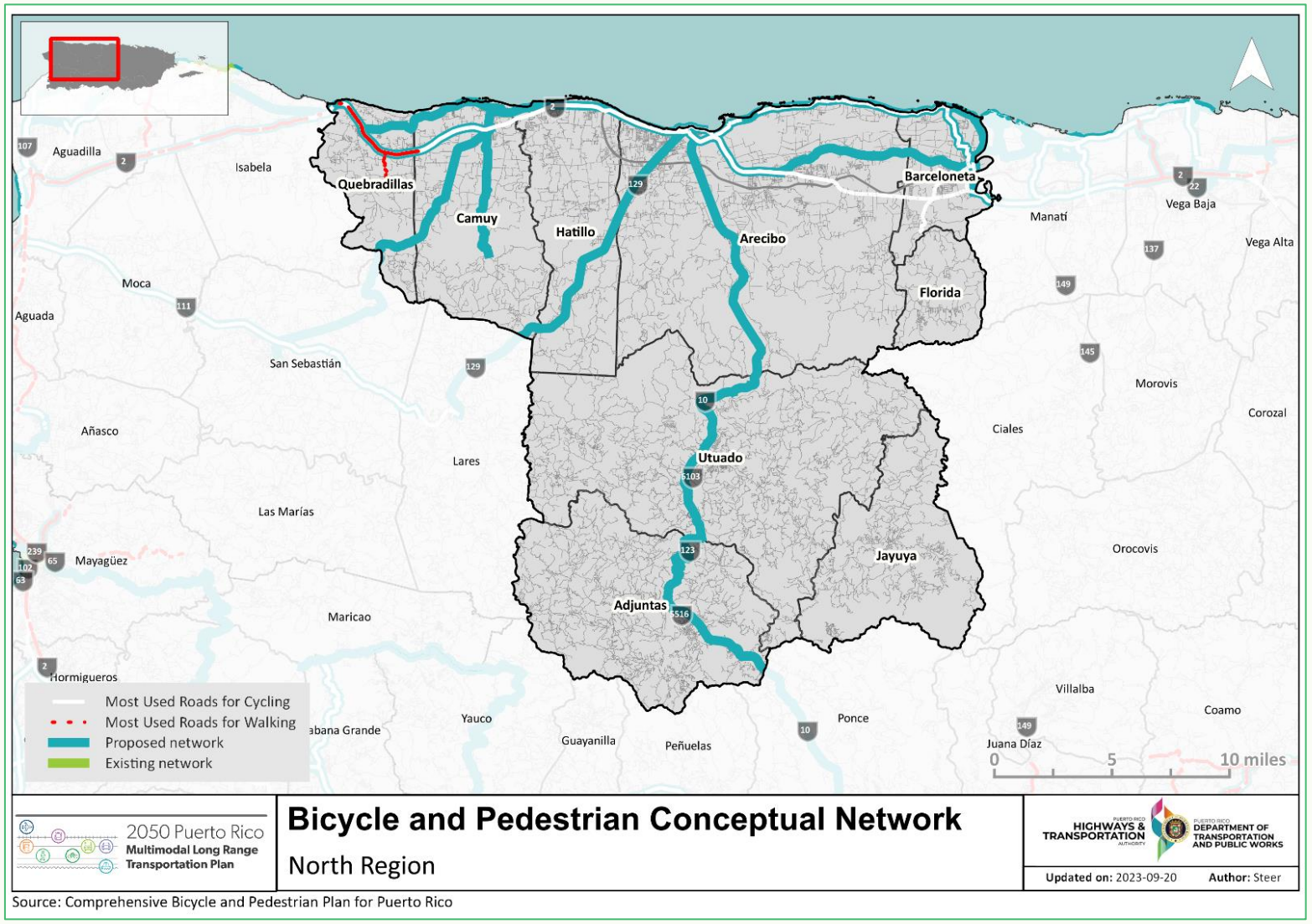
Table 3.2: Roads Most Used for Cycling in UZAs

Region	Municipality	Road Used for Walking			
North	Barceloneta	PR-2	PR-681	PR-684	PR-140
	Camuy	PR-2			
	Quebradillas	PR-2			
	Arecibo	PR-2	PR-681	Víctor Rojas Ave	
East	Luquillo	East	PR-3		
	Fajardo	PR-3			
	Ceiba	PR-3	Roosevelt Roads Trails		
	Culebra	PR-251	PR-250		
	Vieques	PR-200	PR-997		
South	Coamo	PR-14	PR-153		
	Santa Isabel	PR-1	PR-153		
	Juana Díaz	PR-14	PR-1.		
	Ponce	PR-1	PR-14	PR-123	PR-2
	Peñuelas	PR-127	PR-385	PR-132.	
	Yauco	PR-127	PR-121	PR-335	
	Guánica	PR-116			
Southeast	Arroyo	PR-3			
	Patillas	PR-3	PR-799	PR-184	
Southwest	Cabo Rojo	PR-202	PR-301	PR-307	PR-308
		PR-3301	12 Street	Los Vélez Path	El Zapato Path
		Las Guanábanas Path	PR-100	Monte Carlo Path	
	Sabana Grande	PR-120	PR-121	PR-102	David Méndez Street
	Guayanilla	PR-132	PR-335	PR-127.	
	Lajas	PR-116	PR-305	PR-303	PR-304
	San Germán	PR-102	PR-36	PR-329	PR-347
		PR-114			

Source: Comprehensive Bicycle and Pedestrian Plan for Puerto Rico, 2018

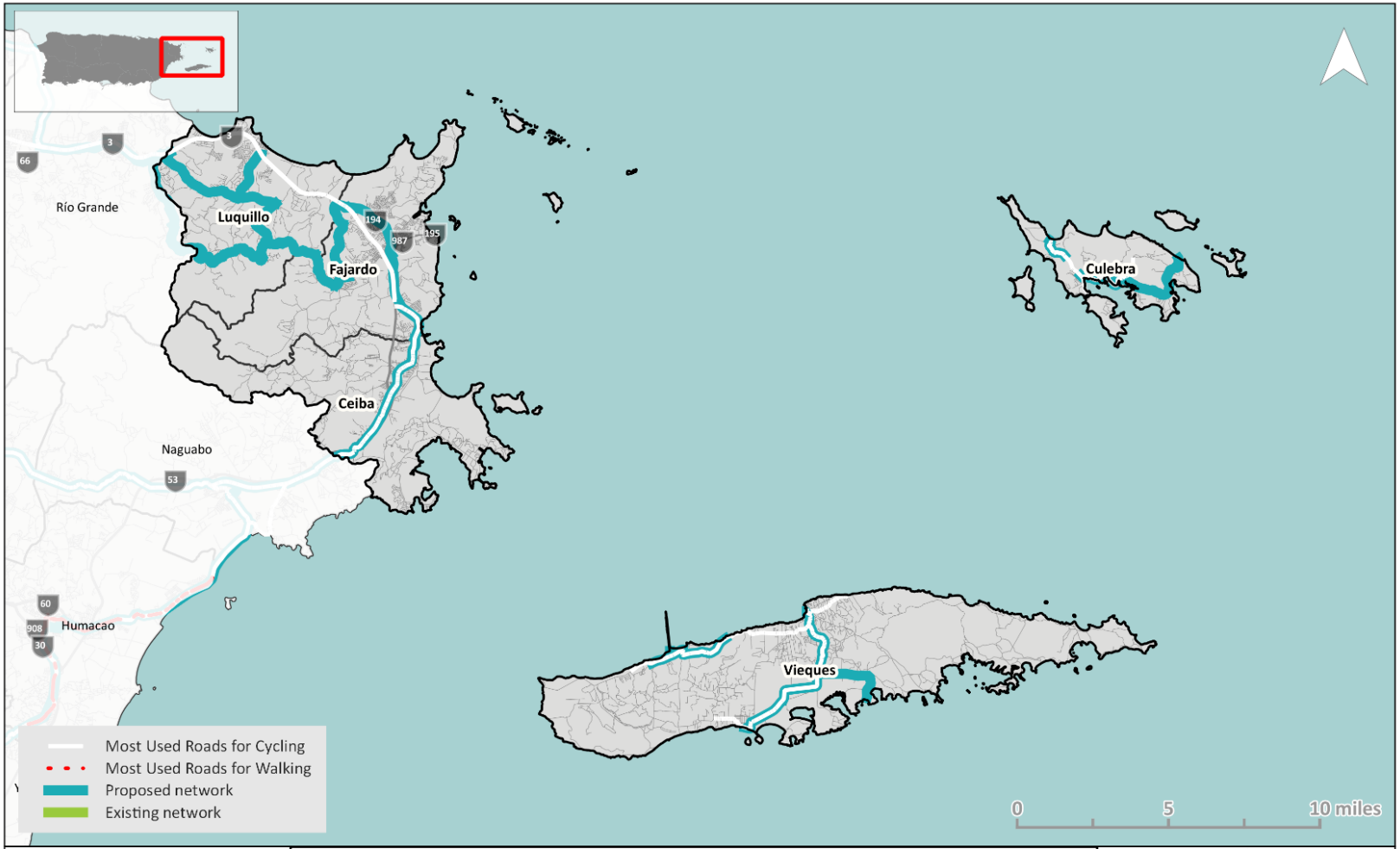
For more details on the bicycle and pedestrian paths and facilities available, please refer to the 2045 Long-Range Transportation Plan (LRMTP) or the Comprehensive Bicycle and Pedestrian Plan for Puerto Rico (see Appendix "Comprehensive Bicycle and Pedestrian Plan for Puerto Rico").

Figure 3.1: North TPR Bicycle and Pedestrian Conceptual Network 2050



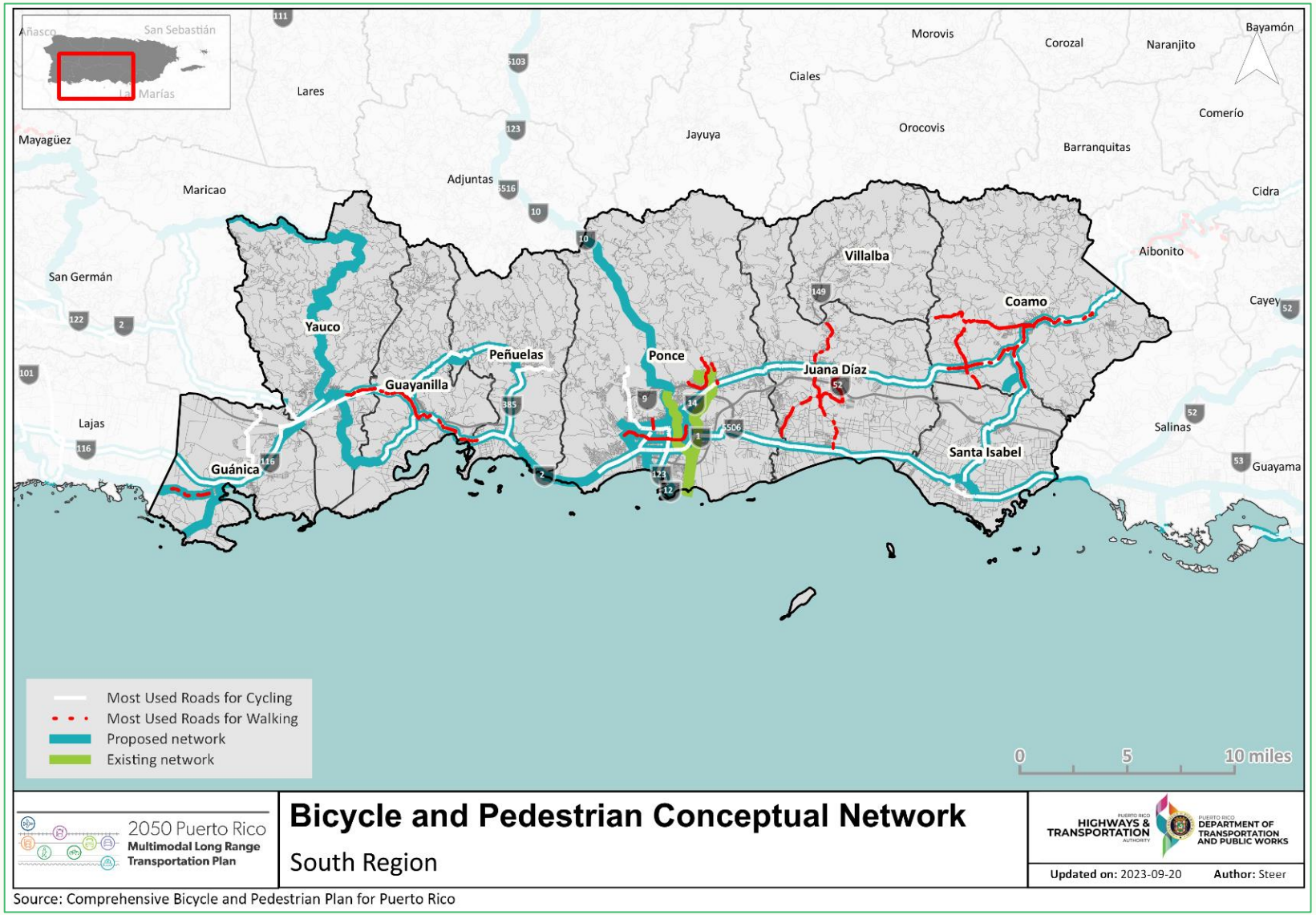
Source: Comprehensive Bicycle and Pedestrian Plan for Puerto Rico

Figure 3.2: East TPR Bicycle and Pedestrian Conceptual Network 2050



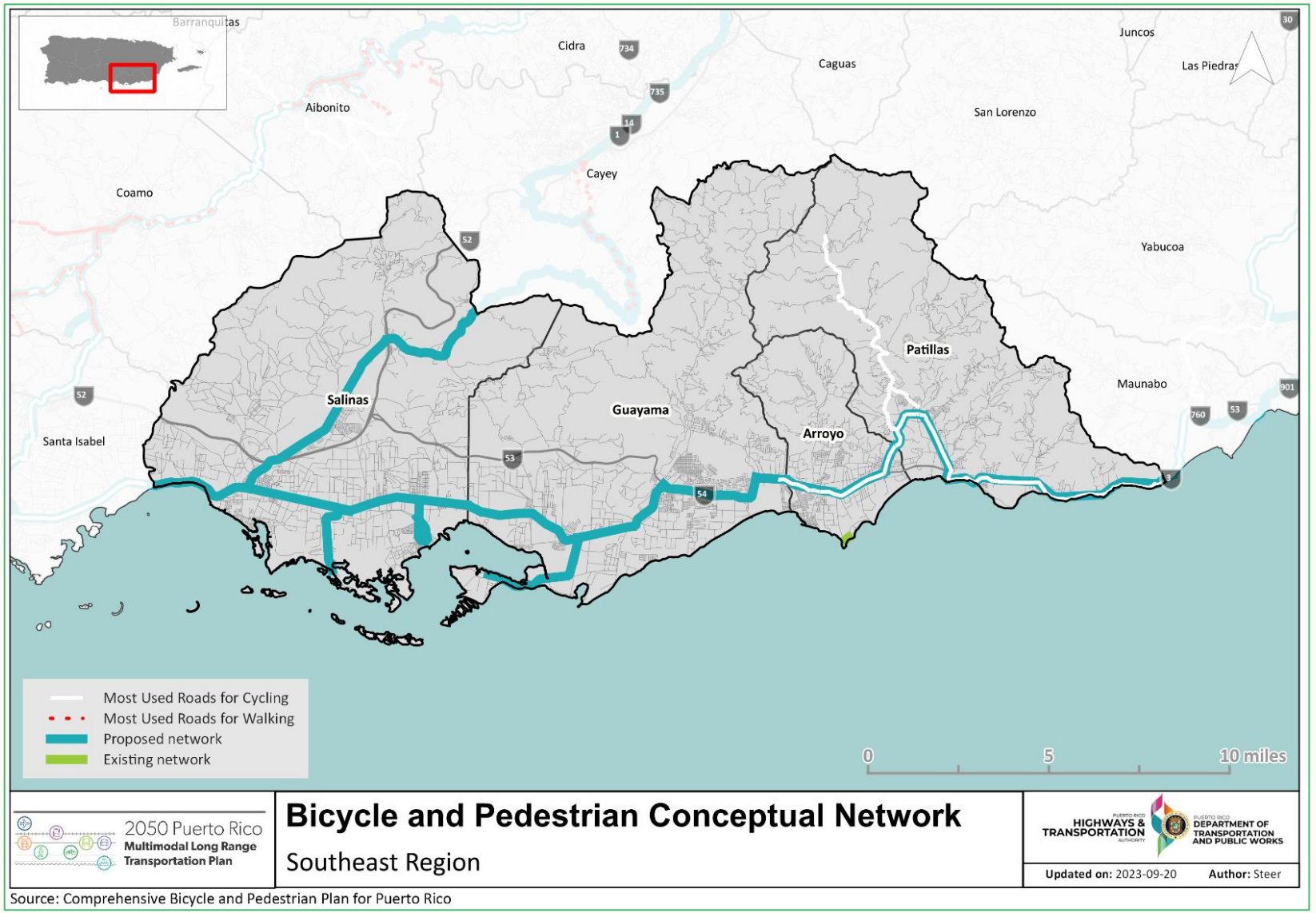
Source: Comprehensive Bicycle and Pedestrian Plan for Puerto Rico

Figure 3.3: South TPR Bicycle and Pedestrian Conceptual Network 2050



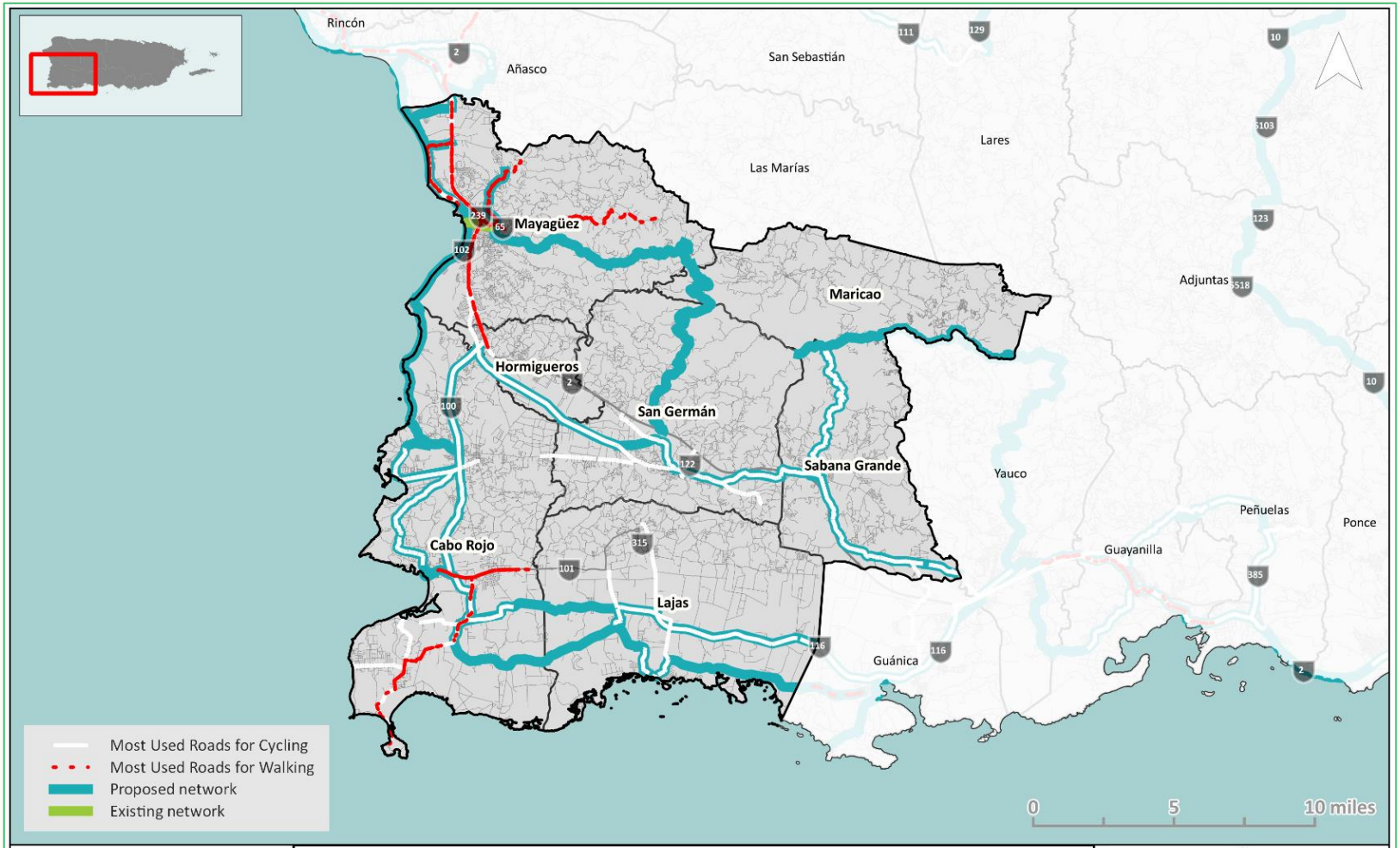
Source: Comprehensive Bicycle and Pedestrian Plan for Puerto Rico

Figure 3.4: Southeast TPR Bicycle and Pedestrian Conceptual Network 2050



Source: Comprehensive Bicycle and Pedestrian Plan for Puerto Rico

Figure 3.5: Southwest TPR Bicycle and Pedestrian Conceptual Network 2050



Source: Comprehensive Bicycle and Pedestrian Plan for Puerto Rico

Micromobility

Micromobility is defined by the FHWA as "any small, low-speed, human-, or electric-powered transportation device"[51]. Micromobility vehicles can include bicycles, scooters, skateboards, and any alternative that falls inside the aforementioned parameters.

Micromobility modes are preferred for trips with short distances ranging up to 10 km[52]. These distances can be reached by electric-powered micromobility vehicles with speeds up to 45 km/h (28 mph).

In Puerto Rico, this electric-powered micromobility vehicles started gaining popularity when the first shared micromobility company started operating in 2019. Since then, private, and shared micromobility has seen an increase in users in urban areas. Despite lacking official metrics on private micromobility users, their presence in urban settings can be distinguished by identifying vehicles without branding.

Shared micromobility can be described as the operational model consisting in the short-term rental of micromobility vehicles. These can be placed in strategic zones where users can pay to unlock them through a mobile application, use them, and lock them at their destination. These systems can have docking stations to park the vehicles (mainly bicycles or scooters), or they can have self-locking vehicles that do not require docks. In Puerto Rico, the current systems operate with dockless vehicles that are placed in activity zones and are monitored by GPS and sensors.

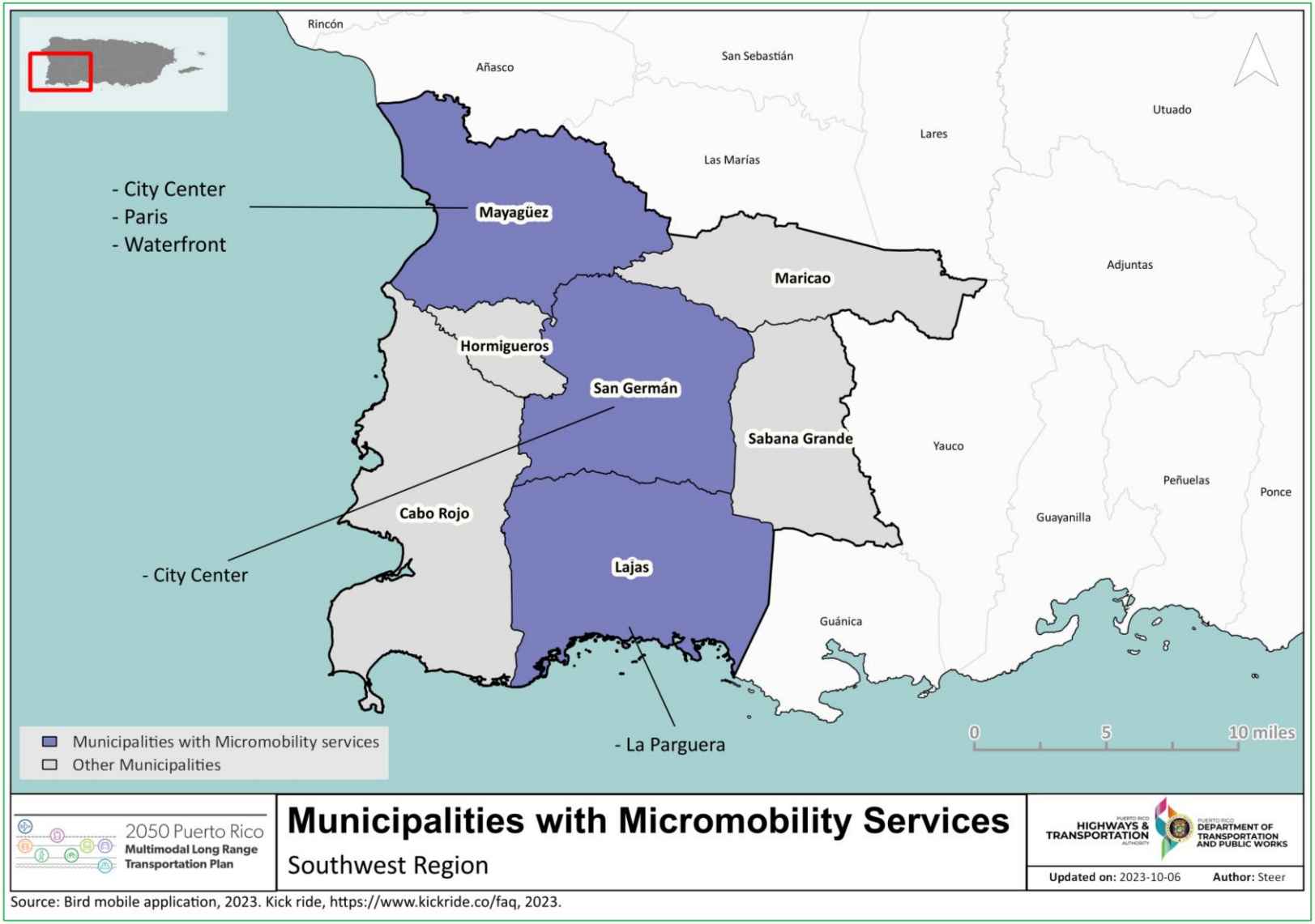
Currently there are two shared micromobility providers and three systems operating in Puerto Rico. One provider offers shared electric-powered scooters (e-scooters) and e-bicycles, and one only offers e-scooters. Due to the short-distance nature of micromobility operations, the service areas are reduced and focus on urban zones within multiple municipalities. Figure 3.6 shows the municipalities in UZA Regions where shared micromobility options exist and a label specifying the urban zones with service within the municipalities.

This has become a competitive transportation alternative for city dwellers, visitors, and tourists, which use it for errands. In 2022, there were an estimated 730,000 miles traveled by shared scooters and bicycles, as reported by one of the shared system operators, which estimates an 80% market share on the shared micromobility market[53]. Some people might see them as a threat to pedestrians and bikes given the higher speeds it can reach in the sidewalks and bike lanes.

Micromobility, shared and private, has not yet been fully considered in existing legislation and the current transportation regulatory framework of the Puerto Rico Vehicle and Traffic Act.

51. Price, J., Blackshear, D., Blount, W., Jr., & Sandt, L. (2021). Micromobility: A Travel Mode Innovation. Public Roads, 85(1). Retrieved from: https://highways.dot.gov/public-roads/spring-2021/02.
52. Institute for Transportation & Development Policy. (n.d.) Defining Micromobility. Retrieved from: https://www.itdp.org/multimedia/defining-micromobility/
53. Skootel (January 2023) Micromobility in Puerto Rico Impact Report 2022. Provided by Skootel.

Figure 3.6: Map of the Municipalities in Southwest TPR with Micromobility Services



Source: Bird mobile application, 2023. Kick ride, https://www.kickride.co/faq, 2023.

Transit

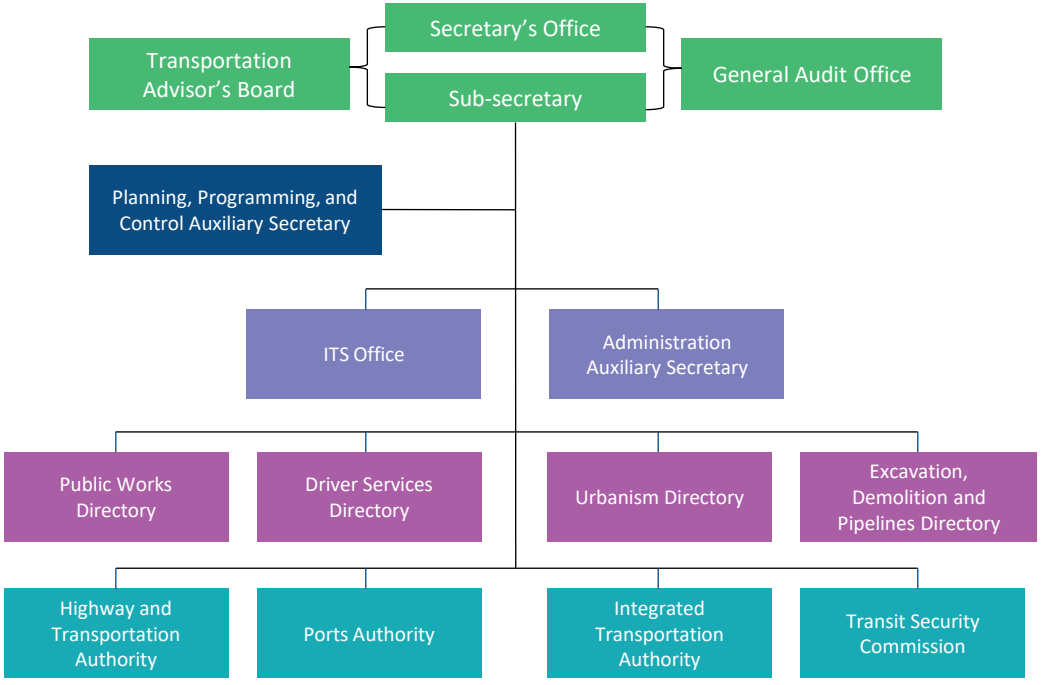
Governmental Structure

Puerto Rico Department of Transportation and Public Works (DTPW)

The DTPW was created by the Constitution of the Commonwealth of Puerto Rico of July 25, 1952 "to develop, conserve, manage and regulate the infrastructure and systems for the transportation of persons, goods and services in a safe, fast, environmentally and citizen-sensitive, durable, efficient and effective manner to promote the integration and economic development of the country and the quality of life of its citizens"[54]. Figure 3.7 shows in detail the Department's organizational structure.

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

Figure 3.7: DTPW Organizational Chart (2016)



Source: Modified by Steer from the OGP Organizational Chart from OGP Virtual Library webpage. Government of Puerto Rico (OGP), DTOP-diagrama9-04 (pr.gov), 2016

54. Puerto Rico Government Web Page. Retrieved from: https://www.pr.gov/directorio-de-agencias/departamento-de-transportacion-y-obras-publicas-dtop-5

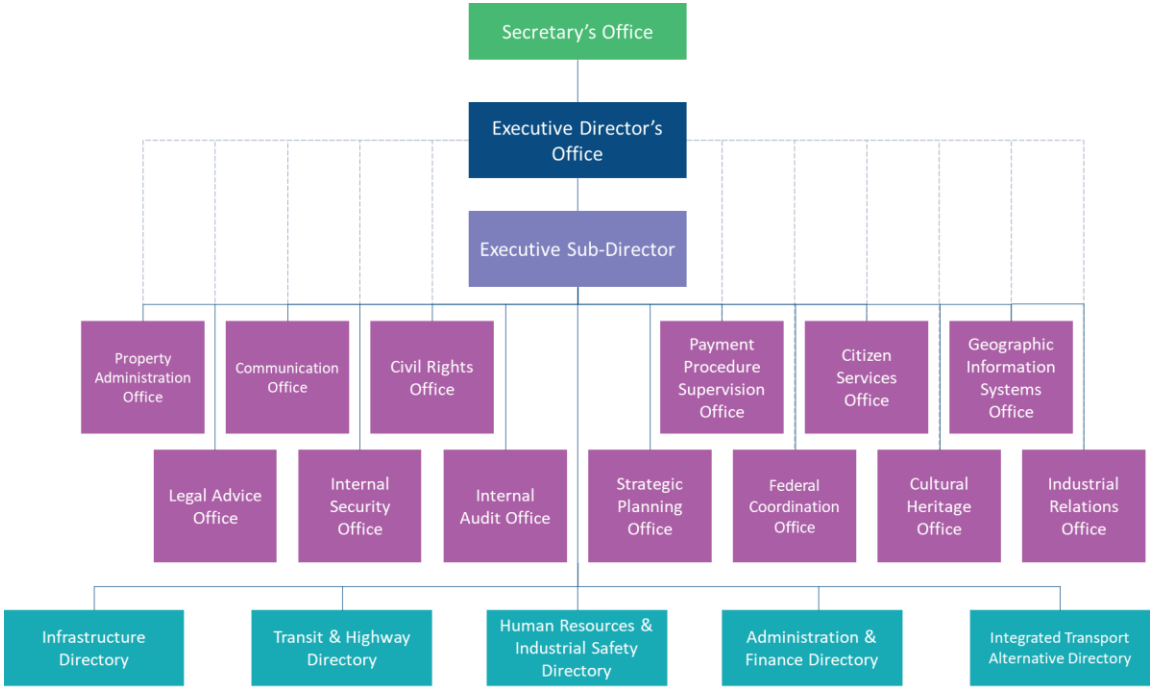
Puerto Rico Highway and Transportation Authority (PRHTA)

The PRHTA is a public corporation under the DTPW; and was created through Act. No. 74 of June 23, 1965, as amended. Years later, Act No. 4 of August 24, 1990, authorizes it to sign contracts with private entities for the construction, operation, and maintenance of highways, bridges, avenues, highways and other transit facilities.

Later on, Act No. 1 of March 6, 1991, renames the Highway Authority as Puerto Rico Highway and Transportation Authority. This act enables PRHTA to provide the Puerto Rican citizens with an integrated, efficient, reliable, and safe transportation system that contributes to the development of Puerto Rico's economy and improves the quality of life. PRHTA organizational chart can be found in Figure 3.8.

PUERTO RICO HIGHWAYS & TRANSPORTATION AUTHORITY

Figure 3.8: PRHTA Organizational Chart (2020)



Source: Modify by Steer from the 2020 DTPW Transition Report. Government of Puerto Rico (DTPW), DTOP Informe de Transición 2020.pdf (pr.gov), 2020

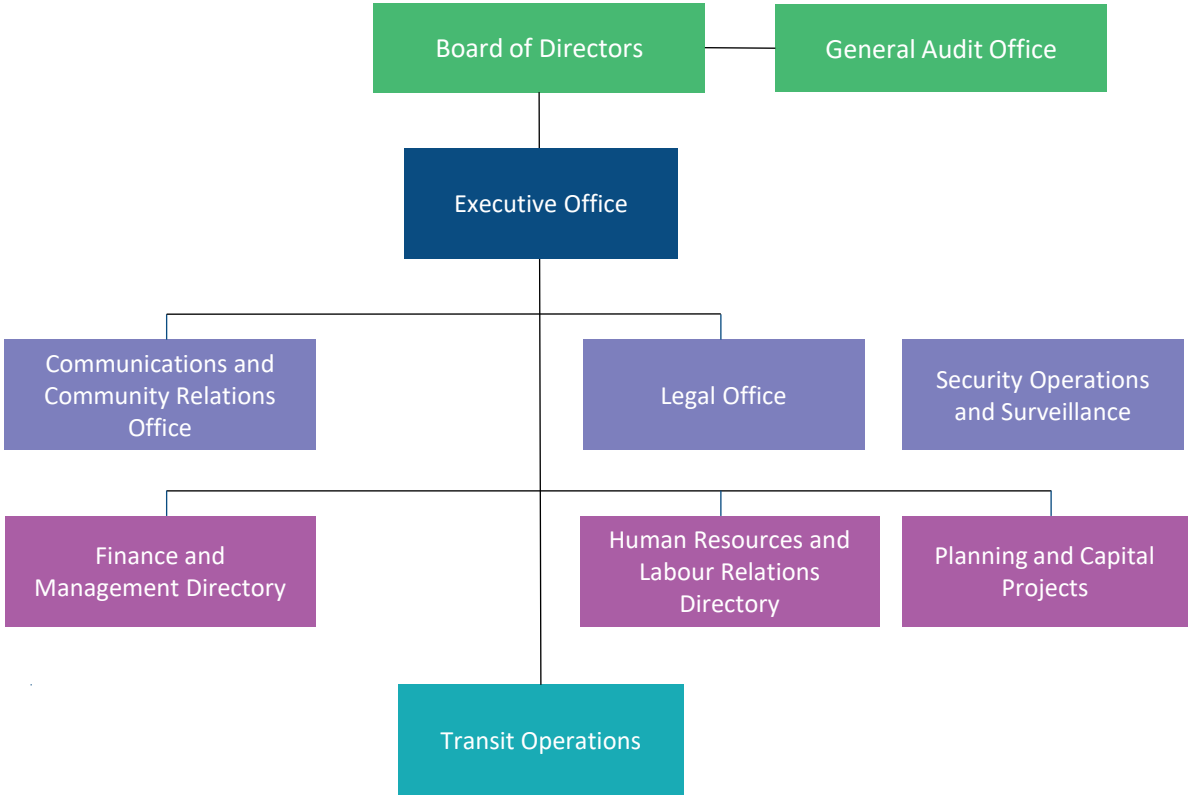
Puerto Rico Integrated Transit Authority (PRITA)

PRITA is created by Law 123-2014 of August 3, 2014, as amended. This law gave the PRHTA powers to transfer to PRITA its operations, assets, rights, obligations, and funds related to Tren Urbano (TU), transit programs operated by the PRHTA. The Law also authorized the fusion of the Metropolitan Bus Authority (Autoridad Metropolitana de Autobuses, AMA) and the Maritime Transportation Authority (MTA).

The Authority's mission is to provide major and better transit facilities to ensure the effective mobility of people and goods; and to promote economic and social growth in areas adjacent to train stations, bus terminals and intermodal or multimodal stations. Figure 3.9 shows PRITA's organizational structure.

AUTORIDAD DE TRANSPORTE INTEGRADO DE PUERTO RICO

Figure 3.9: PRITA Organizational Chart (2016)



Source: Modified by Steer from the OGP Organizational Chart from OGP Virtual Library webpage. Government of Puerto Rico (OGP), Organigramas – All Documents (pr.gov), 2016

Transit Modes

The UZA Region has transit services provided by Municipal services and Públicos.

Públicos

Due to the limitation on data available disaggregated for each region, only Island-wide information is presented.

Públicos are privately owned and operated services regulated under the Transportation and Other Public Services Bureau. Services are allowed to operate specific routes but without a specific schedule.

Públicos are operated under individual franchise agreements with fares regulated by route and special insurance requirements. Vehicle capacity varies from eight (8) to twenty-four (24) passengers and the vehicles may be owned or leased by the operator. The service has charged a variety of fares and does not have specific stops.

From data obtained from the Reduced Reporting (RR-20) Small Systems Summary of the National Transit Database (NTD), it is quite evident that the Públicos system has had a significant drop in trips made in between 2016 and 2018 with an upstream for 2019 and another dropdown from 2020 to 2021. There is a dropdown of 39% meaning more than 3 million less trips from 2020 and 2021. This is presented in Figure 3.10.

Also, between 2016 and 2021 there was a reduction of vehicles available for maximum service from 1,971 to 1,620[55].

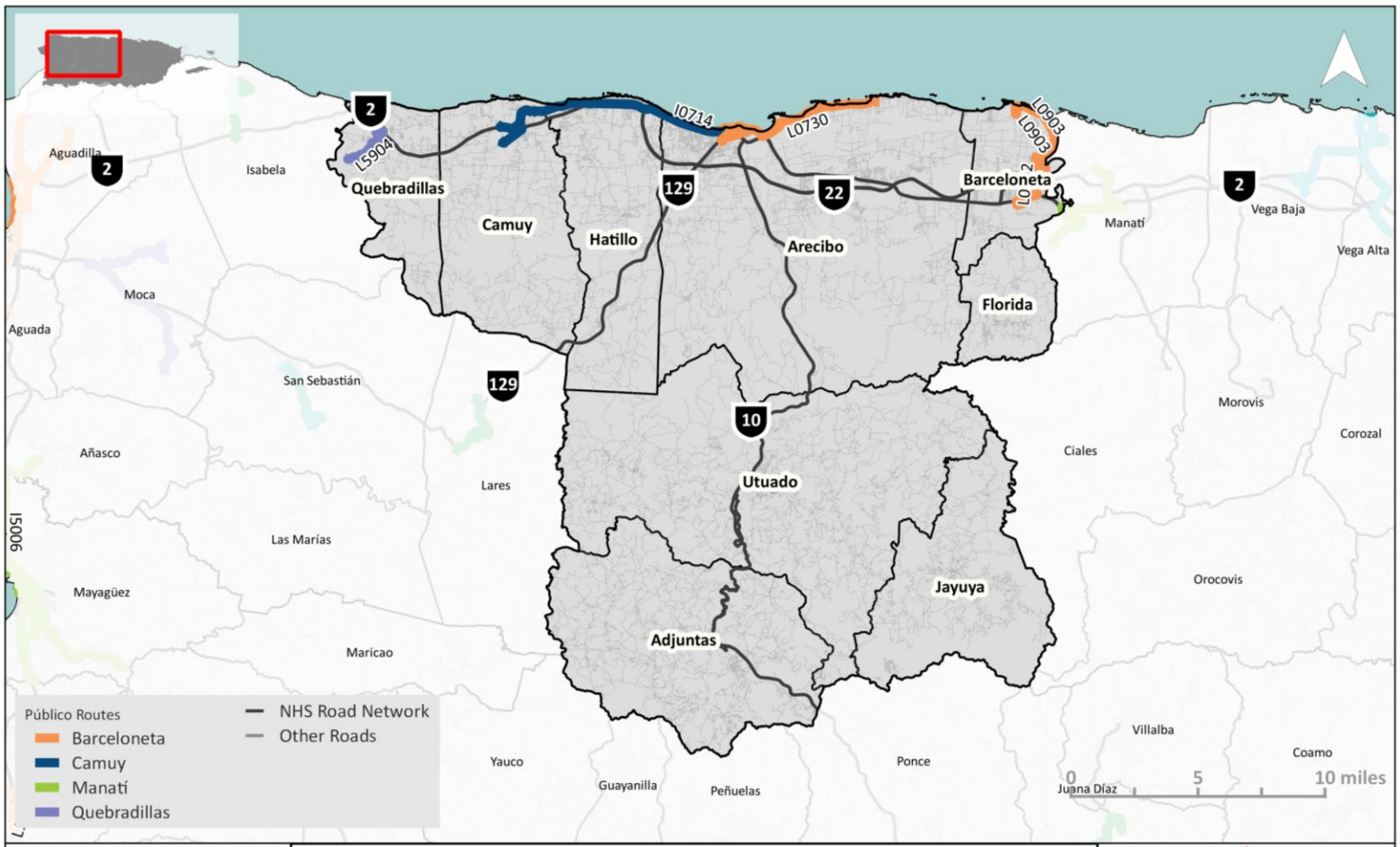
Figure 3.11 to Figure 3.15 shows the Públicos routes available for the different UZA Regions for the year 2022.

Figure 3.10: Annual Unlinked Trips[56] for Públicos Service in Puerto Rico 2021

Source: 2021 RR-20 Report National Transit Database, 2022

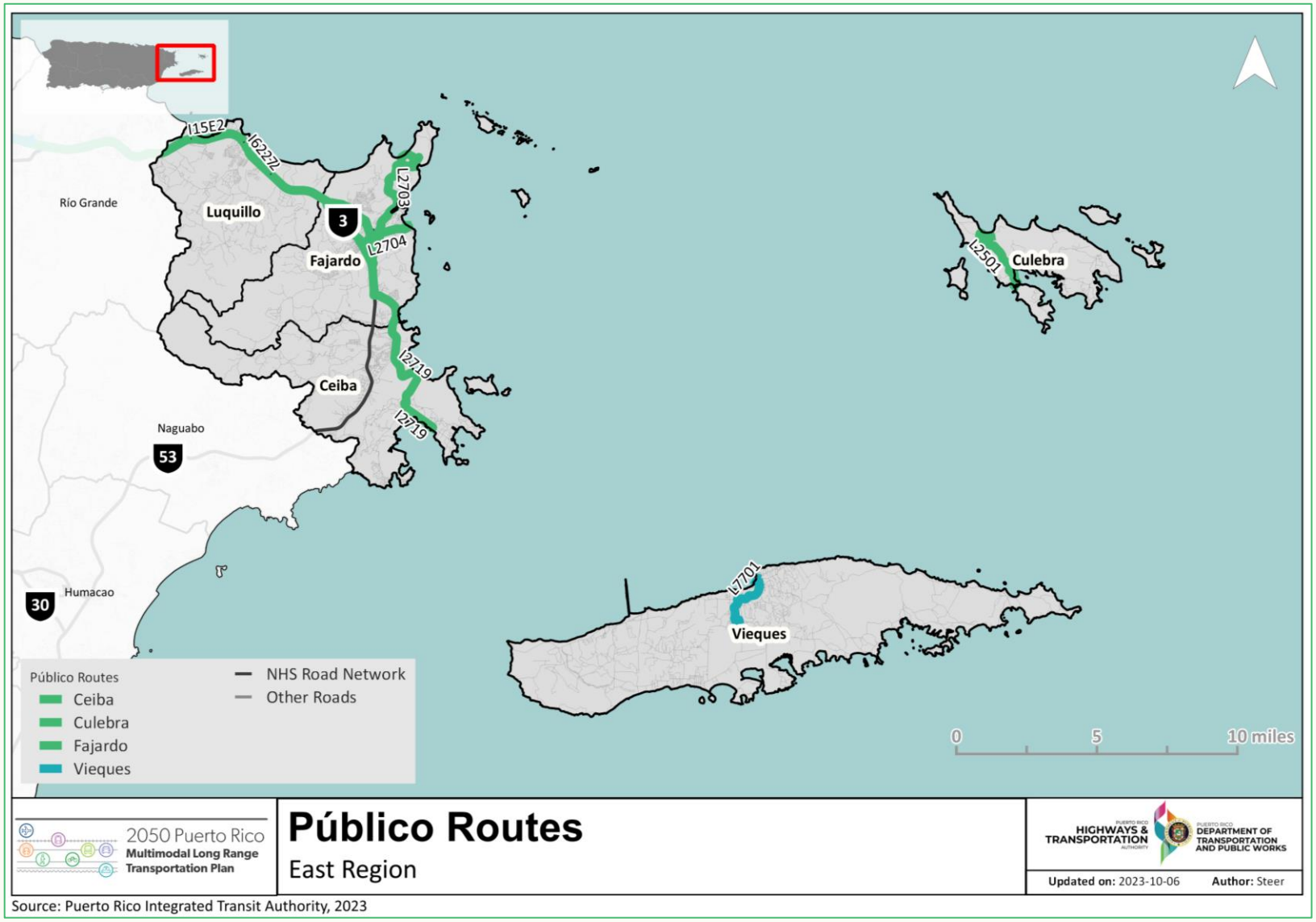
55. Unlinked Trips are defined by the Federal Transit Administration as "The number of passengers who board public transportation vehicles. Passengers are counted each time they board vehicles no matter how many vehicles they use to travel from their origin to their destination." https://www.transit.dot.gov/ntd/national-transit-database-ntd-glossary.
56. According to RR-20 2021 NTD Report, 2022.

Figure 3.11: North TPR Público Routes



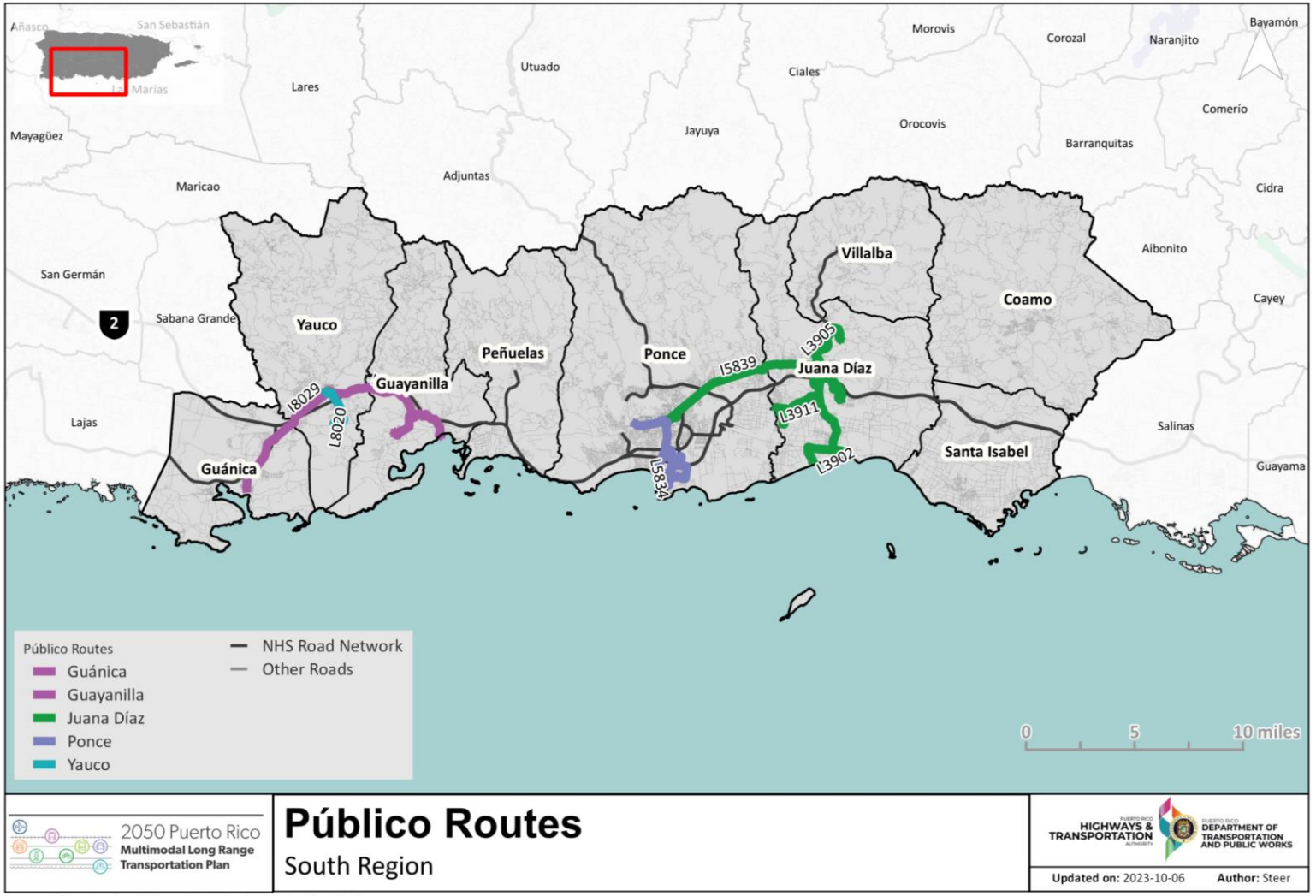
Source: Puerto Rico Integrated Transit Authority, 2023

Figure 3.12: East TPR Público Routes



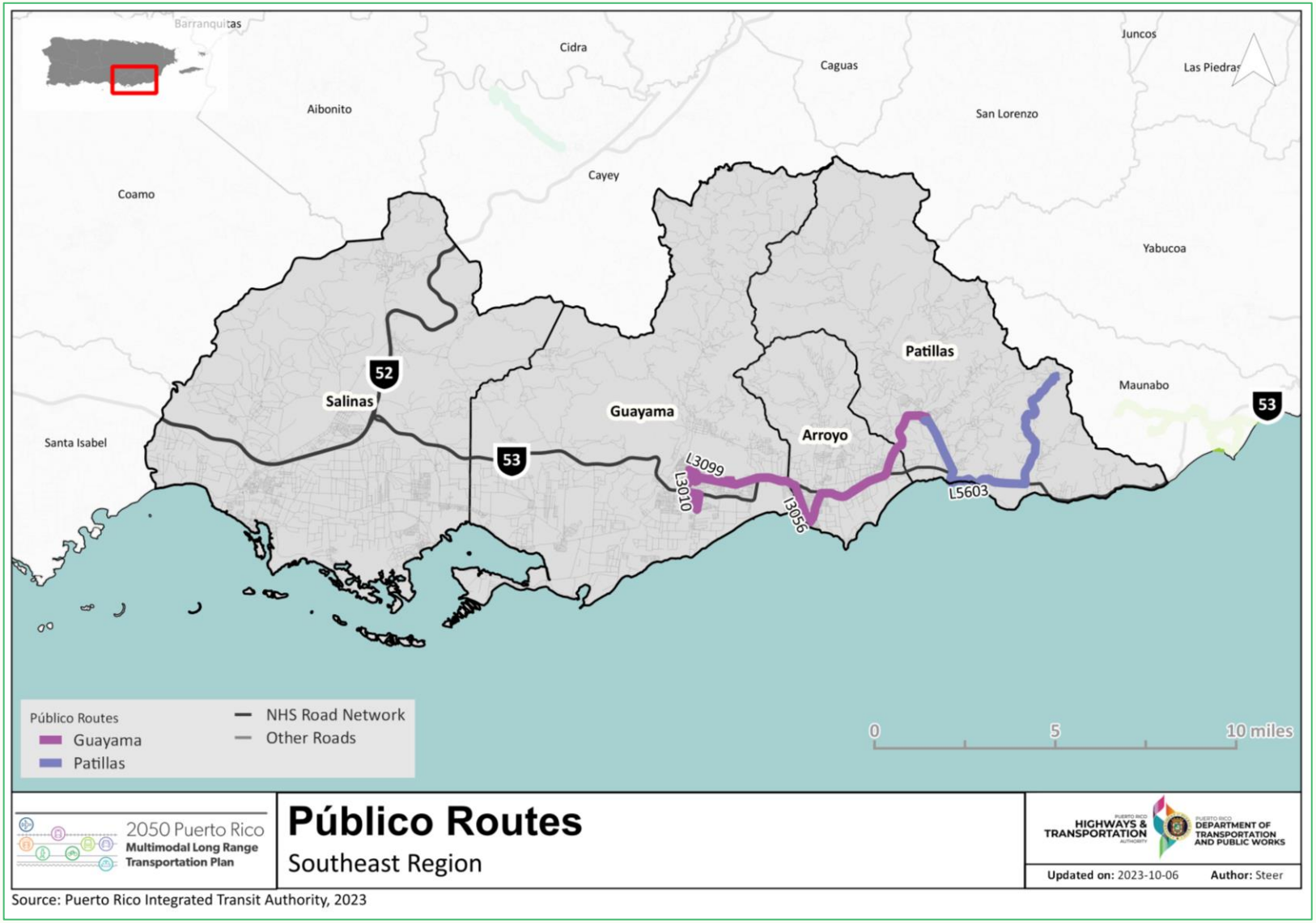
Source: Puerto Rico Integrated Transit Authority, 2023

Figure 3.13: South TPR Público Routes



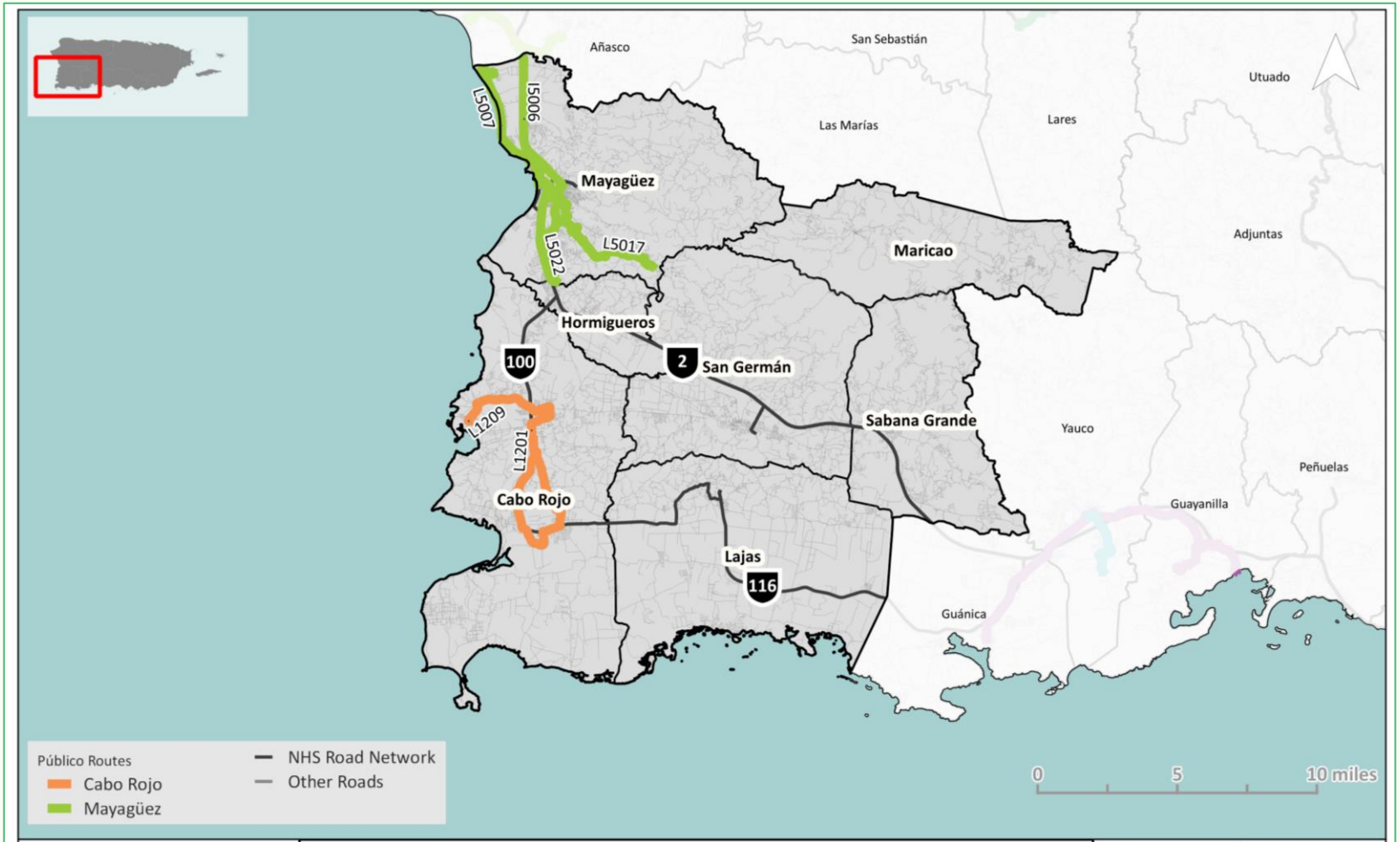
Source: Puerto Rico Integrated Transit Authority, 2023

Figure 3.14: Southeast TPR Público Routes



Source: Puerto Rico Integrated Transit Authority, 2023

Figure 3.15: Southwest TPR Público Routes



Source: Puerto Rico Integrated Transit Authority, 2023

Municipal Transit Services

There is a total of sixteen (16) municipalities within the UZA Regions offering transit services within the limits of their municipalities. According to data provided from the National Transit Database (NTD), the UZA Region has fourteen (14) municipalities reporting operational transit services for their residents, and the remaining two (2) municipalities are known to be offering services for local knowledge (Villalba – local news[57]; Guayanilla – local knowledge). As of 2021, these municipal transport systems used a variety of vehicles, primarily motor trolleys and transport vans. All the municipal transit systems are fixed routes with pre-defined[58] stops within the municipal limits, and free of charge.

For the North Region, with five (5) municipalities offering services in 2021, there were a total of approximately 26,771 annual unlinked passengers' trips[59] for the municipal services. From this, 16,522 correspond to the fixed route service[60] and 10,249 to the demand response service[61]. From 2016 to 2021 only one (1) municipality (Jayuya) is included as offering services as reports from the NTD.

For the East Region, with two (2) municipalities offering services in 2021, there were a total of approximately 4,980 annual unlinked passengers' trips[62] for the municipal services. From this, 4,980 correspond to the fixed route service and there were no trips corresponding to the demand response service. From 2016 to 2021 only one (1) municipality (Vieques) is included as offering services as reports from the NTD.

For the South Region, with five (5) municipalities offering services in 2021, there were a total of approximately 123,467 annual unlinked passengers' trips[63] for the municipal services. From this, 114,836 correspond to the fixed route service and 8,631 to the demand response service. From 2016 to 2021 only three (3) municipalities were included as offering services, one (1) (Coamo) as reports from the NTD, and two (2) as reported on local news[64] (Villalba) and local knowledge (Guayanilla).

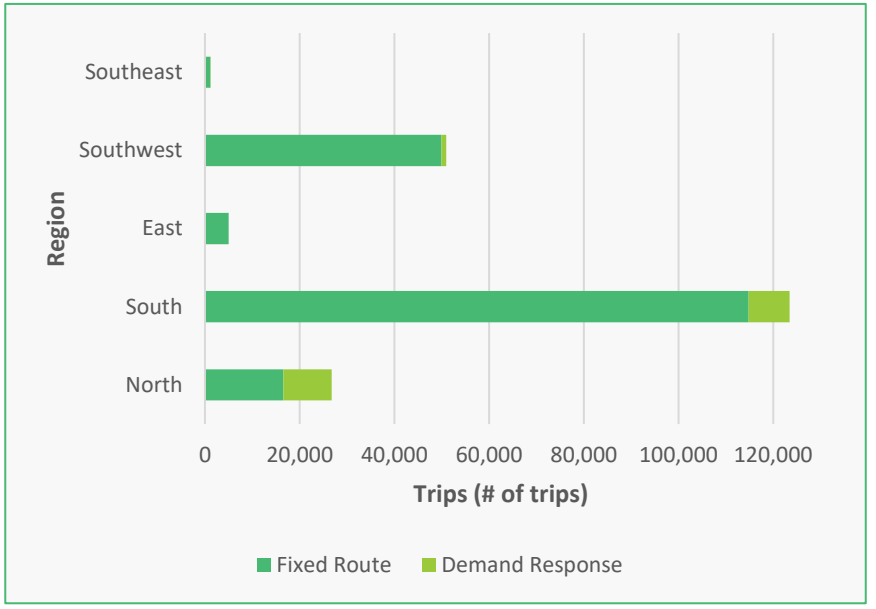
For the Southeast Region, with 2 municipalities offering services in 2021, there were a total of approximately 1,234 annual unlinked passengers' trips[65] for the municipal services. From this, 1,155 correspond to the fixed route service and 79 for the demand response service. From 2016 to 2021 both municipalities (Arroyo and Patillas) offered services as reports from the NTD.

For the Southwest Region, with two (2) municipalities offering services in 2021, there were a total of approximately 50,949 annual unlinked passengers' trips[66] for the municipal services. From this, 49,940 correspond to the fixed route service and 1,009 to the demand response service. From 2016 to 2021 both municipalities (Hormigueros and Mayagüez) were maintained as offering services as reports from the NTD.

57. Metro Puerto Rico. Villalba renueva y expande sistema de transporte gratuito – Metro Puerto Rico, 2022.
58. In some cases, there are fixed routes with no predefined stops (as long as a user it's in the establish route the driver picks up the passenger – request stop service), especially in rural communities. Also, this has been the case has an aftermath of Hurricane María, some of the infrastructure from stops was destroyed or badly damaged (signage poles, signs, shelters, among others).
59. According to the 2021 RR-20 Report. National Transit Database. Federal Transit Administration, 2022.
60. According to the FTA-NTD Glossary, Unlinked passengers' trips (UPT) are the number of passengers who board public transportation vehicles. Passengers are counted each time they board vehicles no matter how many vehicles they use to travel from their origin to their destination. National Transit Database (NTD) Glossary | FTA (dot.gov)
61. According to the FTA-NTD Glossary, Demand response services (DR) is a transit mode comprised of passenger cars, vans or small buses operating in response to calls from passengers or their agents to the transit operator, who then dispatches a vehicle to pick up the passengers and transport them to their destinations. National Transit Database (NTD) Glossary | FTA (dot.gov)
62. According to the 2021 RR-20 Report. National Transit Database. Federal Transit Administration, 2022.
63. According to the 2021 RR-20 Report. National Transit Database. Federal Transit Administration, 2022.
64. Metro Puerto Rico. Villalba renueva y expande sistema de transporte gratuito – Metro Puerto Rico, 2022.
65. According to the 2021 RR-20 Report. National Transit Database. Federal Transit Administration, 2022.
66. According to the 2021 RR-20 Report. National Transit Database. Federal Transit Administration, 2022.

Figure 3.16: shows the annual unlinked trips for the UZA Regions for 2021 divided in TPR's.

Figure 3.16: 2021 Annual Unlinked Trips by TPR's within the UZA Region

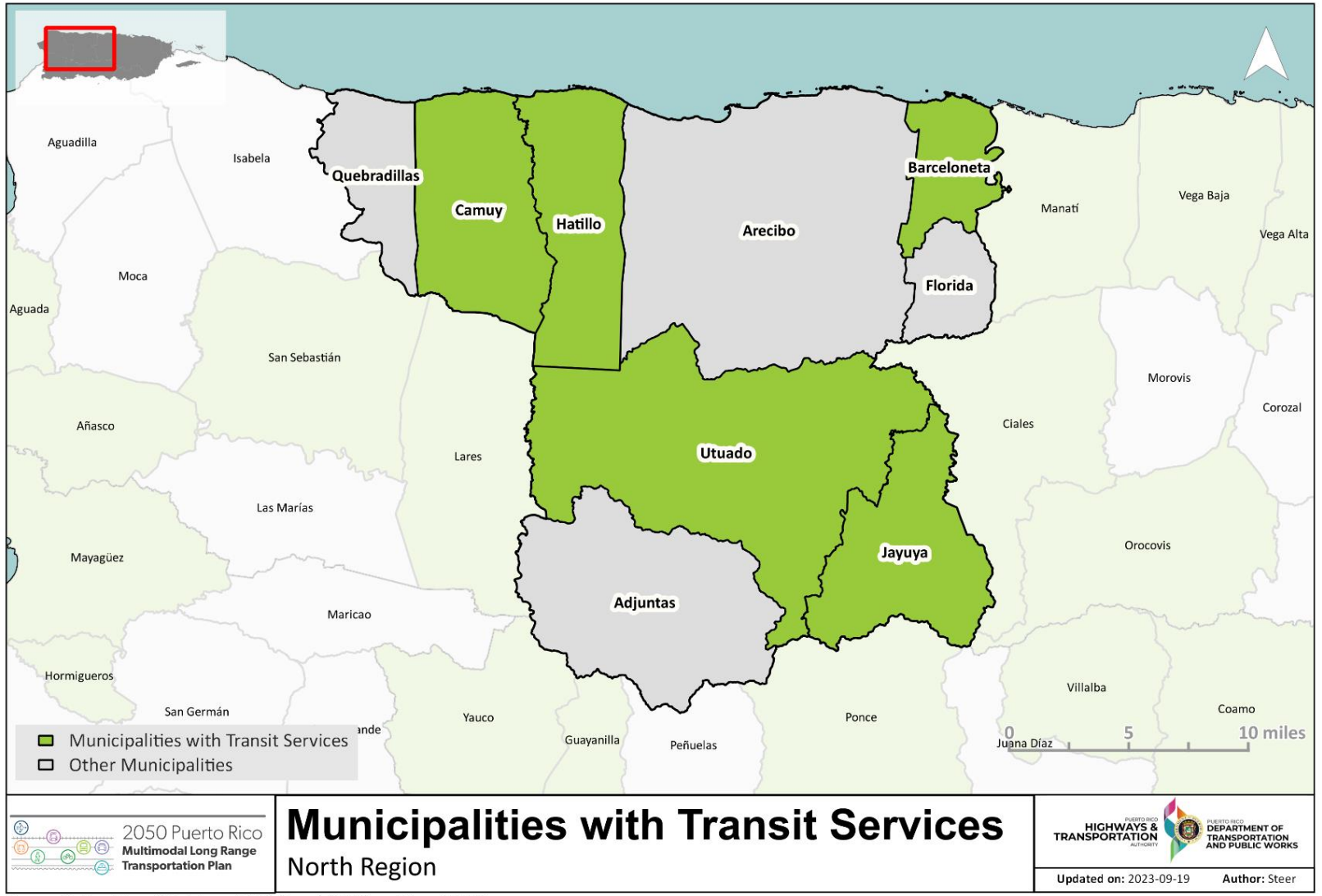


Source: 2021 RR-20 Report National Transit Database, 2022

In each region there is a certain number of municipalities that have an active transit service, as follows :

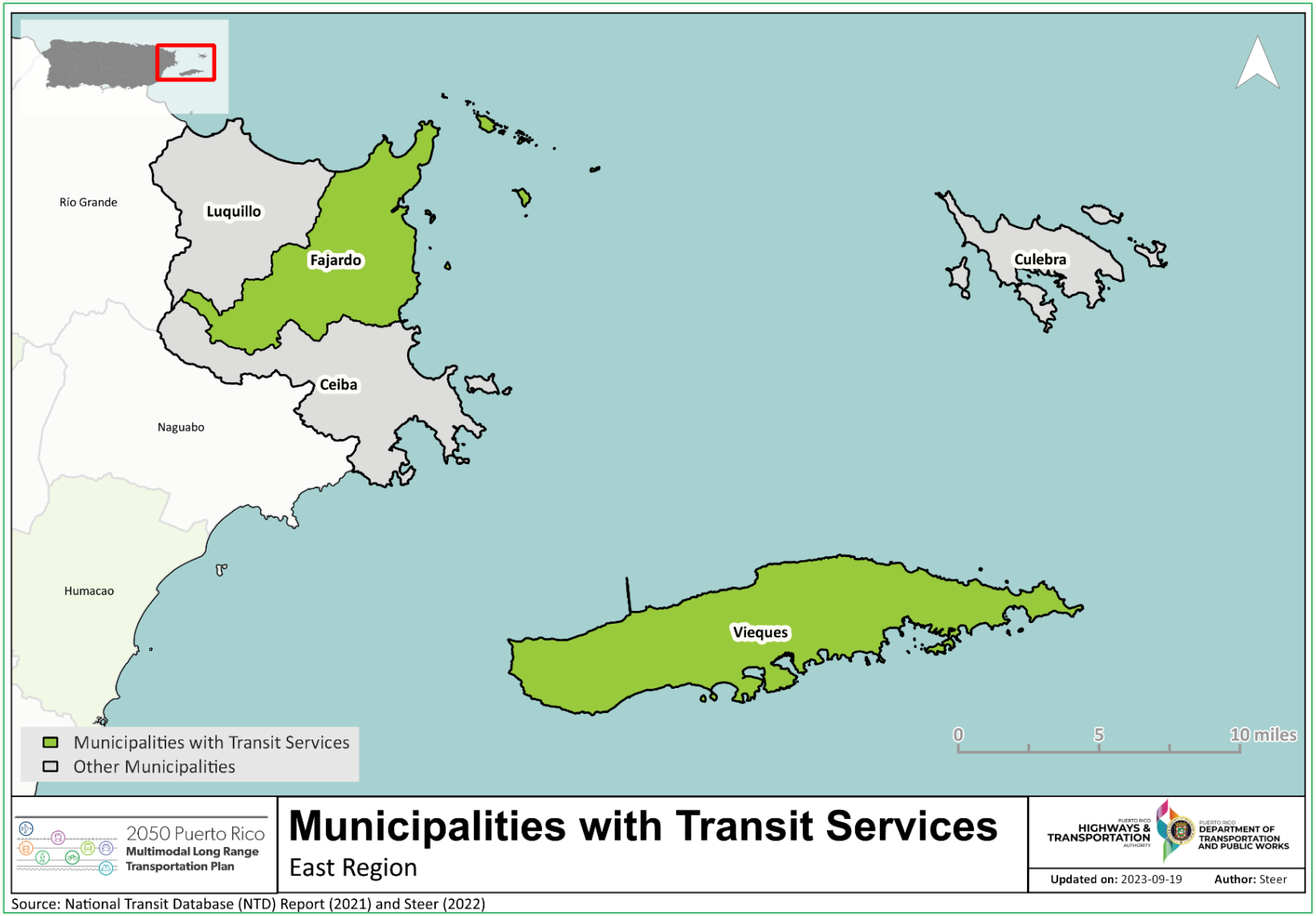
- In the North TPR the municipalities of Barceloneta, Camuy, Hatillo, Jayuya and Utuado have an active transit service. These are illustrated in Figure 3.17.
- In the East TPR the municipalities of Fajardo and Vieques have an active transit service. These are illustrated in Figure 3.18.
- In the South TPR the municipalities of Coamo, Guayanilla, Ponce, Villalba, Yauco have an active transit service. These are illustrated in Figure 3.19.
- In the Southeast TPR the municipalities of Arroyo and Patillas have an active transit service. These are illustrated in Figure 3.20.
- In the Southwest TPR the municipalities of Hormigueros and Mayagüez have an active transit service. These are illustrated in Figure 3.21.
- Furthermore, regardless of whether municipal transit services are provided, some municipalities provide paratransit services to the elderly and those with disabilities.

Figure 3.17: Municipalities in the North TPR with Transit System



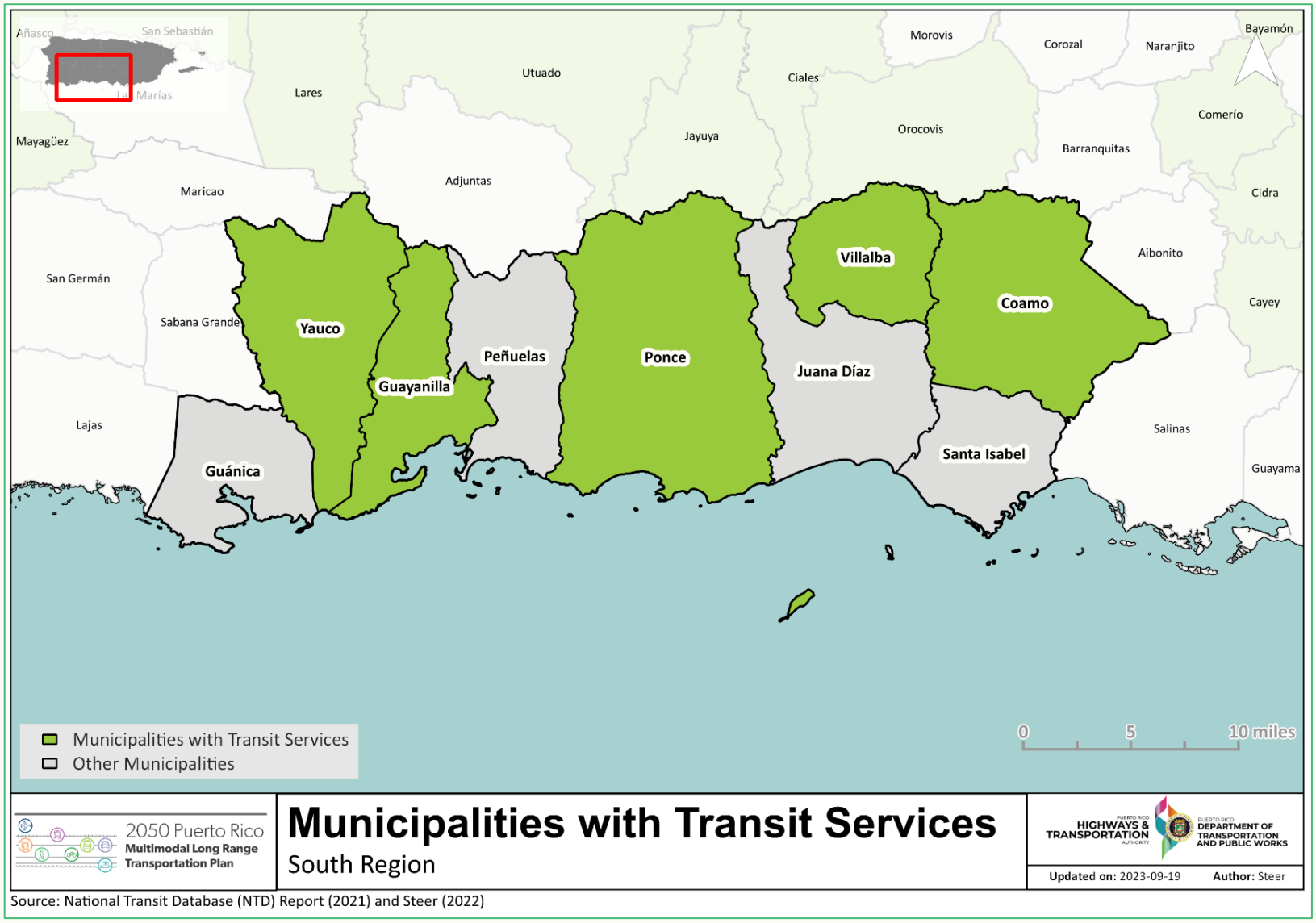
Source: National Transit Database (NTD) Report (2021) and Steer (2022)

Figure 3.18: Municipalities in the East TPR with Transit System



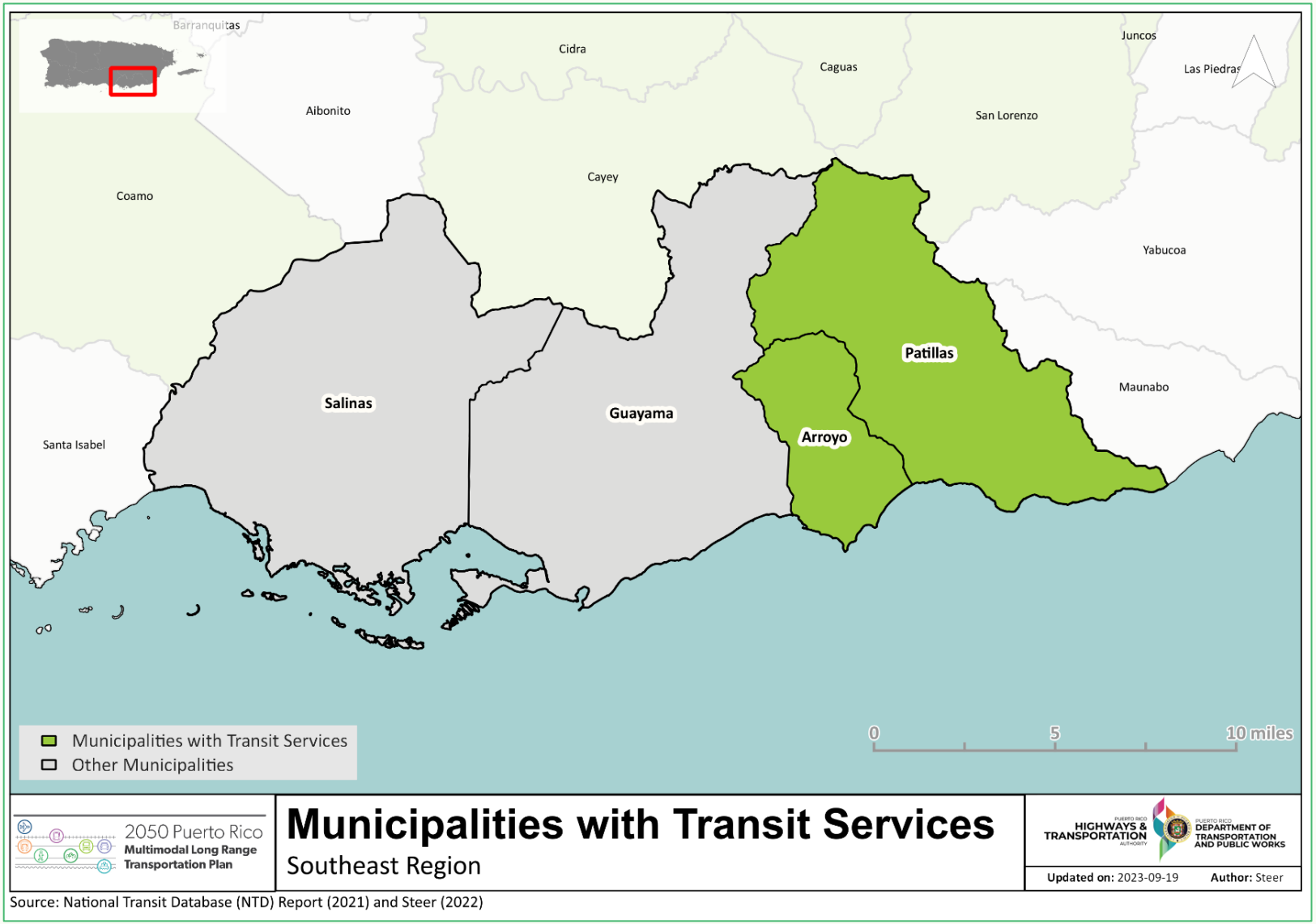
Source: National Transit Database (NTD) Report (2021) and Steer (2022)

Figure 3.19: Municipalities in the South TPR with Transit System



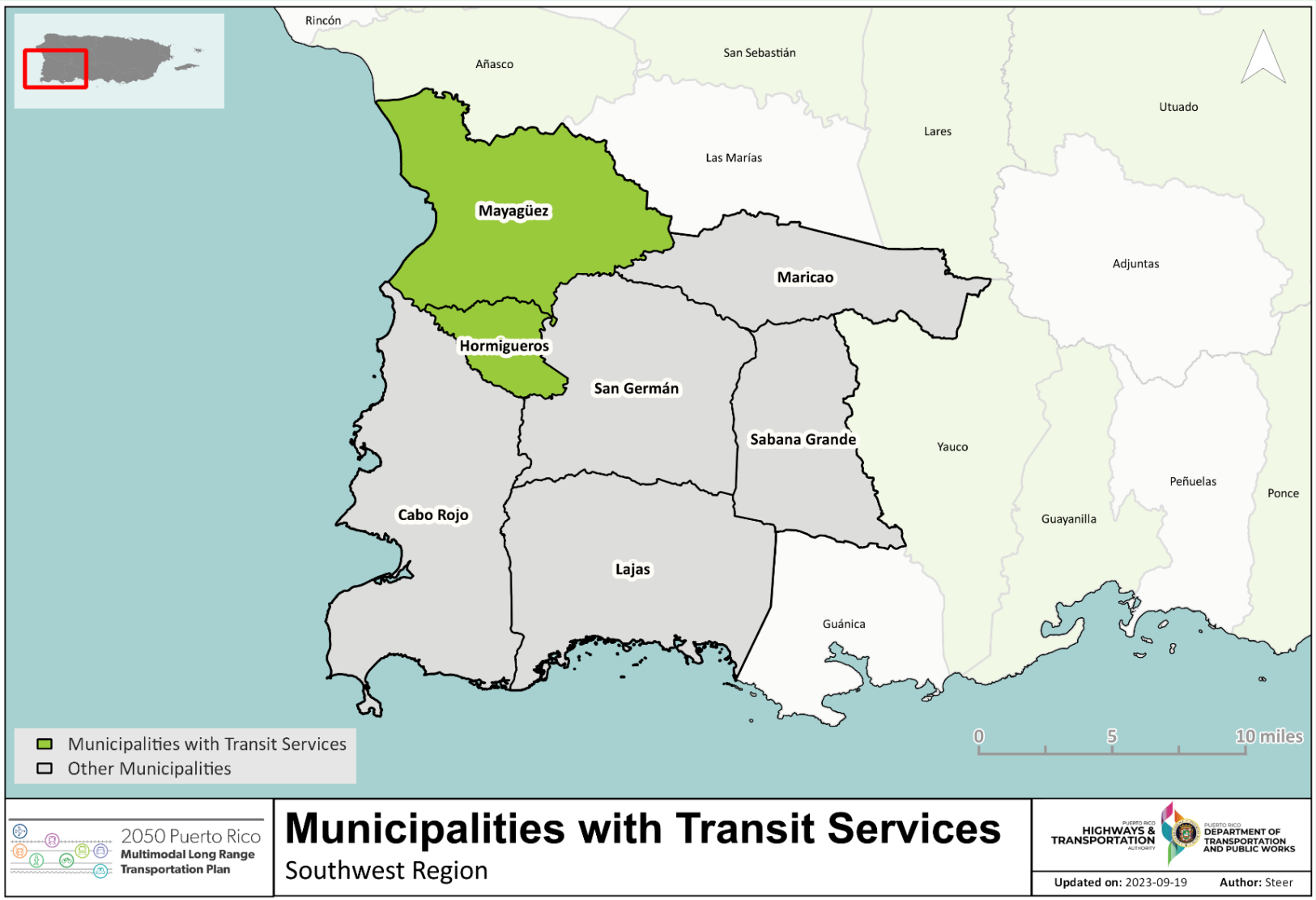
Source: National Transit Database (NTD) Report (2021) and Steer (2022)

Figure 3.20: Municipalities in the Southeast TPR with Transit System



Source: National Transit Database (NTD) Report (2021) and Steer (2022)

Figure 3.21: Municipalities in the Southwest TPR with Transit System



Source: National Transit Database (NTD) Report (2021) and Steer (2022)

Maritime Transportation Authority (MTA)

The MTA is a public corporation that under Law 123-2014 will be operated under Puerto Rico Integrated Transit Authority (PRITA) to control, administer, operate, and maintain the maritime transportation service between Ceiba with Vieques and Culebra.

Provides maritime transportation services, including passenger and freight movement, for residents and visitors to and from the island municipalities of Vieques and Culebra. This program has been merged into PRITA as of fiscal year 2015-2016, in compliance with the stipulations of 123-2014 ACT[67].

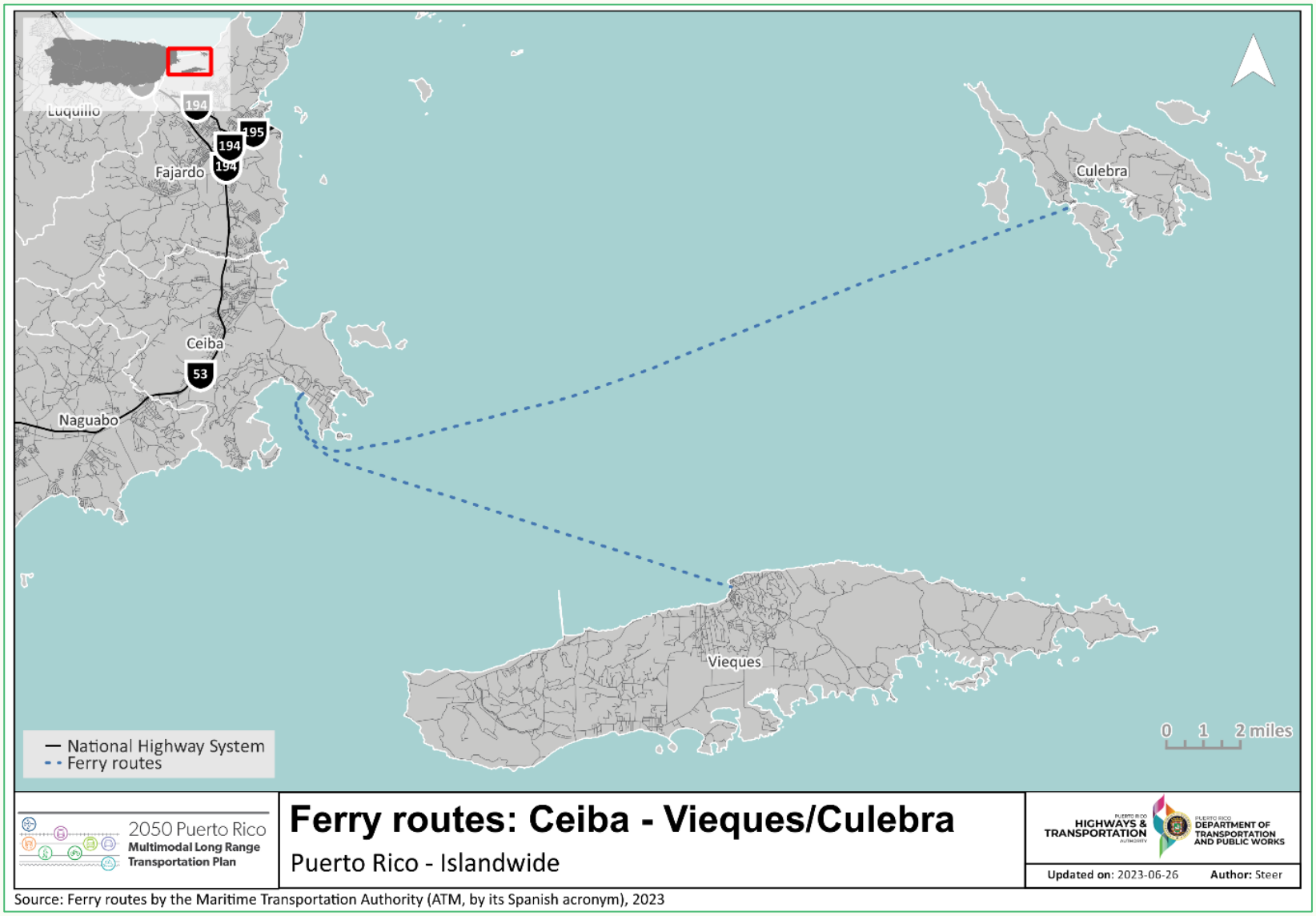
In the East TPR, the ferry service from Ceiba to Vieques is Monday to Friday from 4:30 a.m. until 9:30 p.m. and Saturday to Sunday from 5:00 a.m. until 9:00 p.m., this trip includes passenger and cargo trips in both ways.

In the East TPR, the ferry service from Ceiba to Culebra operates Monday to Friday from 3:30 a.m. until 9:30 p.m. and Saturday to Sunday from 4:00 a.m. until 9:30 p.m., this trip includes passenger and cargo trips in both ways.

Figure 3.22 shows the ferry trips between Ceiba to/from Vieques and Culebra.

67. Puerto Rico Integrated Transit Authority (2021) Retrieved from: https://presupuesto.pr.gov/Presupuesto_Aprobado2021-2022/Presupuesto_Agencias_pdf/Autoridad%20de%20Transporte%20Integrado%20de%20Puerto%20Rico.pdf

Figure 3.22: Puerto Rico Ferry Routes: Ceiba – Vieques/Culebra



Source: Ferry routes by the Maritime Transportation Authority (ATM, by its Spanish acronym), 2023

Roadway System

The roadway network inside of the Urbanized Areas Under 200,000 in Population had a total of 8,387.95 road miles[19] as defined by the Highway Performance Monitoring System (HPMS) and the Roadway Information Management System (RIMS).

The roadways that are part of the National Highway System (NHS) are classified by the Federal Highway Authority (FHWA). There is a complex non-NHS system within the Island (local system) due to their provision of direct access to adjoining land, they are not intended for use in long distance travel, except at the trip origin or destination[68]. The classification is based on the functionality and is aimed at defining the role of roadways in the overall roadway network. The classification is as follows[69]:

- **Interstate:** Officially designated as part of the Eisenhower Interstate System, these roads are focused on providing the infrastructure for high mobility and long-distance travel.
- **Other Freeways and Expressways**: Designed and built to increase mobility function. The land uses next to these roads are not directly served by them. Access and egress points are limited to on- and off-ramps or a limited number of at-grade intersections. They have directional travel lanes, usually separated by some type of physical barrier.
- **Principal Arterials:** These roads serve main centers of metropolitan and some rural areas, offering a high mobility degree. Adjoining land uses can be served directly by them.
- **Minor Arterial:** Provide connectivity to the higher Arterial system and service for trips of moderate length.
- **Major Collector:** Provide more mobility through more travel lanes. These roads tend to have higher annual average traffic volumes and speed limits. They have lower connecting driveway densities, are longer in length and are spaced at greater intervals than their Minor Collector counterparts.
- **Minor Collector:** Offer less mobility and more access than their Major Collector counterparts. Also, they serve both land access and traffic circulation in lower-density residential and commercial/industrial areas instead of the higher-density service in Major Collectors.

The UZA Roadways map shown from Figure 3.21 to Figure 3.25 illustrate the 2022 roadway network as it is described on the Highways Performance Monitoring System (HPMS) and Roadway Information Management System (RIMS). The map displays an extensive network of Interstate, Principal Arterials, Major Collector, Minor Arterial and Minor Collector.

The North Region of UZA roadway network for 2021 had a total of 2,443.51 road miles as defined by the Highway Performance Monitoring System (HPMS) and the Roadway Information Management System (RIMS). Figure 3.22 shows the roadway system as defined by the HPMS and RIMS for the North Region.

Table 3.8 describes the number of road miles according to the network functional classifications. This table was created based on the HPMS information layer.

Table 3.3: Roadway System by Functional Classification, Route Miles – North Region (UZA)

Functional Classification	Road Miles
Interstate	31.57
Freeways and Expressways	66.83
Principal Arterials	129.20
Major Collector	192.14
Minor Arterials	65.55
Minor Collector	1,958.22
Local	31.57

Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server

68. U.S. Department of Transportation. Federal Highway Administration. Office of Planning, Environment, and Realty (HEP).
69. Based on the 2045 MLRTP (ACT, 2018)

Table 3.4 shows the roads that belong to the first three (3) functional classifications available by FHWA Categories (Interstate, freeway and expressway, principal arterial), when applicable.

Table 3.4: Roadway System by Functional Classification, Route Name – North Region (UZA)

Functional Classification	Road Name
Interstate	PR-2, PR-22
Principal Arterial	PR-10, PR-6104, PR-6103, PR-129, PR-5516, PR-6104, PR-123, PR-5518, PR-140

Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server

The East Region of UZA roadway network for 2021 had a total of 674.20 road miles as defined by the Highway Performance Monitoring System (HPMS) and the Roadway Information Management System (RIMS). Figure 3.23 shows the roadway system as defined by the HPMS and RIMS for the East Region.

Table 3.5 describes the number of road miles according to the network functional classifications. This table was created based on the HPMS information layer.

Table 3.5: Roadway System by Functional Classification, Route Miles – East Region (UZA)

Functional Classification	Road Miles
Interstate	16.60
Principal Arterials	8.49
Minor Arterials	29.55
Major Collector	48.41
Minor Collector	21.95
Local	549.19

Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server

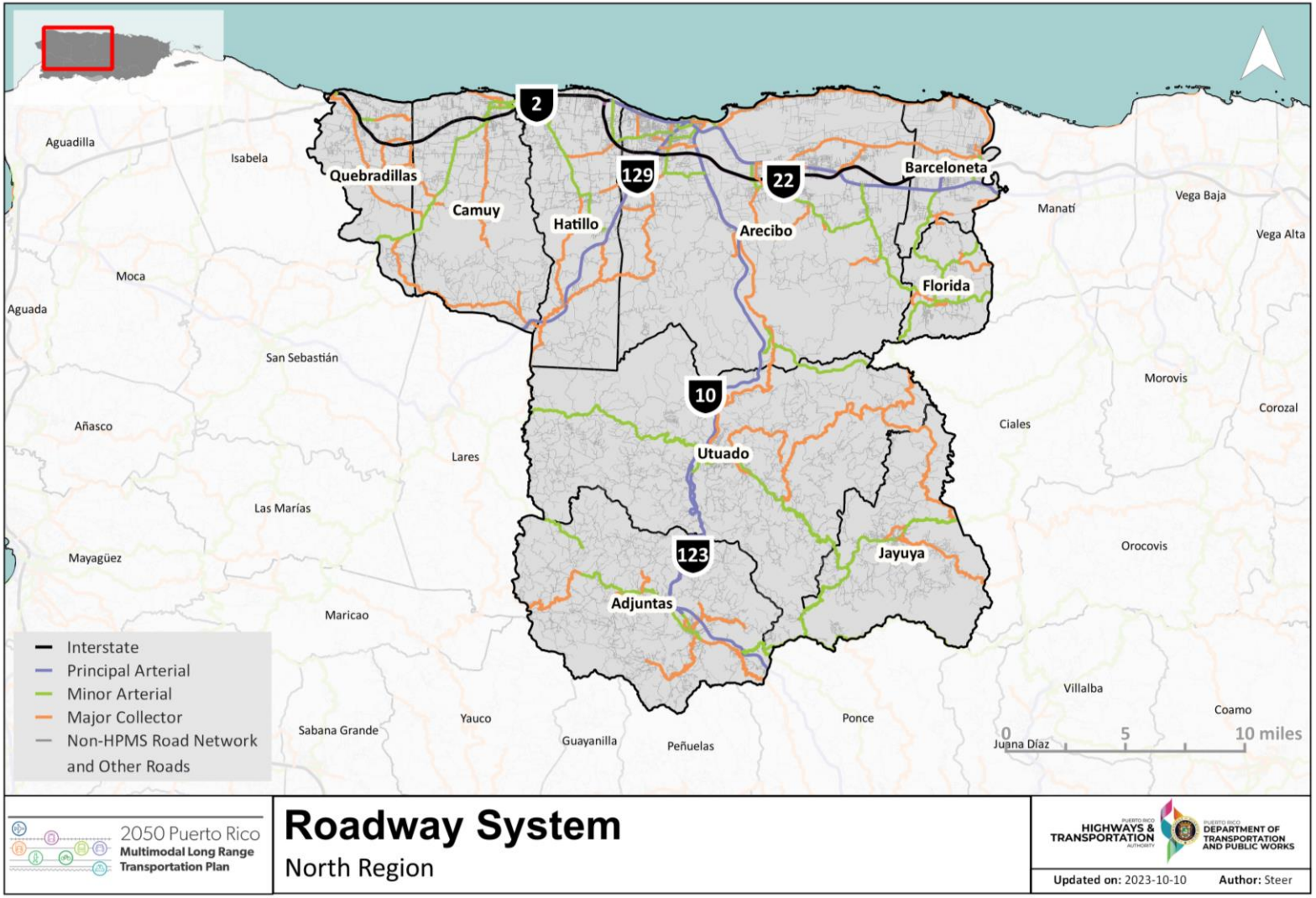
Table 3.6 shows the roads that belong to the first three (3) functional classifications available by FHWA Categories (Interstate, freeway and expressway, principal arterial), when applicable.

Table 3.6: Roadway System by Functional Classification, Route Name – East Region (UZA)

Functional Classification	Road Name
Interstate	PR-3, PR-53
Principal Arterial	PR-194, PR-195, PR-987, Forestal Drive, Tarawa Drive

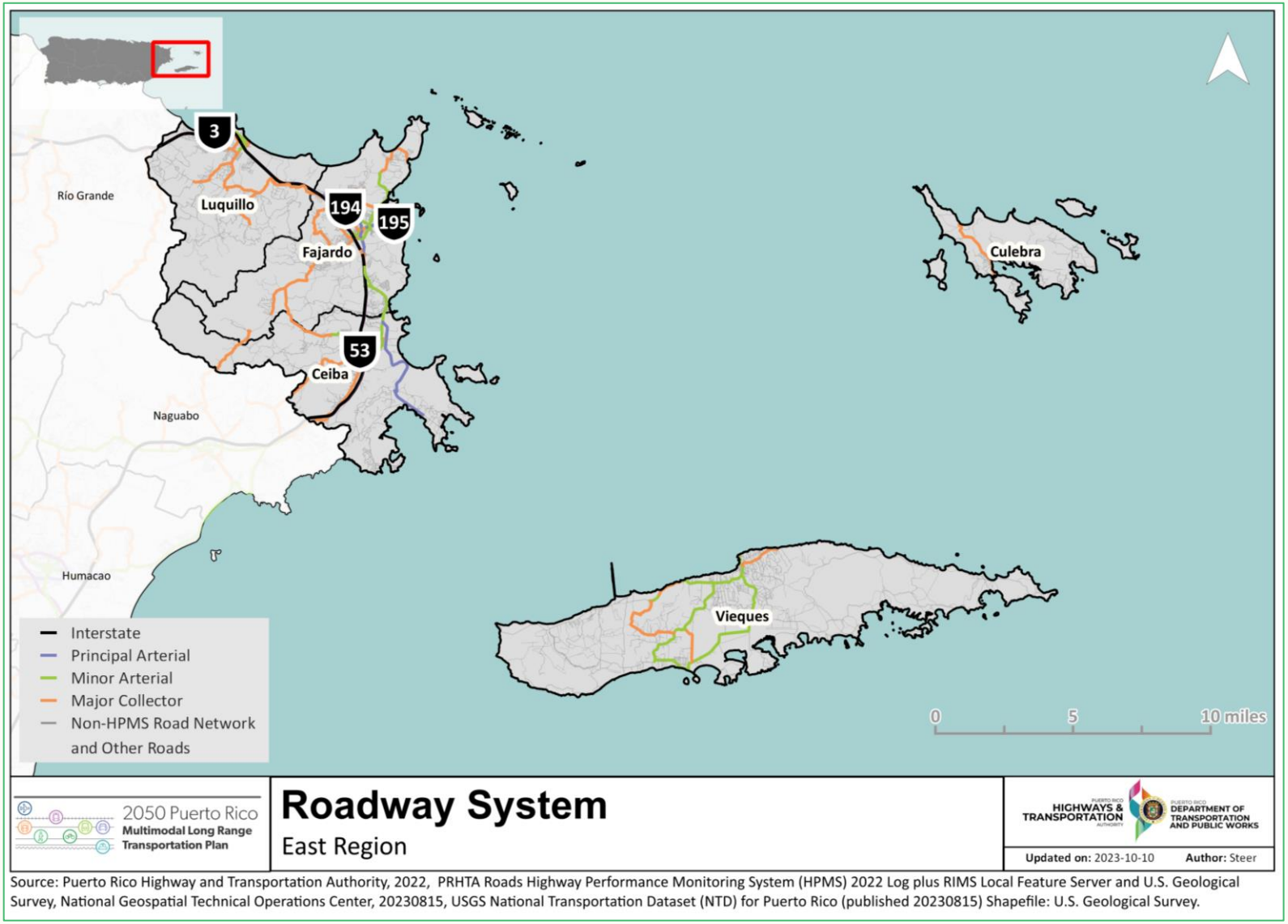
Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server

Figure 3.23: North TPR Roadway System



Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.24: East TPR Roadway System



Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

The South Region of UZA roadway network for 2021 had a total of 2,590.37 road miles as defined by the Highway Performance Monitoring System (HPMS) and the Roadway Information Management System (RIMS). Figure 3.24 shows the highway system as by the HPMS and RIMS for the South Region.

Table 3.7 describes the number of road miles according to the network functional classifications. This table was created based on the HPMS information layer.

Table 3.7: Roadway System by Functional Classification, Route Miles – South Region (UZA)

Functional Classification	Road Miles
Interstate	45.65
Freeways and Expressways	11.40
Principal Arterials	37.91
Minor Arterials	147.16
Major Collector	188.25
Minor Collector	35.59
Local	2,124.40

Table 3.8 shows the roads that belong to the first three (3) functional classifications available by FHWA Categories (Interstate, freeway and expressway, principal arterial), when applicable.

Table 3.8: Roadway System by Functional Classification, Route Name – South Region (UZA)

Functional Classification	Road Name
Interstate	PR-2, PR-52
Freeway and Expressway	PR- 12, PR-10, PR-9
Principal Arterial	PR-1, PR-116, PR-10, PR-12, PR-123, PR-14, PR-149, PR-2, PR-385, PR-5506, PR-9

Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server

The Southeast Region of UZA roadway network for 2021 had a total of 909.85 road miles as defined by the Highway Performance Monitoring System (HPMS) and the Roadway Information Management System (RIMS). Figure 3.24 shows the highway system as defined by the HPMS and RIMS for the Southeast Region.

Table 3.9 describes the number of road miles according to the network functional classifications. This table was created based on the HPMS information layer.

Table 3.9: Roadway System by Functional Classification, Route Miles– Southeast Region (UZA)

Functional Classification	Road Miles
Interstate	24.86
Principal Arterials	15.24
Minor Arterials	65.21
Major Collector	48.56
Minor Collector	20.76
Local	735.23

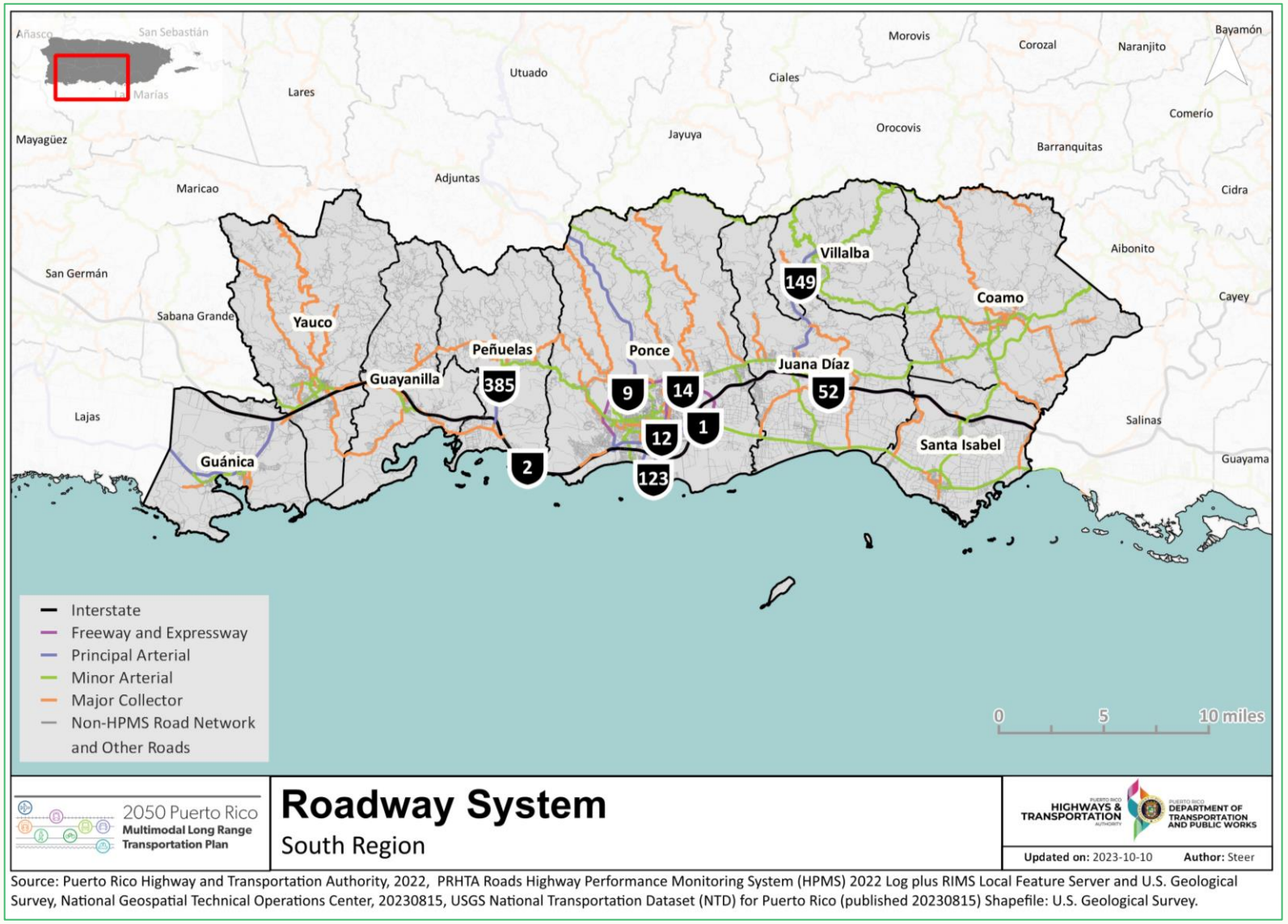
Table 3.10 shows the roads that belong to the first three (3) functional classifications available by FHWA Categories (Interstate, freeway and expressway, principal arterial), when applicable.

Table 3.10: Roadway System by Functional Classification, Route Name – Southeast Region (UZA)

Functional Classification	Road Name
Interstate	PR-53, PR-52
Principal Arterial	PR-54, PR-3

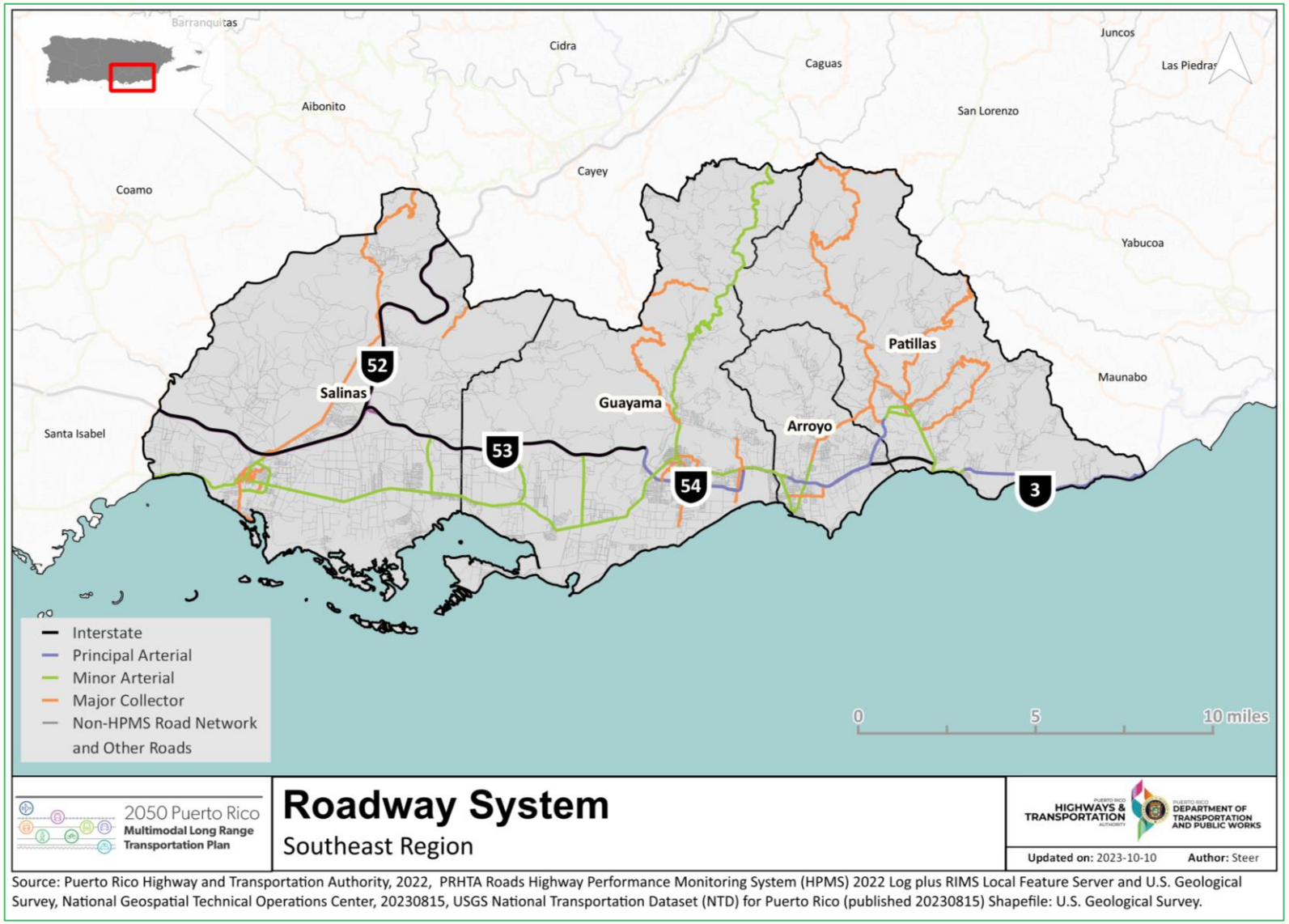
Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server

Figure 3.25: South TPR Roadway System



Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.26: Southeast TPR Roadway System



Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

The Southwest Region of UZA roadway network for 2021 had a total of 1,770.02 road miles as extracted from the Highway Performance Monitoring System (HPMS) and the Roadway Information Management System (RIMS). Figure 3.26 shows the highway system as defined by the HPMS and RIMS for the Southwest Region.

Table 3.11 describes the number of road miles according to the network functional classifications. This table was created based on the HPMS information layer.

Table 3.11: Roadway System by Functional Classification, Route Miles – Southwest Region (UZA)

Functional Classification	Road Miles
Interstate	26.10
Principal Arterials	32.43
Minor Arterials	139.02
Major Collector	112.94
Minor Collector	42.92
Local	1,416.61

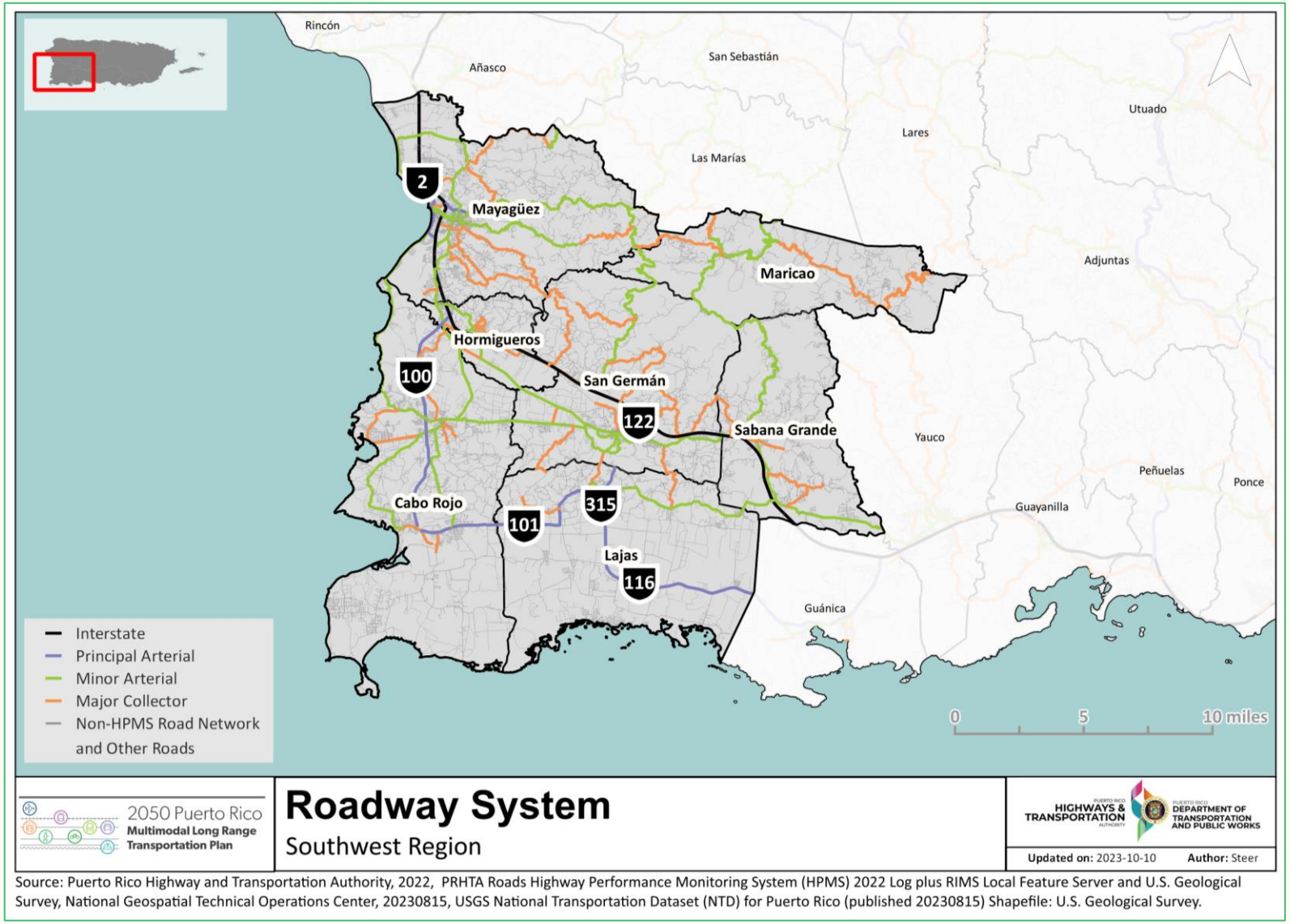
Table 3.12 shows the roads that belong to the first three (3) functional classifications available by FHWA Categories (Interstate, freeway and expressway, principal arterial), when applicable.

Table 3.12: Roadway System by Functional Classification, Route Name – Southwest Region (UZA)

Functional Classification	Road Name
Interstate	PR-2
Principal Arterial	PR-100, PR-101, PR-102, PR-116, PR-122, PR-239, PR-315, PR-63, PR-65

Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server

Figure 3.27: Southwest TPR Roadway System



Source: Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Luis Muñoz Marín Panoramic Route

The Luis Muñoz Martín Panoramic Route is a combination of routes that ran through the central mountain range. This road was finished in 1974 and has served the Island as a recreational facility that crosses the territory from East to West.

The DTPW and the PRHTA completed the Update to the Corridor Management Plan for the Luis Muñoz Marín Panoramic Route in 2021 with an allocation of the FHWA State Planning and Research Program. The Updated plan includes goals for the preservation of the cultural and scenic values of the Route, as well as for the safety of its users and socio-economic development.

The Panoramic Route provides visitors of all ages diverse opportunities to explore the Island's cultural, historical, natural, scenic, and recreational resources as well as to experience local traditions and the rural way of life[70].

This route serves as a gateway, connecting the traveler to other regions in a safe and coherent manner, educating the users about its resources. It is also meant to preserve and enhance the natural beauty of the interior of Puerto Rico for residents and visitors, while offering an opportunity of socio-economic development and the achievement of goals related to vitality and tourism[71].

Figure 3.28 to Figure 3.31 show more details about the Panoramic Route. The Route begins in the Municipality of Mayagüez and ends in the Municipality of Maunabo. The Panoramic Route does not cross the East TPR, it crosses through the following UZAs as shown in Table 3.13.

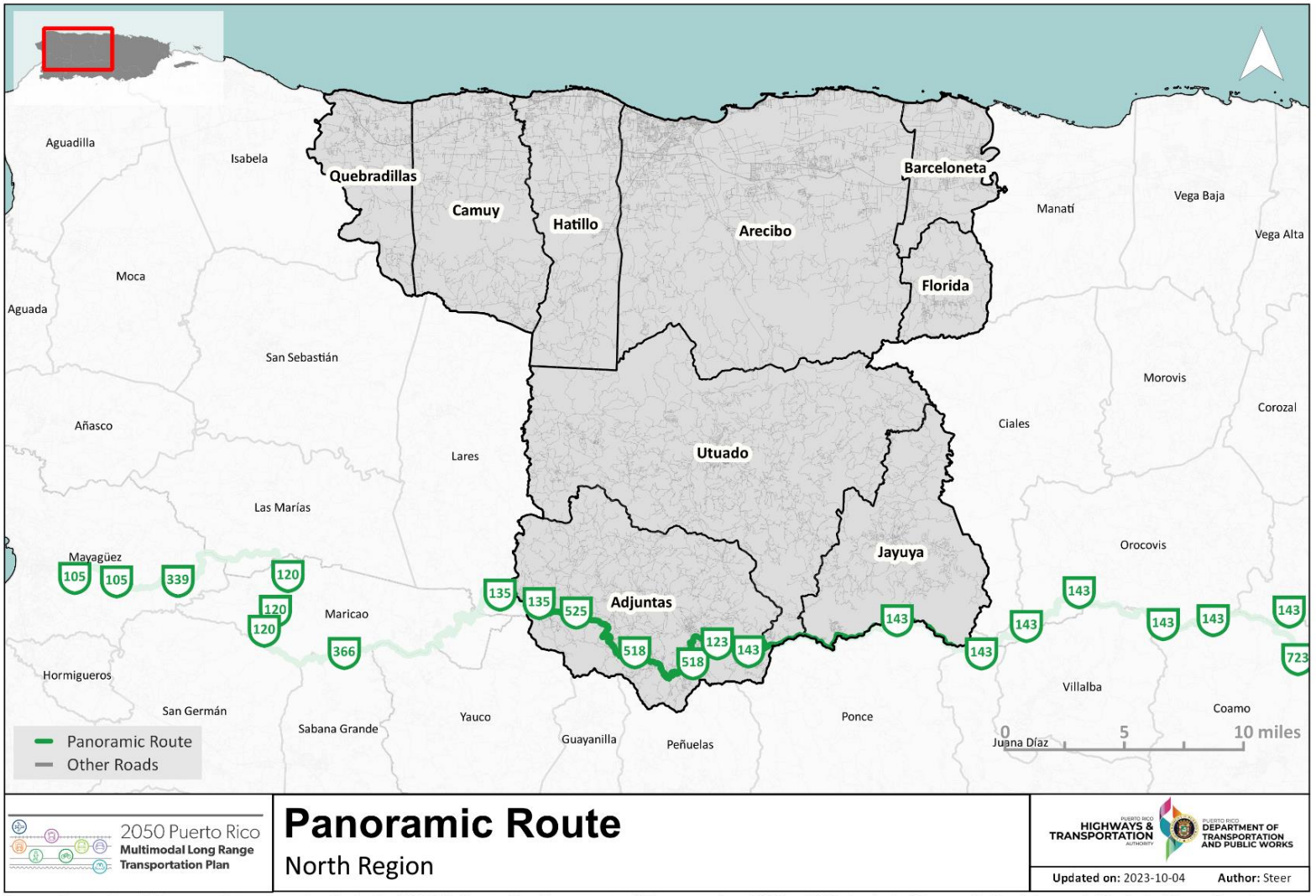
Table 3.13: Panoramic Route Details (Municipalities) - UZA Regions

TPR	Impacted Municipalities				
North Region	Adjuntas	Jayuya	Utuado		
South Region	Coamo	Yauco	Villalba	Ponce	Juana Díaz
Southeast Region	Patillas	Guayama			
Southwest Region	Sabana Grande	Maricao	San Germán	Mayagüez	

Source: 2045 LRTP, ACT, 2018

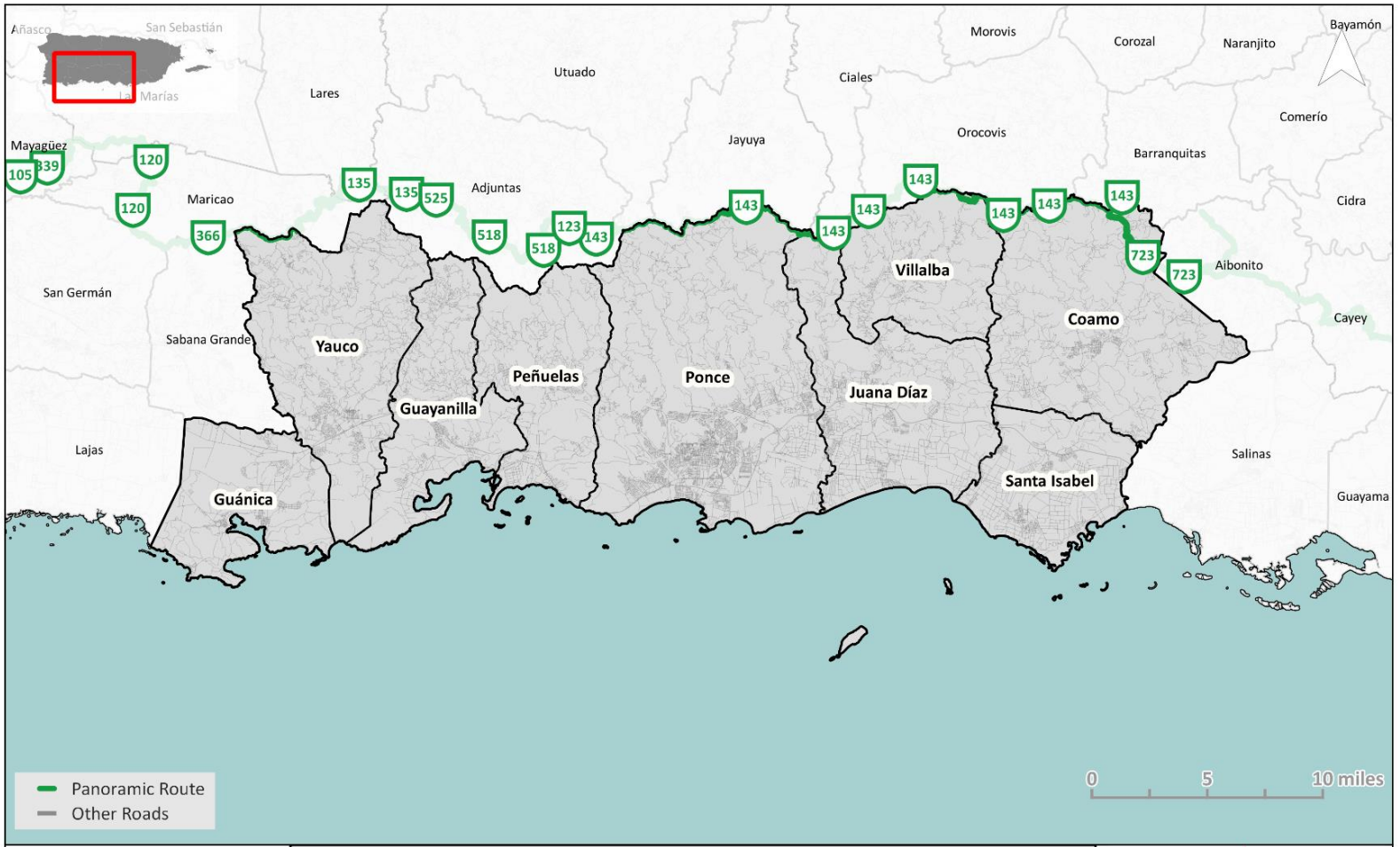
70. Puerto Rico Highway and Transport Authority (2023). Planificación Estratégica. Retrieved from: https://act.dtop.pr.gov/planificacion-estrategica/ on October 2023.
71. Puerto Rico Highway and Transport Authority (2023). Planificación Estratégica. Retrieved from: https://act.dtop.pr.gov/planificacion-estrategica/ on October 2023.

Figure 3.28: North TPR Impact of the Luis Muñoz Marín Panoramic Route



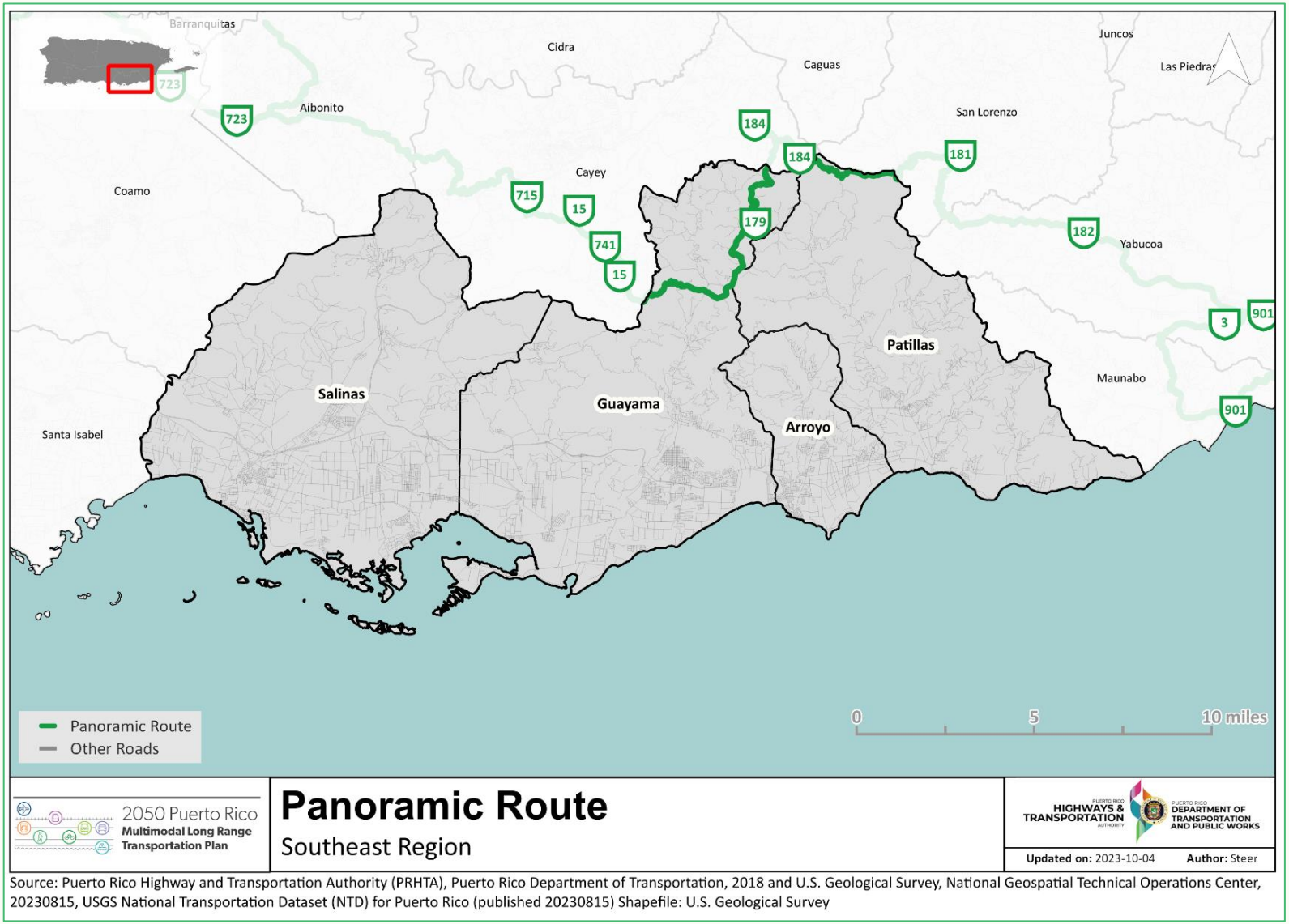
Source: Puerto Rico Highway and Transportation Authority (PRHTA), Puerto Rico Department of Transportation, 2018 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey

Figure 3.29: South TPR Impact of the Luis Muñoz Marín Panoramic Route



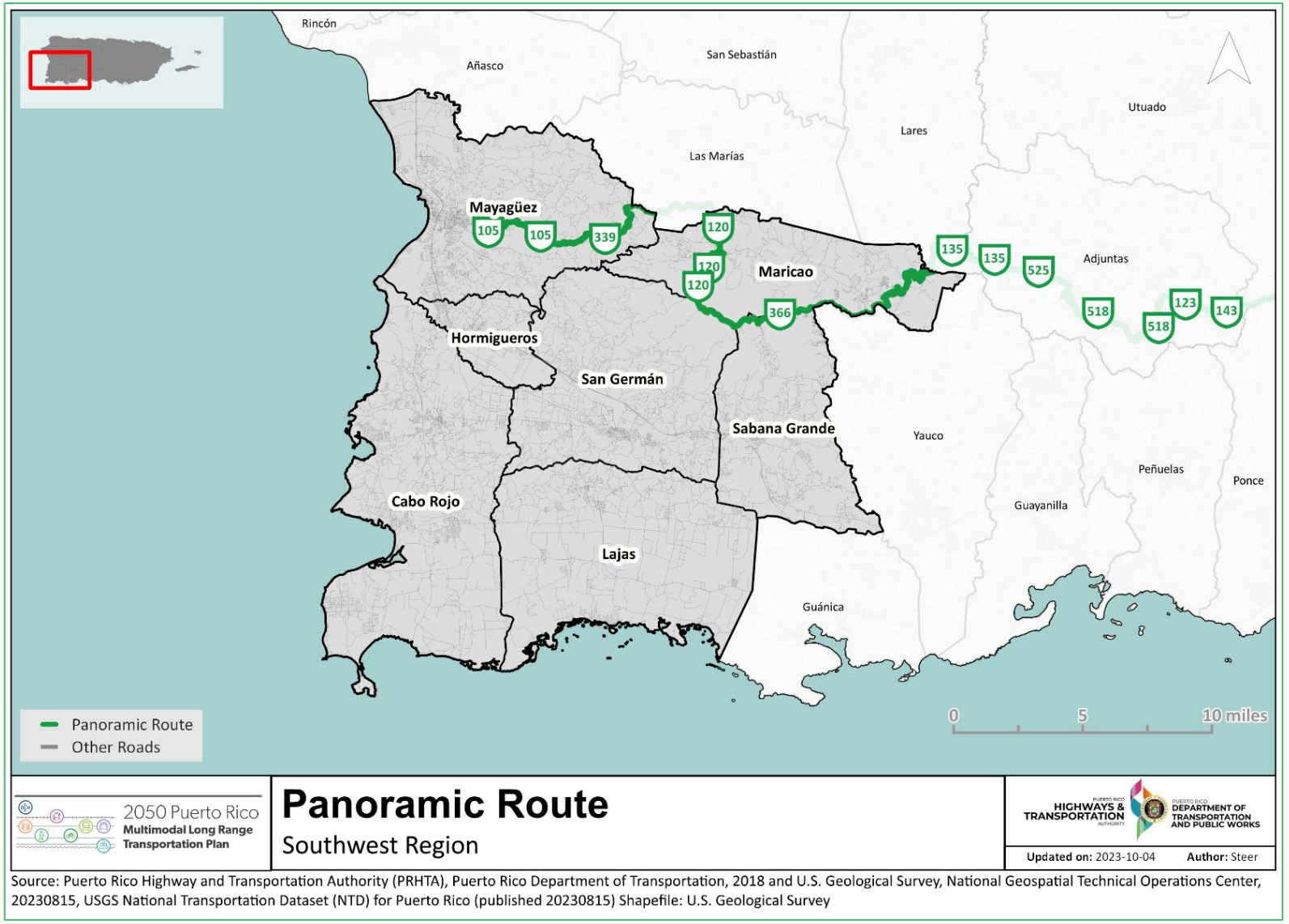
Source: Puerto Rico Highway and Transportation Authority (PRHTA), Puerto Rico Department of Transportation, 2018 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey

Figure 3.30: Southeast TPR Impact of the Luis Muñoz Marín Panoramic Route



Source: Puerto Rico Highway and Transportation Authority (PRHTA), Puerto Rico Department of Transportation, 2018 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey

Figure 3.31: Southwest TPR Impact of the Luis Muñoz Marín Panoramic Route



Source: Puerto Rico Highway and Transportation Authority (PRHTA), Puerto Rico Department of Transportation, 2018 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey

Airports

Puerto Rico is an important location and a central focus for tourism and commercial activity. The Island represents a significant site to national air, terrestrial and maritime transportation as it is well known for its natural resources and its potential for development. Therefore, the airports in the Island serve an important purpose in achieving this potential development through the movement of people and goods in the territory.

The Federal Aviation Administration (FAA), through the National Plan of Integrated Airport Systems (NPIAS) identifies the relevant airports in the U.S. territory for planning purposes. For the Urbanized Areas Under 200,000 in Population, the following airports were identified:

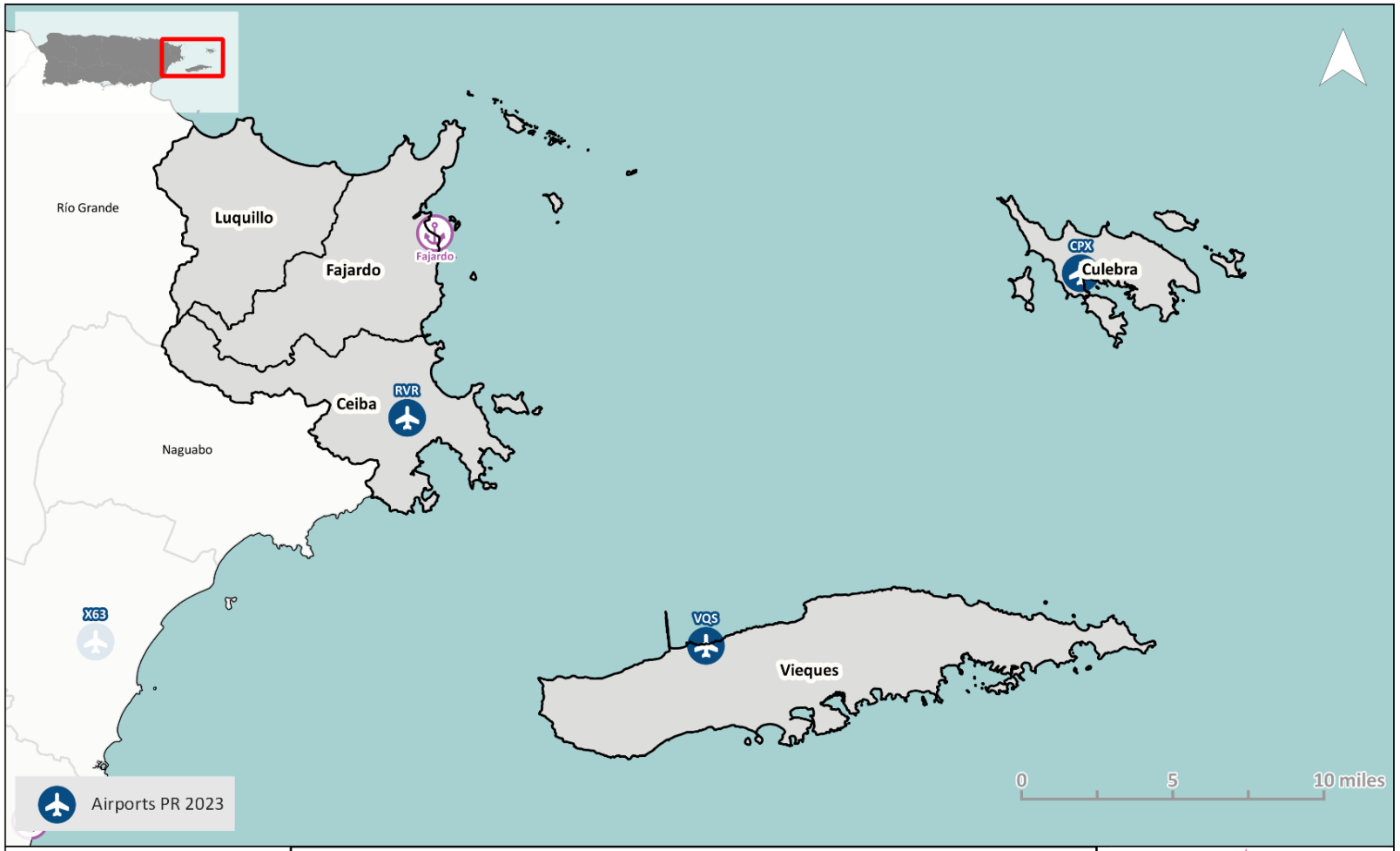
- **Antonio Nery Juarbe Pol Regional Airport in Arecibo (ABO)** – North Region
- **José Aponte de la Torres Airport in Ceiba (RVR)** – East Region.
- **Benjamín Rivera Noriega Airport in Culebra (CPX)** – East Region.
- **Antonio Rivera Rodríguez Airport in Vieques (VQS)** – East Region.
- **Mercedita International Airport in Ponce (PSE)** – South Region.
- **Eugenio María de Hostos Airport in Mayagüez (MAZ)** – Southwest Region

From Figure 3.32 to Figure 3.36 is shown the location for airports and seaports at each TPR within UZA.

Figure 3.32: North TPR Airports and Seaports

Source: U.S. Department of Transportation, Federal Aviation Administration-Aeronautical Information Services, 2023. Puerto Rico Planning Board, 2017

Figure 3.33: East TPR Airports and Seaports

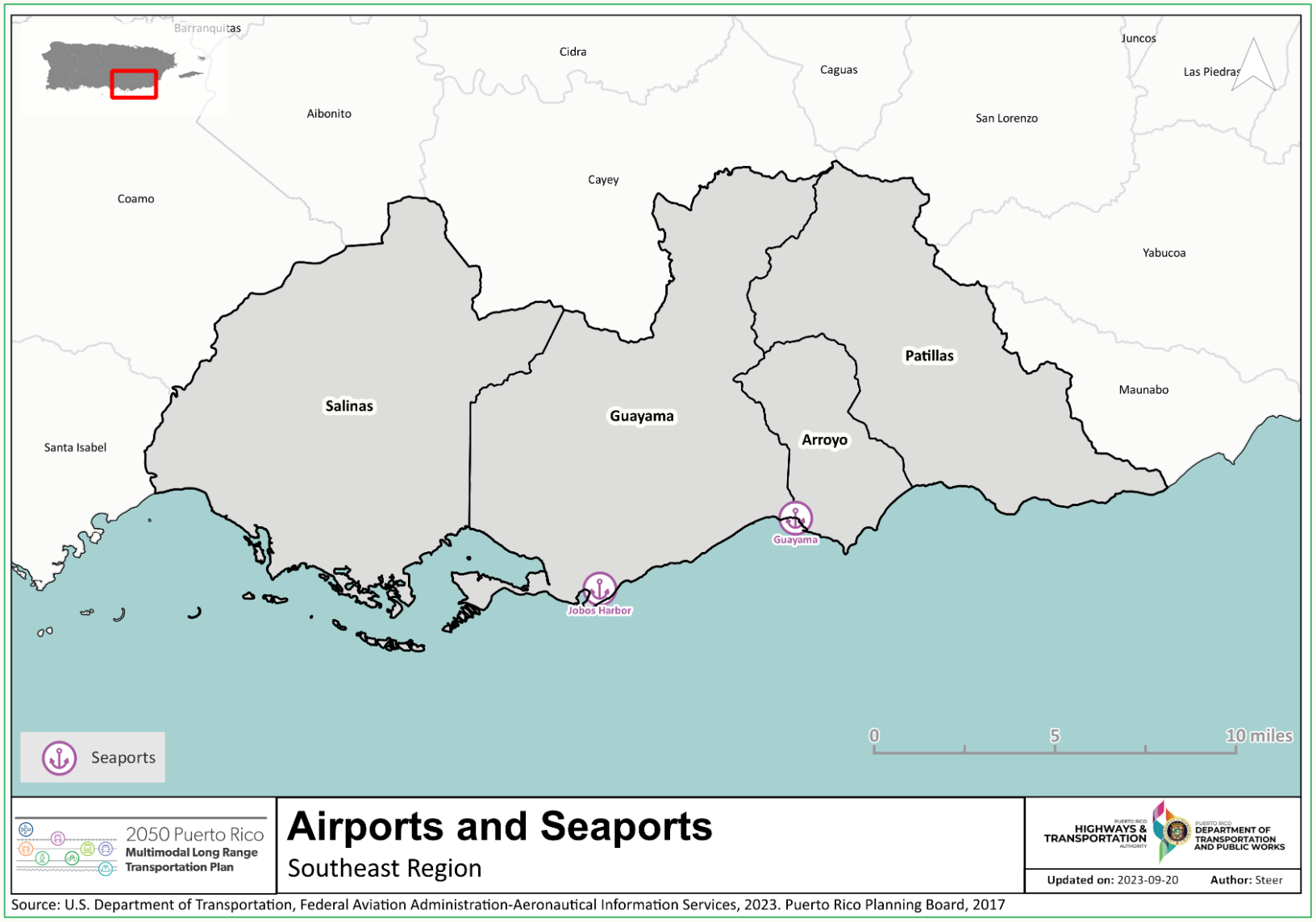


Source: U.S. Department of Transportation, Federal Aviation Administration-Aeronautical Information Services, 2023. Puerto Rico Planning Board, 2017

Figure 3.34: South TPR Airports and Seaports

Source: U.S. Department of Transportation, Federal Aviation Administration-Aeronautical Information Services, 2023. Puerto Rico Planning Board, 2017

Figure 3.35: Southeast TPR Airports and Seaports



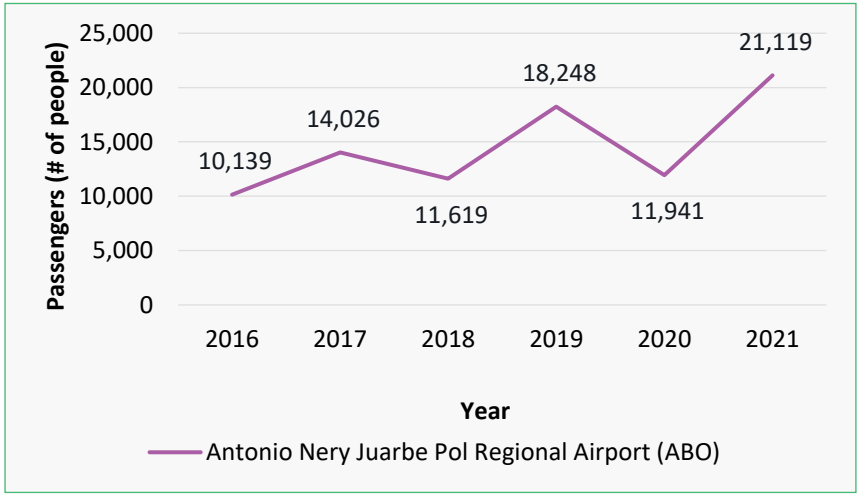
Source: U.S. Department of Transportation, Federal Aviation Administration-Aeronautical Information Services, 2023. Puerto Rico Planning Board, 2017

Figure 3.36: Southwest TPR Airports and Seaports

Source: U.S. Department of Transportation, Federal Aviation Administration-Aeronautical Information Services, 2023. Puerto Rico Planning Board, 2017

The North Region has one (1) airport named Antonio Nery Juarbe Pol Airport (ABO). This airport is located in the Santana neighbourhood, near the southeast part of the city of Arecibo. It was previously used as military facility and now serves for general aviation This airport still open to the public and since 2016 to 2021 this airport had received a total of 87,092 passengers. The total passenger flow for the ABO Airport is shown in Figure 3.37. From 2019 to 2020 this airport had a passenger decrease of 34.6% due to the COVID-19 pandemic.

Figure 3.37: Passengers Flow at North TPR – ABO Airport



Source: Ports Authority, Monthly Operational Report FY2018 to FY2021

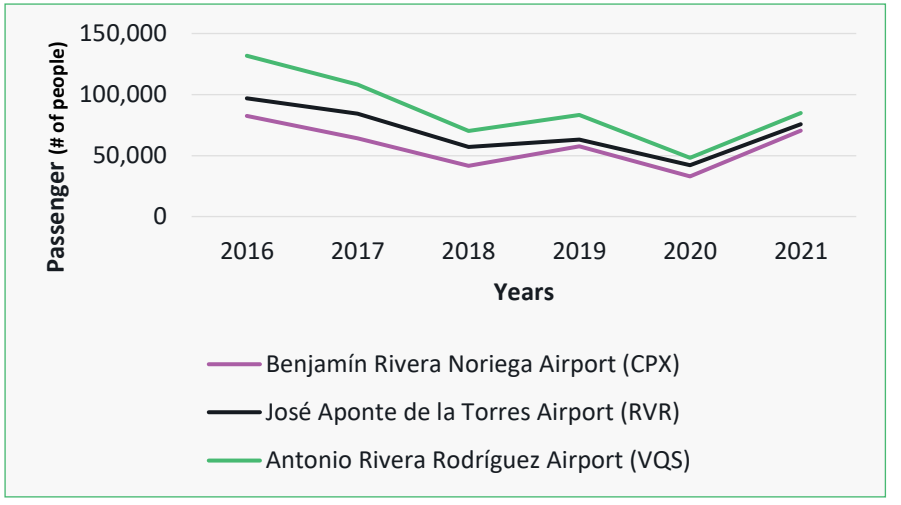
The East Region has three (3) airports located in the municipalities of Ceiba, Culebra, and Vieques.

José Aponte De La Torres Airport is located in the Municipality of Ceiba (RVR). This airport is owned by the Puerto Rico Ports Authority and is primarily used for commercial airlines operating daily flights to Vieques and Culebra. From 2016 to 2021 this airport received a total of 419,907 passengers. The total passenger flow at the RVR Airport is shown in Figure 3.36. From 2019 to 2020 this airport had a passenger decrease of 33.2% due to the COVID-19 pandemic. Table 3.17 shows more detailed information of passenger flow.

Benjamín Rivera Noriega Airport located in the municipality of Culebra (CPX). This airport is owned by the Puerto Rico Ports Authority since 1980 and it's still open to the public. Since 2016 to 2021 this airport has received a total of 349,648 passengers. The total passenger flow at the CPX Airport is shown in Figure 3.36. From 2019 to 2020 this airport had a passenger decrease of 42.9% due to the COVID-19 pandemic. Table 3.17 shows more detailed information of passenger flow.

Antonio Rivera Rodríguez Airport located in the PR-200 in the Municipality of Vieques (VQS). This airport is small airport owned as well by the Puerto Rico Ports Authority and is one of the most important assets in the municipality because of the rising tourism. From 2016 to 2021 this airport had received a total of 527,233 passengers. The total passenger flow at the VQS Airport is shown in Figure 3.38. From 2019 to 2020 this airport has a passenger decrease of 42.1% due to the COVID-19 pandemic. Table 3.14 shows more detailed information of passenger flow.

Figure 3.38: Passengers Flow at East TPR – CPX, RVR, VQS Airports



Source: Ports Authority, Monthly Operational Report FY2018 to FY2021

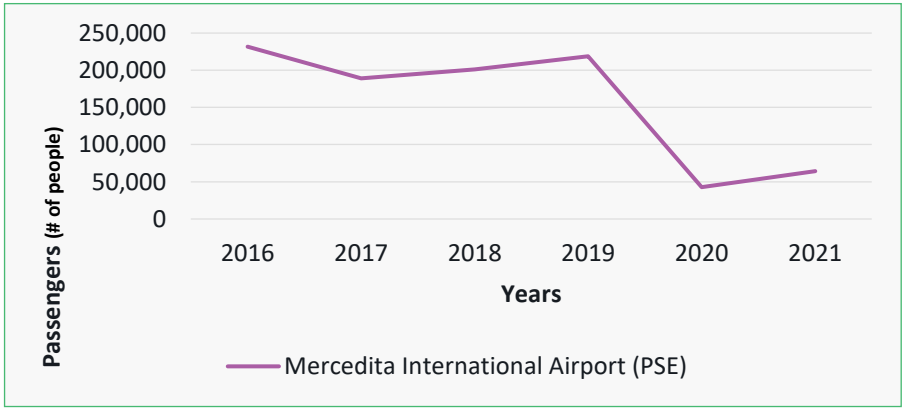
Table 3.14: Airport Passengers Flow for East TPR - CPX, RVR, VQS Airports

Airport	2016	2017	2018	2019	2020	2021
José Aponte De La Torres Airport (RVR)	97,037	84,422	57,202	63,252	42,226	75,768
Benjamín Rivera Noriega Airport (CPX)	82,614	64,303	41,561	57,748	32,971	70,451
Antonio Rivera Rodríguez Airport (VQS)	131,980	108,414	70,374	83,285	48,251	84,929

Source: Ports Authority, Monthly Operational Report FY2018 to FY2021

The South Region has one (1) airport named Mercedita International Airport (PSE). This airport is located in the PR-1 Street, near the east part in the Municipality of Ponce. It was previously a military owned facility, now property of the Puerto Rico's Port Authority. From 2016 to 2021 this airport had received a total of 947,680 passengers. The total passenger flow at the PSE Airport is shown in Figure 3.39. From 2019 to 2020 this airport had a passenger decrease of 80.6% due to the COVID-19 pandemic.

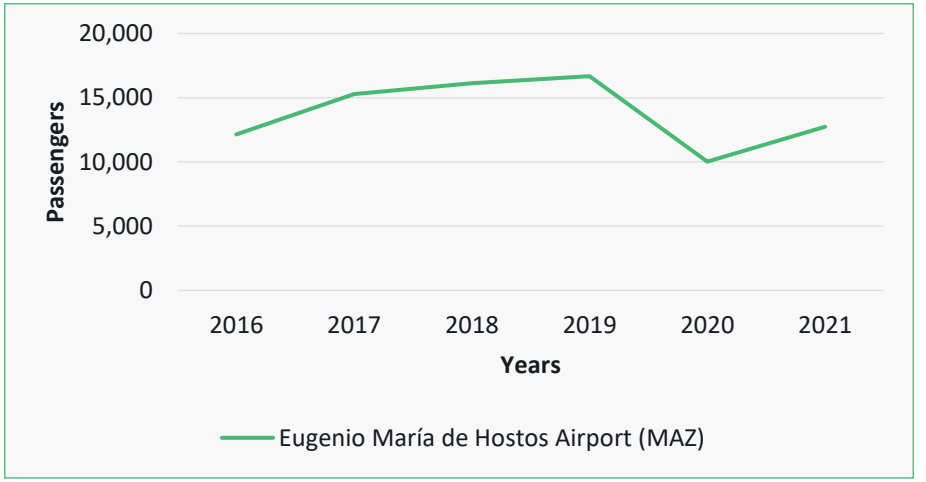
Figure 3.39: Passengers Flow at South TPR – PSE Airport



Source: Ports Authority, Monthly Operational Report FY2018 to FY2021

The Southwest Region have one (1) airport named Eugenio María de Hostos Airport (MAZ). This airport is located near the north side of the city of the Municipality of Mayagüez. This airport serves as an important connection to the Luis Muñoz Marín International Airport, aiding with flights to the U.S. and the Caribbean. Since 2016 to 2021 this airport had received a total of 82,968 passengers. The total passenger flow at the MAZ Airport is shown in Figure 3.40. From 2019 to 2020 this airport had a passenger decrease of 39.9% due to the COVID-19 pandemic.

Figure 3.40: Passengers Flow at Southwest TPR – MAZ Airport



Source: Ports Authority, Monthly Operational Report FY2018 to FY2021

Sea Ports

Puerto Rico is a principal destination in the Caribbean and an important source for economic activity. It also has the capability of managing maritime transportation due to its geographical location. Various seaports in the Island cover the citizen's needs, provide for cruises' arrival, and promote a platform for cargo management and overall development.

The North Region has one (1) seaport located in the north coast of Puerto Rico, specifically in the Municipality of Arecibo and named Port of Arecibo. Is an open bay medium-sized seaport and does not operate with passengers.

The East Region has three (3) seaports located in the municipalities of Ceiba, Vieques and Culebra.

Ceiba's Port is located in the eastern coast of the Island, specifically in the Municipality of Ceiba. This Port is used as a Ferry Terminal in the former Roosevelt Roads Naval Station. Itis mainly used for visitor and local transport to Vieques and Culebra. This Port operates with passengers. There is no official information for this Port from the Puerto Rico Ports Authority.

Vieques Port is located in the Caribbean Sea of Puerto Rico, specifically in the Municipality of Vieques. This port is also known as Isabel Segunda Port and operates with passengers. There is no official information from the Puerto Rico Ports Authority as its operation is controlled for the Maritime Transport Authority.

Culebra's Port is located in the Caribbean Sea of Puerto Rico, specifically in the Municipality of Culebra. This port operates with passengers. There is no official information from the Puerto Rico Ports Authority as its operation is controlled by the Maritime Transport Authority.

The South Region has three (3) seaports located in the municipalities of Ponce, Guayanilla and Guánica.

Rafael Cordero Santiago Port is located in the southern coast of the Island, specifically in the Santiago de los Caballeros Ave. in the Municipality of Ponce. This port is the biggest and main facility in the South Region considering it has eight (8) piers. This port is dedicated to cargo operation and has no passenger operation.

"El Puerto de la Playa de Guayanilla" is located on the south coast of the Island, specifically in the Municipality of Guayanilla. This port has the category of port city and does not have passenger operations.

"El Puerto del Malecón de Guánica" is located south coast of the Island, specifically in the Municipality of Guánica. This is small port with a category of Port City does not have passenger operations.

The Southwest Region has one (1) seaport located at the northwest side of the Municipality of Mayagüez. This port is the third ranked facility in the Island in terms of activity. Located along highways PR-64, PR-341, and PR-3341. This port operates with passenger and is a multipurpose seaport that handles various types of cargo and receives weekly visits by ships serving the Dominican Republic. It is currently the only facility in the Island's western coast capable of docking large cruise ships. There is no official information for this Port from the Puerto Rico Ports Authority.

The North Region of UZA roadway network for 2021 had a total of 2,443.51 road miles as defined by the Highway Performance Monitoring System (HPMS) and the Roadway Information Management System (RIMS). Figure 3.3.22 shows the roadway system as defined by the HPMS and RIMS for the North Region.

Table 3.8 describes the number of road miles according to the network functional classifications. This table was created based on the HPMS information layer.

The Southeast Region has one (1) seaport located in the south coast of the Municipality of Guayama. The Jobos Harbor Port in Guayama have a category of Port city and does not have passenger operations.

Freight

Across the region, UZA's goods enter and exit the Island through seaports and airports, with six (6) available principal airports[72] and eight (8) seaports.

It is important to note, however, that some airports and seaports only service passengers, with no dedicated service for cargo (discussed in greater detail below).

Airports

Locations of principal airports on the UZA Regions are presented before from Figure 3.30 to Figure 3.34.

For the North TPR the ABO, located in the Municipality of Arecibo is dedicated to general aviation, recreational activities, and developments of commercial activities. Location is shown in Figure 3.31.

For the East TPR the RVR located in the Municipality of Ceiba, within the Roosevelt Roads naval base, is principally dedicated to passengers' flights to other near islands. CPX located in the Municipality of Culebra is dedicated to general aviation, commercial and passengers' flights, development of commercial actives and tourism. Finally, VQS located in the Municipality of Vieques is dedicated to commercial aviation, commercial and passengers' flights, development of commercial activities and tourism.

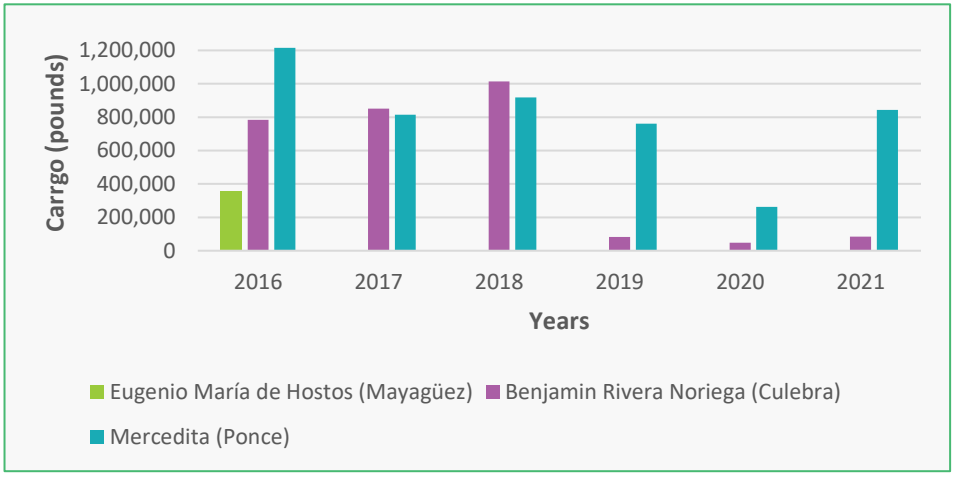
For the South TPR the PSE located in the Municipality of Ponce is dedicated to cargo in support to the Port, commercial flights, development of commercial activities.

For the Southwest TPR the MAZ located in the Municipality of Mayagüez is dedicated to general aviation, aeronautic education, development of commercial activities and tourism. Effects of COVID-19 pandemic in Air cargo

The COVID-19 pandemic evidenced and amplified the territory's economic and social crisis. The immediate response for the Authorities at the Island resulted in quarantine, curfews, and lockdowns per executive orders, including the shutdown of airports. The changes in cargo from each airport is shown in Figure 3.41.

Cargo data for Benjamin Noriega and Eugenio María de Hostos airports, reflects a drop from 2016 to 2017 and then comes with a slight increase by 2018 and 2019, but when it reaches the pandemic year of 2020 it reflects a dramatic decrease for the main airports, and the next year it starts to recover slightly. Mercedita and José Aponte de la Torre airports has been more constant with very slight changes during the years.

Figure 3.41: UZA Region Cargo Airports



Source: Ports Authority, Monthly Operational Report FY2018-2019 to FY2022-2023

72. Airports identified are those included in the National Plan of Integrated Airport Systems (NPIAS) for the period of 2023-2027. This National Plan identifies existing and proposed airports that are significant to national air transportation and are, in consequence, eligible to receive Federal grants under the Airport Improvement Program (AIP)35.

Seaports

In the East TPR the Fajardo Port is located at the Municipality of Fajardo. Information and data for certain ports located within the East, Southeast and North regions is not available.

In the South TPR the Rafael Cordero Santiago Port of the Américas, in the Municipality of Ponce, is a new megaport under construction. The project aims to convert the current Port of Ponce into a value-added, tax-free, customs-free, international shipping hub. Other ports located at the South Region are "El Puerto del Malecón de Guánica", located in the Municipality of Guánica and "El Puerto de la Playa de Guayanilla", located in the Municipality of Guayanilla. Guayanilla's Port is dedicated principally to chemicals and asphalt load and unload, fossil fuels management.

In the Southwest TPR is the Mayagüez Port which is the third ranked facility on the Island in terms of activity. Located along Highways PR-64, PR-341 and PR-3341 It is a multipurpose seaport that handles various types of cargo and receives weekly visits by ships serving the Dominican Republic.

The series of earthquakes in 2020 may have exacerbated damage caused by Hurricane María. A study that assessed underlying infrastructure evidenced that earthquake damage at ports had been exacerbated by underlying corrosion of the structure accelerated by increased exposure to sea water during the hurricane[73].

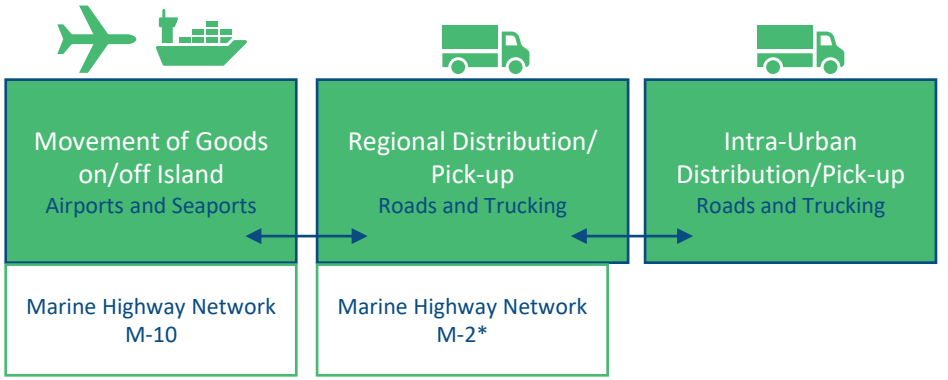
Road Network

With no freight rail on the Island, the road network is the primary facilitator for the movement of goods across the region.

In terms of freight vehicles, goods are moved using a mix of diesel-fueled medium-duty and heavy-duty trucks'[74]. It is assumed that these same trucks are used within smaller urban and local areas, as no light-duty trucks or cars as part of last-mile distribution / pick-up service alternatives (e.g., cargo bikes) have been confirmed. Reflecting 2022 data in the 2050 LRTMP, the existing road freight network is presented from Figure 3.43 to Figure 3.47.

Taking into consideration the above-mentioned information, the current process for moving goods to, from, and within Puerto Rico is presented in the high-level diagram shown in Figure 3.44.

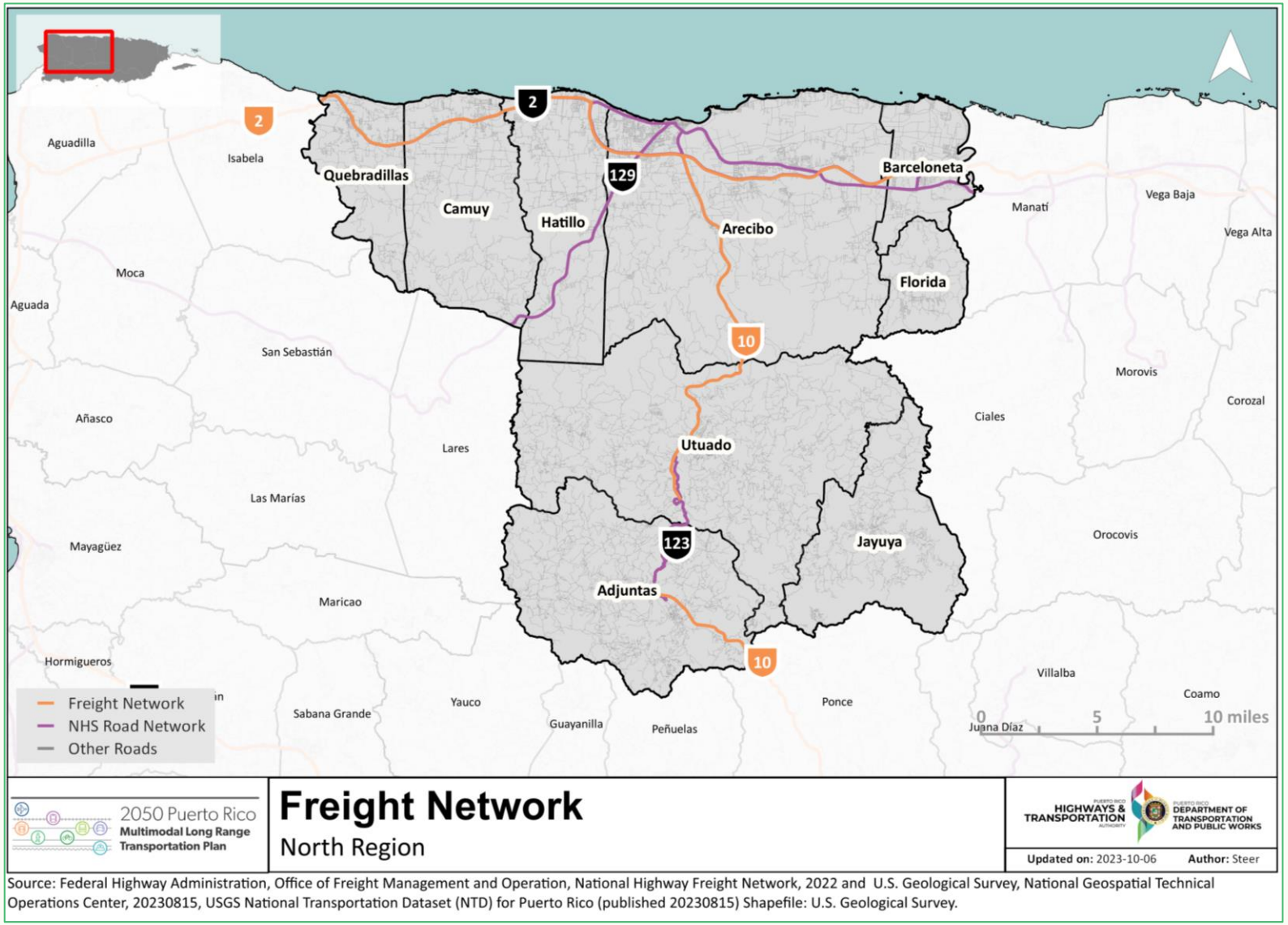
Figure 3.42: Goods Movement Process to / from / within Puerto Rico



*The extent to which the M-2 network is being utilized is currently unknown.
Source: Steer

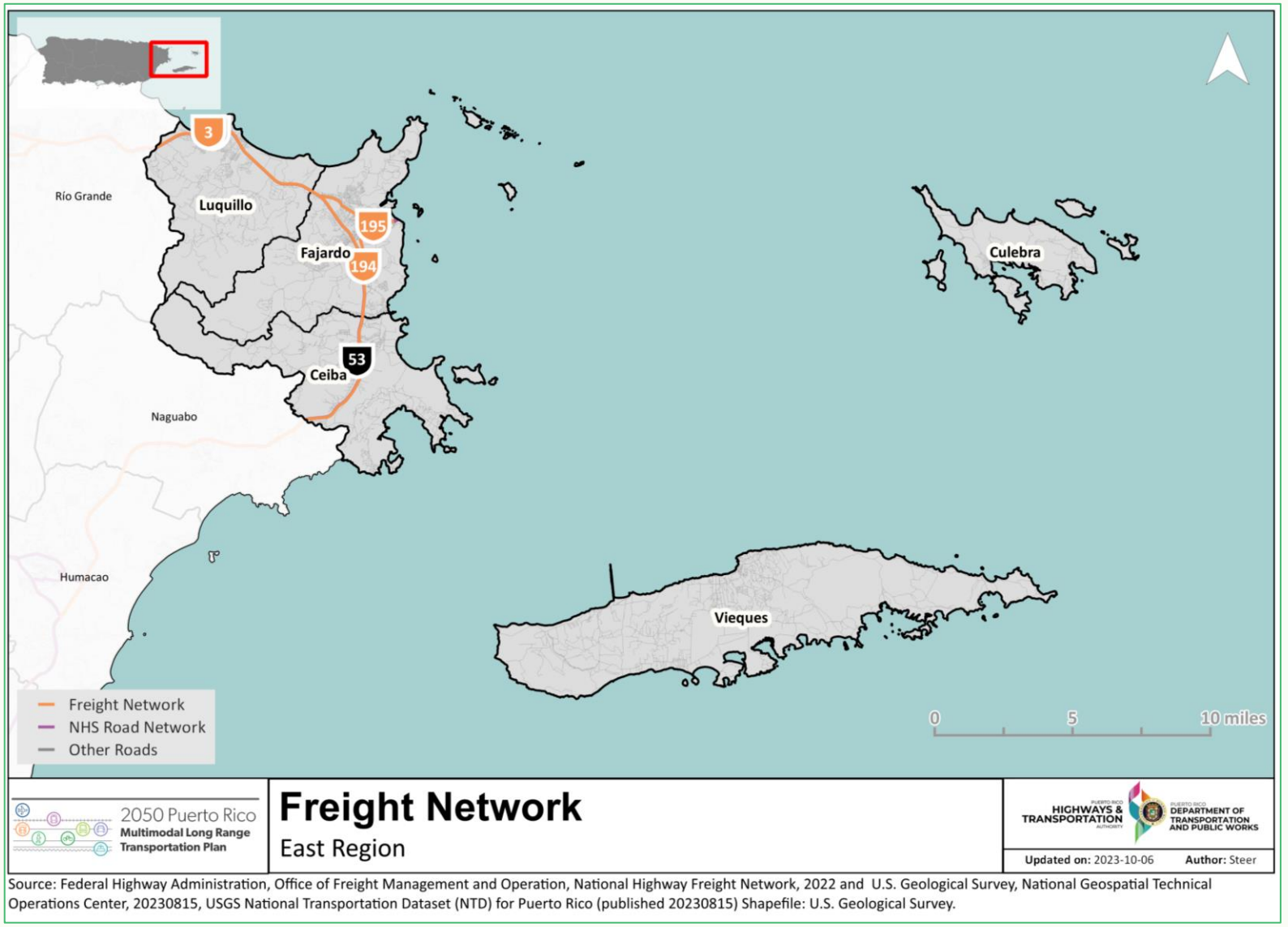
73. Frontiers | Case studies of multi-hazard damage: Investigation of the interaction of Hurricane Maria and the January 2020 earthquake sequence in Puerto Rico (frontiersin.org)
74. Medium trucks are single-unit trucks with two or three axles in FHWA vehicle classifications 5-7. Heavy trucks include all single-trailer and multi-trailer combinations defined in FHWA vehicle classifications 8-13.

Figure 3.43: North TPR Existing Road Freight Network



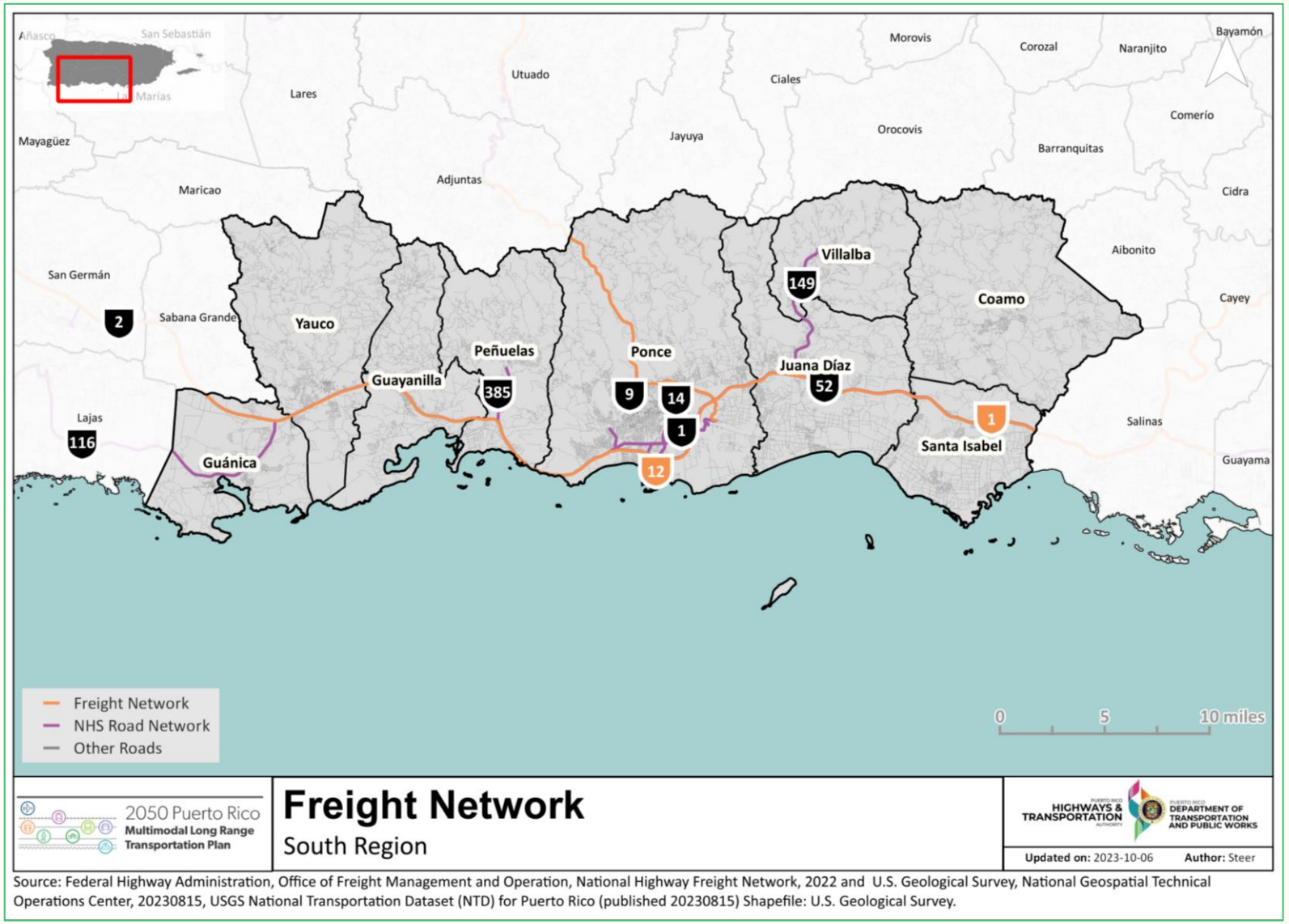
Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.44: East TPR Existing Road Freight Network



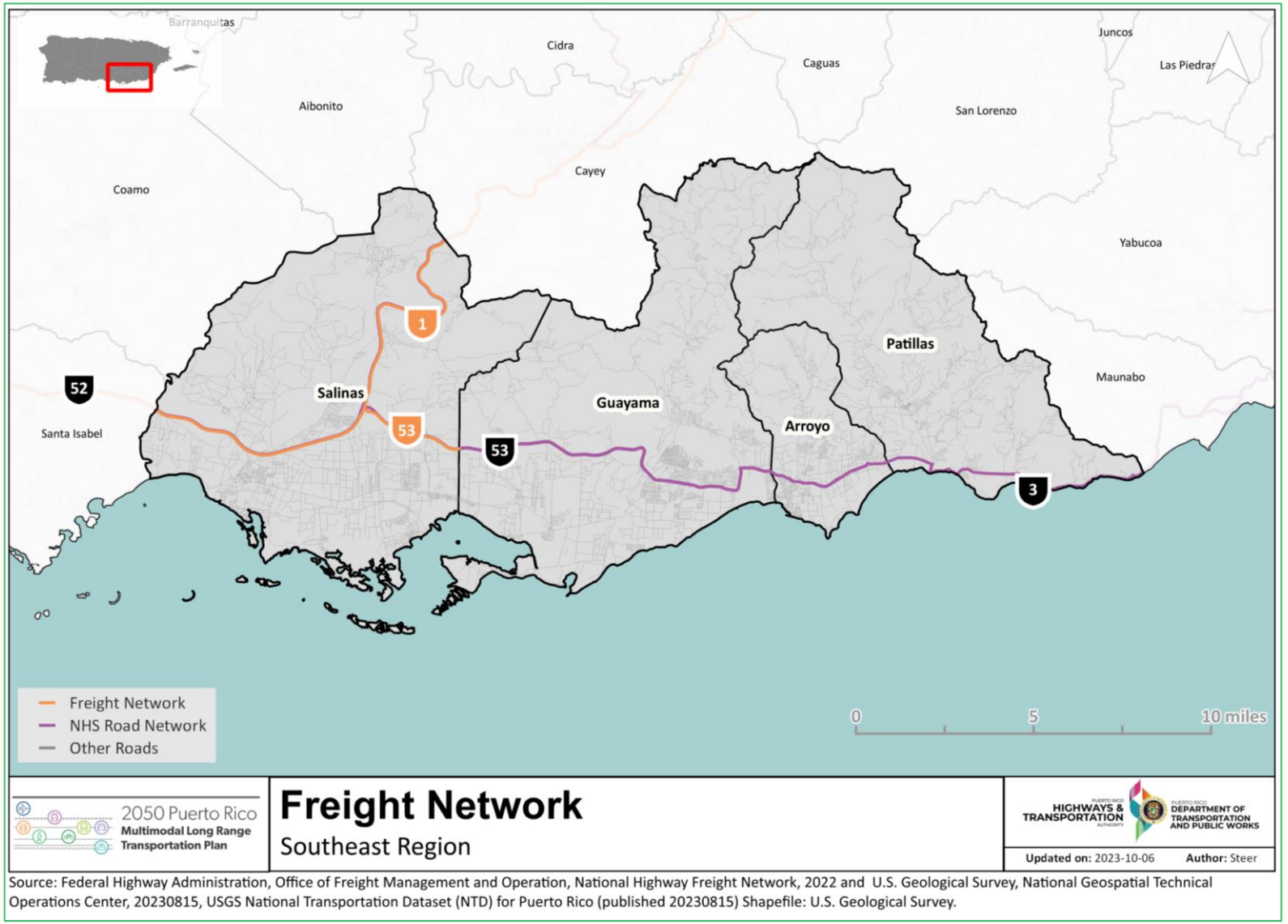
Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.45: South TPR Existing Road Freight Network



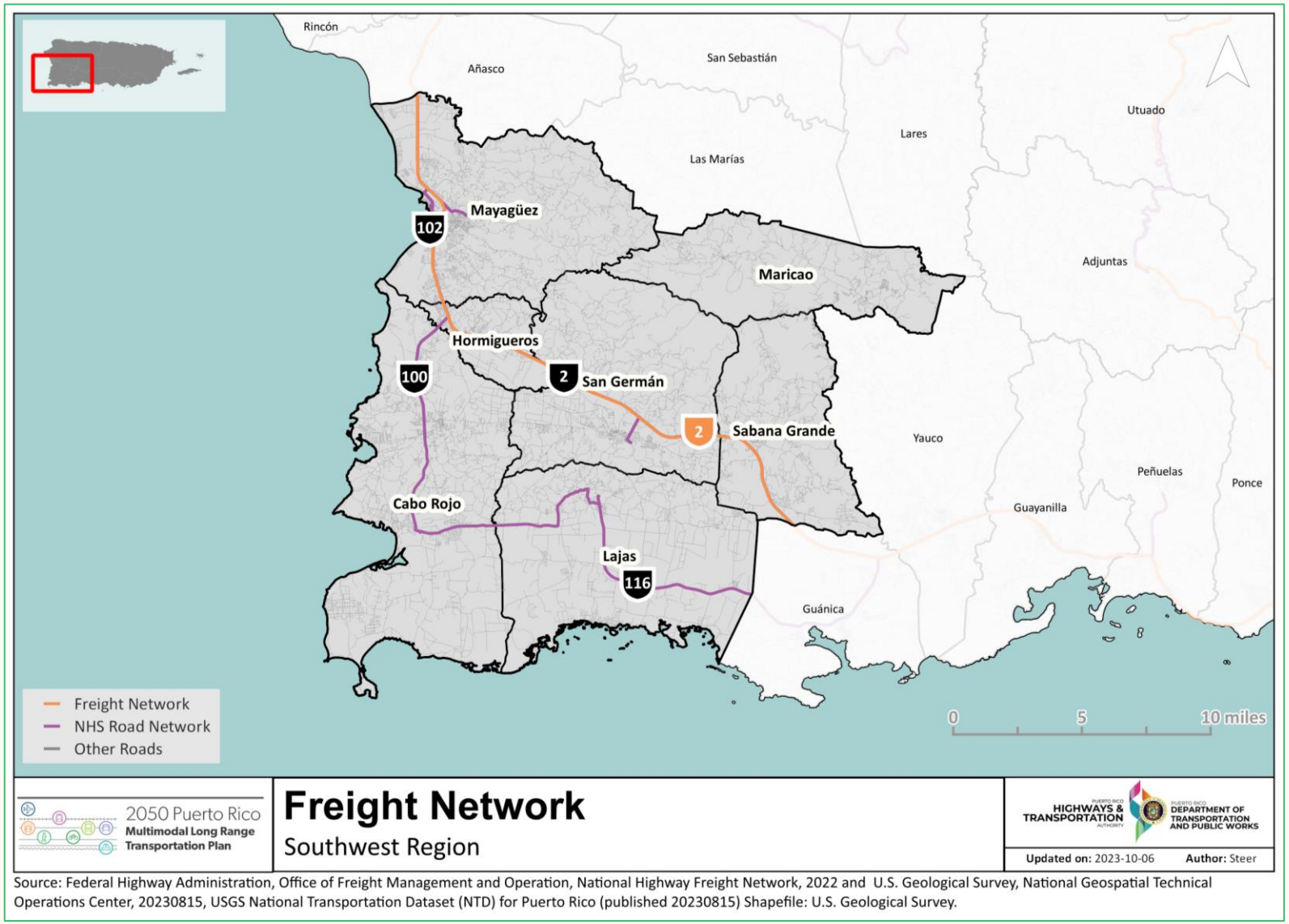
Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.46: Southeast TPR Existing Road Freight Network



Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.47: Southwest TPR Existing Road Freight Network



Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

In the context of Puerto Rico, it is critical to note how this process has and will continue to be disrupted by natural hazard / extreme weather events (e.g., earthquakes, hurricanes, flooding). This will not only impact Puerto Rico's infrastructure, but the welfare of its people and economy.

The most recent hazard events to have disrupted this sector include, for example, Hurricanes María (2017) and Irma (2017), and the 2020 earthquake in the island's southwest region.

Truck Activity

Figure 3.48 to Figure 3.52 shows the existing truck activity in the different UZA Regions as a graduated color graph that represents daily traffic in terms of a truck volume to total vehicle volume ratio. The graph is categorized in three (3) classes: less than 10%, between 10% and 15%; and greater than 15%. The maps indicate sections of the road where traffic is operating at or over the capacity of the road and at the same time being highly used by trucks.

In general, the maps illustrate how truck traffic is increased on the primary interstate highways. Increased traffic can also be observed around ports and industrial zones which is expected but less obvious in minor arterial roads crossing town centers. It shows more concentration on traffic within the metropolitan area, as well as the east and south areas of the Island. Leaving the north and northwest sides of the Island with less concentration of traffic.

In the North TPR, Figure 3.48 shows specifically how the major activity of hotspots is concentrated within the municipalities of Adjuntas, Arecibo, Quebradillas, Camuy, and Hatillo. The concentration of hotspots is noted along PR-2, PR-10, and PR-22

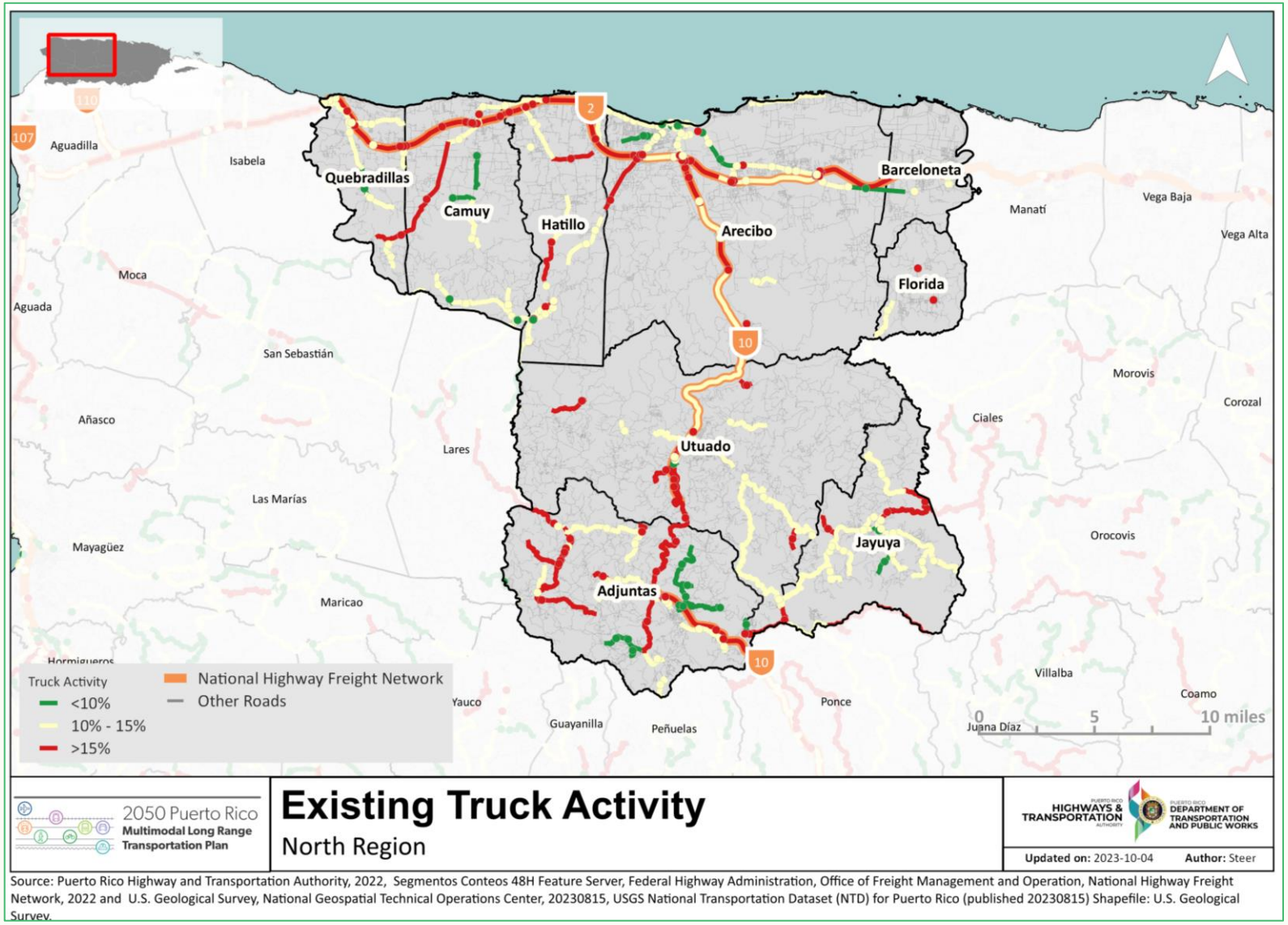
In the East TPR, Figure 3.49 shows specifically how the major activity of hotspots is concentrated within the Municipality of Fajardo. The concentration of hotspots is noted along PR-3, and other main roads as PR-987.

In the South TPR, Figure 3.50 shows specifically how the major activity of hotspots is concentrated within the Municipality of Ponce, but also within the municipalities of Yauco, Guánica, Guayanilla and Juana Díaz. The concentration of hotspots is noted along PR-2, and PR-52, and other main roads as PR-14, PR-12, PR-116, and PR-149.

In the Southeast TPR, Figure 3.51 shows specifically how the major activity of hotspots is concentrated within the municipalities of Guayama and Salinas. The concentration of hotspots is noted along PR-3.

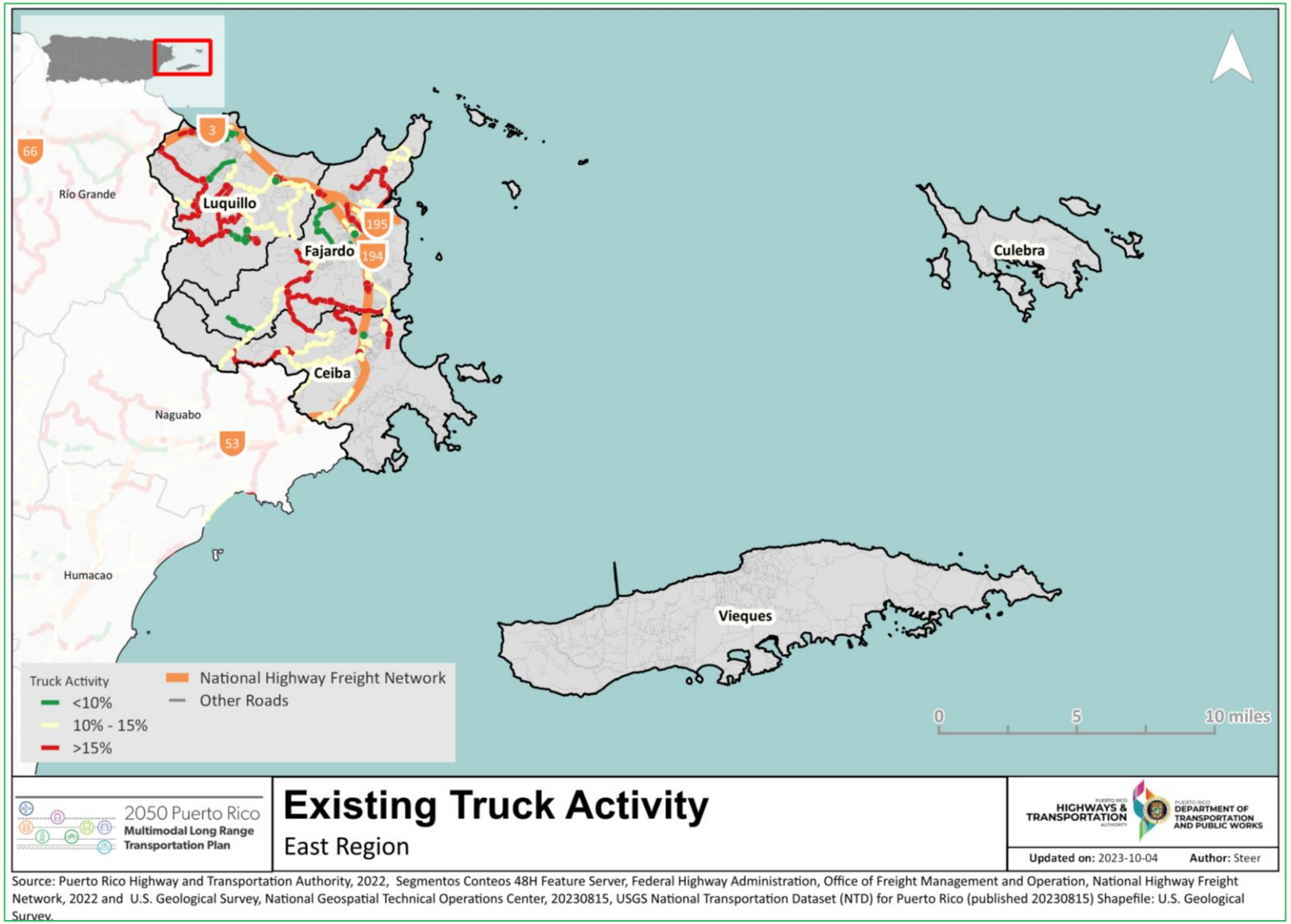
In the Southwest TPR, Figure 3.52 as shown in Figure 3.56 shows specifically how the major activity of hotspots is concentrated within the municipalities of San Germán, Lajas and Mayagüez. The concentration of hotspots is noted along PR-2, and other main roads as PR-101.

Figure 3.48: North TPR Truck Activity



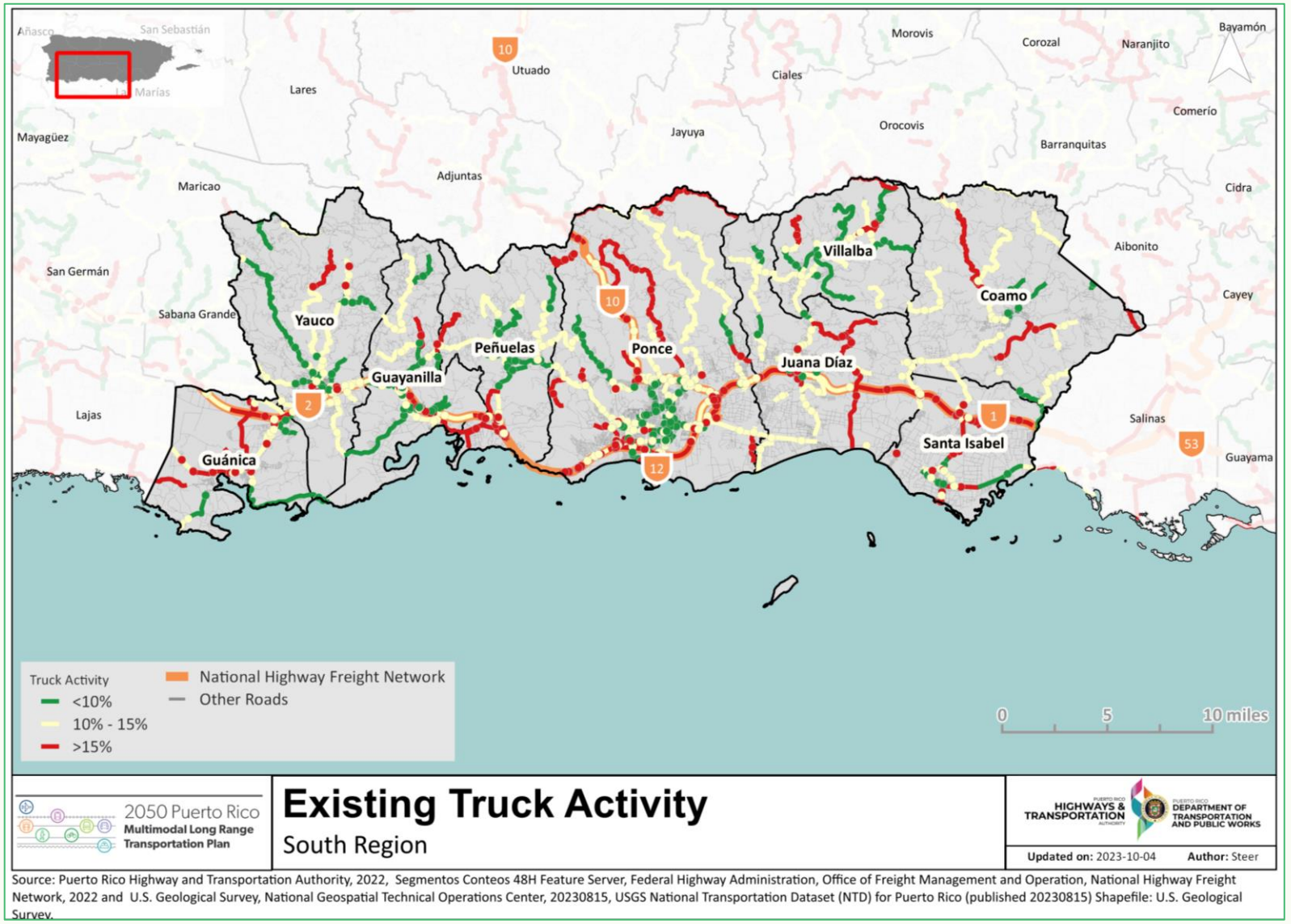
Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.49: East TPR Truck Activity



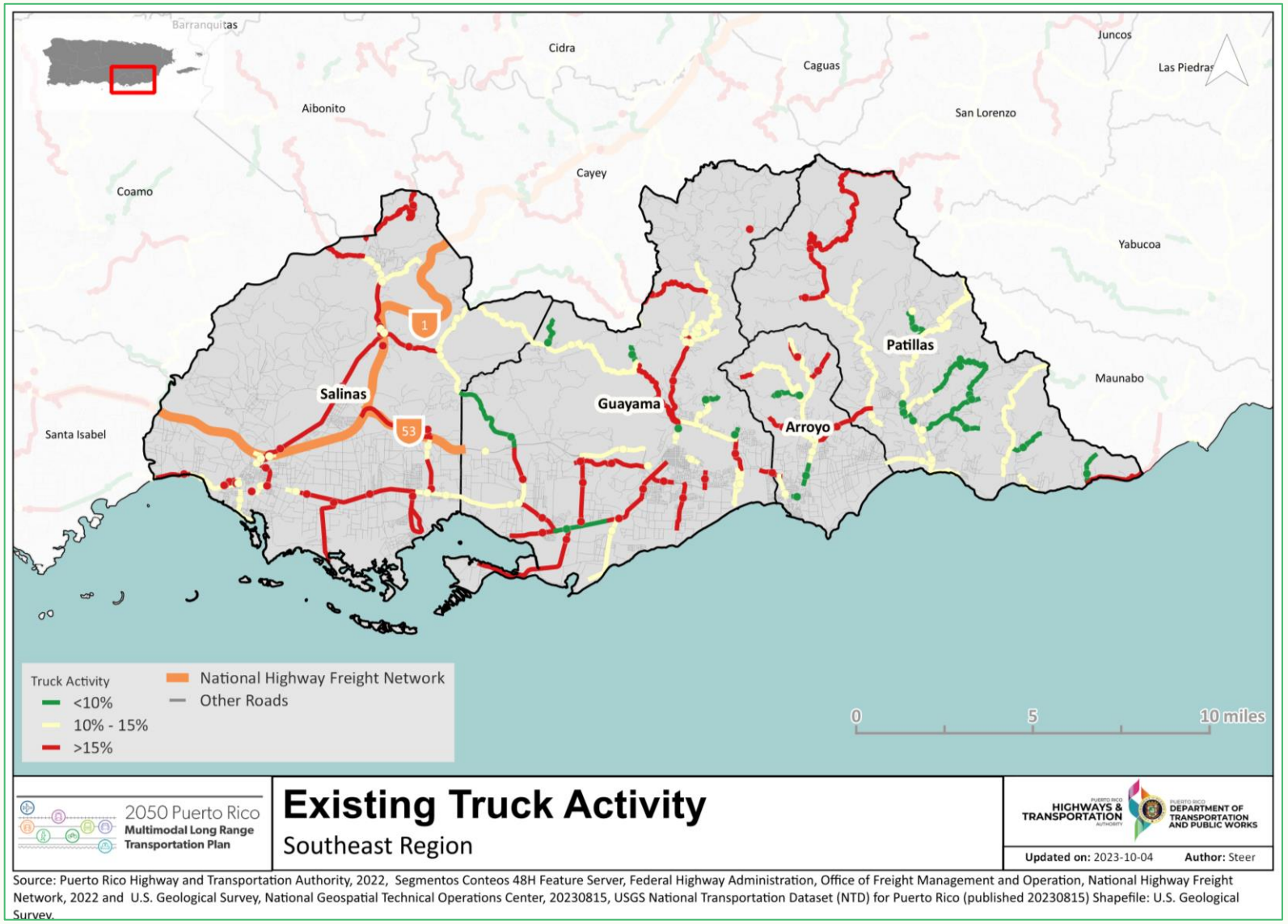
Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.50: South TPR Truck Activity



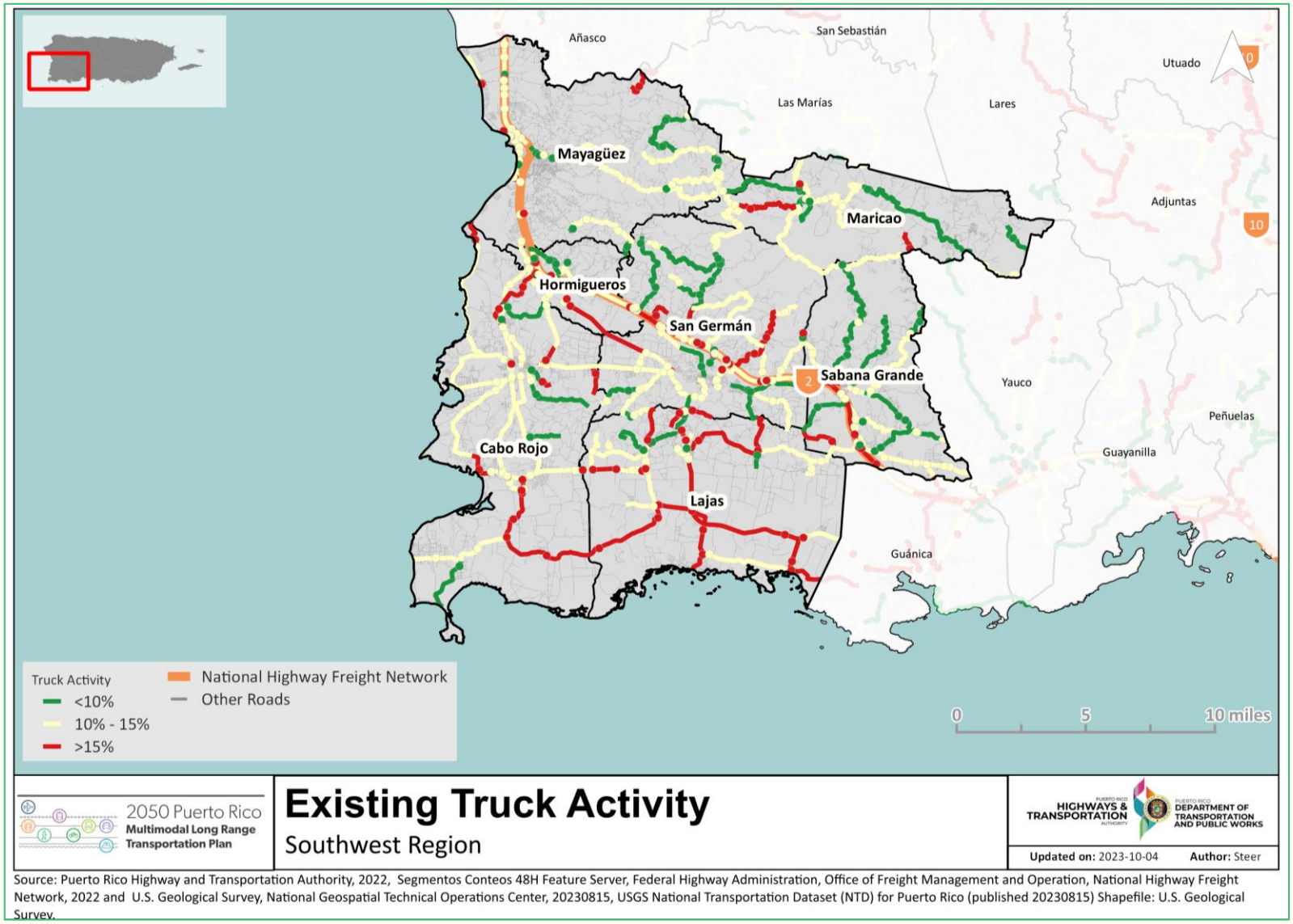
Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.51: Southeast TPR Truck Activity



Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.52: Southwest TPR Truck Activity



Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Truck Activity Hotspots

From Figure 3.53 to Figure 3.57 shows the truck activity hotspots in in the different UZA Regions, indicating sections of the road where traffic is operating at or over the capacity of the road and at the same time being highly used by trucks.

In the North Region, Figure 3.53 shows specifically how the major activity of hotspots is concentrated within the municipalities of Adjuntas, Arecibo, Quebradillas, Camuy, and Hatillo. The concentration of hotspots is noted along PR-2, PR-10, and PR-22.

In the East Region, Figure 3.54 shows specifically how the major activity of hotspots is concentrated within the Municipality of Fajardo. The concentration of hotspots is noted along PR-3, and other main roads as PR-987. It also shows how the major activity concentration is within the three (3) municipalities that composes the Region but isn't along the PR-53 or PR-3 instead it goes from the Ceiba Port along other main roads derived from PR-3 and PR-53 to the interior zone of the Region. The concentration goes through PR-987, PR-982, PR-976, PR-988 and PR-992.

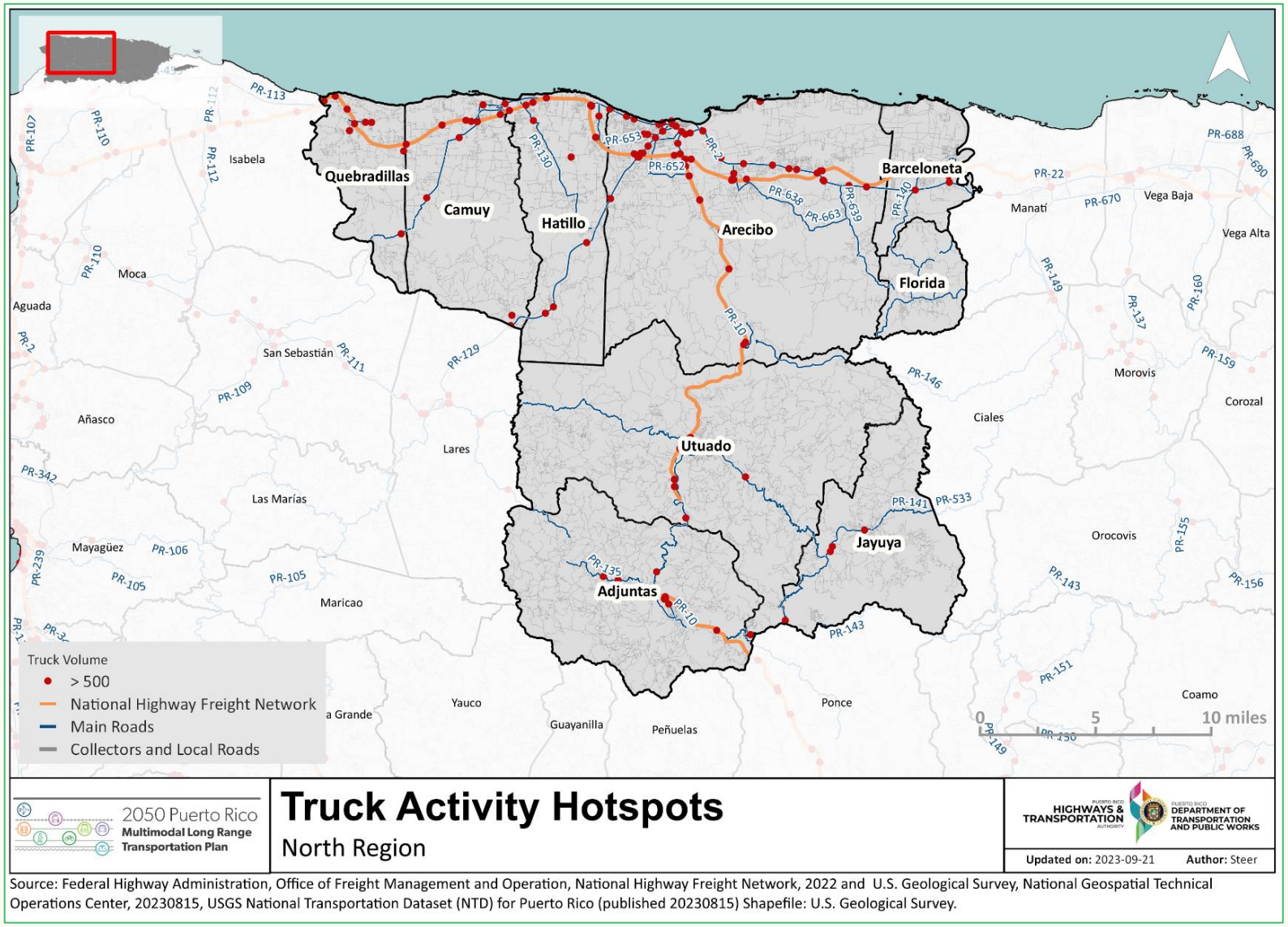
In the South Region, Figure 3.55 shows specifically how the major activity of hotspots is concentrated within the Municipality of Ponce, but also within the municipalities of Yauco, Guánica, Guayanilla and Juana Díaz. The concentration of hotspots is noted along PR-2, and PR-52, and other main roads as PR-14, PR-12, PR-116, and PR-149.

The South Region, as shown in Figure 3.55 shows specifically how the major activity concentration is within the municipalities of Guánica, Guayanilla, Ponce, Juana Díaz and Santa Isabel. The concentration is noted along PR-2 and PR-52, and other main roads as PR-10, PR-116, PR-127, PR-552, PR-551, PR-535, and PR-505 that connects with North Region.

The Southeast Region, as shown in Figure 3.56 shows specifically how the major activity concentration is within the municipalities of Guayama and Salinas. The concentration is noted along PR-1, PR-3, PR-53, and other main roads as PR-15, PR-707, PR-7707, PR-7711, PR-179, PR-184.

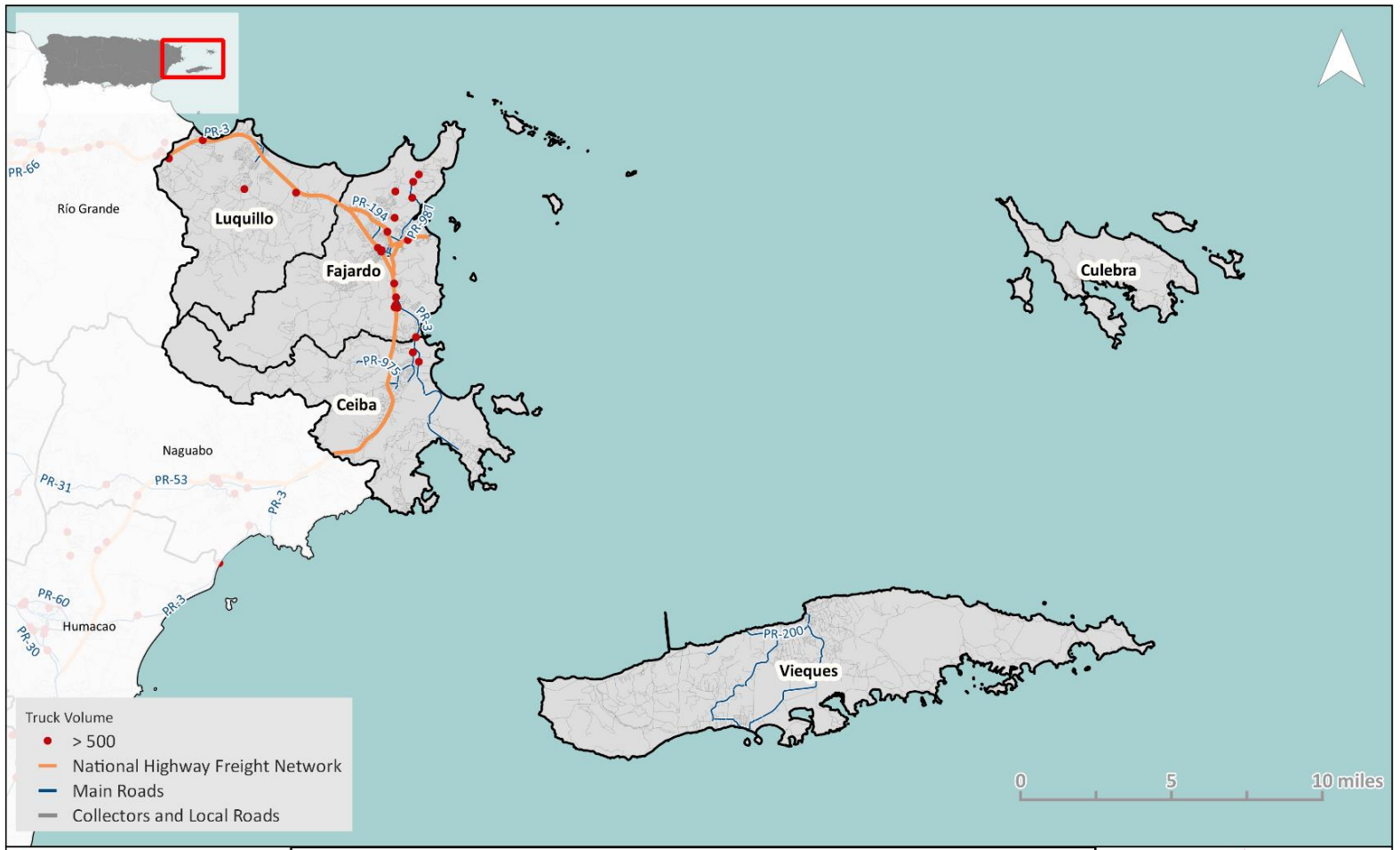
In the Southwest Region, Figure 3.57 shows specifically how the major activity of hotspots is concentrated within the municipalities of San Germán, Lajas and Mayagüez, Hormigueros and Cabo Rojo. The concentration of hotspots is noted along PR-2, and other main roads as PR-101. PR-301, PR-303, PR-304, PR-114, PR-176, PR-117, and PR-202.

Figure 3.53: North TPR Truck Activity Hotspots



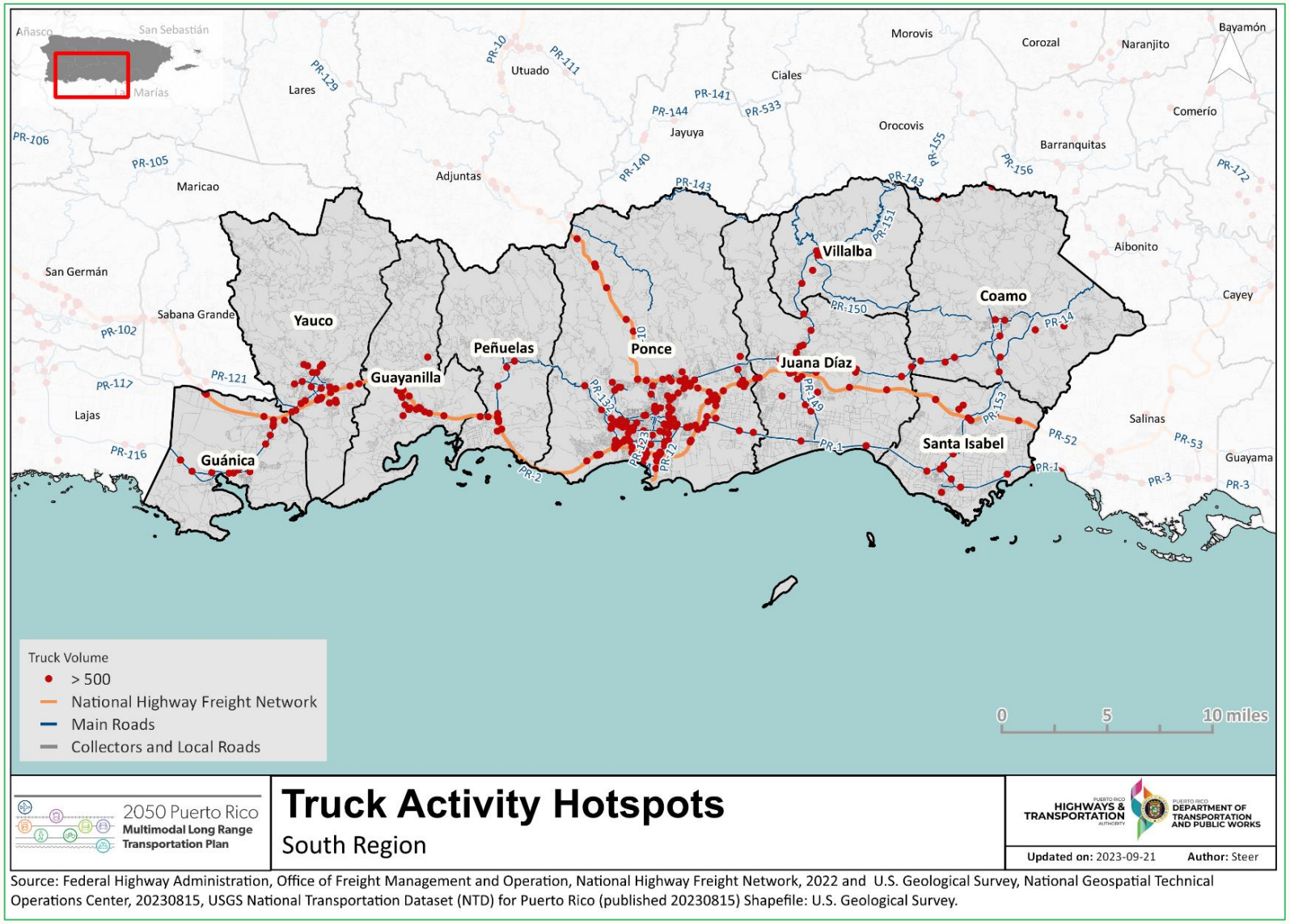
Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.54: East TPR Truck Activity Hotspots



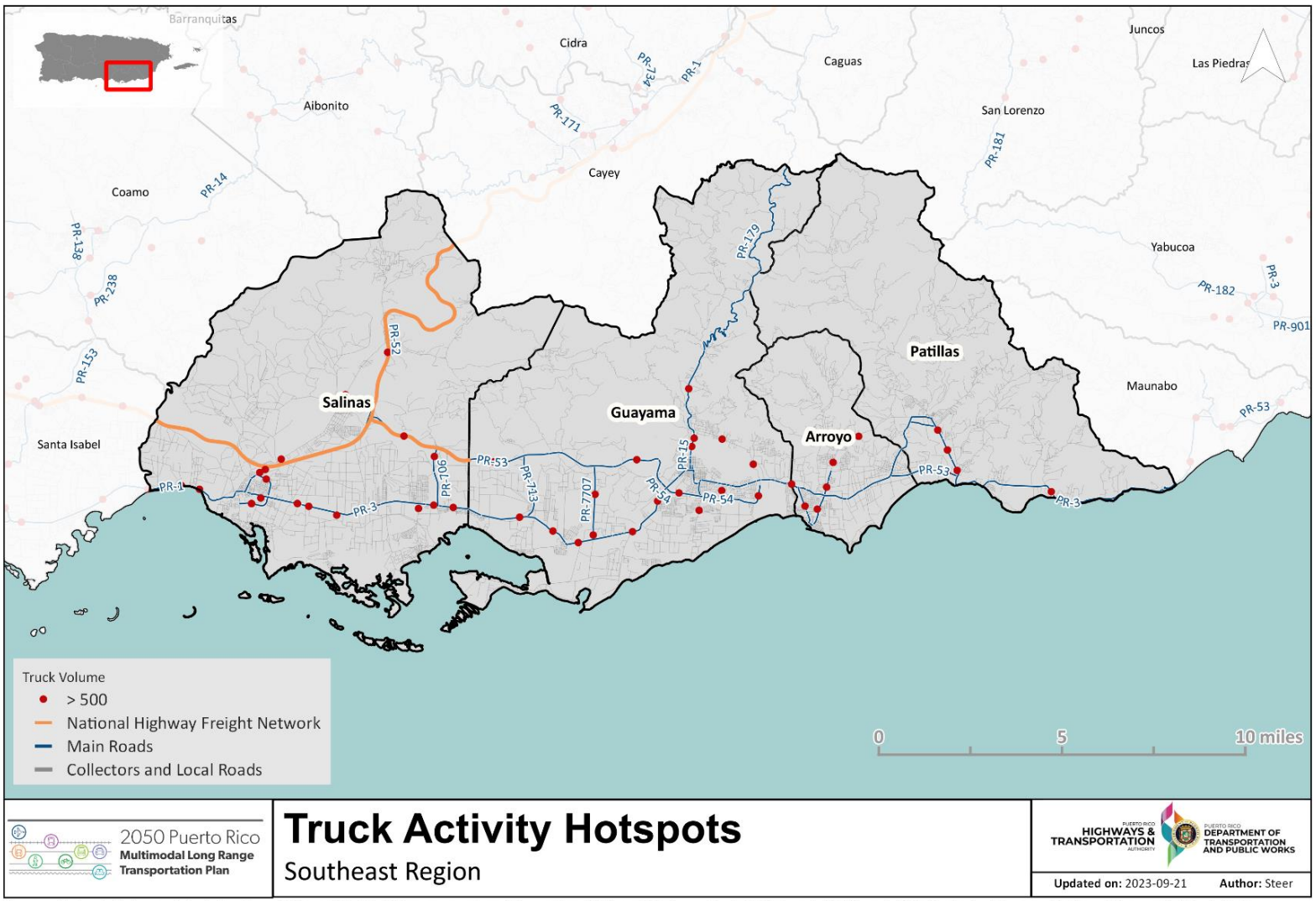
Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.55: South TPR Truck Activity Hotspots



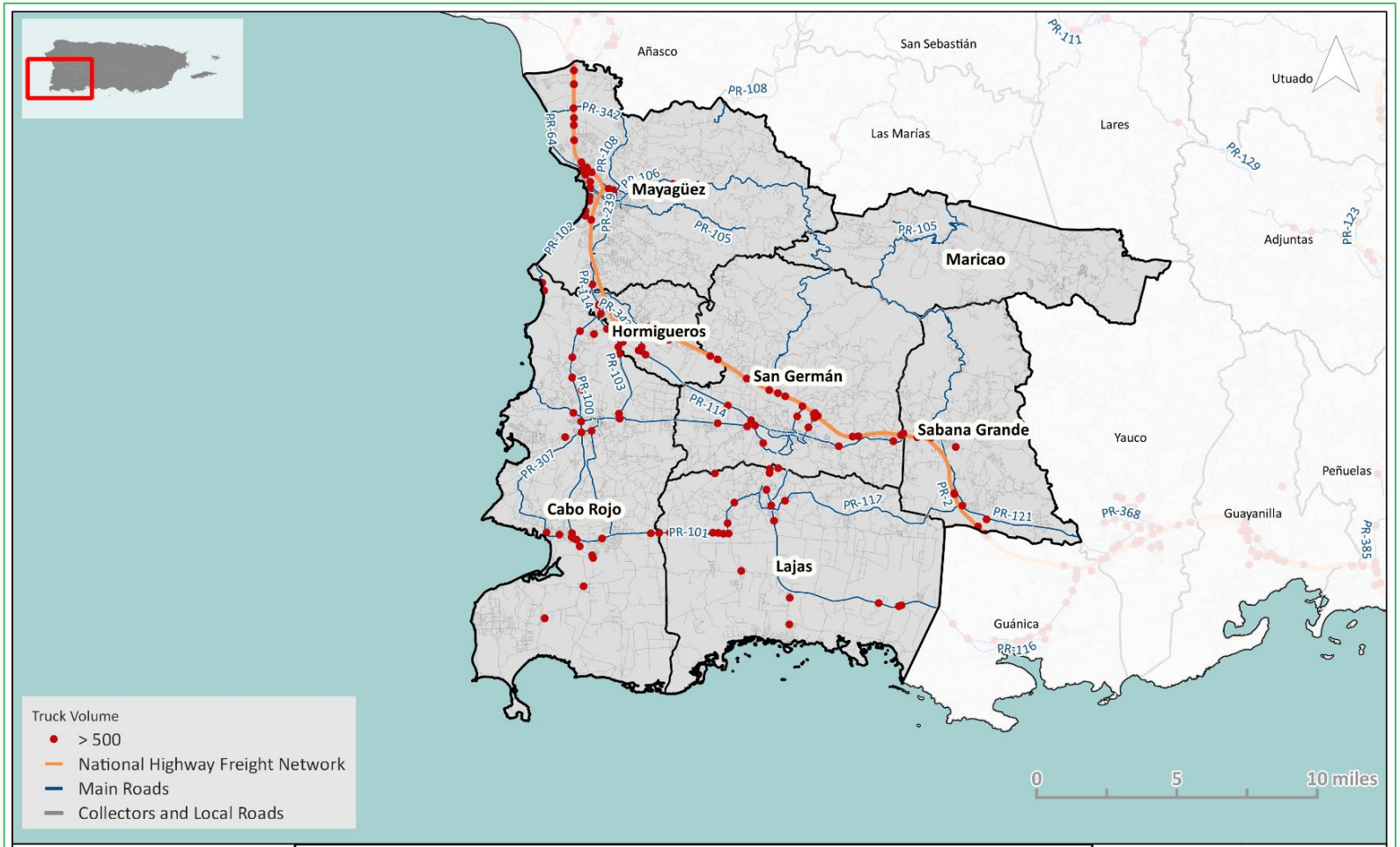
Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.56: Southeast TPR Truck Activity Hotspots



Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.57: Southwest TPR Truck Activity Hotspots



Source: Federal Highway Administration, Office of Freight Management and Operation, National Highway Freight Network, 2022 and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Traffic Volume

From Figure 3.58 to Figure 3.62 shows the traffic volume for 2022 in the different UZA Regions. These maps display the road density in terms of circle size and color, being green with a lowest Average Annual Daily Traffic (AADT) value through red with the highest value.

For the North Region, Figure 3.58 shows specifically that the highest values of the AADT is located within the municipalities of Arecibo, Camuy, and Hatillo, principally along PR-2 and PR-22.

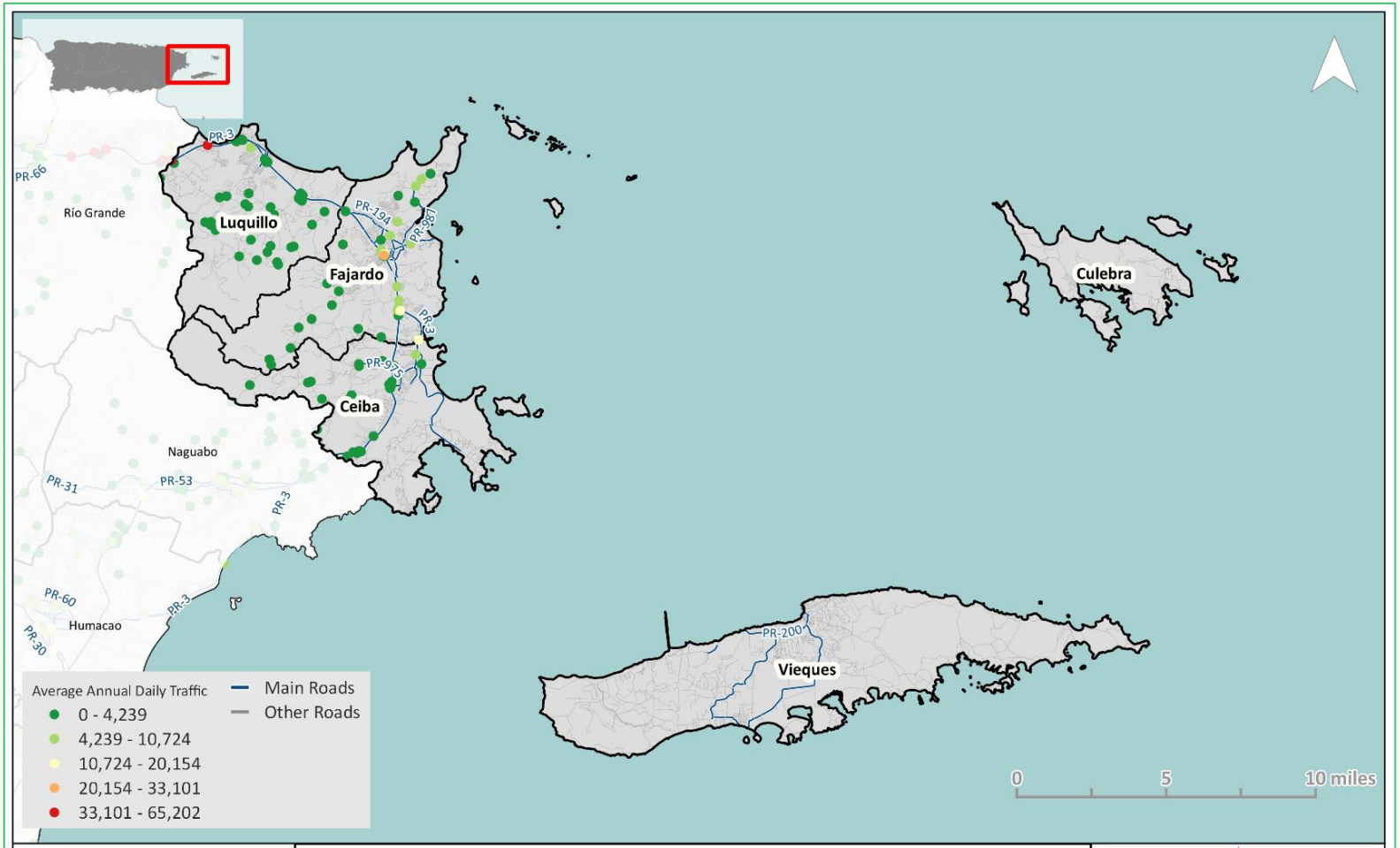
For the East Region, Figure 3.59 shows specifically that the highest values of the AADT is located within the Municipality of Luquillo, along PR-3.

For the South Region, Figure 3.60 shows specifically that the highest values of the AADT is located within the municipalities of Ponce, Santa Isabel, Juana Díaz, Peñuelas, Guayanilla, and Yauco, principally along PR-2, PR-52, and PR-10.

For the Southeast Region, Figure 3.61 shows specifically that the highest values of the AADT is located within the Municipality of Salinas, principally along PR-52.

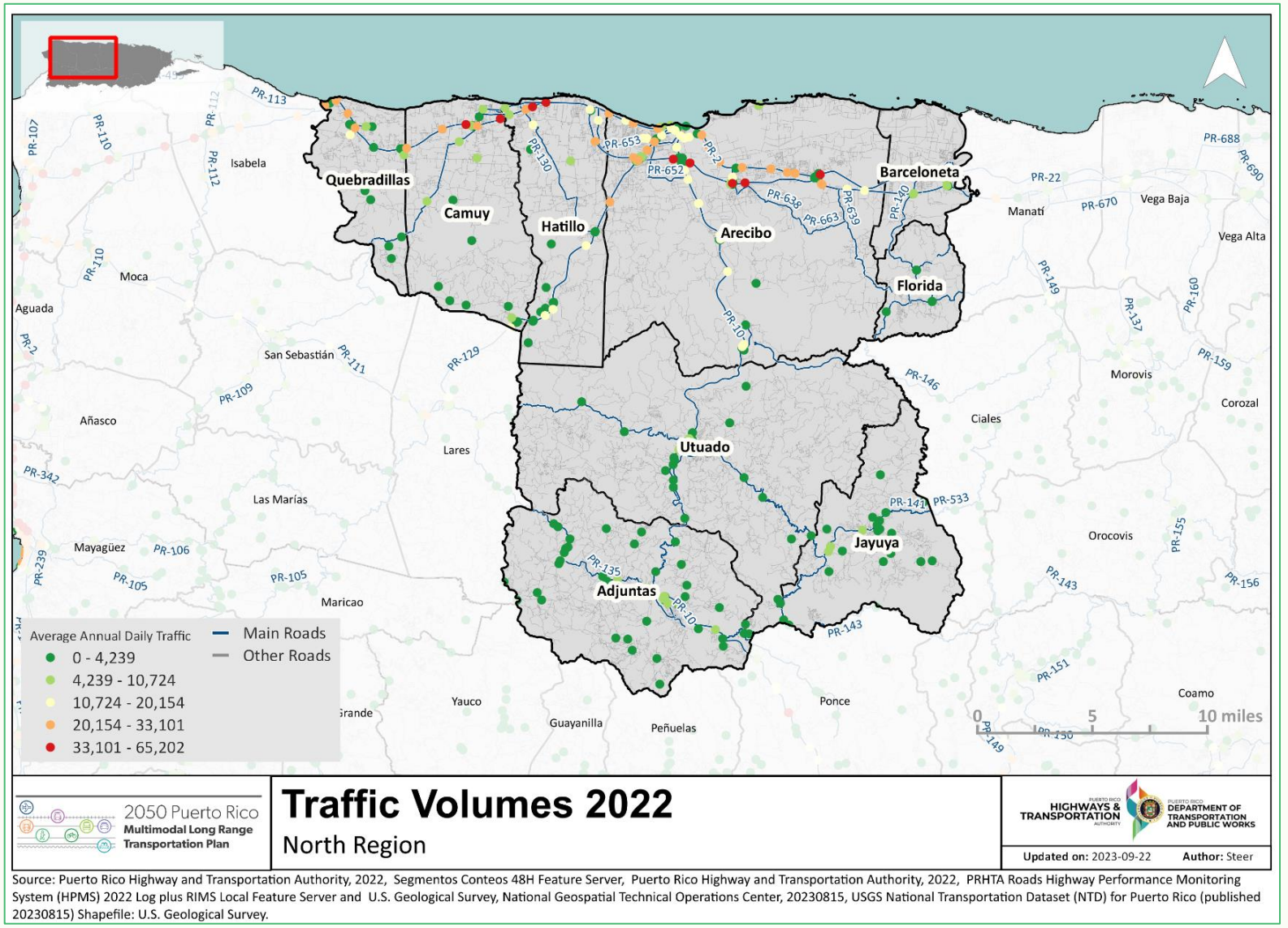
For the Southwest Region, Figure 3.62 shows specifically that the highest values of the AADT is located within the municipalities of Mayagüez, Hormigueros, and San Germán, principally along PR-2.

Figure 3.58: North TPR Traffic Volumes for 2022



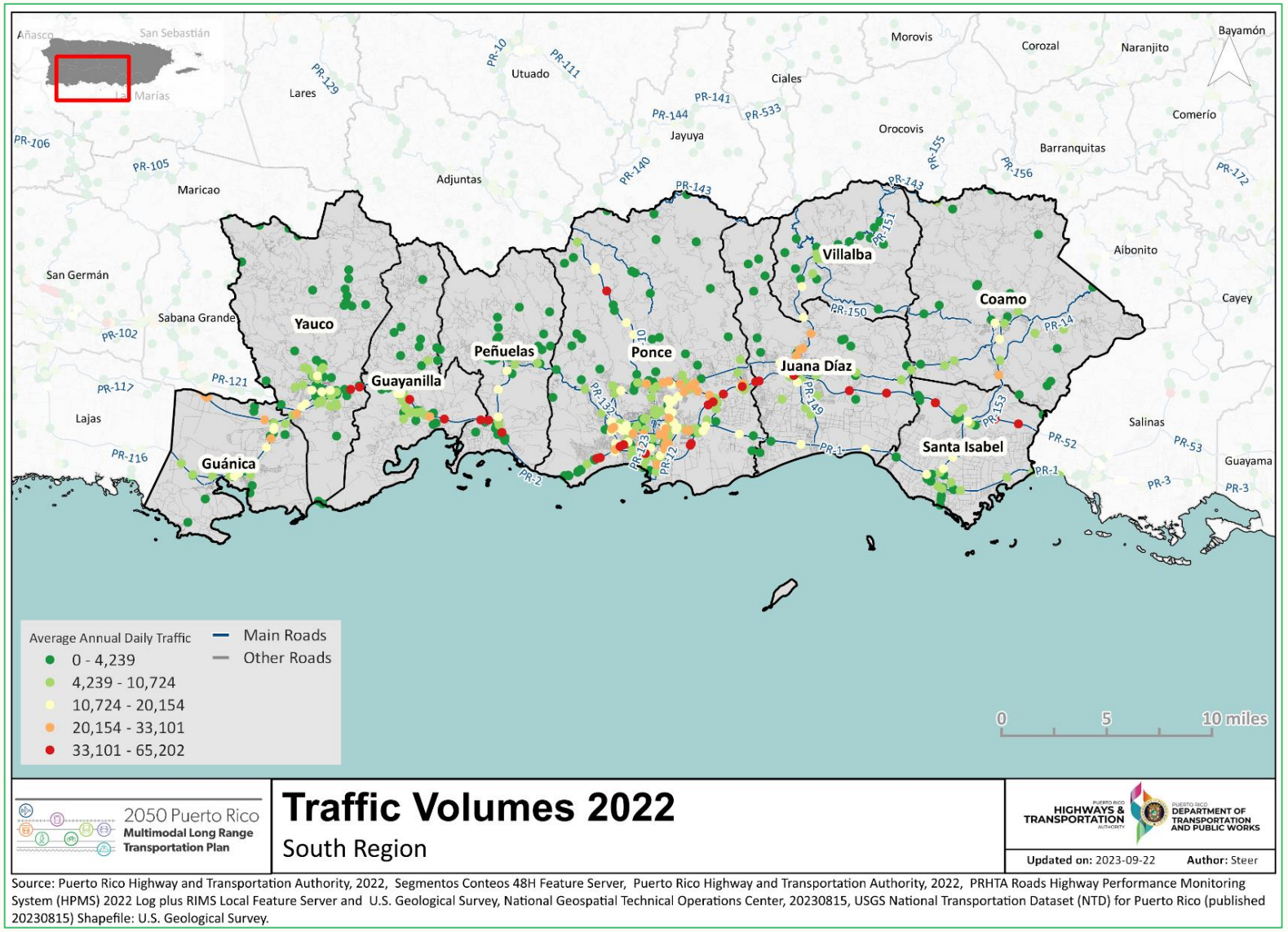
Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.59: East TPR Traffic Volumes for 2022



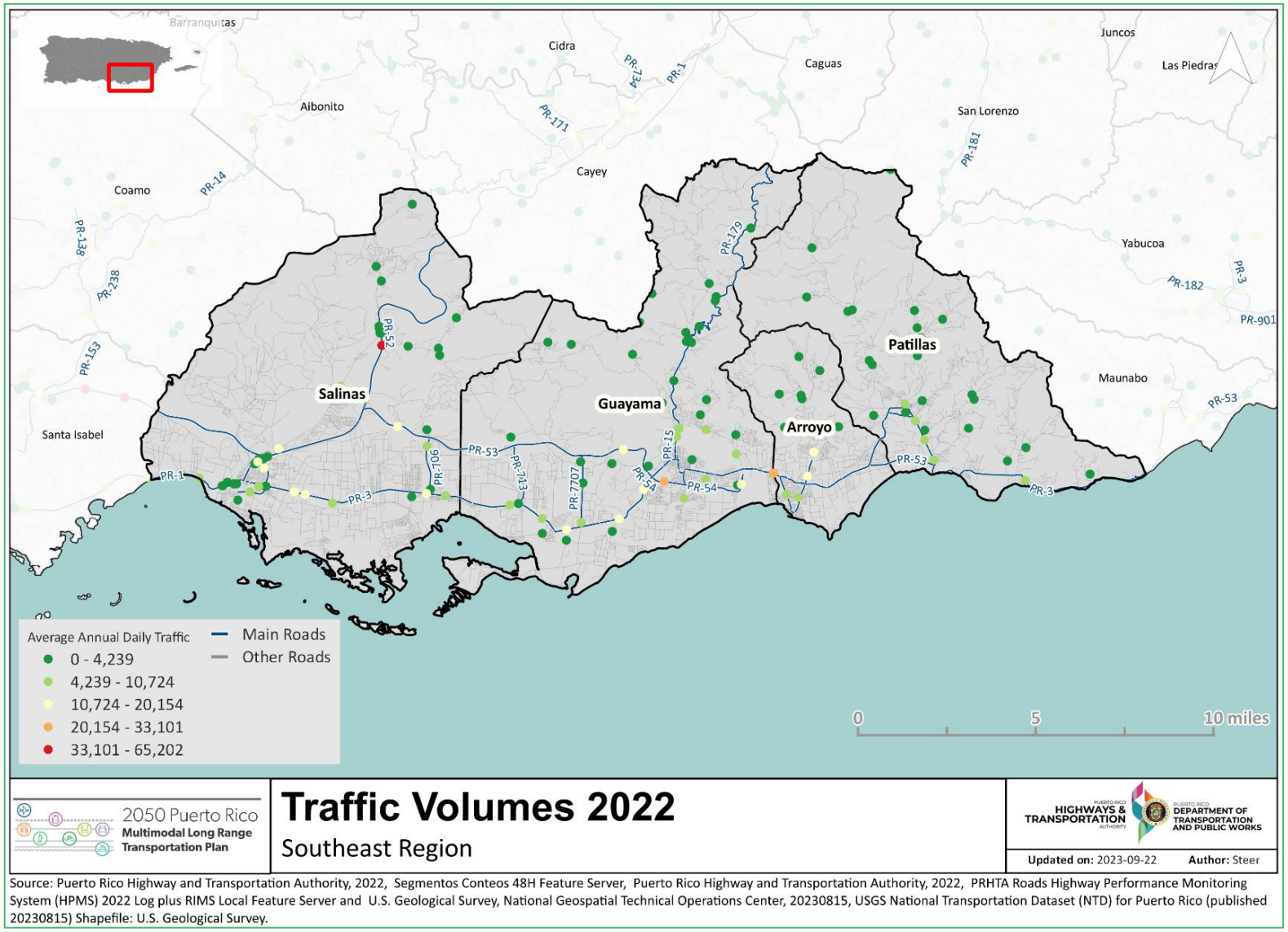
Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.60: South TPR Traffic Volumes for 2022



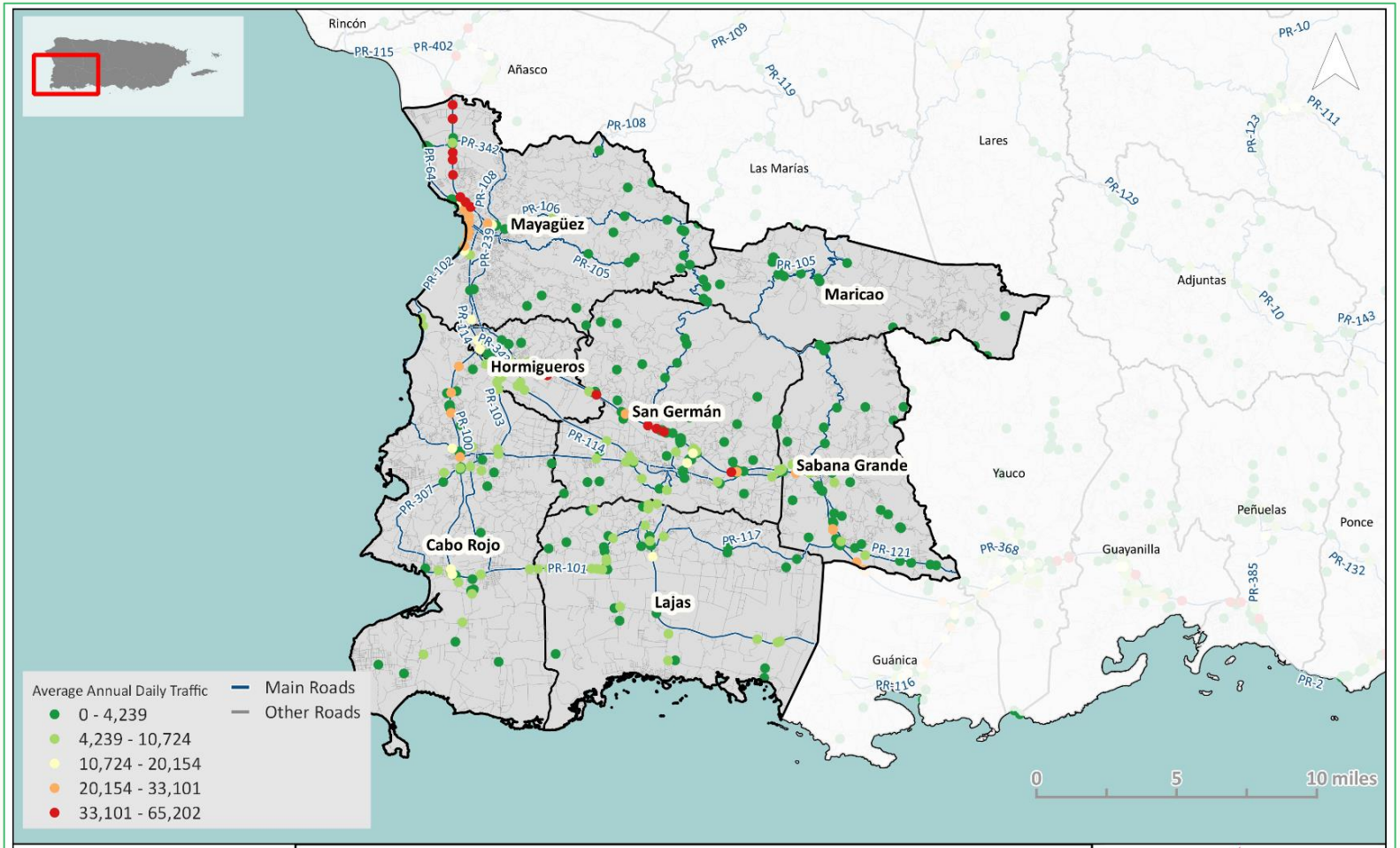
Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.61: Southeast TPR Traffic Volumes for 2022



Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

Figure 3.62: Southwest TPR Traffic Volumes for 2022



Source: Puerto Rico Highway and Transportation Authority, 2022, Segmentos Conteos 48H Feature Server, Puerto Rico Highway and Transportation Authority, 2022, PRHTA Roads Highway Performance Monitoring System (HPMS) 2022 Log plus RIMS Local Feature Server and U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey.

4

Other Urbanized Areas Under 200,000 Population (UZA)

A Shared Vision

This chapter aims to provide a brief description of the Urbanized Areas Under 200,000 in Population Region's (UZA) vision, objectives, targets, goals, and performance measures to provide a better understanding on how the transportation sector is developed within the Region. The chapter is divided into six (6) main sections. The first one describes the vision, goals, and guiding principles. The second one describes how the objectives pursue the goals. The third one describes the planning factors. The fourth one describes the national goals and performance measures. The fifth one describes how the system performance report is developed. And the sixth one describes the federal requirements.

Our Vision and Goals

The 2050 Multimodal Puerto Rico Long Range Transportation Plan (MLRTP) shall guide the development of the multimodal transportation system to create livable communities and contribute to the Region's and Island's strong competitive economy, while considering topics such as Environmental Justice. Current changes in sociodemographic trends, budget constraints, and new needs due to recent natural disasters (hurricanes and earthquakes) in Puerto Rico and the global health emergency due to COVID-19 require a comprehensive plan to address infrastructure needs that will best contribute to the Island envisioned for the future.

The MLRTP is a document that analyzes and develops the policies and strategies toward transportation investment in the Island for the next 27 years through a participatory process integrating diverse demographic, economic, and social characteristics, functional abilities, and different community needs. This planning process reaches out to the general public and key stakeholders and is executed in conformance with regulations that allow for effective citizen participation to assist in defining the path towards an integrated and multimodal transportation system.

The first step in this process was to define how our citizens foresee the future of UZA; how we envision our communities to become in terms of our living spaces, which include: where do we live, work, recreate and shop; safety and security; environmental justice; and how do we travel to those daily destinations. In addition, it was important to understand how the travel patterns changed during the COVID-19 pandemic.

Vision

The 2050 MLRTP vision was originally based on the 2045 Multimodal Long Range Transportation Plan and was revisited in a participatory consulting process developed through active participation with the public and the committees that supported the development of this document. The plan's Vision states:

> "The Island's transportation system will provide safe, efficient, and effective accessibility and mobility for the entire population and the movement of goods and services. It will focus on resilient infrastructure to extreme weather events, fostering energy efficient livable communities and sustainable economic development for the Island."

Guiding Principles

The MLRTP's framework is multimodal in nature and focuses on meeting the UZA need for resilient and sustainable transportation options for all its residents and tourists. This framework will support the definition of specific interventions within each Region to:

1. **Rehabilitate existing roadway network, or complete the current strategic highway network;**
2. **Improve transit services;**
3. **Consider non-motorized accessibility infrastructure and interventions;**
4. **Allow for proper access to air, and sea ports;**
5. **Allow for more efficient freight movements, while working to integrate and interconnect the respective modes considering the complete streets principles.**

Our Objectives in Pursuing These Goals

To aid the implementation of the MLRTP Vision; four goals were developed with specific objectives. The updated goals and objectives are focused on four general topics, or the four E's: Efficiency, Environment, Effectiveness and Economy.

The MLRTP's goals and objectives were updated to reflect the interests and views of the citizens, while continuing the previously set goals in the Island's 2045 Long Range Transportation Plan and following modern planning trends and requirements. These updated goals and objectives also emphasize the imperative to adapt to climate change, and the capability of the transportation infrastructure to withstand extreme weather events.

It is important to mention that with these goals and objectives established at the Plan, will help the PRMPO, the DTPW and PRHTA in the fulfilment of the compromise of the Agency with improving the safety, management of assets, state of good repair of the infrastructure, among other elements, as mentioned below within each transportation plan described.

Table 4.1 presents the resulting updated goals and objectives that guided the development of the MLRTP. For more details on how these Objectives and Goals are directly related to the National Goals and Performance Measures refer to Appendix: A Shared Vision.

Table 4.1: 2050 MLRTP Goals and Objectives

Goals	Objectives
Efficiency	
GOAL A: To Improve the Transportation System's Performance Manage the Island's transportation facilities and services in a proactive and efficient manner to enable better economic development, maximizing the use of available assets and concentrating in safety and security.	**A.1** Ease traffic delays and travel time through accurate congestion management programs.
	A.2 Optimize the use of available transportation assets and develop a better investment management structure to balance the efficiency of prior investments.
	A.3 Use available resources to preserve transportation assets in state of good repair.
	A.4 Develop strategies to deal with the cost of managing and operating the Island's transportation systems.
	A.5 Improve transportation system's safety and security and its ability to provide support when emergencies occur.
Environment	
GOAL B: Focus on the Environment's Sustainable Development Incorporate a careful and responsible environmental management to harmonize the need of a clean environment, social justice, and a well-functioning economy.	**B.1** To promote transportation infrastructure that preserves balanced ecosystems minimizing adverse impacts to the Island's natural environment by conceding a preponderant weight to rehabilitation and improvement of existing infrastructure alternatives.
	B.2 Reduce greenhouse gas emissions, energy consumption, and carbon footprint emittance; promote "smart growth", livable communities and improve air quality by implementing sustainability strategies and environmental management methodologies.
	B.3 Support integrated transportation and land use planning attempting to maintain consistency with existing and planned land uses.
	B.4 Improve alternative modes of transportation and travel demand strategies by implementing and improving pedestrian access, bikes lanes, public transportation plan, recharge ports for electric vehicles, among other environmentally sustainable alternatives, that reduce motorized vehicles dependency and enhance alternative modes of transportation.
	B.5 Reduce transportation infrastructure's vulnerability for it to withstand extreme weather events through resilient infrastructure.
	B.6 Improve physical and mental health by promoting and increase active modes through interventions or new project with proper infrastructure.

Table 4.1: 2050 MLRTP Goals and Objectives (Cont.)

Goals	Objectives
Effectiveness	
GOAL C: Improve Transportation Mobility and Access for the People and for Goods Achieve better mobility and access for all the transportation system users; provide more travel choices, integration between modes and connections between major population centers.	**C.1** Improve connectivity between the Island's fundamental activity Regions, such as, but not limited to employment centers, touristic areas, and dense residential districts.
	C.2 Concentrate efforts in enhancing the connectivity of the Island's available modes of transportation.
	C.3 Facilitate mobility to residents, visitors, and workers in the Island by increasing the availability of travel choices.
	C.4 Invest in areas where users get the most benefit.
	C.5 Facilitate the access of transportation to elderly population, people with disabilities, or economic disadvantaged communities.
Economy	
GOAL D: Reinforce Economic Growth Procure the sustainment of livable and viable communities by encouraging economic strength, economic competitiveness, and the flexibility to withstand economic difficulties.	**D.1** Facilitate the efficient movement of freight, business, and tourism activities to achieve economic competitiveness.
	D.2 Encourage potential public-private collaborations.
	D.3 Focus in providing commercial connectivity throughout the Island.

Source: Steer, PRHTA

Planning Factors

The Fixing America's Surface Transportation Act, also known as the FAST-Act, was signed into law in December 2015 and replaces the previous Moving Ahead for Progress in the 21st Century Act (MAP-21). This legislation, like its predecessor, outlines the requirements for the transportation planning process, including the compliance with planning factors. Although planning factors have been part of previous highway legislation, the FAST-Act has a total of ten (10) planning factors, two more than the previously stated by MAP-21. Key transportation planning factors of the FAST-Act include, resiliency, reliability, the mitigation of storm water impacts and the enhancing of travel and tourism.

Planning factors identify the most important aspects of the transportation development. All projects, strategies, goals, and objectives considered in developing the 2050 MLRTP were designed to meet the FAST-Act required planning factors. Taking this into account, the ten (10) identified planning factors in this legislation were considered when analyzing the Island's economic development patterns, the path to achieve a more efficient use of the transportation system and resilience capabilities and the possible strategies to attend congestion issues, improve safety and mobility. Table 4.2 summarizes how the Island's 2050 LRTMP goals and objectives will meet the planning factors as required by the referred legislation. All planning factors were adequately considered by relating them to two (2) or more goals/objectives. These key objectives will determine the priority of the projects included in the plan's financial analysis and help secure the proposed investment on the sort, mid and long-term compliance with the FAST-Act Planning Factors.

Table 4.2: Relation Between Planning Factors and 2050 MLRTP Goals

Planning Factors	2050 Goals Related to Planning Factor
Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.	Goal A: Considers traffic congestion reduction, optimize use of assets and use of resources and existing infrastructure while dealing with efficient cost management. Goal B: Considers integrated transportation and land use planning to achieve livable communities. Goal C: Considers improving and enhancing connectivity, increase travel choices, and invest in higher cost/benefit initiatives. Goal D: Considers improving economic competitiveness thru movement, private investment in infrastructure and improving commercial connectivity.
Increase the safety of the transportation system for motorized and non-motorized users.	Goal A: Considers good state of repair maintenance and improving safety. Goal B: Considers integrated transportation and land use planning to achieve enhance alternative modes of transportation. Goal C: Considers improving access to elderly population, people with disabilities.
Increase the security of the transportation system for motorized and non-motorized users.	Goal A: Considers state of good repair maintenance and improving security. Goal B: Considers integrated transportation and land use planning to achieve livable communities. Goal C: Considers improving access to activity centers, improving, and increasing people movement populating the streets.
Increase the accessibility and mobility of people and freight.	Goal A: Considers managing the Island's transportation facilities and services. Goal B: Considers developing transportation related solutions by better use of existing infrastructure. Goal C: Considers better mobility and access for all the transportation system users. Goal D: Considers facilitating efficient movement of freight, business, and tourism activities.
Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and state and local planned growth and economic development patterns.	Goal A: Considers extending its life and provide a safe and secure operating environment for users. Goal B: Considers incorporating a careful and responsible environmental management to harmonize the need of a clean environment, social justice, and a well-functioning economy. Goal C: Considers better mobility and access for all the transportation system users; provide more travel choices, integration between modes and connections between major population centers. Goal D: Considers sustainment of livable and viable communities by encouraging economic strength, economic competitiveness, and the flexibility to withstand economic difficulties.
Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.	Goal B: Considers projects and programs that reduce reliance on motorized travel and better manage vehicle congestion; promote the use of energy efficient products and more "reduce, reuse, recycle" practices in infrastructure projects and improve alternative modes of transportation and travel demand strategies. Goal C: Considers improving and enhancing connectivity, increase travel choices, and invest in higher cost/benefit initiatives. Goal D: Considers providing commercial connectivity Island-wide.

Table 4.2: Relation Between Planning Factors and 2050 MLRTP Goals (Cont.)

Planning Factors	2050 Goals Related to Planning Factor
Promote efficient system management and operation.	Goal A: Considers managing the Island's transportation facilities and services in a proactive and efficient manner to enable better economic development, maximizing the use of available assets and concentrating safety and security. Goal B: Considers applying Congestion Management Process or transportation network analysis to manage travel demands and improve the coverage, capacity, and service of alternative modes of transportation. Goal C: Considers addressing the Island's most important transportation corridors, their infrastructure, and surrounding developments. Goal D: Considers investing in the completion of projects that facilitate commercial connections.
Emphasize the preservation of the existing transportation system.	Goal A: Considers optimizing the use of available transportation assets and preservation of these assets. Goal D: Considers congestion management on the Island's main freight network.
Improve the resiliency and reliability of the transportation system and reduce or mitigate storm water impacts of surface transportation.	Goal A: Considers investment to promote better services before and after emergencies, resilience-redundancy capabilities to resist or assist during extreme climatic events, incidents, and system blockage. Goal B: Considers reducing transportation infrastructure's vulnerability for it to withstand extreme weather events for a resilience and reliable infrastructure.
Enhance travel and tourism.	Goal A: Considers traffic congestion reduction, optimize use of assets and use of resources and existing infrastructure while dealing with efficient cost management. Goal C: Considers facilitating mobility to visitors in the Island by increasing the availability of travel choices. Goal D: Considers facilitating the efficient movement of tourism activities to achieve economic competitiveness.

Source: Steer, PRHTA

National Goals and Performance Measures

National Goals

The FHWA has stablished the National Goals in the areas of Safety, Infrastructure Conditions, Congestion Reduction, System Reliability, Freight Movement and Economic Vitality, Environmental Sustainability, and Reduced Project Delivery Delays. These goals are part of the 23 U.S. Code § 150 - National Goals and Performance Management Measures. The main goal is to provide a mean to the most efficient investment of Federal Transportation fund, increasing the accountability and transparency of the Federal-aid highway program, and improving project decision-making through performance base planning and programming. Table 4.3 shows the relationship between Goal Area and National Goals.

Table 4.3: National Transportation Goals

Goal Area	National Goal
Safety	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
Infrastructure Condition	To maintain the highway infrastructure asset system in a state of good repair.
Congestion Reduction	To achieve a significant reduction in congestion on the National Highway System.
System Reliability	To improve the efficiency of the surface transportation system.
Freight Movement and Economic Vitality	To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
Environmental Sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment.
Reduced Project Delivery Delays	To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

Source: 23 Untied States Code § 150

Performance Measures

While a performance measure allows comparison, there should be identified desired targets associated with performance measures. By providing a direction or a specific level of performance that is intended to be achieved within a timeframe, this information helps to demonstrate whether the area is making progress toward achieving its goals and objectives. Federal regulations require States and MPOs to set targets for each of the national performance measures (23 C.F.R. 490.105, 23 C.F.R. 450.206, and 23 C.F.R. 450.306).

Table 4.4 establishes a relationship between the National Performance Measures, Performance Areas, the established Goal Area, and the transportation plans containing each Performance Measure.

Table 4.4: List of National Performance Measures by Performance Area

Goal Area	Report	Performance Area	Performance Measure
Safety	Puerto Rico Strategic Highway Safety Plan[75]	Highway Safety	Average of the number of fatalities on all public roads
			5-year moving average of the number of fatalities on all public roads
			5-year moving rate (per 100 million VMT) of fatalities on all public roads
			Average of the number of serious injuries on all public roads (Revised)
			5-year moving average of the number of serious injuries on all public roads (Revised)
			5-year moving average of the rate (per 100 million VMT) of serious injuries on all public roads (Revised)
			5-year moving average of the number of non-motorized fatalities and serious injuries on all public roads (Revised)
Infrastructure Condition	Puerto Rico Transportation Asset Management Plan[76]	Pavement Condition	% of pavement lane miles on the Interstate and Non-Interstate National Highway System (NHS) in good condition**
		Pavement Condition	% of pavement lane miles on the Interstate and Non-Interstate NHS in poor condition**
		Bridge Condition	% of bridge deck area on the NHS in good condition
		Bridge Condition	% of bridge deck area on the NHS in poor condition
System Reliability		Travel Time Reliability	% of person-miles traveled with reliable travel times on the Interstate and Non-Interstate NHS**[77]
Freight Movement and Economic Vitality	Freight Plan	Freight Reliability	Truck Travel Time Reliability Index[78]
Environmental Sustainability		Emissions	Total emissions reductions from CMAQ projects (for criteria pollutants and precursors, where applicable) [79]

75. Targets established for 2023 as stipulated at the Puerto Rico Strategic Highway Safety Plan 2023
76. Targets established for 2025 as stipulated at the Puerto Rico Strategic Highway Safety Plan 2032
77. Data not collected; it could be an opportunity to start collecting this data.
78. Data not collected; it could be an opportunity to start collecting this data.
79. Data not collected; it could be an opportunity to start collecting this data.

Table 4.4: List of National Performance Measures by Performance Area (Cont.)

Goal Area	Report	Performance Area	Performance Measure
Congestion Reduction	Congestion Management Process	Congestion	Annual hours of peak hour excessive delay per capita (for urbanized areas, where required) [80]
			% of non-single occupancy vehicle travel (for urbanized areas, where required) [81]
System Reliability	Transit Asset Management Plan[82]	Transit Asset Management	% of assets not in an SGR
			% of assets over ULB
			% of track segments with performance restrictions
			% of facilities rated below condition 3 on the Transit Economic Requirements Model (TERM) scale (by asset class)
Safety	Public Transportation Agency Safety Plan	Transit Safety	Number of reportable fatalities by mode***
			Rate of reportable fatalities (per total vehicle revenue miles) by mode
			Number of reportable injuries by mode***
			Rate of reportable injuries (per total vehicle revenue miles) by mode
			Number of reportable safety events by mode***
			Rate of reportable safety events (per total vehicle revenue miles) by mode
			Number of major mechanical failures***
			Mean distance between major mechanical failures by mode

* Revised 2023 goals for the SHSP
**Note: Separate measures for Interstates and Non-Interstate NHS
*** Total numbers based on an average of 200k VRM for fixed route service and 50k VRM for demand response service
Source: 23 CFR § 450.216 - Development and content of the long-range statewide transportation plan.

80. Data not collected; it could be an opportunity to start collecting this data.
81. Data not collected; it could be an opportunity to start collecting this data.
82. Goals established for 2022 as stipulated at the Transit Asset Management Plan 2020. The Plan is divided into three (3) types of assets: rolling stock, facilities, and equipment.

System Performance Report

The System Performance Report for this MLRTP evaluates the condition and performance of the Island's transportation system, sets performance targets and updates on current progress in meeting those established targets. There are several planning documents that are part of the MLRTP as appendices and have been considered in the development of the performance measures and targets of this MLRTP. Within these documents are the Strategic Highway Safety Plan (SHSP), the Transportation Asset Management Plan (TAMP), the Highway Safety Improvement Program (HSIP), the Public Transportation Agency Safety Plan (PTASP) and the Transit Asset Management Plan (TAM).

The summary of progress data towards the compliance of targets and performance measures presented here is at Island-wide level as the transportation plans evaluated provide the data in that format.

- The summary of progress data towards the compliance of targets and performance measures presented here is at Island-wide level as the transportation plans evaluated provide the data in that format.

- All the municipalities that compose the different TPR's within the UZA are included as part of the SHSP, HSIP, TAM and TAMP. For the PTASP:

- **North TPR**

– The municipalities of Adjuntas, Arecibo, Florida, Jayuya, and Quebradillas does not appear to be included in the PTASP state plan or to have his own plan.
– The municipalities of Barceloneta, Camuy, Hatillo, and Utuado are part of the state Plan.

- **East TPR**

– The municipalities of Ceiba, Culebra, Fajardo, and Vieques does not appear to be included in the PTASP state plan or to have his own plan.
– The Municipality of Luquillo is the only one included as part of the state Plan.

- **South TPR**

– The Municipality of Santa Isabel is the only one that does not appear to be included in the PTASP state plan or to have his own plan.
– There remaining eight (8) municipalities are included as part of the state Plan.

- **Southeast TPR**

– The municipalities of Arroyo and Guayama does not appear to be included in the PTASP state plan or to have his own plan.
– The municipalities of Patillas and Salinas are included as part of the state Plan.

- **Southwest** TPR

– The municipalities of Maricao, Sabana Grande, and San Germán does not appear to be included in the PTASP state plan or to have his own plan.
– The municipalities of Cabo Rojo, Hormigueros, Lajas, and Mayagüez are included as part of the state Plan.

Puerto Rico Strategic Highway Safety Plan (SHSP, 2019)

The SHSP is a major component and requirement for the HSIP, required by the FHWA (23 U.S.C. 148). This is a comprehensive plan that establishes Puerto Rico's goals, objectives, and safety emphasis areas. The Plan is developed by the PRHTA in close coordination with the Puerto Rico Traffic Safety Commission (PRTSC) and the Puerto Rico Police (PRP), among many other entities from all sectors, including other public and federal agencies, non-governmental organizations, and private companies. It allows highway safety stakeholders to work in an effort to align goals, leverage resources, and to address Puerto Rico safety's challenges.

According to the data obtained and the progress reported on each of the Performance Measure of the SHSP, there's only one (1) Performance Measure that achieved and overachieved the goal proposed, meanwhile three (3) of the performance reflected a reduction to get closer to the goal and three (3) of them reflected an increase. More detailed information on the progress related to the Performance Measures of the SHSP can be found at Appendix: A Shared Vision.

Puerto Rico Transportation Asset Management Plan (TAMP, 2022)

The TAMP describes the condition of the National Highway System (NHS) pavement and bridges in Puerto Rico. It also identifies PRHTA's investment strategies to manage them for ten (10) years, and forecasts their condition based on those strategies. The 10-year financial plan included is linked to the Statewide Transportation Improvement Program (STIP) as well as the 28-year Fiscal Plan approved by the Financial Oversight and Management Board. The TAMP applies life-cycling planning to develop the investment for preserving, maintaining, rehabilitating, and reconstructing or replacing critical assets.

The actual progress data reported for 2021 reflects that for 2023 goals' only the % Interstate in good condition and % Non-NHS Interstate in good condition did not get to the target. But as stated at the TAMP, there is programmed at the STIP projects related to pavement projects at the Interstates, meaning that once delivered, it will continue to make progress in reducing Poor Interstate miles. For the bridge's measures, the data reflects that has reached or overreach the targets established. More detailed information on the progress related to the Performance Measures of the SHSP can be found at Appendix: A Shared Vision.

Highway Safety Improvement Program (HSIP, 2022)

The HSIP is a core Federal-aid program with the purpose of achieving a significant reduction in fatalities and serious injuries on all public roads. As per 23 U.S.C. 148(h) and 23 C.F.R. 924.15, States are required to report annually on the progress being made to advance HSIP implementation and evaluation efforts. The Program is responsible for managing the 25% of federal funds allocated for Puerto Rico under de ZP-30 Fiscal Management Information System program code for highway safety improvement projects.

The Program is guided by the SHSP, being responsible for coordinating the highway safety initiatives, performance measures, and targets with internal and external safety stakeholders.

According to the HSIP 2022 Report, during 2021, four (4) out of five (5) safety targets were met o were better than the baseline established.

According to the HSIP 2022 Report, during 2021, four (4) out of five (5) safety targets were met o were better than the baseline established.

The number of fatalities did not meet the 2021 target, but was better than the baseline 2015-2019, representing a decrease of 0.7%.

The number of serious injuries met the 2021 target and was better than the baseline 2015-2019. Nevertheless, for the 2022 report, the definition of serious injuries changed to comply with the requirements of the HSIP, changing the database from ACAA to the KABCO severity scale found in the digital crash report PR-621.4. however, the actual number of serious injuries was better than the baseline, representing a reduction of 2.1%.

The fatality rate did not meet the 2021 target nor the baseline 2015-2019, representing an increase of 3.2% for the 2021 targets and 2.0% for the baseline 2015-2019.

The serious injuries rate met the 2021 target but was not better than the baseline 2015-2019, where the increase represents a 0.7%.

The non-motorized fatalities and serious injuries met the 2021 target and was better than the baseline 2015-2019. This performance measure involved the same characteristics of change in the definition of serious injuries, resulting in a decrease when comparing targets versus actual values. The actual number of non-motorized fatalities and serious injuries represented a reduction of 3.8%. More detailed information on the progress related to the Performance Measures of the SHSP can be found at Appendix: A Shared Vision.

Public Transportation Agency Safety Plan (PTASP, 2022)

On July 2018, the FTA issued the new Public Transportation Agency Safety Plan (PTASP) final rule (49 C.F.R. Part 673) to improve public transportation safety by guiding transit agencies to manage safety risks more effectively and proactively in their systems. The PTASP Final Rule (49 C.F.R. Part 673.1) requires recipients or sub-recipients of financial assistance under 49 U.S.C. Chapter 53 (Public Transportation) that operates a public transportation system to develop PTASPs. It also indicated that this part does not apply to operators of public transportation that only receives federal financial assistance under 49 U.S.C. 5310 (enhanced mobility of seniors and individuals with disabilities), 49 U.S.C. 5311 (formula grants for rural areas), or both.

The PTHRA procured the development of a PTASP for the PRHTA's small provider subrecipients that did not opt out the group, as required by federal regulation (49 CFR 673.11 (3)).

There is no data available to track if there has been progress of the Plan towards the achievement of the targets established. More detailed information on the progress data related to the Performance Measures of the SHSP can be found at Appendix: A Shared Vision.

Transit Asset Management Plan (TAM, 2020)

The Final Rule issued by MAP-21 established the requirement for recipients and sub-recipients of FTA funding to develop a Transit Asset Management Plan (TAMP). TAMPs are required to be updated every four years, though agencies may decide to update their TAMPs intermittently to reflect the most up-to-date information. It is noted that the TAMPs will need to be realigned with their respective agency's capital budget process as well as other regulatory investment and work plans.

The Plan is used to assess the current condition of the assets owned by transit providers, support the long-term capital planning process, and provide justification for the use of taxpayer's dollars and fares. The TAMP aims to demonstrate the optimal use of funds to maintain and improve the service provided.

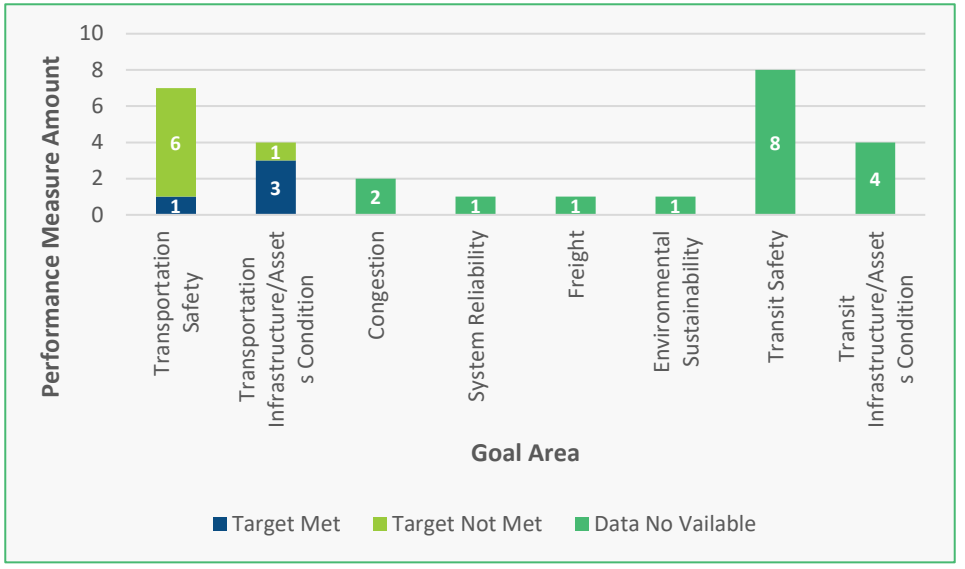
By developing the TAMPs, FTA aims to improve safety and performance of the transportation network, reduce the $85.9 billion backlog to achieve a State of Good Repair (SGR), and enhance the asset management capabilities of transit providers nationwide. According to the Final Rule, "[a] capital asset is in an SGR if it is in a condition sufficient for the asset to operate at a full level performance"[83].

There is no data available to track if there has been progress of the Plan towards the achievement of the targets established. More detailed information on the progress data related to the Performance Measures of the SHSP can be found at Appendix: A Shared Vision.

Guided by those targets/trends and the data available, is reflected that through the Safety Goal Area and the SHSP and the HSIP Performance Measures, there has been progress made towards the targets projected, even though most of the targets haven't been met, there has been progress towards it. Through the System Reliability Goal Area and the TAMP there has been progress made towards the targets projected. Figure 4.1 shows the different Goal Areas within are distributed the different plans containing the performance measures considered for this plan as presented in Table 4.4.

83. Sec. 625.17 of FTA Final Rule on Transit Asset Management

Figure 4.1: List of National Performance Measures by Performance Area



Source: Steer, 2023

Final Requirements

This 2050 MLRTP update has been characterized by important challenges conforming the transportation infrastructure and its vision of developing a livable Island with economic competitiveness. The PRMPO, and its transportation agencies, considered the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA), a 2016 federal law that established an oversight board and procedures for approving critical infrastructure projects to improve the Puerto Rican government-debt crisis, and as a result, the certified Fiscal Plan for the PRHTA was considered as the financial basis of this analysis. The investment plan for infrastructure in this 2050 MLRTP is thus fiscally constrained to the current Puerto Rico financial and fiscal conditions.

The 2045 MLRTP considered aspects as the planning factors required by MAP-21 as well as additional key issues as set out by the FAST-Act federal legislation and the local public policy (Law 201-2010[84], Law 74-1965 as amended by Law 97-2012[85] and Law 22[86]) including a wider emphasis on non-motorized modes, complete streets, freight mobility, livability, resilient infrastructure, reliability, environment, energy, tourism considerations, and principles of sustainability and smart growth. But the updated 2050 MLRTP also considers the Bipartisan Infrastructure Law (BIL), also known as the Infrastructure Investment and Jobs Act (IIJA; Pub. L. No. 117-58) enacted in November 2021.

In accordance with the regulations mentioned, the federal transportation planning requirements to comply with are:

- Consideration of ten (10) planning factors.[87]
- Inclusion in the plan of a "discussion of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the plan. [88]
- Consultation with governments and participation by interested parties.[89]
- Air quality conformity requirements in States and metropolitan areas containing nonattainment and maintenance areas (compliance with sections 174 and 176(c) and (d) of the Clean Air Act, as amended (42 U.S.C. 7504, 7506(c) and (d) and 40 C.F.R. part 93)). [90]

84. Law 201, 2010 to declare the public policy regarding the adoption of the concept of Complete Streets.
85. Law 74 of June 23, 1965, PRHTA Law ("Ley de la Autoridad de Carreteras y Transportación de Puerto Rico") amended by Law 97 in 2012 to include a disposition of adding a fence to all bridges with pedestrian facilities.
86. Vehicle and Traffic Law of Puerto Rico, as amended by Law 132 of June 3, 2004, which includes the charter of rights and obligations of cyclists and drivers.
87. 23 C.F.R. 450.206(a) and 23 C.F.R. 450.306 (b)
88. 23 C.F.R. 450.216(k) and 23 C.F.R. 450.324 (f) (10)
89. 23 C.F.R. 450.210 and 23 C.F.R. 450.316
90. 23 C.F.R. 450.220(a)(7) and 23 C.F.R. 450.336(a)(2)

In addition, all aspects of the planning process are subject to Federal laws, regulations, and executive orders concerning the fair and equitable treatment of people, including, but not limited to:

- Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d-1) and 49 C.F.R. part 21, which prohibit recipients of Federal financial assistance from taking actions that discriminate on the basis of race, color, or national origin.
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which further amplifies Title VI by providing that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" [91].
- 49 U.S.C. 5332, which prohibits discrimination on the basis of race, color, creed, national origin, sex, or age in employment or business opportunity.
- Section 11101(e) if BIL and 49 C.F.R. part 26, regarding he involvement of disadvantage business enterprises in DOT funded projects.
- 23 C.F.R. part 230, regarding implementation of an equal employment opportunity program in Federal and Federal-aid highway construction contracts.
- The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) and 49 C.F.R. parts 27, 37 and 38.
- The Age Discrimination Act of 1975, as amended (42 U.S.C. 6101 et seq.), prohibiting discrimination on the basis of age in programs or activities receiving Federal financing assistance.
- 23 U.S.C. 324, regarding the prohibition of discrimination based on gender.
- Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) and 49 C.F.R. part 27 regarding discrimination against individuals with disabilities.

91. Federal Register. February 11, 1994. "Executive Order 12898." http://www.archives.gov/files/federal-register/executive-orders/pdf/12898.pdf.

5

Other Urbanized Areas Under 200,000 Population (UZA)

Public and Stakeholder Participation

Stakeholder & Public Involvement Process in Other Urbanized Areas (UZAs)

Public participation is an important aspect of any planning process. It is an integral part of the transportation system's improvement by helping to ensure that decisions are made in consideration with and for the benefit of the public needs and preferences. These public inputs help agencies to: (1) make better informed decisions through collaboration, (2) build mutual understanding and trust between agencies and citizens. In order to make these public events accessible to the general community all the engagements were done in Spanish, and we also had staff available to assist any English-speaking individual that wanted to participate of the Open Houses.

Gathering this collaborative information, as part of the MPO's planning process, requires obtaining broad insight from the public, professional and civic organizations, private companies, and key governmental stakeholders. It is necessary to consider all sectors for a final determination, especially those traditionally underserved by existing transportation systems, such as low-income and minority households. As a result of these considerations, both rounds of the MLRTP's Informative seminars were held in locations where these underserved groups could travel without the use of a private vehicle.

A summary of the different strategies utilized to accommodate different underserved groups in the UZAs TPR, can be found below:

- **Universities:** to accommodate the student's needs.
- **CESCOS and Integrated Services Center:** for people that were doing other governmental processes.

The 2050 MLRTP Public Involvement Plan (PIP) was developed early in the process. As presented in Appendix: Puerto Rico MLRTP 2050 Public Involvement Plan, this document establishes the different goals and strategies that were proposed to engage the public in the discussion of the 2050 MLRTP. This document is in alignment with the MPO Public Involvement Plan, vision, goals, and objectives.

Vision

> The vision of the PRMPO's Public Involvement Plan is to involve and enable agencies, the interested parties, and the community to provide meaningful input to the transportation planning process.

Goals

> To consult with the public and stakeholders to gather their ideas for solutions to transportation needs. This process is an opportunity for the community to voice concerns and opinions about current and future transportation policies, plans and programs across Puerto Rico.

> To inform and involve the public throughout the process. This plan is structured to inform, listen to, and learn from the public throughout the process.

Strategies

Several methods for engaging the public in the discussion of the 2050 MLRTP were recommended as part of the PIP. Those strategies are listed below and will be discussed in further detail in the next section.

Website: Significant effort was put into the development of a website that provided relevant information about the project to anyone interested, as well as a space to collect useful information from citizens.

Policy (PRMPO) Committees: Throughout the development of the MLRTP, policymaking officials were approached, in four(4) meetings, to acquire their perspective and ideas on various project activities.

Technical Committees: The Technical Committee participated to provide their opinions on the development of the projects that is responsive to their reality.

Informative Workshops: Workshops were held in an Open House format and were designed to inform and collect essential details from participants to use in the data collection process for the 2050 Plan. Workshops took place at two project milestones: during project initiation and before implementation plan development.

Public Notices

First Round of Public Involvement Events: A public notice was published in English and Spanish in two (2) local newspapers, El Nuevo Día and Primera Hora, on April 18, 2022. This event was also promoted via the Facebook page of the DTPW on April 21 and 26.

Second Round of Public Involvement Events: The public notice for the second round of public involvement events was published in English and Spanish in two (2) local newspapers, El Nuevo Día and Primera Hora, on April 6 and 10, 2023. It was also published on the DTPW Facebook page in April 11 and 19, 2023, and flyers were posted in all the train stations on April 12, 2023.

For both rounds, a banner was created on the PRHTA home page announcing the open houses to make the announcement visible.

Public Involvement Activities

Open Houses

While all types of community engagement and outreach are important, of particular importance are open community forums where individuals can come and hear information about the study process and provide input regarding their specific needs and concerns. Two rounds of open houses were held to inform and receive input from the public on the MLRTP. The first round of open houses took place in between April 27 and May 3, 2022, and the second round in April 19 and May 4, 2023, from 7:30 am to 2:00 pm. Further details regarding the Open Houses performed in Other Urbanize Areas (UZA) can be found in Appendix: Public Involvement Summary Report.

Table 5.1 shows a summary of both rounds of the open house's location, participants and dates.

Table 5.1: First and Second Round of Open Houses Locations, Participants, and Dates Summary in UZA

TPR	First Round	Participants	Date	Second Round	Participants	Date
North	**Hatillo:** Convention Center Solvia Lucerna *(Hybrid)*	**12** In-person **25** Virtual	• April 27, 2022 • 2:00 pm – 4:00 pm	**Arecibo:** CESCO	**5** In-person	• April 19, 2023 • 9:30 am – 2:00 pm
Southwest	**Mayagüez:** University of Puerto Rico Mayagüez	**71** In-person	• May 3, 2022 • 10:00 am – 2:00 pm	**Mayagüez:** CESCO	**54** In-person	• April 27, 2023 • 9:30 am – 2:00 pm
South	**Ponce**: Municipal Legislature Hall (Hybrid)	**8** In-person **25** Virtual[1]	• April 27, 2022 • 2:00 pm – 4:00 pm	**Yauco:** Integrated Service Center	**63** In-person	• May 2, 2023 • 9:00 am – 2:00 pm
East	**Fajardo:** Multipurpose Center (upper Municipal parking lot) (Hybrid)	**8** In-person **25** Virtual[92]	• April 27, 2022 • 2:00 pm – 4:00 pm	**Ceiba:** Ferry Terminal in Ceiba	**57** In-person	• April 20, 2023 • 7:30 am – 2:00 pm
Southeast	**Guayama:** Interamerican University; Guayama	**48** In-person	• April 28, 2022 • 10:00 am – 2:00 pm	**Guayama:** CESCO	**80** In-person	• May 4, 2023 • 8:30 am – 2:00 pm

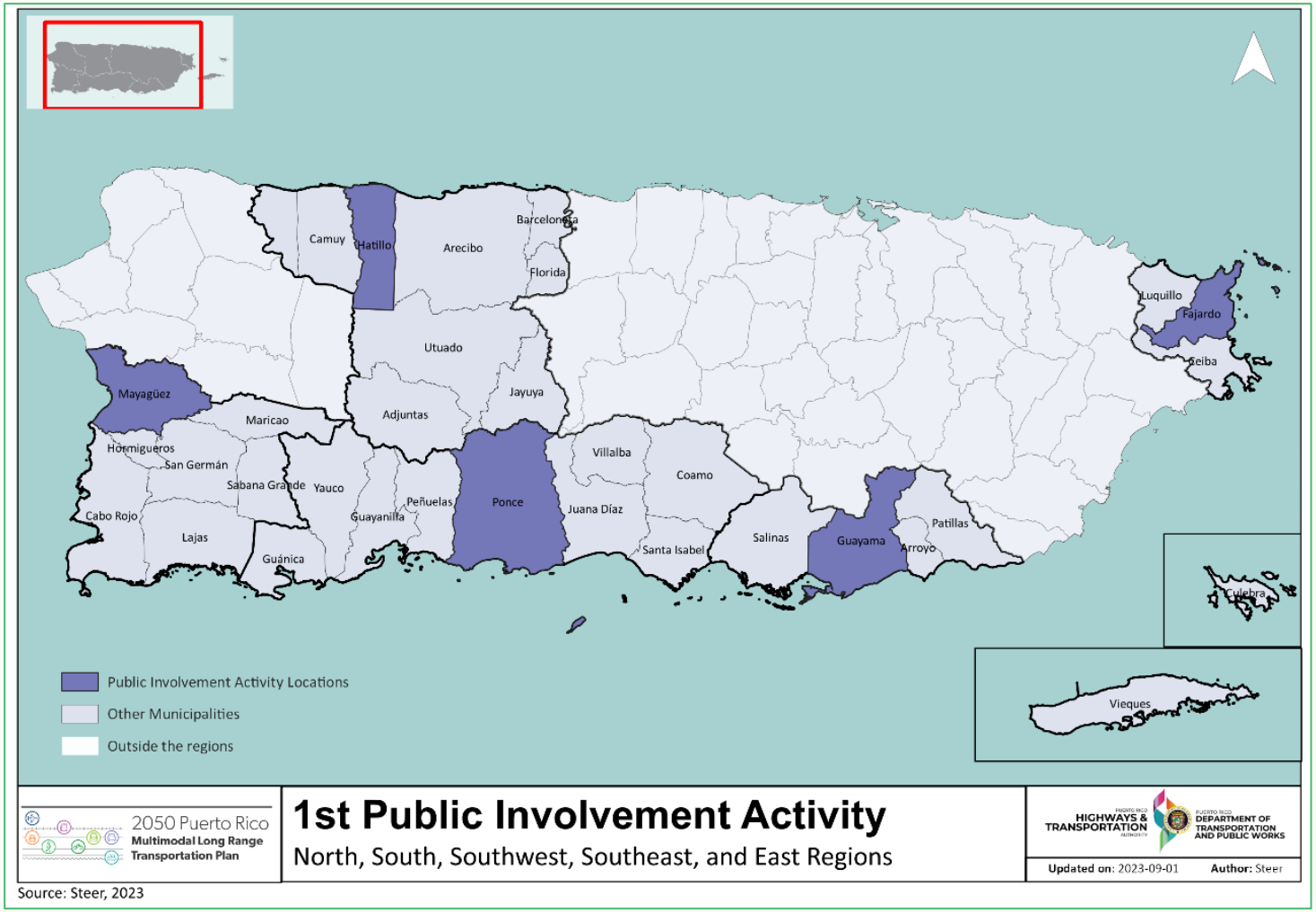
Source: Steer, 2022

92. The number of virtual participants in these Hybrid Open House is a combination of the ones celebrated in Hatillo, Fajardo, and Ponce.

First Round In-person and Hybrid Open Houses

The first round of Open Houses served as an educational process where citizens received information about the MLRTP and provided input regarding their mobility needs. Figure 5.1 shows the location of the Open Houses in the first round of open houses.

Figure 5.1: First Round of Open House Locations



Source: Steer, 2023

Hybrid Open House

To avoid the spread of COVID-19, this round was held in a hybrid format with in-person participation and virtual participation (via Microsoft Teams). The was able to participate using either option. The objective was to present to participants about:

- the work team that will be leading the tasks for the 2050 MLRTP,
- the definition and the importance of a LRTMP and the challenges that the Puerto Rico transportation system faces,
- the work plan schedule including dates and places for the In-person Open Houses,
- and the QR Code to complete the online survey.

This meeting was held simultaneously in the evening session 2:00 pm – 4:00 pm in three (3) locations: Fajardo, Ponce, and Hatillo. For this meeting twenty-five (25) people joined through Microsoft Teams and twenty-eight (28) attended in-person, for a total of 53 in attendance. Table 5.1 shows a complete distribution of the attendance in the regions.

In-Person Open Houses

These Open Houses were held at two locations around the UZA region; the Interamerican University Guayama's Campus and the University of Puerto Rico Mayagüez Campus. These In-person Open Houses had 119 attendees.

The participants were asked to select their Top 10 Issues with the Transportation System. Table 5.2 shows the responses from the different regions to the online survey. More details about the number of respondents by each region below.

- In the **East** region participated eleven (11) persons.
- In the **North** region participated eight (8) persons.
- In the **South** region participated twenty-one (21) persons.
- In the **Southeast** region participated twenty-tree (23) persons.
- In the **Southwest** region participated: forty-one (41) persons.

Figure 5.2: Hybrid Open Houses in Ponce, Hatillo, and Fajardo

Ponce

Fajardo

Hatillo

Source: Steer, 2022

Table 5.2: UZA's Top 10 Issues with the Puerto Rico Transportation System

East TPR

Top Issue with the Transportation System	Mode	Percentage
Insufficient routes	Public transportation	70%
Vehicular congestion	Automobile	70%
Not accessible to everyone	Public transportation	50%
Lack of cycling infrastructure (lanes, parking, etc.)	Cyclists	50%
Poor condition of roads (gaps, poor lane identification, etc.)	Automobile	50%
Unsafe intersections	Automobile	40%
Lack of lighting	Automobile	40%
Poor coverage of existing routes	Public Transportation	30%
Lack of available user information	Public Transportation	30%
Slower than using my car	Public Transportation	30%

Source: Steer, 2022

North TPR

Top Issue with the Transportation System	Mode	Percentage
Vehicular congestion	Automobile	71%
High costs (gasoline, vehicle maintenance)	Automobile	71%
Not accessible to everyone	Public transportation	57%
Slower than using my car	Public Transportation	57%
Poor condition of sidewalks	Pedestrians	57%
Insufficient routes	Public Transportation	43%
Lack of information available to users	Public Transportation	43%
Few routes for freight vehicles	Freight Movement	43%
Lack of sidewalks	Pedestrians	43%
Ramps not available or in poor condition	Pedestrians	43%

Table 5.2: UZA's Top 10 Issues with the Puerto Rico Transportation System

South TPR

Top Issue with the Transportation System	Mode	Percentage
Insufficient routes	Public Transportation	62%
Poor condition of sidewalks	Pedestrians	52%
Lack of lighting/signalling	Pedestrians	52%
High costs (gasoline, vehicle maintenance)	Automobile	52%
Poor coverage of existing routes	Public Transportation	43%
Slower than using my car	Public Transportation	43%
Lack of sidewalks	Pedestrians	43%
Poor condition of roads (gaps, poor lane identification, etc.)	Automobile	43%
Lack of available user information	Public Transportation	38%
Lack of exclusive lanes	Public Transportation	38%

Source: Steer, 2022

Southeast TPR

Top Issue with the Transportation System	Mode	Percentage
Insufficient routes	Public Transportation	52%
Not accessible to everyone	Public Transportation	48%
Poor condition of facilities (docks, roads, etc.)	Freight Movement	48%
Few routes for freight vehicles	Freight Movement	43%
High costs (gasoline, vehicle maintenance)	Automobile	43%
Poor coverage of existing routes	Public Transportation	39%
Lack of exclusive lanes	Public Transportation	39%
Slower than using my car	Public Transportation	39%
Lack of sidewalks	Pedestrians	39%
Poor condition of sidewalks	Pedestrians	39%

Table 5.2: UZA's Top 10 Issues with the Puerto Rico Transportation System

Southwest TPR

Top Issue with the Transportation System	Mode	Percentage
Lack of cycling infrastructure (lanes, parking, etc.)	Cyclists	63%
Poor road condition (gaps, poor lane identification, etc.)	Automobile	60%
Vehicular congestion	Automobile	55%
High costs (gasoline, vehicle maintenance)	Automobile	55%
Poor coverage of existing routes	Public Transportation	53%
Poor condition of sidewalks	Pedestrians	53%
Lack of information available to users	Public Transportation	45%
Lack of sidewalks	Pedestrians	43%
Lack of lighting/signage	Pedestrians	43%
Unsafe	Pedestrians	43%

Source: Steer, 2022

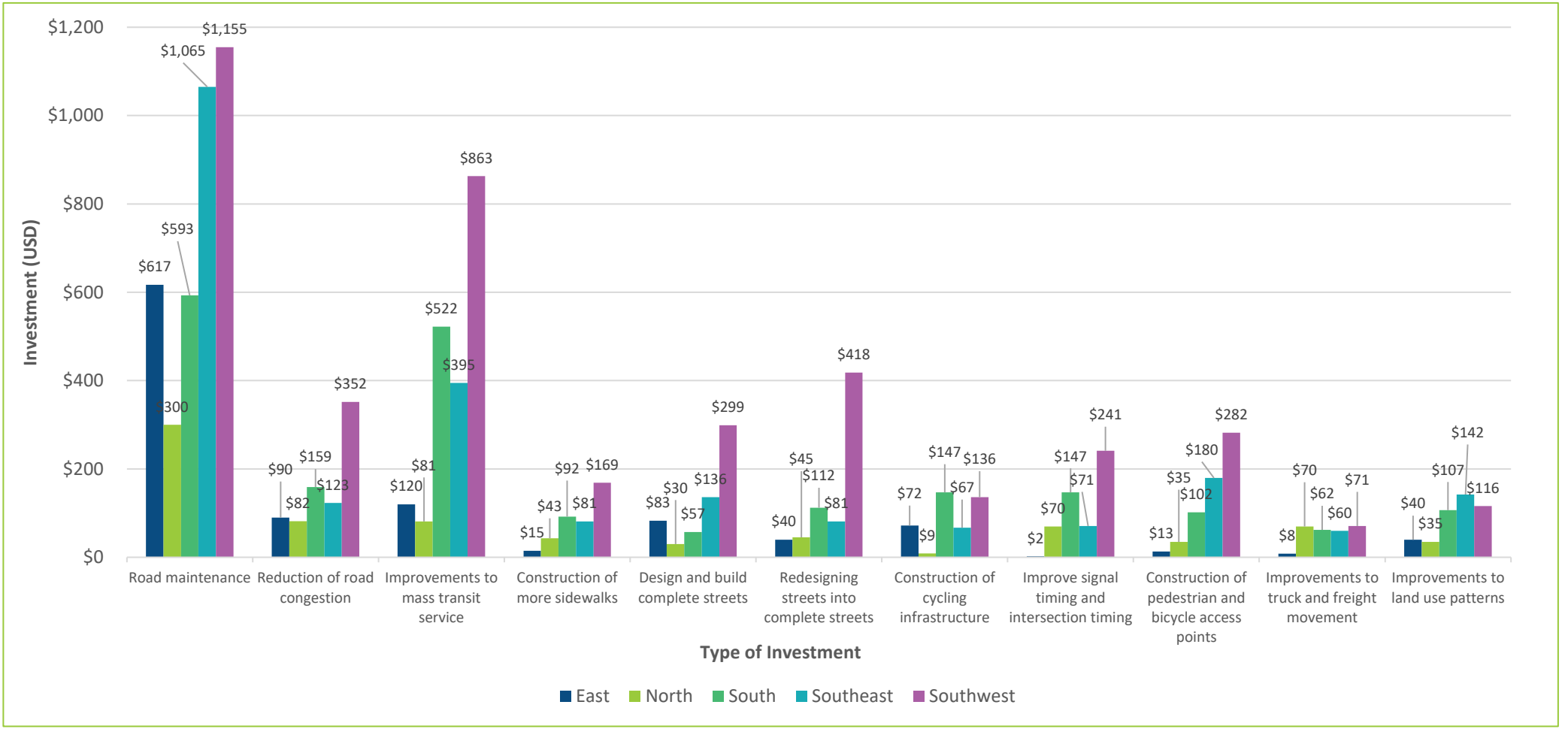
Source: Steer, 2023

Figure 5.2 shows the responses of a total of one hundred four (104) participants in total, for the five (5) regions, that responded to the following question:

If you had $100 to invest in the Island transportation system, how would you distribute the money to improve the transportation system?

A summary of the responses given by the UZAs TPR participants to the topics of trips before and during COVID, safety, equality and inclusion, and accessibility can be found in the next page. Note that not every participant responded to every question, thus there will be a disparity in the number of responses.

Figure 5.3: Investment in the Transportation System Responses



Source: Steer, 2022

North TPR

Trips Before and During COVID 19

- Before the COVID-19 pandemic, 100% of the trips of the eight (8) participants were made in private vehicles.
- During the COVID-19 pandemic, private vehicles accounted for 100% of all the trips of two (2) participants.

Safety

- Participants were asked how safe they felt utilizing transportation systems (automobiles, public transportation, and non-motorized modes). From the eight (8) people who responded, 75% said they were neutral, followed by 13% who said they felt unsafe and 13% said that they felt safe utilizing the transit system.

Equality and Inclusion

- Participants were asked to assess if "transportation in Puerto Rico takes into consideration equity and Inclusion". From the eight (8) people who responded, 50% answered that they were neutral in this regard, while 25% stated that they disagreed and 25% said they agreed with this statement.

Accessibility

- Participants were asked to assess if they "consider transportation in Puerto Rico (cars and mass transit/non-motorized modes) to be accessible". From the eight (8) participants, 50% said they consider neutral with the statement, while 28% said they disagreed.

South TPR

Trips Before and During COVID 19

- Before the COVID-19 pandemic, 87% of the trips were made in private vehicles, followed by walking, bicycle, and public transportation with 4% each of the twenty-three (23) participants.
- During the COVID-19 pandemic, private vehicles accounted for 71% of all the trips, with walking accounting for 29% of the seven (7) participants.

Safety

- Participants were asked how safe they felt utilizing transportation systems (automobiles, public transportation, and non-motorized modes). From twenty-one (21) participants, 43% said they were neutral, followed by 24% who said they felt unsafe utilizing the transit system.

Equality and Inclusion

- Participants were asked to assess if "transportation in Puerto Rico takes into consideration equity and Inclusion". From the twenty-one (21) people who responded, 48% answered that they were neutral in this regard, while 19% stated that they agreed with this statement.

Accessibility

- Participants were asked to assess if they "consider transportation in Puerto Rico (cars and mass transit/non-motorized modes) to be accessible". From the twenty-one (21) people who responded, 52% said they disagreed or strongly disagreed with the statement, while 19% said they agreed.

East TPR

Trips Before and During COVID 19

- Before the COVID-19 pandemic, 100% of the trips were made in private vehicles of the eleven (11) participants.
- During the COVID-19 pandemic, private vehicles accounted for 100% of all the trips of the one (1) participant.

Safety

- Participants were asked how safe they felt utilizing transportation systems (automobiles, public transportation, and non-motorized modes). From eleven (11) participants, 55% said they were neutral, followed by 27% who said they felt unsafe utilizing the transit system.

Equality and Inclusion

- Participants were asked to assess if "transportation in Puerto Rico takes into consideration equity and Inclusion ". From the eleven (11) people who responded, 36% answered that they were neutral in this regard, while 27% stated that they agreed with this statement.

Accessibility

- Participants were asked to assess if they "consider transportation in Puerto Rico (cars and mass transit/non-motorized modes) to be accessible". From the eleven (11) people who responded, 27% said they were neutral, 27% disagreed, and 27% strongly disagreed with the statement, while 18% said they agreed.

Southeast TPR

Trips Before and During COVID 19

- Before the COVID-19 pandemic, 68% of the trips were made in private vehicles of the thirty-one (31) participants.
- During the COVID-19 pandemic, private vehicles accounted for 85% of all the trips of the thirteen (13) participants.

Safety

- Participants were asked how safe they felt utilizing transportation systems (automobiles, public transportation, and non-motorized modes). From twenty-four (24) participants, 44% said they were neutral, followed by 24% who said they felt unsafe utilizing the transit system.

Equality and Inclusion

- Participants were asked to assess if "transportation in Puerto Rico takes into consideration equity and Inclusion ". From the twenty-five (25) people who responded, 68% answered that they were neutral in this regard, while 16% stated that they agreed with this statement.

Accessibility

- Participants were asked to assess if they "consider transportation in Puerto Rico (cars and mass transit/non-motorized modes) to be accessible". From the twenty-three (23) people who responded, 52% said they were neutral, 24% disagreed.

Southwest TPR

Trips Before and During COVID 19

- Before the COVID-19 pandemic, 66% of the trips were made in private vehicles of the forty-one (41) participants.
- During the COVID-19 pandemic, private vehicles accounted for 85% of all the trips of the thirteen (13) participants.

Safety

- – Participants were asked how safe they felt utilizing transportation systems (automobiles, public transportation, and non-motorized modes). From forty-one (41) participants, 51% said they were neutral, followed by 22% who said they felt safe, and 17% who said they felt unsafe utilizing the transit system.

Equality and Inclusion

- Participants were asked to assess if "transportation in Puerto Rico takes into consideration equity and Inclusion ". From the forty-one (41) people who responded, 49% answered that they were neutral in this regard, while 27% stated that they disagreed with this statement.

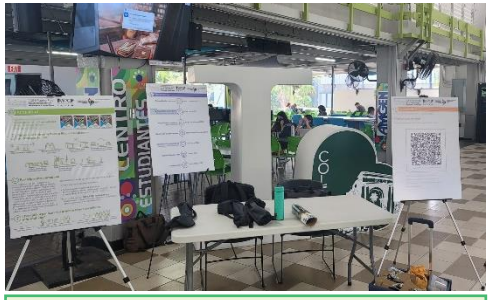
Accessibility

- Participants were asked to assess if they "consider transportation in Puerto Rico (cars and mass transit/non-motorized modes) to be accessible". From the forty-one (41) people who responded, 49% said they agreed, 44% were neutral, and 34% disagreed with the statement, while 15% said they strongly agreed.

For more details about all the findings of this round of open houses can be found in Appendix: Public Involvement Summary Report.

Figure 5.4: In-Person Open Houses

Guayama



Mayagüez

Figure 5.5: Informative Boards – First Round of Open Houses

Source: Steer, 2022

Second Round of Open Houses In-Person and Virtual Room

The purpose of the second round of Open Houses was to provide an update on the progress of the MLRTP and to validate the vision, goals, and objectives for the 2050 MLRTP. This round was held in-person alongside a virtual room for online participation. The public had the opportunity to participate using either format.

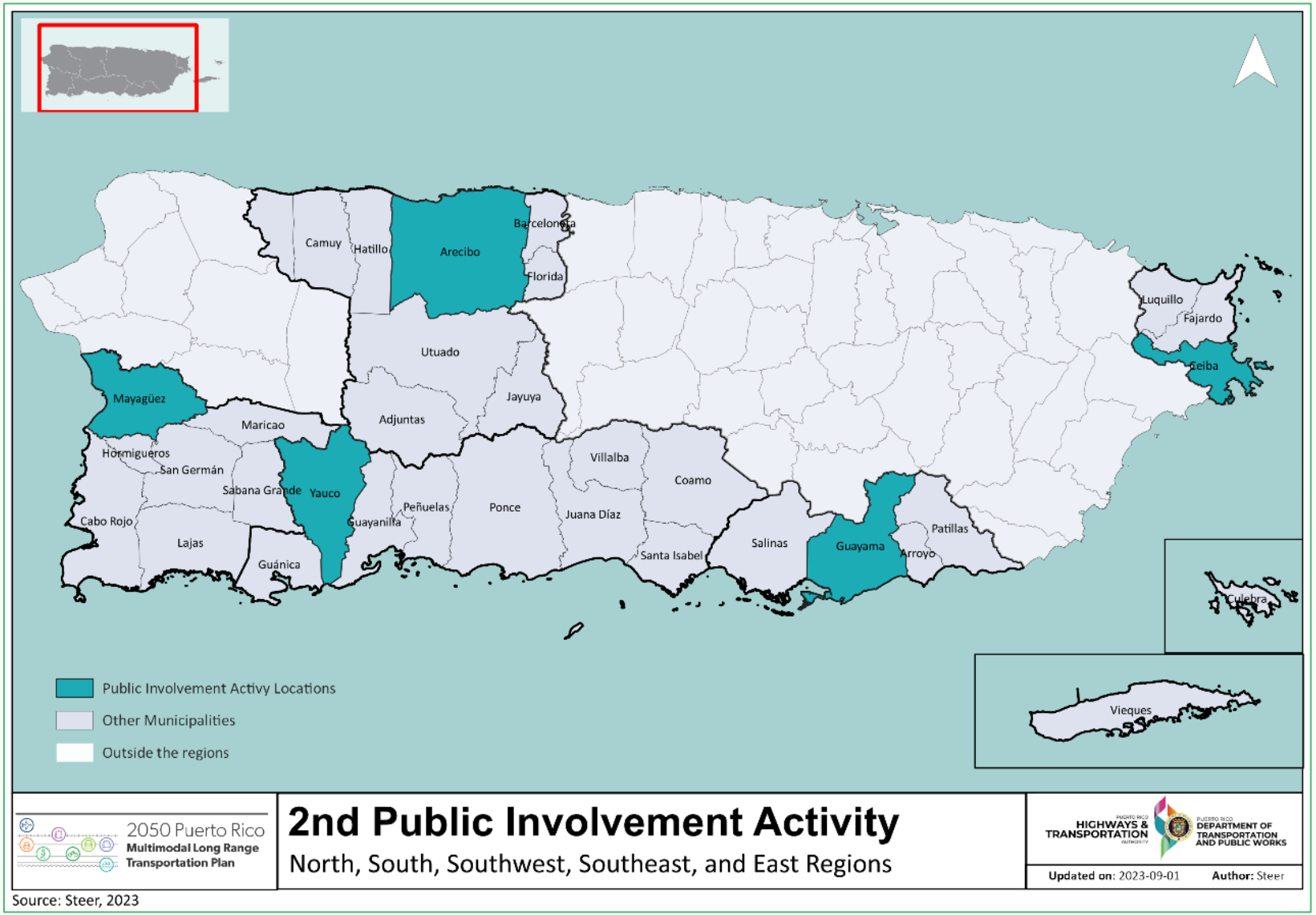
The virtual room was an experience created specifically for this second round of Open Houses where the participants had the opportunity to be part of the activities from any devices (computer, tablet, or cellphone) and any location. The public could access this via a link provided in multiple places. The virtual room contained the same information and boards as the in-person activities. The virtual boards also allowed public to complete different exercises, such as the validation of the goals and objectives of the MLRTP and the Transportation Demand Management (TDM) survey. Figure 5.5 shows the virtual room experience entered from a computer.

In the UZA's region, the Open Houses were held at the CESCOs of Arecibo, Mayagüez, and Guayama, the Integrated Service Center of Yauco, and in the Ferry Station of Ceiba. These Open Houses had an attendance of 259 participants for the in-person events.

Figure 5.6: Virtual Room Experience

Source: Steer, 2023

Figure 5.7: Second Round of Open House Locations



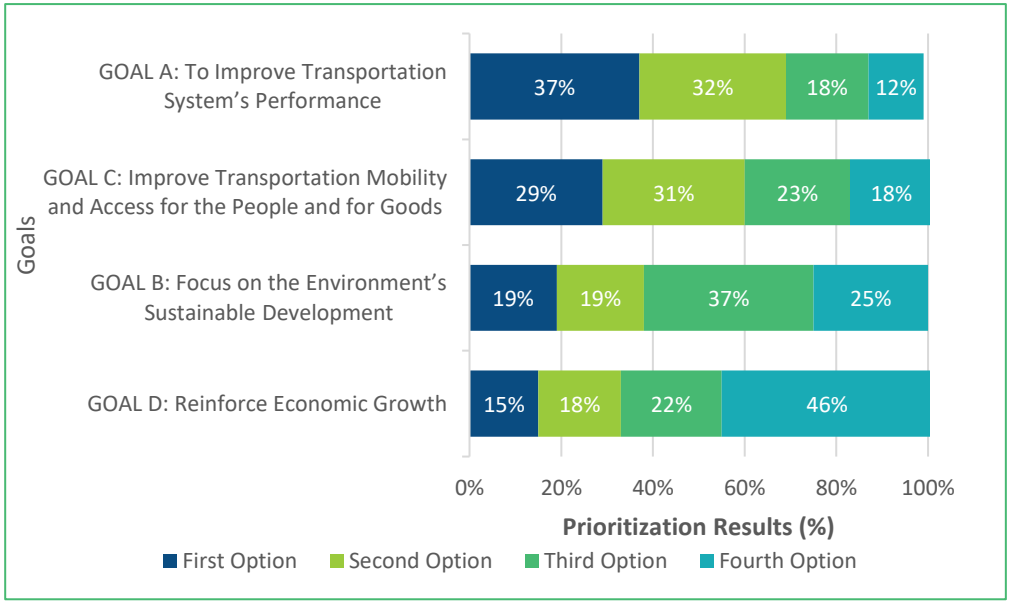
Source: Steer, 2023

Goals and Objectives Prioritization Survey

As mentioned previously, one of the purposes of this round was to validate and prioritize the vision, goals, and objectives of the 2050 MLRTP, the following table shows the results of this prioritization.

Figure 5.7 shows the ranking position occupied by each of the 2050 MLRTP goals. Goal A received 37% of the 142 votes received as the most important goal of the MLRTP. Goal C received 29% of the votes as the first option, Goal B received 19%, and Goal D received 15%.

Figure 5.8: Goals Ranking Prioritization



Source: Steer, 2023

Transportation Demand Management

During this round of Open Houses, a Transportation Demand Management (TDM) survey was conducted to learn about Puerto Rican's transportation challenges. The purpose of the survey was to inform the development of an appropriate package of measures targeted at encouraging sustainable travel and minimizing the effects of transportation on climate change with an emphasis on reducing Single Occupancy Vehicles (SOV) trips, congestion, Vehicle Miles Traveled (VMT), and parking demand. For more information regarding TDM see Appendix: Long-Range Multimodal Plan Travel Survey and TDM Report.

Figure 5.8 represents the Survey respondents of the UZA's Regions Commute Modes. Note that there is no Commute Mode graphic for the North TPR since there were not enough surveys to consider in this analysis.

East TPR

95% of 20 survey respondents in the East TPR drive alone 5+ days a week. The second most popular commute choice over a 5-day period is walk at 36%, followed by public transit at 20%.

South TPR

75% of 28 survey respondents in the South TPR drive alone 5+ days a week. The second most popular commute choice over a 5-day period is walk at 26%, followed by dropped off at 11%.

Southeast TPR

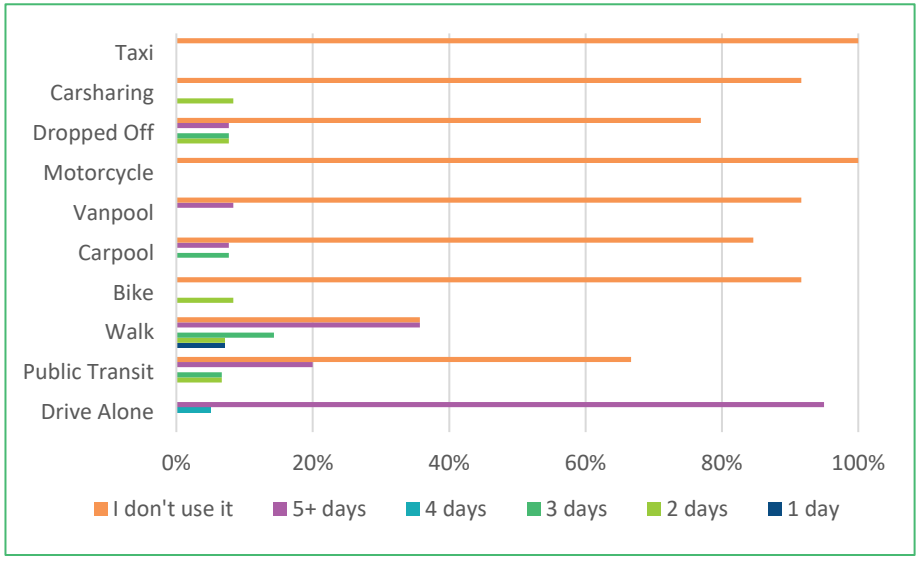
90% of 10 survey respondents in the Southeast TPR drive alone 5+ days a week. The second most popular commute choice over a 5-day period is walk at 25%, followed by bicycle, carpool, and dropped off at 13%.

Southwest TPR

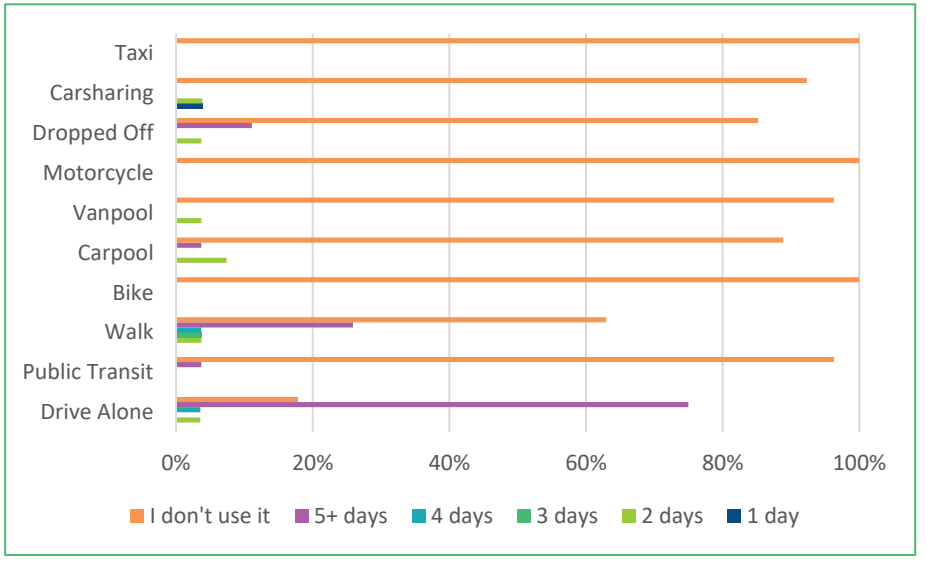
68% of survey respondents in the San Juan TMA drive alone 5+ days a week. The second most popular commute choice over a 5-day period is walk at 23%, followed by public transit at 16%.

Figure 5.9: UZA's Regions Commute Mode

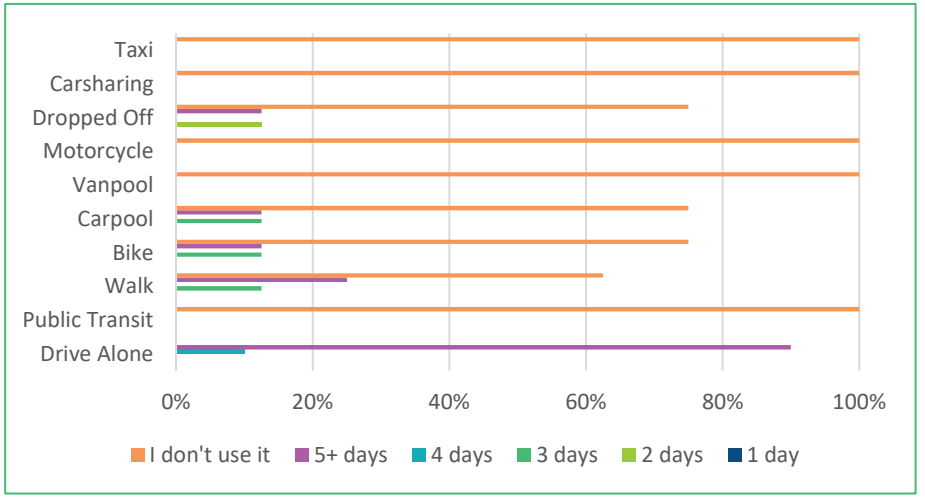
East TPR



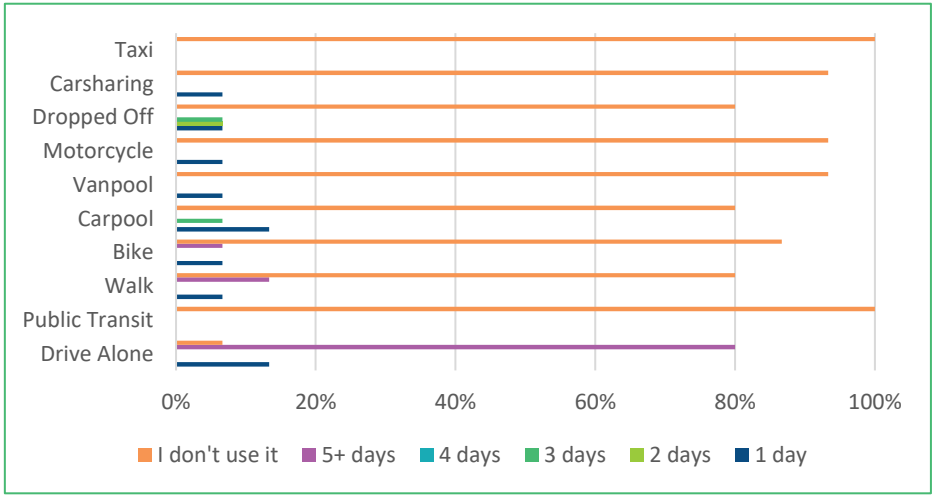
South TPR



Southeast TPR



Southwest TPR



Source: Steer, 2023

Throughout the survey, particularly through the comments section, respondents stressed that inadequate public transportation amenities were a major challenge to them exploring alternative transportation modes. They also indicated safety concerns, lack of bike infrastructure, and commute times being too long as some of the reasons they choose to drive.

Figure 5.10: UZA's Region Open Houses in Guayama, Mayagüez and Yauco

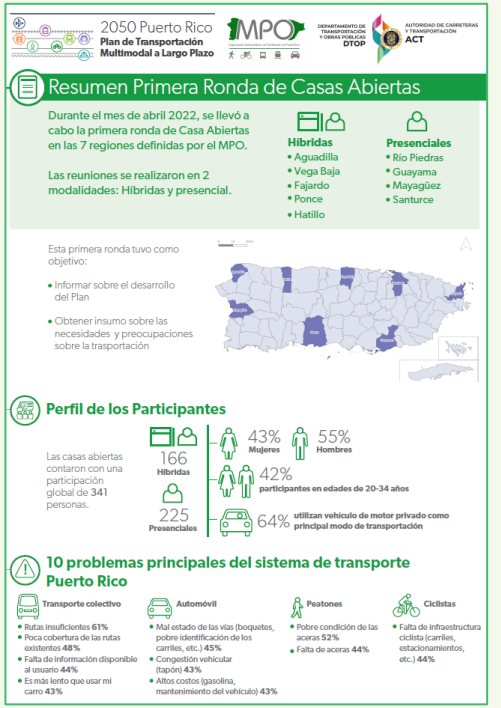
Guyama

Mayagüez

Yauco

Source: Steer, 2023

Figure 5.11: Informative Boards – Second Round



Source: Steer, 2023

Other Engagement Activities

Meetings with Stakeholders

Individuals, organizations, and stakeholders were provided with additional options to engage in the Plan's process and development of the 2050 MLRTP. These groups were invited to committee meetings to review the latest issues and decisions and to provide their inputs.

MPO Meetings: MPO participants received updated on the MLRTP process and provided regular input and recommendations.

Stakeholder Meetings: Meetings were held with all committees as appropriate, to provide input, discuss any issues, and to ensure wide participation in the decision-making process to benefit the plan. Some of these stakeholders were the Puerto Rico Integrated Transit Authority (PRITA), Skootel, and the PRHTA Directive Committee.

Web Page

A web page was built as part of the efforts to involve the public in the development of the 2050 MLRTP. The website was primarily used to collect public input for the 2050 MLRTP review process. Citizens will be able to access all the documents for the 2050 MLRTP on this website, as well as assess the process and provide comments and recommendations on the documents.

Figure 5.12: 2050 MLRTP Web Page

Source: Steer, 2023

6

Other Urbanized Areas Under 200,000 Population (UZA)

Tomorrow's Needs

This chapter aims to outline the future transportation demands of the Other Urbanized Areas (UZAs) while considering the regional needs of each mode. It will help to have a greater understanding of what future strategies should be implemented to accomplish the state and regional goals. This chapter is divided into four (4) sections: Regional Needs by Mode, Strategic Approach by Mode, Policy Guidelines, and Future Scenarios.

Regional Deficiencies by Mode

During the 2050 UZA MLRTP preparation, transportation needs have been assessed from different perspectives. An evaluation from the agencies' viewpoint was performed in Appendix: A Shared Vision. There, the progress of current transportation system goals was recorded. It is important to note that this progress data is only available at an Island-wide level because policy goals are communicated by the state government. From the user's perspective, results from the first public involvement survey are considered. Specifically, a summary of their main transportation system concerns by mode and by region is included, more information on the surveys can be found in Chapter 5.

Performance Deficiencies

The performance deficiencies discovered during the System Performance Report (found in Appendix: A Shared Vision), reflected a lack of progress on several goals by plan. The evaluated documentation with recorded progress includes the PR Strategic Highway Safety Plan (SHSP), the PR Transportation Asset Management Plan (TAMP), and the Highway Safety Improvement Program (HSIP). Additional planning documents were described, but the data on progress was not available.

The progress made on the 2019 SHSP goals showed deficiencies in reducing the 5-year moving averages in fatalities and fatality rate, and in reducing serious injuries and their corresponding moving averages. In addition, there has been a failure to reach the projected goals on non-motorized fatalities and serious injuries.

In contrast, the 2022 TAMP showed more progress on their goals. The only deficiencies were found on the percentage of pavement lane miles in good condition and on the percentage of non-interstate lane miles in poor condition. Like the 2022 TAMP, the 2022 HSIP showed only two measures without progress made. These measures were the number of fatalities and the fatality rate.

Transit System

The following section summarizes the main transit deficiencies identified along the 2050 MLRTP development process.

North TPR

Out of the nine (9) municipalities that belong to the North region, currently seven (7) of them operate municipal transit systems and/or have registered público routes. This data implies broad transit coverage in the region, but a closer analysis suggests otherwise. Out of these municipalities, Adjuntas and Florida are the only municipalities without an operating transit system, although the latter has a municipal transit plan. And Arecibo, the most populated municipality in the region, has one (1) intramunicipal and one (1) intermunicipal público route in operation.

There is limited data available on municipal transit systems, but, according to residents, there is insufficient information available, and there are concerns about safety and security.

East TPR

In the East region, all five (5) municipalities have at least one público route, but Fajardo and Vieques are the only municipalities that have a municipal transit system. There is interconnectivity in the region, with público routes that extend from Luquillo to Fajardo and from Fajardo to Ceiba. The municipal islands of Vieques and Culebra are also connected to the region through a privately operated ferry service. Transit coverage in the East region is more present than in other regions, where there are municipalities without any transit presence.

Nonetheless, there is a need for additional transit coverage to and from residential and commercial areas extending beyond the main roads in the region (PR-3, PR-194). Additionally, concerns regarding the operation of existing transit were recorded in the survey from the first public involvement activity. Security concerns, lack of information available, and no nightly service were some of these concerns.

South TPR

The South region, like the North, has nine (9) municipalities and seven (7) with at least a municipal transit system or one (1) público route. The two (2) municipalities without transit services are Peñuelas and Santa Isabel, although both have recently initiated the process to prepare their transit plans. The municipalities of Guayanilla, Yauco and Guánica have interconnectivity through their público routes that start/end in Yauco. In the center of the region, the municipalities of Ponce and Juana Díaz are also interconnected by público routes. This intermunicipal connection is interrupted by the lack of routes in Peñuelas.

Although most of the region has a transit presence, there are still some areas for improvement. The main improvement areas, as noted in the first survey, relate to stop/infrastructure location and accessibility, and the operation of the systems. It is also important to mention that there is reduced transit coverage, with two (2) of the municipalities not receiving any transit service. And there is insufficient coverage in municipalities that only have one (1) público route running through main roads.

Southeast TPR

Three (3) out of the four (4) municipalities in the Southeast region currently have either a municipal transit system or a público route. Similar to other regions, the público routes run through main roads, but one (1) of these routes (I3056) connects three (3) municipalities in the region (Patillas, Arroyo, and Guayama). Out of the four (4) municipalities, Guayama and Salinas are the only ones without a municipal transit system, but both have a recent transit plan.

The lack of municipal transit implies reduced transit access in rural areas. In addition, the existing transit infrastructure brings challenges to users, like a lack of weather protection and insecurity. Another challenge exists in their operation, which was mentioned by residents that responded to the first public involvement activity survey. This is because the transit systems do not compete with private vehicles in travel times, and they have limited operating hours.

Southwest TPR

The Southwest region has the most reduced transit coverage of the UZA regions. Out of its seven (7) municipalities, four (4) do not have any transit available. The municipalities of Maricao, San Germán, Sabana Grande and Lajas are the ones without transit options. In contrast, Mayagüez has inter- and intramunicipal público routes, a municipal transit system, and an additional transit system on its University of Puerto Rico campus. The other two (2) municipalities with transit are Hormigueros and Cabo Rojo, where one has a municipal transit system and the other has two (2) público routes.

This region's main transit deficiency is the lack of transit access within municipalities and interconnecting them. Additionally, there were operational concerns regarding the current operating systems. These concerns echo those from other regions and include a lack of information and limited operating hours (no nighttime service).

General Transit Needs for UZAs

Among the UZAs, there were overarching transit needs that were repeated throughout the regions. Some of the main identified transit deficiencies were:

- Reduced transit interconnectivity between municipalities in the same region
- Reduced transit coverage within municipalities. Focused in non-rural areas.
- Reduced information available on existing transit systems
- Limited operating hours. Only during daytime hours.
- Lack of connectivity between transit systems

Roadway System

The main roadway system concerns by region are described in the following sections as a result of the analyses performed with current data and the first public involvement activity survey.

North TPR

The North region's road network includes segments of interstate (PR-22 and PR-2) and principal arterial roads like PR-129 and PR-10. These roads connect seven (7) out of the nine (9) municipalities in the region. Arecibo has the point of entry (and exit) from the PR-22 expressway, which converts to the PR-2 to the west. From the traffic volume analysis, PR-22 and PR-2 are the roads with the highest volumes in the region.

East TPR

The main East region roads include interstates, principal arterials, and minor arterials. Along the PR-3 and PR-194 are the points with the highest traffic volumes in the region. It is important to highlight that volume data was not available for Vieques or Culebra. This gap in recent traffic data affects the ability to assess current roadway system operations in both municipalities. Additional concerns from the public express insecurity in parking facilities, lack of lighting, and unsafe intersections. Deteriorated pavement conditions were also a concern to the public, and this coincides with the deficiencies identified in the 2022 TAMP.

South TPR

In the South region, the PR-52 expressway is the road with the highest traffic volume, according to 2022 data. This expressway connects seven (7) out of the nine (9) municipalities in the region. Just as in the East region, residents expressed concerns regarding pavement conditions and quality. These concerns are in accordance with the recorded TAMP pavement deficiencies. Additional concerns were obtained from the responses to the first public involvement activity survey. The main concern was the congestion caused by road maintenance and construction.

Southeast TPR

In the Southeast region, only one (1) municipality, Salinas, is crossed by the PR-52 expressway. The traffic data available for this region is limited in comparison to regions with similar extensions. From the available data, the highest traffic volume in the region was recorded in Salinas in PR-52. As in the East region, this void in recent traffic data affects the ability to assess current roadway system operations in the region. Additional concerns from stakeholders relate to both operation and infrastructure maintenance. As shared by other regions, these issues are traffic congestion and pavement deterioration.

Southwest TPR

Four (4) out of the seven (7) municipalities in the Southwest region are connected by the PR-2, which is categorized as an interstate. This road has the highest traffic volume in the region, especially in the municipalities of Mayagüez, Hormigueros, and San Germán. Additional concerns from stakeholders relate to both operation and infrastructure maintenance. As shared by other regions, these issues are traffic congestion and pavement deterioration.

General Roadway System Needs for UZAs

There are general roadway system deficiencies that were identified across the UZA regions. These were:

- Road congestion
- Deteriorated pavement conditions
- Insecurity in parking facilities
- Lack of road maintenance and construction coordination
- Reduced availability of traffic count data

Non-Motorized

The non-motorized system has general deficiencies that may give rise to safety issues for pedestrians and cyclists. In general, failure to reach the projected safety goals to reduce non-motorized fatalities and serious injuries has been reported on the SHSP.

North TPR

The North region does not have dedicated bicycle facilities. The proposed bicycle conceptual network from the Comprehensive Bicycle and Pedestrian Plan (CBPP) connects seven (7) out of the nine (9) municipalities in the region. The roads mostly used for cycling or walking include the PR-2. Comments from the public on the state of pedestrian infrastructure sheds light to deficiencies. Out of the survey from the first public involvement activity, residents pointed out that there are poor sidewalk conditions or lack of ramps, uncompliant ramps, and difficulties in crossings.

East TPR

The East region, like the North, does not have dedicated bicycle facilities. In this region, most cyclists use PR-3, PR-997, and PR-251. Residents expressed their concerns for the lack of pedestrian and bicycle infrastructure. Especially, they highlighted the lack of ramps in terms of pedestrian accessibility.

South TPR

In the South region, only the municipality of Ponce has existing bicycle infrastructure. Although this is the only municipality with bicycle facilities, across all but one municipality in the region (Villalba) there is significant cyclist activity. In its plan to create an elderly friendly city[93], the municipality of Coamo identified deficiencies in sidewalks including obstructions, uncompliant ramps for persons with mobility disabilities, and lack of marked crossings. In answers from the first public involvement activity survey, residents of the region echoed the sentiments expressed in Coamo's plan. Additional concerns were the lack of sidewalks, and lighting.

Southeast TPR

The Southeast region has a dedicated bicycle facility in Arroyo, and the recorded bicycle activity in the region extends from Arroyo to Patillas. Resident's concerns from the first public involvement activity survey included lack of ramps in sidewalks.

Southwest TPR

The Southwest region has one existing bicycle facility in Mayagüez. The most used roads by cyclists extend across almost all municipalities in the region, except to Maricao. Although cycling is very popular in the region due to many mountain bike trails, there is a need for dedicated cyclist infrastructures. Additionally, in the first survey conducted during the 2050 MLRTP development, concerns with deteriorated or non-existent sidewalks, as well as lack of lighting and marked crossings were expressed.

General Roadway System Needs for UZAs

Through the description of the existing non-motorized system and their deficiencies some shared concerns between UZA regions were identified. These identified deficiencies include:

- Absence of, and deteriorated sidewalks
- Absence of ADA compliant ramps
- Absence of bicycle facilities
- Absence of crosswalks
- Faulty or broken lighting

93. Autonomous Municipality of Coamo (2021) Coamo Ciudad Amigable con Adultos Mayores Retrieved from: https://www.aarp.org/content/dam/aarp/livable-communities/age-friendly-network/2021-action-plans/pr-coamo-action-plan-2021.pdf

Strategic Approach by Mode

After evaluating sociodemographic and employment trends, transportation demands, and potential challenges, the following section outlines the strategies required to meet Puerto Rico's transportation and planning needs.

This section is divided into four (4) categories that describe the strategies:

1. Transit System;
2. Roadway System;
3. Non-Motorized; and
4. Resiliency Strategies.

Transit System

Transit improvement strategies are essential for enhancing the efficiency, accessibility, and sustainability of public transportation systems. PRITA is working on the five (5) key transit improvement strategies:

1. Improve, Rehabilitate, and Preserve the Infrastructure of the Transit Network.

Upgrading transit infrastructure, including stations, terminals, and transit hubs. This can involve adding amenities such as shelters, seating, and digital information displays, making transit more comfortable and user-friendly.

2. Enhance the Transit Network at the Regional, Metropolitan, and Rural Level.

Expanding the coverage of transit by adding new routes and increasing the frequency of services. This can help serve more communities, reduce congestion, and provide convenient access to public transportation.

3. Increase the Efficiency, Effectiveness, and Reliability of the Transit System.

Leveraging technology to enhance transit services. This includes implementing real-time tracking and scheduling systems, contactless payment options, and smart ticketing solutions, which improve the overall passenger experience and operational efficiency. In addition to the use of data analytics and ridership information to optimize routes, schedules, and service frequencies.

4. Improve Transit Accessibility and Equity.

Integrating different modes of transportation, such as buses, train, ferry, bicycles, and walking into a seamless transit system. This allows passengers to easily transfer between modes, reducing travel time and increasing convenience. In addition, mode integration ensures that everyone, regardless of their income, age, or physical abilities, can access essential services, employment opportunities, educational, and recreational activities.

5. Strengthen Mobility to Support the Environment and the Economy.

Implementing sustainable practices and eco-friendly technologies in transit operations. This includes transitioning to electric or hybrid buses, incorporating green infrastructure, and promoting active transportation options such as biking and walking to reduce emissions and environmental impact.

A comprehensive approach that combines elements of these strategies can lead to significant improvements in public transportation systems, ultimately benefiting both commuters and the environment.

Table 6.1 shows which strategic approaches should be emphasized for the transit system in each region over the term of the 2050 MLRTP. It should be clarified that all policies described previously apply to all the UZA regions, and the emphasise given to each policy may change.

Table 6.1: Transit System Strategic Approach Emphasis Area for 2050

Regions	1. Improve, Rehabilitate, and Preserve the Infrastructure of the Transit Network	2. Enhance the Transit Network at the Regional, Metropolitan, and Rural Level	3. Increase the Efficiency, Effectiveness, and Reliability of the Transit System	4. Improve Transit Accessibility and Equity	5. Strengthen Mobility to Support the Environment and the Economy
North					
East					
South					
Southeast					
Southwest					

Source: Steer, 2023

Roadway System

1. Improve, Rehabilitate and Preserve Existing Roadways

The Transportation Asset Management Plan 2032 (TAMP) is the PRHTA four-(4) year update to the Federally required TAMP. This document provide the investment strategies to manage the national highway systems' infrastructure (pavements and bridges) during the following ten (10) years. The strategies are based on the infrastructure status diagnosis and a forecast of future conditions after implementing the pertinent actions.

The PRHTA has updated the TAMP aiming to accomplish a systematic process of operating, preserving, and improving physical assets. Specifically, the plan seeks to rehabilitate pavement conditions and bridges to get the infrastructure to a state of good repair.

As a federal requirement the NHS cannot have more that 5% of the pavement in a poor condition. According to 2023 two (2) year goal of the TAMP, for bridges the target is that the infrastructure in poor conditions should be under 10% of the total.

The objectives established to guide the TAMP are[94]:

1. "PRHTA will implement data-driven, life cycle-based pavement and bridge management processes to achieve the condition targets and the desired SOGR, enhance safety, increase resilience, and lower life-cycle costs for managing pavements and bridges."

2. " PRHTA will partner with the MPO to communicate the targets and incorporate asset management-based projects into the Transportation Improvement Program, the Long-Range Statewide Transportation Plan, and the Metropolitan Transportation Plan."

3. " PRHTA will work with stakeholders to communicate the importance of reliable and sufficient funding to achieve condition targets and desired SOGR to provide safe and reliable bridges and pavements for the movement of people and goods."

2. Comply with the data collection requirements and Monitoring Systems for the Agency.

There are various programs that help maintain the infrastructure inventory to have a better transportation system, and this may be done through the various data collection programs that the PRHTA has available, such as Model Inventory of Roadway Elements (MIRE), Road Information Management System (RIMS), and Strategic Highway Safety Plan (SHSP).

3. Monitoring Road Safety and Data Collection Thru the Strategic Highway Safety Plan (SHSP)

The Federal Highway Administration's (FHWA) should develop planning tools to improve road safety in the US territory such as Highway Safety Improvement Programs (HSIP). The main goal of this effort is to reduce severe traffic crashes as the incidents with victims' fatalities and serious injuries. Puerto Rico receives $30 million per year of federal funds to implement the HSIP under the Fiscal Management Information System (FMIS) ZP-30 initiative for improving road safety.

Puerto Rico prepared and executed the 2014-2018 SHSP and the 2019-2023 SHSP in accordance with this rule. The SHSP is a five-year plan that has benefited from the involvement and work of road safety delegates from around the country. The primary road safety concerns and possibilities to meet the aim of the HSIP, as well as other transportation plans, have been identified and studied through this Plan[95]. One of the conditions specified by FHWA was that the SHSP be revised on or before the conclusion of the five (5) year cycle.

94. Puerto Rico Highways and Transportation Authority. (2022). Retrieved from Puerto Rico Transportation Asset Management Plan 2032: https://act.dtoppr.gov/wp-content/uploads/2023/04/2022-12-29-BIL-Compliant-TAMP-2032.pdf, p.17
95. Puerto Rico Highway and Transportation Authority. (2021). About Us. Retrieved from Strategic Highway Safety Plan: https://carreteraseguraprc.com/en/about-us/

4. Continue to gather the information required for the Model Inventory of Roadway Elements (MIRE)

The MIRE Fundamental Data Element (FDE) 2023-2026 Action Plan provides the roadmap towards the collection of FDE for all Puerto Rico public roads by September 30, 2026. The collection of FDE will allow the PRHTA and partners to better work collaboratively by using coordinated data. The Action Plan is among one of the strategies that are being taken to ensure Puerto Rico's continuous improvement for all road users.

To ensure that the September 30, 2026, deadline is met the Action Plan identifies the following major actions to take place by and continuously through 2026:

- Continue with bi-weekly progress meetings coordinated by PRHTA's Integrated Technical Committee;
- Identify a methodology for AADT estimation on local roads;
- MIRE FDE data gathering (minus AADT gathering);
- MIRE FDE data sharing with other databases; and
- AADT data gathering and continuous update.

Table 6.2 shows which strategic approaches should be emphasized for the roadway system in each region over the term of the 2050 MLRTP. It should be clarified that all policies described previously apply to all the UZA regions, and the emphasise given to each policy may change.

Table 6.2: Roadway System Strategic Approach Emphasis Area for 2050

Regions	1. Improve, Rehabilitate and Preserve Existing Roadways	2. Comply with the data collection requirements and Monitoring Systems for the Agency.	3. Monitoring Road Safety and Data Collection Thru the Strategic Highway Safety Plan (SHSP)	4.Continue to gather the information required for the Model Inventory of Roadway Elements (MIRE)
North				
East				
South				
Southeast				
Southwest				

Source: Steer, 2023

Non-Motorized

The Non-motorized modes strategies intend to construct a multi-modal transportation system that combines all modes of transportation to enhance mobility and access conditions, as well as to create a more livable urban environment and a more efficient transportation system. To do this, the measures outlined below must be implemented.

1. Comply with the Puerto Rico Complete Streets Plan and Design Guideline

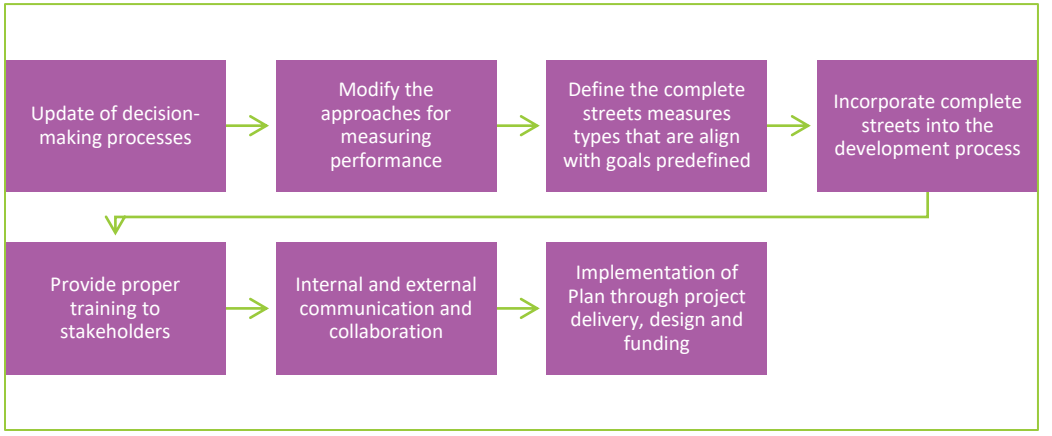
The MPO accepted this plan in September 2018, and it has not been amended subsequently. As a result, the information on the Complete Street Plan has not changed since the 2045 LRTP.

In this project complete streets will be considered as the definition of the Puerto Rico Complete Streets Plan and Design Guidelines of the PRHTA:

> …designed to allow safe, comfortable and convenient access for pedestrians, cyclists, drivers, and public transport users, regardless of age, abilities or capacities. Also, a complete street implies that mobility in all its forms, is safe, it has the infrastructure to make travel enjoyable, is aesthetically pleasing and promotes the social and economic exchange. (PRHTA, 2018)

The Puerto Rico Complete Streets Plan and Design Guidelines is developed under three main objectives. First, infrastructure to improve people's quality of life. Second, the guideline includes tools to enhance pedestrians and cyclist access to the transit system. Finally, defines components to create accessible infrastructure that is inclusive to every population group despite its individual characteristics such as age or physical conditions. These objectives should be implemented based on a seven (7) step strategy, consisting of the ones described in the Figure 6.1.

Figure 6.1: Implementation Strategy of the Puerto Rico Complete Streets Plan and Design Guidelines



Source: PRHTA, 2018

2. Comply with the Comprehensive Bicycle and Pedestrian Plan.

The MPO accepted this plan in September 2018, and it has not been amended subsequently. As a result, the information for the Bicycle and Pedestrian Plan has not changed since the 2045 LRTP. The Plan "aims to make bicycling and walking safe, accessible and integrated transportation choices for residents and visitors" (PRHTA, 2018).

The main objectives of this plan are:

- "Promote and increase the use of cycling and walking as alternative modes of transportation;
- Enable the physical integration of urban centers through a cycling and pedestrian network that improves accessibility to different land uses;
- Incorporate the development of projects and bicycle/pedestrian facilities into statewide and municipal transportation plans;
- Provide cycling and walking infrastructure to improve mobility, accessibility, and safety for all users of public roads; and
- Develop an educational program for all users to share the public roads in a safe manner"(PRHTA, 2018).

This plan define a four (4) step implementation process that includes:

- Set up a timeframe to accomplish the improvements;
- Development of a monitoring and evaluation process;
- Funding sources definition; and
- The stakeholder's involvement

Other strategies under the scope of the PRHTA for this 2050 UZA MLRTP are:

- Road safety analysis
    - Study roads with motor vehicle and bicycle conflicts and identify potential improvements to increase safety for all users.
- Improve and expand bike signage for the bike network
    - Along essential bike network routes, bike should be placed. On or near roadways, signs should offer direction and distances to major destinations.
- Improve and Expand the Bike Lanes along the Bike Network by analyzing the feasibility of implementing a continuous Class II or Class IV bike lane.
- Continuous maintenance of the roadway keep the road free of landslides and debris.

3. Comply with the Vulnerable Road User (VRU) Safety Assessment Recommendations

Pedestrian, bicyclist, and other non-motorist road users account for a growing share of all United States traffic fatalities and are referred to as vulnerable road users. Puerto Rico has a history of fatal crashes involving pedestrians. As established in the SHSP, in Puerto Rico pedestrians make up 3 out of every 10 traffic fatalities per year. Halting the growing number of non-motorists killed or injured by motor vehicles requires a collaborative and comprehensive, data-oriented approach to road user safety. Therefore, as part of the Puerto Rico Strategic Highway Safety Plan (SHSP) all state transportation agencies are required to complete a Vulnerable Road User (VRU) Safety Assessment by November 2023[96].

VRU Safety Assessment shall be a data-driven process considering fatal and severe injury crash data, infrastructure data and social and demographic data to identify areas of high-risk for vulnerable road users. The State must consult with local governments, metropolitan planning organizations (MPOs), and regional transportation planning organizations that represent these high-risk areas and develop a program of projects or strategies to reduce safety risks to vulnerable road users in areas identified as high-risk.

The quantitative analysis and project or strategy program results from the VRU Safety Assessment should be included into applicable SHSP priority areas, strategies, and actions. It should also be carried out through state and municipal planning procedures. Vulnerable road user safety should be fully considered in States transportation investment decisions, from planning and programming, environmental analysis, project design, and construction, to maintenance and operations. States should use data-driven safety analyses to ensure that safety is a key input in any decision made in the project development process for all project types and fully consider and improve the safety of all road users, especially vulnerable road users, in project development.

96. Federal Highway Administration (October 21, 2022) Vulnerable Road User Safety Assessment Guidance Memorandum. Retrieved from: https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-10/VRU%20Safety%20Assessment%20Guidance%20FINAL_508.pdf

Table 6.3 shows which strategic approaches should be emphasized for the non-motorized in each region over the term of the 2050 MLRTP. It should be clarified that all policies described previously apply to all the UZA regions, and the emphasise given to each policy may change.

Table 6.3: Non-motorized Strategic Approach Emphasis Area for 2050

Regions	1. Comply with the Puerto Rico Complete Streets Plan and Design Guideline	2. Comply with the Comprehensive Bicycle and Pedestrian Plan.	3. Comply with the Vulnerable Road User (VRU) Safety Assessment Recommendations
North			
East			
South			
Southeast			
Southwest			

Source: Steer, 2023

Resiliency Strategies

The information from the 2045 LRTP remains current given that the data used for the following section, such as flood zones by FIRMS and other data, has not been updated after Hurricane Maria. However, the 2050 MLRTP has been updated with information on earthquakes, which were causing damage to roadways in Puerto Rico, particularly but not limited to the southern part of the Island, during December 2019 and January 2020.

Because of its geographical location, Puerto Rico is especially vulnerable to catastrophic weather events such as earthquakes, tropical storms, and hurricanes moving close to or passing through the island every year, mainly between the months of July and November. Due to the exposure to severe rainfall, high-speed winds, and storm surge, landslides and flooding occur, affecting transportation infrastructure, it is critical to have a transportation system that can anticipate, prepare for, and adapt to changing conditions, as well as withstand, respond to, and recover quickly from disruptions.

Vulnerability Assessment - Hurricanes

In order to incorporate actions into decision making process, it is key to understand the existing transportation infrastructure's vulnerabilities. Such an understanding would serve as basis for developing the resiliency strategy as stated by the FHWA framework: "assessing and addressing vulnerabilities allows agencies to build their resilience, or the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions".

The MLRTP incorporates a vulnerability assessment. This assessment was mainly triggered by the effects of Hurricane María and the earthquakes in the south of the Island on the transportation infrastructure. The assessment is focused on hurricane and earthquake-related hazards.

A more comprehensive analysis should be completed not only considering flooding and landslides but also earthquakes given the tectonic events that occurred in the year 2020 in the Island. Additionally, analysis of design and construction elements that will make for a more resilient transportation infrastructure is recommended.

Earthquakes

Based on the additional vulnerability assessment need created by the previous earthquake occurrences in 2020, the resilience and vulnerability assessment are considering the recent seismic events that occurred in Puerto Rico, particularly in the island's southern portion. The goal of this analysis is to assess the system's vulnerability based on the knowledge gained after the 2020 earthquakes, as well as the connection or future connectivity difficulties based on the system's vulnerability. When comparable incidents take place, this risk assessment can assist PRHTA in identifying locations that require increased connectivity.

The data utilized for this research is the liquefaction[97] in the area caused by the effects of the 2020 earthquakes. Considering the communities and the locations of the roadways that assist the people in moving or obtaining goods and services during an emergency. Furthermore, having an official procedure to attend earthquakes is beneficial in the event of a major disasters that need additional logistics. This helps to identify where these risks exist and where the PRHTA should strengthen or offer alternative infrastructure to ensure that these communities remain accessible.

97. Liquefaction takes place when loosely packed, water-logged sediments at or near the ground surface lose their strength in response to strong ground shaking. Liquefaction occurring beneath buildings and other structures can cause major damage during earthquakes. U.S. Geological Survey (n.d.) What is Liquefaction? Retrieved from: https://www.usgs.gov/faqs/what-liquefaction#:~:text=Liquefaction%20takes%20place%20when%20loosely,cause%20major%20damage%20during%20earthquakes.

Table 6.4 shows which strategic approaches should be emphasized for the resiliency in each region over the term of the 2050 MLRTP. It should be clarified that all policies described previously apply to all the UZA regions, and the emphasise given to each policy may change.

Table 6.4: Resiliency Strategic Approach Emphasis Area for 2050

Regions	Hurricane	Earthquakes
North		
East		
South		
Southeast		
Southwest		

Source: Steer, 2023

Policy Guidelines and Evaluation for the Transportation Infrastructure

Following the national transportation goals, this 2050 MLRTP update emphasizes safety (lower fatalities), increasing asset conditions to a state of good repair, decreasing congestion, improving freight mobility, and protecting the environment and air quality. This section discusses policies that have been or will be developed to handle these concerns.

This chapter is separated into four (4) sections that describes the policies by mode:

1. Transit System for the Next Five (5) Years;
2. Roadway System;
3. Non-Motorized; and
4. Freight.

Transit System for the Next Five (5) Years

This section presents an overview of PRITA Transit Systems upcoming and identified as high priority projects for Puerto Rico for the next five (5) years. This section is divided into five (5) sections that corresponds to PRITA's programs, and the development of a Transit Master Plan. The five (5) programs are:

- Reliability and Integration;
- Mobility for All;
- A Sound Infrastructure;
- Culture of Excellence; and
- Climate Action.

Reliability and Integration

To enhance the transit network at the metropolitan, regional, and municipal level.

- Ceiba San Juan Intercity Bus
    - Viability, planning and design of new Intercity route between Ceiba Ferry Terminal to Tren Urbano Station in San Juan (YEARLY).
- Rehabilitation of the Mosquito Terminal and Ticketing Area
    - New Route for Vieques - "Short Route" from Ceiba to Mosquito. Rehabilitation of the Mosquito Terminal and Ticketing Area.

Mobility for All

To improve transit accessibility and equity.

- Purchase and installation of bike racks for entire bus fleet.

A Sound Infrastructure

To improve, rehabilitate, and preserve the infrastructure of the transit stations.

- Acquisition of four (4) New Cargo/passenger Vessels for the Island Service. 300 + passenger capacity. Replacement of vessels in process of disposition.
- New Ceiba Terminal for the Island Service
- Rehabilitation of the Maintenance Base and pier for Marine Hoist
- Acquisition of a Marine Hoist
- Acquisition of New Barge for the Island Service
- Preventive Maintenance and drydock activities for the Island Service
    - Preventive Maintenance and drydock activities for Authority owned vessels.
- New integrated transit fare collection system
- New PRITA Office Building
    - Design and construction of new administration building

Culture of Excellence

To increase the efficiency, effectiveness, and reliability of the transit system.

- Operation and Maintenance contract for eight (8) routes
- Bus service and users profile study (Data Collection and analysis activities) yearly.
    - Field study to identify the actual bus user profile.
- Train service and users profile study (Data Collection and analysis activities) yearly
    - Field study to identify the actual bus user profile.
- Ferry service and users profile study (Data Collection and analysis activities) yearly
    - Field study to identify the actual bus user profile.
- Transit Marketing Campaign yearly
    - Educational and marketing campaign of about the transit system
- Website
    - Creation and Maintenance of Website to provide information, service, and support of all transit related activity in Puerto Rico.
- Trip Planner
    - Create and maintain of a web tool to help clients make transit travel arrangements of existing operation.
- New transit system maps
    - Map update for the transit system including train, bus, and ferry.
- Online engagement surveys (Data collection and analysis activities) yearly
- Real-Time Transit Data
    - Provide users with transit data updates in real time to enhances their experience of the transit services. Providing up-to-date information about current arrival and departure times allows users to smoothly plan their trips.
- Transit Economic Sustainability Plan
    - Economic sustainability study to identify challenges and opportunities for the financial stability of the transit system.

Climate Action

To strengthen mobility to support the environment and the economy.

- Zero-emission Transit Plan
    - Research, development, and deployment plan of cleaner, more efficient public transit vehicles to scale up the electrification program to meet its zero-emission targets.

Development of a Transit Master Plan

Transit in Puerto Rico has been concentrated in the San Juan Transit Metropolitan Area. With the proliferation of other municipal transit systems and the decline of the Público services, as stated in Chapter 2, it is important for PRITA to stablish a Transit Master Plan.

A Transit Master Plan will create strategies and policies in the short, medium, and long term to direct and improve the growth around the public transportation system Island-wide, whether it consider buses, rail, or transit centers. This plan will have a strategic vision for the transit service as well as forecast future transit demands.

Roadway System

Puerto Rico Transportation Asset Management Plan (TAMP) 2032

PRHTA has established some short-term goals (two (2) years and four (4) years). These terms are based on the targets reported to the FHWA through the Transportation Performance Management (TPM) process. The targets are set according to estimated projections based on expected investment, expected improvement, and expected deterioration.

As stated in the TAMP 2032, the Table 6.5 shows the FHWA metrics used for the computation of pavement ratings. "The Federal measure is based on four pavement condition metrics. For asphalt pavements the rating is based on the International Roughness Index (IRI), percent of cracking and rutting. For concrete pavements, the measure is based on IRI, cracking, and faulting.[98]" (PRHTA, 2022)

Table 6.5: FHWA Condition Metrics - Calculation of Performance Measures

Condition	IRI Asphalt & Concrete (in/mi)		Rutting Asphalt (inches)	Faulting Concrete (inches)	Cracking (%)	
					Asphalt	Concrete
Good	<	95	0.2	0.1	5	5
Fair	<=	170	0.4	0.15	20	15
Poor	>	170	0.4	0.15	20	15

Source: Puerto Rico Transportation Asset Management Plan 2032

98. Puerto Rico Transportation Asset Management Plan 2032 (pr.gov)

Table 6.6 shows the short-term pavement targets, and Table 6.7: shows the short-term bridge targets.

Table 6.6: PRHTA Pavements Targets for 2 and 4 Years

Condition Measure	2-year (2023)	4-year (2025)
Interstate Pavements in Good Condition	20.0% or more	25.0% or more
Interstate Pavements in Poor Condition Poor	11.0% or less	11.0 % or less
Non- Interstate NHS Pavements in Good Condition	5.0% or more	10.0% or more
Non- Interstate NHS Pavements in Poor Condition	12.0% or less	14.0% or less

Source: Puerto Rico Transportation Asset Management Plan 2032

Table 6.7: PRHTA Bridge Condition Targets for 2 and 4 Years

Condition Measure	2-year target (2023)	4-year target (2025)
NHS Bridges in Good Condition	15% or more	15% or more
NHS Bridges in Poor Condition	10% or less	11% or less

Source: Puerto Rico Transportation Asset Management Plan 2032

The TAMP does not define projects, but rather the types of work to be conducted every year to fulfill the goals, depending on budget, degradation, and forecast progress. The TAMP 2023 has a tool designed to identify plan projects that are aligned with the targets of the document. The principal tools are the Pavement Data, Bridge Data, Pavement Scenario 1, and Bridge Scenario 1.

- **Pavement Scenario 1 and Bridge Scenario 1:** provide information on the mileage lanes and bridge area to be intervened in by type of work and by year.

- **Pavement Data and Bridge Data:** provides the information to identify specific roadway segments and bridges requiring each type of work or treatment, which can then be assigned by year as indicated on the Pavement Scenario 1 and Bridge Scenario 1 tabs.

Safety thru the Strategic Highway Safety Plan

PRHTA is attempting to be proactive rather than reactive in the present scenario. Although there will always be a reaction to how fatalities occur, the idea is that by designing complete streets and incorporating various safety devices, we can avoid these fatalities rather than waiting for them to occur and then solving the problems.

The Puerto Rico SHSP contemplates the following high priority and focus areas for 2024-2028:

High Priority Areas

- Vulnerable Road Users (VRU);
- Speed Management;
- Impaired Driving;
- Occupant Protection;
- Lane Departure; and
- Communication Integration.

Focus Areas

- Traffic Record Systems;
- Motorcyclists;
- Aging Driver (65+); and
- Legislations and Procedures.

One of the High Priority Areas that can be highlighted is the execution of the VRU as part of the work of the SHSP.

PRHTA prepares the High Crash Location Report as part of the implementation strategies of the SHSP. This report is created every two (2) years, and the main purpose of this report is to define the corridors (3-km or more), hot-spots (500-meters), and intersections that has the highest Crash Cost Factor and Frequency Indexes for a period of five (5) years[99].

Installation of Intelligent Transport System (ITS) Devices for Traffic Incident Management and Traveler Information Dissemination.

PRHTA has been implementing ITS technology for several years and intends to keep pursuing these projects in the future. This section will offer an overview of recent ITS initiatives as well as forthcoming projects, both now in place and suggested for the next five (5) years.

The ITS devices to be installed include CCTV cameras, vehicle detectors, Bluetooth readers for travel time, dynamic message signs, and communication systems (wired and/or wireless). These devices will aid in the detection/verification of traffic incidents, dissemination of information to the travelers, including roadway/lane closure events, alternate routes, and travel time, and real-time performance measurement.

The following is a list of upcoming ITS projects:

- PR-52 ITS Implementation from Caguas Sur Toll Plaza to Ponce
- PR-53 ITS Implementation on PR-53 (All concession segments)
- New Integrated Corridor Management Center

Non-Motorized

Safety of pedestrian as part of the SHSP Vulnerable Road User (VRU) Potential future Projects

The VRU assessment will be implemented for the first time in 2023 and is still in development at the time of this MLRTP's release. As a result, while information on the VRU is limited, it is nevertheless highly important and should be considered as a future policy guideline.

As part of the plan, the VRU examines three (3) potential projects, which are stated below:

- Evaluation of site crash report conditions including crash report review and road safety audits.
- Identification of countermeasures, design, implementation, and evaluation.
- Prioritize roadway segments by high-risk roadway features for potential projects.

99. Puerto Rico Highways and Transportation Authority. (2022). 2021 High Crash Location Report Version 2.0.

Complete Streets Projects

The DTPW has considered the Complete Streets under several initiatives to implement the Complete Street in collaboration with the PRHTA.

Among the projects that have been done are the following:

- The incorporation of the Complete Streets Guide into the Puerto Rico Housing Department's Community Development Block Grant (CDBG)
- The DTOP arranged this Peer-Exchange in collaboration with the FHWA to reaffirm and educate about the Concepts of Complete Streets and Complete Streets Guidelines for Puerto Rico. This initiative was tailored to the many Complete Streets consultants and specialists in Puerto Rico.
- Memorandum of Understanding with AARP to incentivize a culture shift toward Complete Streets among DTPW and municipalities' umbrella employees, including consultants.
- DTPW is working with the Planning Board to integrate the Complete Street Guidelines to their projects and regulations.

Bicycle and Pedestrian

Among PRHTA's goals are many initiatives that the agency intends to begin during the next five (5) years. The Projects shown in the Table 6.8 includes interventions in these two levels:

- **Short Term:** Road Safety Analysis
- **Short-Medium Term:** Install signpost indicating the presence of bicycles along the route.

Table 6.8: Non-motorized Projects Intervention Types

Project	Short Term	Short-Medium Term
PR-194 (Fajardo)		
PR-129 (Hatillo y Arecibo)		
PR-1 (Santa Isabel to Ponce)		
PR-3 (Patillas, Arroyo, Guayama except urban center, and Salinas)		
PR-324 (Lajas)		

Source: PRHTA, 2018

Freight

The 2045 Puerto Rico LRTP identified a series of freight-related interventions, including projects, strategies, and recommendations. These interventions, which are still ongoing due to the lack of progress as of this MLRTP update, are summarized below. Additional information regarding this topic can be found in the Appendix: 2050 MLRTP Freight Assessment. The UZA Freight Network is fully described in Chapter 3; all the strategies suggested in this section must be undertaken at the relevant locations.

Freight Network Extensions

A travel demand analysis[100] was undertaken, to identify new freight corridors and freight corridors for improvement.

- **Five (5) new freight corridors were identified,** with the largest being the PR-22 Extension to Aguadilla (27.63 miles).

- **Freight corridors were also identified for improvement,** with most of these corridors spanning Aguadilla and San Juan.

These extensions implies an important benefit which is an optimized distribution of trucks on roadways: freight related vehicles move from minor, local roads to those offering better and most suitable capacity (such as expressways and major arterials).

It is likely that this spreading of heavy traffic could result in positive effects on other road users, result in better Level of Service (LOS), more reliable travel times and ideally, improved road safety.

State Freight Plans

The Fixing America's Surface Transportation (FAST) Act included a provision requiring states to develop a State Freight Plan[101]. This plan should provide a comprehensive plan for the state's immediate and long-term freight planning activities and investments (US Department of Transportation, 2015) [102].

State Freight Plans can assist states in contributing to the National Multimodal Freight Policy goals in 49 U.S.C. 70101(b) and the NHFP goals in 23 U.S.C. 167(b). The Department of Transportation strongly believes that these objectives provide critical direction and assistance for the advancement of freight transportation across all modes (US Transportation Department, 2016).

> "When implementing complete streets guidelines, the Freight Plan is critical for those specific locations. Complete Streets are significant because they provide economic activity on both sides of the road. Because people will be using both roads for movement, adequate infrastructure is required" (US Transportation Department, 2016).

As these locations where the complete streets are implemented have businesses and restaurants, there is and additional truck loading activity when supplies are distributed. This is why a truck loading and unloading plan is required in locations with complete streets where we want to have the best infrastructure between automobiles and pedestrians during the day.

This type of plan also supplements complete streets projects and guidelines for urban zones. Especially in mixed commercial and residential areas, they can support the logistics of when and how goods should be supplied to the businesses and restaurants. An example of this is the Loíza Street, where there is commercial activity along both sides of the street, and people cross the street at different points to access different services.

100. The travel demand analysis considered 2016 levels of population and employment.
101. This requirement applies to states that receive funding under the National Highway Freight Program.
102. https://www.transportation.gov/sites/dot.gov/files/2023-01/State%20Freight%20Plan%20and%20State%20Freight%20Advisory%20Committee%20Guidance_signed.pdf

State Freight Advisory Committees

The FAST-Act requires DOT to encourage each State to establish a local Freight Advisory Committee, comprising a representative cross-section of public and private freight stakeholders. The role of a State Freight Advisory Committee is based on five (5) main aspects. First, to advise the state administration in the actions to take in order to attend the territorial freight related needs. Second, create a discussion space to address the freight relevant topics. Additionally, it should create communication channels between both public and private sector to prioritize the reginal main affairs. Finally, to participate in the definition of the state freight plan[103].

Complete and Enhance Freight Network (Strategy)

Alongside the Freight Network Extensions identified, the 2045 MLRTP recommended additional improvements to the freight network, including:

- Improving the Mayagüez to Aguadilla corridor;
- Improving cargo services to Vieques and Culebra; and
- Completing PR-10; PR-53.

Improving roads providing access to/from ports and distribution centers to the strategic highway network.

Congestion Reduction Strategy

The 2045 LRTP identified that strategies to reduce congestion on the strategic highway network would benefit the freight network. Congestion Management Processes (CMPR) were therefore developed, and include the following objectives:

- Monitor and evaluate the performance of multimodal transportation system;
- Identify the causes of congestion;
- Identify and evaluate alternative actions that provide information supporting the implementation of actions; and
- Evaluate the efficiency and effectiveness of implemented actions.

Transportation Demand Management (TDM) (Related to Congestion Reduction Strategy)

The intention of TDM is to help alleviate travel congestion through lower-cost means than major capital investments for physical system capacity. Additionally, TDM provides strategies to increase shared and non-motorized forms of transportation, while addressing the need to reduce congestion and air pollution.

As TDM is clearly an integral component of congestion reduction, TDM measures have been included in the Congestion Management Process (CMP) developed for the San Juan and Aguadilla TMAs, however, freight-specific TDM measures have not currently been identified.

In the case of UZA they don't meet with the federal requirements to have their own CMP and or TDM strategy. This strategy is left in in this 2050 UZA MLRTP because it can be beneficial to be used in any of the UZA regions.

103. 49 U.S. Code § 70201 - State freight advisory committees

Resilience

For the first time, the 2045 LRTP incorporated a vulnerability assessment based on the FHWA's 2017 Vulnerability Assessment and Adaptation Framework. This assessment was mainly triggered by the effects of Hurricane Maria on transportation infrastructure and focused on floods and landslides.

Considering the recent seismic activity in the south of the island from December 2019 to January 2020, it was concluded that an earthquake resilience strategy for the freight network was necessary for this MLRTP update. The FHWA's 2017 Vulnerability Assessment and Adaptation Framework did not consider earthquakes in its approach. More details about the resiliency strategy are included in the Future Scenarios.

A more comprehensive assessment should be designed to include additional risk factors and adaptation measures. The assessment should also be expanded to include design/construction-related considerations as these considerations play a key role in infrastructure resilience.

Intelligent Transportation

It is important that Puerto Rico continues to build on the progress made with ITS (primary focus being on congestion management in key corridors and on non-car mode trips to influence behaviour change) and identify opportunities for ITS to improve the goods movement process across the Island. For example, Intelligent Communication Technologies have been observed to enhance supply chain performance, contributing to three main functions related to freight: resource management; ports and terminals operations management; and freight and vehicle tracking and tracing.

New modes, such as Transportation Network Companies (TNCs), electric bike share, electric scooters etc. are mixing with more traditional modes such as transit, providing a much broader "transportation ecosystem" to the user. In many cases, these new services are providing "first/last mile" solutions for riders who live a distance from transit stops and stations. An opportunity therefore exists to expand this type of service into the goods movement sector as a last-mile urban delivery / pick-up service.

Electrification

The emissions from on-road fleets (light duty cars and trucks as a well as heavy-duty trucks), reached peak levels during the 2000-2010 decades and are predicted to fall over time. However, despite this prediction, reductions are not sufficient to reach the desired goal of having emission levels comparable to 1990 levels. In addition, the most significant driver for the reductions in emissions: new fuel efficiency standards, are not predicted to continue up to 2050. Therefore, additional measures will be needed to be taken to continue helping to reduce vehicle-related emissions. Examples include:

- Provision of electric vehicle charging infrastructure, specifically rapid charge points for the commercial sector;
- Easing of the permitting process for the construction of private charging facilities;
- Establishing or enhancing subsidies for charging equipment and/or vehicles; and
- Enhancing tax credits for electric vehicles purchases.

Recent advancements in the electrification of goods movement vehicles (e.g., heavy trucks) has improved the ability / willingness of companies to transition their fleets away from diesel and towards electric[104].

Issues and Opportunities

Taking into consideration the findings discussed above, several key issues and challenges, as well as opportunities related to current and potential future goods movement conditions in Puerto Rico are identified and summarized in Table 6.9.

104. Trends in heavy-duty vehicles, IEA Global Outlook 2023

Table 6.9: Issues, Challenges, Opportunities of the Freight Network

Issue / Challenge	Description and Example	Opportunities
Natural Hazards / Extreme Weather Events	• Puerto Rico is highly susceptible to natural hazards, which damages freight-related infrastructure (e.g. seaports, airports, roads) and the movement of goods. • An example of this was when the 2020 Southwest Puerto Rico Earthquake Sequence compounded damage caused by Hurricane Maria (2017). ○ The Rafael Cordero Santiago Port of the Americas was weakened by the impacts of the hurricane, and further damaged by the earthquakes, delaying construction of the mega port.	• Comprehensive Vulnerabilities Assessment that expands current analysis and adaptation framework. Workforce capacity building, including truck drivers, to address logistics challenges ahead of the development and roll out of recovery plans. • Scenario planning to assist with preparedness for unprecedented / rapid systems change. • Land use assessments to identify more resilient locations to provide new/ retrofitted infrastructure.
Congestion	• The road network routinely exceeds its capacity as a result of too many vehicles and trucks being on the road. As a result, Puerto Rico sees sustained congestion and air quality issues. • Capacity constraints on inter-modal connecting nodes, and/or a configuration that limits network redundancy can create or exacerbate freight bottlenecks. • A recent example of this was post-hurricane Maria, where supply chain challenges arose in Puerto Rico centered around the Port of San Juan. While cargo was able to make it to the port, due to blocked roads and shortages of trucks and drivers, many goods could not be transported out of the port area.	• Logistics hubs and ITS technologies can work to help to optimize fleets and movement of goods, which can then help to reduce congestion along the network as delivery vehicle trips are reduced. • Hubs can be located at a regional or urban scale to assist with the (re)distribution of goods. ○ Urban logistics hubs pair well with sustainable last-mile service alternatives (e.g. cargo bikes) to reduce the amount of diesel-fueled medium / heavy trucks in cities, helping to reduce air and noise pollution as well as road and curbside congestion (provided bikes do not have to operate in mixed traffic, and have, at least to some extent, access to dedicated cycling infrastructure). • Policies around the timing of goods movement, such as through off-peak and nighttime delivery requirements / incentives can help to reduce congestion as it re-assigns truck traffic to a time when roads are less busy. • The Marine Highway Network is an effective alternative to road-based trucking for regional distribution as it capitalizes on underutilized waterways, moving goods more efficiently and, to some degree, more sustainably: ships, like trucks, have their own environmental footprint as they require a fuel source and contribute to emissions/pollution unless powered electrically or by more sustainable bio-fuels[105]. That said, removing diesel-fueled trucks from the road nonetheless helps tackle pollution and congestion issues. Importantly, the logistics of shipping / receiving goods by ships in other ports would have to be managed accordingly.

Source: Steer, 2023

105. https://www.resilience.org/stories/2022-07-28/making-waves-electric-ships-are-sailing-ahead/

Table 6.9: Issues, Challenges, Opportunities of the Freight Network (Cont.)

Issue / Challenge	Description and Example	Opportunities
Connectivity	• In Puerto Rico, the road network is dominated by circumferential routes around the perimeter / coast of the country. Subsequently, inland locations, away from metropolitan centers along the coast, are more isolated, and can face more severe problems with delivery of critical goods.	• Expand the road network and improve efficiency / communication of routes using ITS technology. • Expand the regional road and sustainable transport network, adding infrastructure not just in cities, but between them. • Expand network redundancies. • Add truck only lanes.
Traffic Safety / Accidents	• According to the2022 Puerto Rico Highway Safety Plan , hundreds of people are killed, and thousands injured from traffic crashes. Although, a reduction of less than 300 between 2016 to 2020 has been achieved, still road users' behaviors are the biggest problem and the hardest to change. Over the last years, alcohol-impaired driving and pedestrian fatalities have represented two-thirds of total traffic fatalities in Puerto Rico. While the relationship between accidents and freight are not discussed in this report specifically, accident-caused delays undoubtedly impact the goods movement process. As well, medium and heavy trucks being the size that they are would be more dangerous to other road users if ever involved in a crash as compared to other vehicle types. • Some of the state's problems that hinder traffic safety are funding constraints and budget cuts, out of date technology and data gathering, VMT delayed actualization, among other situations. All these limits the traffic data analysis process, which depends on multiple microanalyses of different databases, manual reports, and data (where entries are often delayed).	• Better road safety design that accommodates the needs of all users, particularly people who are most vulnerable (e.g. people on foot). • Capacity / resource improvements to better manage this issue-area. • Reducing the overall number of vehicles would help reduce congestion, as well as potentially mitigating conflicts between users in certain locations.
Air Quality	• As diesel-fueled trucks are still the primary mode for regional and urban goods movement, the emissions from these trucks, particularly when idling along congested corridors / in cities, has a notably negative impact on air quality.	• With advancements in truck electrification technology, it is becoming more feasible for trucking companies to transition away from diesel-fueled trucks towards electric. Currently, Puerto Rico has some charging infrastructure on the Island, which could be outfitted (if necessary) for truck charging. Expansion of charging infrastructure is also possible. • In addition to the electrification of fleets, there is a role to be played by more sustainable transport modes (e.g. cargo bikes), particularly for the urban 'last mile', as well as TDM whereby the implementation of measures can help reduce the number of trucks needed on the road.

Source: Steer, 2023

Table 6.9: Issues, Challenges, Opportunities of the Freight Network (Cont.)

Issue / Challenge	Description and Example	Opportunities

COVID-19 Pandemic	The COVID-19 pandemic led to unprecedented changes to nearly all aspects of life.
	
	In terms of how COVID-19 impacted the goods movement sector / process, more goods were being demanded and more frequently. Buying habits / patterns shifted, particularly with lockdowns and people working from home. Unprecedented supply chain issues resulted from the unprecedented demand for goods. As well, how goods were being delivered (and picked-up) changed, from contactless / curbside delivery to a surge in bicycle and motor-cycle delivery modes.
	
	Congested roads were, in some places, made worse, although with a reduction in traffic from lockdowns this was temporarily offset. Also increased was the demand for sustainable transport infrastructure to accommodate bike delivery services, as well as curbside/parking space.
		• Logistics hubs and ITS technologies to help to optimize fleets and movement of goods.
		• Curbside/Parking Management Strategies
		• Expand/improve safety conditions of the road and sustainable transport network.
		• Invest Puerto Rico (a public-private partnership), in collaboration with the Department of Economic Development and Commerce (DEDC)[106], identified opportunities for public/private coordination for supply chain development in Puerto Rico, post COVID-19 pandemic including:
		  • Maintain stability of Island's supply chain connectivity in terms of price, frequency, and security between mainland US resulting from pandemic.
		  • An increase in tourism to the Island can help support increased air cargo capacity.

Data Collection / Sharing / Analysis	There is an overall lack of freight-related data collection /sharing /analysis in Puerto Rico, from ports, to regional road, to cities and curbs. As well, there is a lack of data related to freight-adjacent sectors such as traffic safety, as well.	• An opportunity exists to collect freight-related data both through ports and through freight vehicles (ships or trucks) and their companies. Having consistent and up-to-date datasets is critical for effective goods movement planning as it can provide insight into issue areas, and therefore, what may be an effective method for tackling said issues. • Data collection requirements can be incorporated into licensing/permitting processes, particularly for new gig economy businesses.

Source: Steer, 2023

106. "Puerto Rico's Path Towards Competitiveness", presentation by DEDC, published by Puerto Rico Chamber of Commerce, 2021.

Congestion Management Process

Congestion management is the application of strategies to improve transportation system performance and reliability by reducing the adverse impacts of congestion on the movement of people and goods. “A congestion management process (CMP) is a systematic and regionally accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meet state and local needs” (Federal Highway Administration’s (FHWA), 2011).

Some expected benefits from the CMP and derived strategies are the improvement of infrastructure capacity, environmental quality and livability and safety, to support sustainability, economic advancement, promote innovation and interagency collaboration, interdisciplinary integration and procure new financial opportunities.

This regulation does not apply to UZAs because each region has a population of less than 200,000 people. It continues to be included in the 2050 UZA MLRTP because it offers the UZA some suggestions for using some of these methods as appropriate to their areas based on the municipality own independent research and conclusions.

The CMP has eight elements/actions that are:

Regional objectives

The first element of a CMP is to consider the desired outcome, this includes the goals that the region wants to achieve. For this CMP, the regional objectives[107] for San Juan TMA and Aguadilla TMA are:

- Reduce congestion intensity;
- Reduce and provide reliable travel times in the National Highway System (NHS);
- Promote alternative modes of transportation and intermodal connectivity;
- Improve transportation system’s safety and security;
- Reduce delay caused by incidents and emergencies;
- Reduce transportation infrastructure’s vulnerability for it to withstand extreme weather events through resilient infrastructure; and
- Facilitate the efficient movement of freight.

Regional CMP Network

The CMP network involves the geographic boundaries or area of application and the system components/network of surface transportation facilities. This CMP will be initially applied in the metropolitan areas of San Juan and Aguadilla, since federal law requires a CMP for metropolitan areas in Puerto Rico with populations over 200,000. Between San Juan and Aguadilla TMAs, this CMP covers the 50.3% of the island surface.

Multimodal Performance Measures

One key to the effectiveness of the CMP is the ability to adequately assess system performance by quantifying levels of congestion and providing an analytical framework to determine congestion trends. For this purpose, Performance Measures are the key measures that will define and measure congestion. These measures relate and support the regional objectives developed on the first element.

Data Collection/Monitor System Performance

This element of the CMP describes the data needed to support the performance measures and those responsible for collection. The data must be continuously collected to determine the evolution of the performance measures, therefore the congestion, and to analyse the level of accomplishment of the regional objectives mentioned before.

The data that needs to be constantly collected includes Traffic Counts, Vehicle Speed, Vehicle Occupancy Rates, Transit data, Inventory of transportation facilities and infrastructure and Crash reports.

107. The regional objectives does not apply to the UZAs.

Congestion Problems and Needs

To identify the congestion management strategies, it is necessary to identify what system problems, location and cause. There are different traffic analysis tools that can be effective at identifying the potential causes of congestion, as well as reports/literature that are periodically updated and that identify problems. These reports include the Strategic Highway Safety Plan (SHSP) and the Long-Range Transportation Plan (LRTP).

Identification and Assessment of Strategies

This element turns the data of action 4 and the analysis of action 5 into a set of recommended solutions to effectively manage congestion and achieve congestion management objectives. A wide range of strategies are available and can be broadly grouped into: Demand Management, Traffic Operations, Public Transportation and Road Capacity.

Programmed and Implementation Strategies

It is important to transform the strategies identified on the previous section into implemented projects. For this, the strategies can be implemented/categorized in regional or local strategy. Regional-level implementation consists of including the strategies into the Long-Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP). At local level, the strategies can be assessed by individual studies and implemented using a variety of funding sources.

In case it is necessary to rank projects using the CMP objectives, Appendix: Congestion Management Process contains a specific scoring process for the congestion management.

Evaluation Strategies of Effectiveness

It is important to ensure that implemented strategies are effective at addressing congestion as intended, and to make changes based on the findings. Two general approaches used for this type of analysis are System-Level Performance Evaluation and Strategy Effectiveness Evaluation. At this point, the process will repeat itself, with the feedback from the strategies implemented, the regional objectives, performance measures, congestion problems and the assessment of strategies should be reviewed.

Transit Demand Management (TDM)

Transportation Demand Management (TDM) is the application of strategies and policies to encourage the use of sustainable modes within a transportation network. A TDM Strategy is a plan for a region, city, neighbourhood, or site that seeks to deliver sustainable transportation objectives. It is articulated in a document that is regularly reviewed by the implementing organization, usually on an annual basis. It involves identifying an appropriate package of measures aimed at promoting sustainable travel and mitigating climate change impacts of transportation, such as greenhouse gases (GHG) and decarbonization, with an emphasis on reducing SOV trips, congestion, Vehicle Miles Traveled (VMT), and parking demand. It can also assist in meeting other objectives such as increasing the accessibility of different transportation options, improving access to economic options, improving health and safety, attracting, and retaining staff.

The TDM Strategy will support the implementation of the CMP and the 2050 MLRTP by enabling residents, employees, and visitors to make sustainable transportation choices given the suite of available options. The effective implementation of TDM strategies aims to reduce congestion in the focus areas of San Juan and Aguadilla TMAs, but also on the Island as a whole. In addition, it aims to reduce the demand for parking and will align with the Island's environmental goals of encouraging sustainable modes of transportation. It should be reviewed on an annual basis separate from the MLRTP to ensure that adjustments can be made to the TDM Strategy if goals are not being met, this will assist in the entire MLRTP meeting its goals.

This policy guideline does not apply to UZAs because each region has a population of less than 200,000 people. It continues to be included in the 2050 UZA MLRTP because it offers the UZAs municipalities some suggestions for using some of these general methods as appropriate to their municipality based on their own independent research and conclusions.

Given the opportunities, the main goals of the TDM Strategy are:

- **Congestion Management:** Reduce demand for parking and congestion on major highways, by promoting alternative modes of transportation and off-peak travel culture.
- **Promotion of Travel Options**: Identify innovative and cost-effective solutions that encourage mode shift from single-occupant vehicles to multi-modal options.
- **Environmental Stewardship:** Reduce VMT and GHG emissions in Puerto Rico by supporting sustainable modes of transportation.
- **Collaboration:** Leverage and support other regional and local initiatives related to public health, active transportation, sustainability, climate change, and smart growth.

Table 6.9 presents a summary of all the recommended TDM Strategies that could contribute towards mitigating congestion challenges. The strategies summarized in this section are strategies that can potentially be implemented at a regional or MPO level. More detail regarding the TDM strategy can be found at the Appendix: Long Range Multimodal Transportation Plan Travel Survey and TDM Report.

Considering that there is currently no TDM program in Puerto Rico, it is important to conduct an inventory of data that is readily available through other programs such as the CMP, traffic modelling, and traffic data. The review of existing data provides the opportunity to streamline data being collected. It also allows for the uniformity of data collection across all municipalities, if and when a TDM program is implemented.

Table 6.10: Summary of TDM Strategies

Mode/Program	Strategy
Policies and Programs	Advisory board at regional level-TDM Regulations
	Regional collaboration and Leadership-TMA/Commuter program
	Voluntary Employer Commute Program
	Congestion Charges
	Multimodal Information
	Policy on Hybrid/modified Schedule
	New Hire Packages
	Support Strategies: guaranteed ride home, multi modal wayfinding, personal trip planning
Transit	Expanded Transit Network
	Transit Education and Awareness Integration and Collaboration
	Transit Subsidy
Active Transportation	Secured Public Bike Parking + Support facilities
	Provision of Funding and Grants for Cycle Tracks
	Provision of Funding and Grants for Shared Micromobility
	Bike Education
Carpooling and Parking	Carpool and Ride Matching Program
	Priority Carpool Parking + Carpool Lanes-advisory role
	Parking Fees

Source: Steer, 2023

Based on the inventory of existing data, a standardized reporting system should be developed across all municipalities that collects a core set of data measuring the same metrics. This will enable the progress of TDM to be compared across various municipalities and provide opportunities for the data to be aggregated on a regional level. It also provides opportunities for the region to set region wide TDM targets that reduce congestion.

If instituted, TDM Regulations should encourage individual sites (of a certain number of employees or occupants) to develop annual compliance reports, which would include:

- TDM Plan describing the list of strategies being implemented (how and where implemented) and projected impact.
- Annual Travel Survey to understand motivations and challenges to using TDM strategies, as well as impact.
- Annual Monitoring Report describing the status of TDM strategies and their impact on reducing congestion and parking demand.

The implementation of a Voluntary Employer Commute program further provides the opportunity for TDM metrics to be collected on a site level. The compliance reporting from sites in conjunction with the Congestion Management Process (CMP) can form the base of the monitoring strategy for the region. Municipalities in the regions are encouraged to develop annual TDM reports based on information from individual sites and other available metrics. This can be further amalgamated on a regional level.

Air Quality Analysis

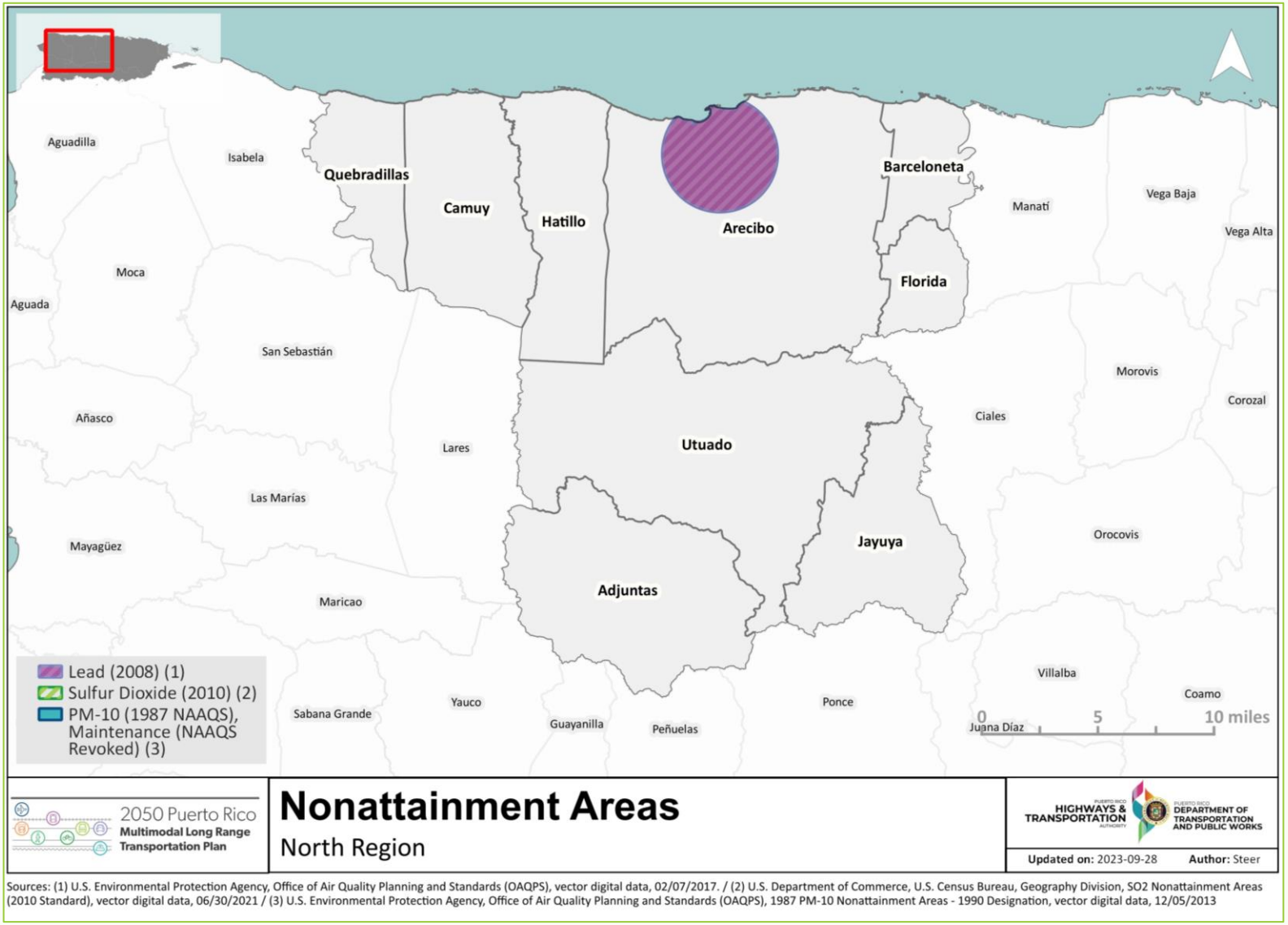
This section summarizes the status of the air quality for Puerto Rico with emphasis on those pollutants that are related to transportation sources. Air quality measurement stations are located through the entire island in municipalities such as Bayamón, Juncos, San Juan, Adjuntas, Arecibo, Mayagüez, Salinas, Cataño, Guaynabo, Ponce, Guayama and Guayanilla[108]. The Puerto Rico Air Monitoring Network Plan 2022, prepared by the DNER, provides evidence that meets current federal air monitoring requirements. The air quality data of the Puerto Rico Air Monitoring Network is used to determine compliance with the National Ambiental Air Quality Standards (NAAQS). The results of the mentioned plan were that Puerto Rico Air Monitoring Network meets the monitoring requirements established by the federal regulations. The procedures that are used and the instruments that are operated meet the standards that has been established by Environmental Protection Agency (EPA).

Pursuant to the provisions of the Clean Air Act (CAA) and its subsequent amendments, the EPA has established the NAAQS for six (6) criteria pollutants. These standards have been established to protect the public health. When an area meets a particular standard, it is stated that it is an “Attainment” area. Otherwise, it is designated as a “Nonattainment” area, which implies that a compliance plan shall be developed until the “Attainment” status is obtained. Nevertheless, transportation sources contribute to four (4) of the six (6) criteria pollutants for which EPA has established standards to protect public health and/or safety. The pollutants are ozone (O3), carbon monoxide (CO), particulate matter (PM10 and PM2.5), and nitrogen dioxide (NO2).

Until 1991, the entire Island was designated as meeting NAAQS. Current Nonattainment and Maintenance Areas in Puerto Rico are identified in Figure 6.2 and 6.3[109].

108. https://www.drna.pr.gov/wp-content/uploads/2022/05/Air-Monitoring-Plan-PR-2022-english.pdf
109. US EPA. Green Book. Puerto Rico Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants.

Figure 6.2: Nonattainment and Maintenance Areas in Puerto Rico – North TPR



Sources: (1) U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards (OAQPS), vector digital data, 02/07/2017. / (2) U.S. Department of Commerce, U.S. Census Bureau, Geography Division, SO2 Nonattainment Areas (2010 Standard), vector digital data, 06/30/2021 / (3) U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards (OAQPS), 1987 PM-10 Nonattainment Areas - 1990 Designation, vector digital data, 12/05/2013

Figure 6.3: Nonattainment and Maintenance Areas in Puerto Rico – Southeast TPR

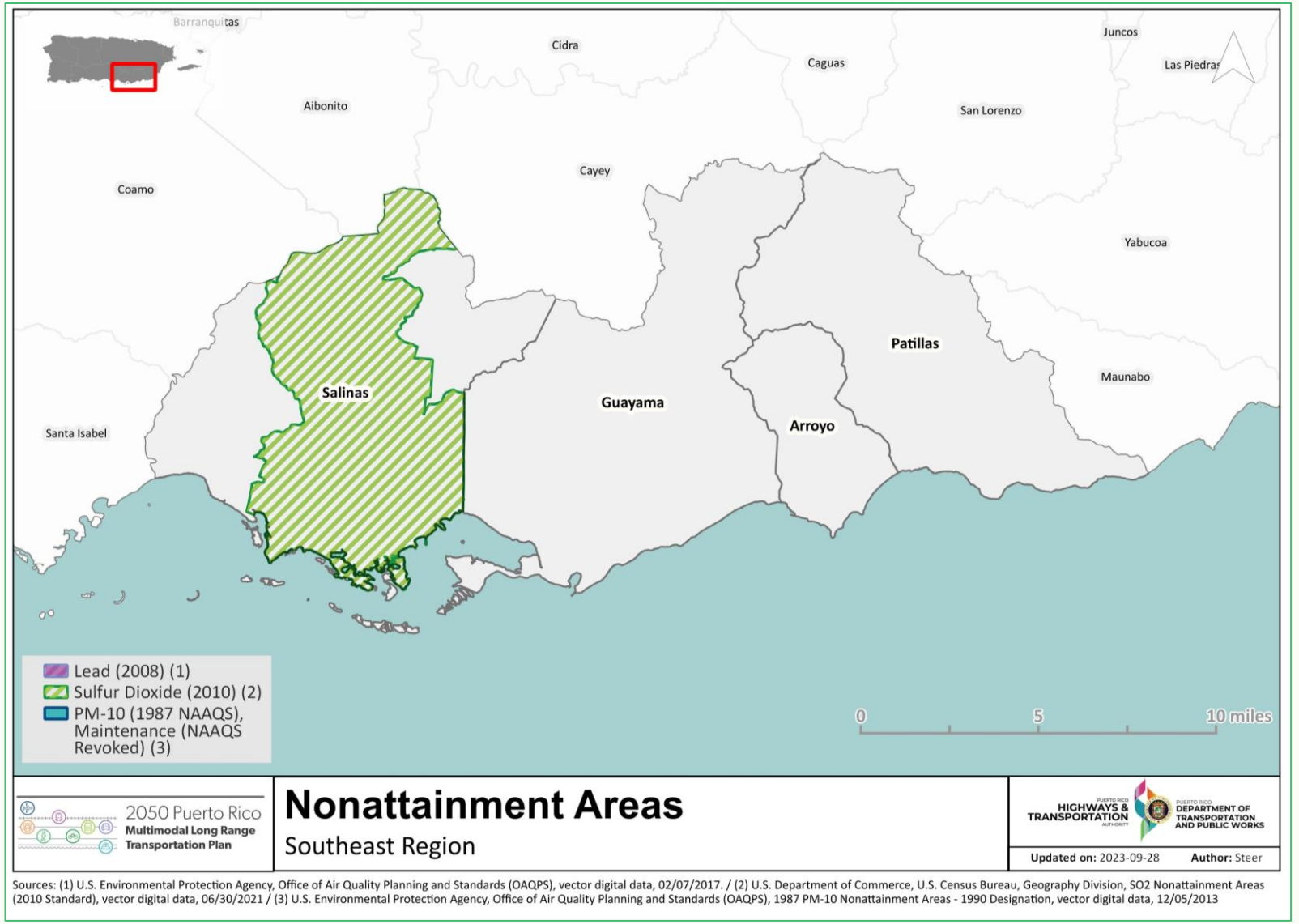


Table 6.11 shows that currently there are not Nonattainment Areas for transportation related NAAQS in the UZAs. The North and Southeast regions are the only ones with maintenance areas, but for due to lead and sulfur dioxide, respectively.

Table 6.11: Puerto Rico Nonattainment and Maintenance Areas in 2022 – UZA

County: Puerto Rico	NAAQS	Area Name	Period under Nonattainment	Whole or/ Part County
Arecibo Municipio	Lead (2008)	Arecibo, PR	2011-2023	Part
Salinas Municipio	Sulfur Dioxide (2010)	Guayama-Salinas, PR	2018-2023	Part

Source: EPA, 2022

The Transportation Conformity Rule apply to Nonattainment Areas and Maintenance Areas by an approved maintenance plan. Air quality conformity is a process intended to ensure that FTA funding goes to transit activities that are consistent with the air quality goals set forth in the Clean Air Act.

A variety of concerted actions and policies help to maintain PM10 Attainment status in the Municipality of Guaynabo improving air quality and creating more sustainable communities. They include, among others, pedestrian friendly land uses and improvement of pedestrian facilities, intersection improvements and other low-cost transportation measures, covering of loads on trucks, stabilizing the sides of roadways, paving parking areas, street cleaning and removal of road dust, and restoring roads to good repair. The increased emphasis on and implementation of transit improvements is a major commitment that will bring benefits for many years to come. These and other actions of the responsible agencies and officials will serve to improve the air quality on the Island.

The aforementioned actions and policies, if implemented at Island-wide level would yield similar benefits to air quality and communities. Other concerted actions and policies would improve the air quality at Island-wide level, such as:

- Strict enforcement of vehicle inspection requirement prescribed by the Vehicles and Transit Law of Puerto Rico (Law 22- 2000). This law requires that every vehicle that travels on public roads must be equipped with the exhaust emission control system, including catalytic converter and parts related. Catalytic converters speed up the chemical reactions between oxygen and pollutants in the air to convert them into less toxic byproducts like water vapor, carbon dioxide, and nitrogen gas.

- Additional measures to reduce emissions. The most promising of them is the adoption of a local strategy that provides incentives for the conversion of the auto fleet to electric vehicles. Potential candidates for this strategy are:
  - Provide vehicles charging infrastructure.
  - Easing of the permitting process for the construction of private charging facilities
  - Establishing or enhancing subsidies for charging equipment and/or vehicles; and
  - Enhancing tax credits for electric vehicles purchases.

Environmental Mitigation

Another important facet of transportation is the impact of transportation projects on the environment. The prevalence of environmental assets across the Island heightens the need to plan projects to avoid or minimize environmental impacts, and to devise proactive mitigation strategies to compensate properly for needed improvements with unavoidable impacts. As individual projects are developed, they are subjected to the required environmental planning process scrutiny, complying with both federal and Commonwealth laws and regulations. Puerto Rico has in place its local environmental impact review process that, in tandem with National Environmental Policy Act (NEPA) requirements for environmental assessment of qualifying projects, creates a framework for minimizing environmental harm.

As part of the environmental planning process for transportation projects the Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) could be implemented. INVEST is a web-based self-evaluation tool comprised of voluntary sustainability best practices, called criteria, which cover the full lifecycle of transportation services, including system planning, project planning, design, and construction, and continuing through operations and maintenance. Some of the criteria include integrated planning (land use, natural environment and social) air quality, energy and fuels, financial sustainability, life cycle cost analysis, tracking environmental commitments, habitat restoration, stormwater quality and flow control and ecological connectivity, among others. FHWA developed INVEST for voluntary use by transportation agencies to assess and enhance the sustainability of their projects and programs.

Overall, environmental transportation sustainability is a complex and multifaceted issue that requires the implementation of a wide range of strategies. One of them is the mitigation of environmental impacts through a process of analysis, alternative designs, and various design/construction.

Roadway Network Vulnerability Assessment -Update Incorporation of Earthquake Scenario

Resilience Component for The Long-Range Transportation Plan 2045: Hurricane Vulnerability

Puerto Rico's Location in the Caribbean makes it susceptible to the passing of hurricanes each year. The hurricane season is between the months of July and November, with September being the month with the most historical activity. The hurricane season is distinguished by heavy rainfall, high-velocity winds, and storm surges, which cause flooding and landslides throughout the Island.

However, the level of destruction varies based on several factors, such as the hurricane's trajectory, severity, size, forward speed, geotechnical characteristics in each place, land elevation, and so on.

In 2017, the Island was hit by two consecutive storms, Irma and María. Hurricane María was the most powerful hurricane in 80 years. The electricity, communications, and water systems were all seriously affected in terms of infrastructure. The Roadway network was damaged by the floods, landslides, or storm surges. Bridges suffered the greatest amount of structural damage because of river floods.

For the resilience component established by the 2045 LRTP, a vulnerability analysis for the transportation network was performed in accordance with the U.S. Department of Transportation's vulnerability assessment and adaptation methodology .

The information from the 2045 LRTP remains current since the data utilized for the vulnerability assessment was not updated following Hurricane María. Therefore, the results of the vulnerability assessment will only be summarized for the purposes of this MLRTP update. The complete methodology can be found in the Appendix Roadway Network Vulnerability Assessment -Update incorporation of Earthquake Scenario.

It is important to note that just because risk assessment data has not changed, it does not indicate that no additional weather-related incidents have occurred in the last several years. When Hurricane Fiona hit Puerto Rico in 2022, particularly in the southern half, there was damage to the roadway system. Specifically, there was structural damage to some NHS and non-NHS roadways caused by landslides that was not necessarily reflected in this study.

- Results as presented in the 2045 LRTP Vulnerability Assessment

The vulnerability index was obtained by combining the three components: Exposure, Sensitivity and Adaptive Capacity. A simple average might hide single-component criticalities that is why the scoring for vulnerability index followed these rules:

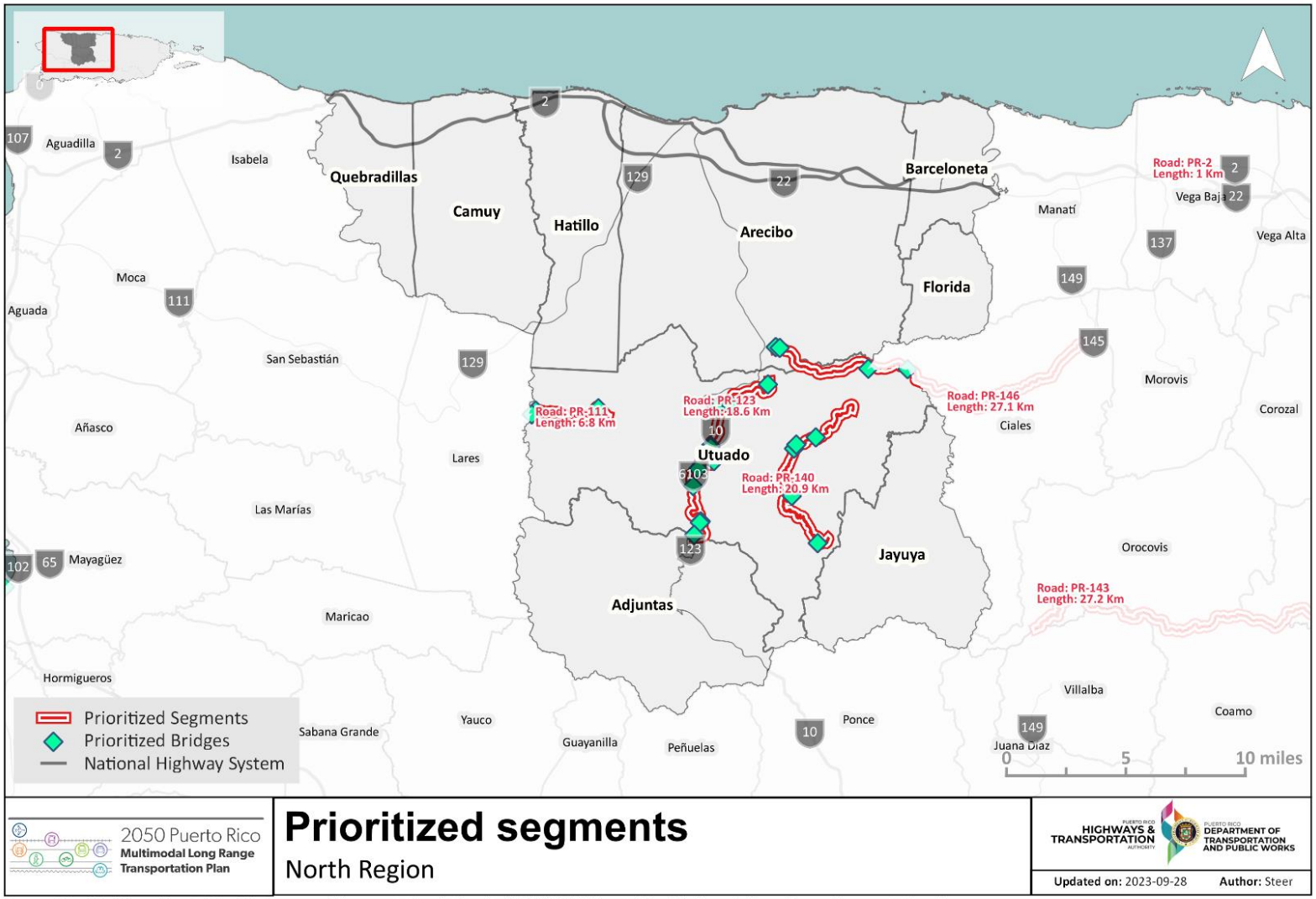
- Score=5: If the three (3) components had score of five (5)
- Score=4: If two (2) out of three (3) had a score equal or higher than four (4)
- Score=3: If at least one (1) of the components had score equal or higher than four (4), or the average is above three (3)
- Score=2: If the average is above two (2) and below three (3); and
- Score=1: Any other case.

Due to the level of detail defined in this analysis, the vulnerability index is defined as a discrete scale from 1 to 5, where “one” (1) is the lowest score and “five” (5) the highest. It is important to note that three (3) of the selected segments were given a score of “0” because there was no evidence of Exposure. However, these might be due to uncertainties in the location or type of hazard responsible for failure. Therefore, it is important to re-visit these points and develop further hazard analysis.

These results were shared with the stakeholders in a final workshop, where the top twenty-one (21) segments (i.e., score four (4) and five (5)) were selected for further analysis and definition of mitigation analysis.

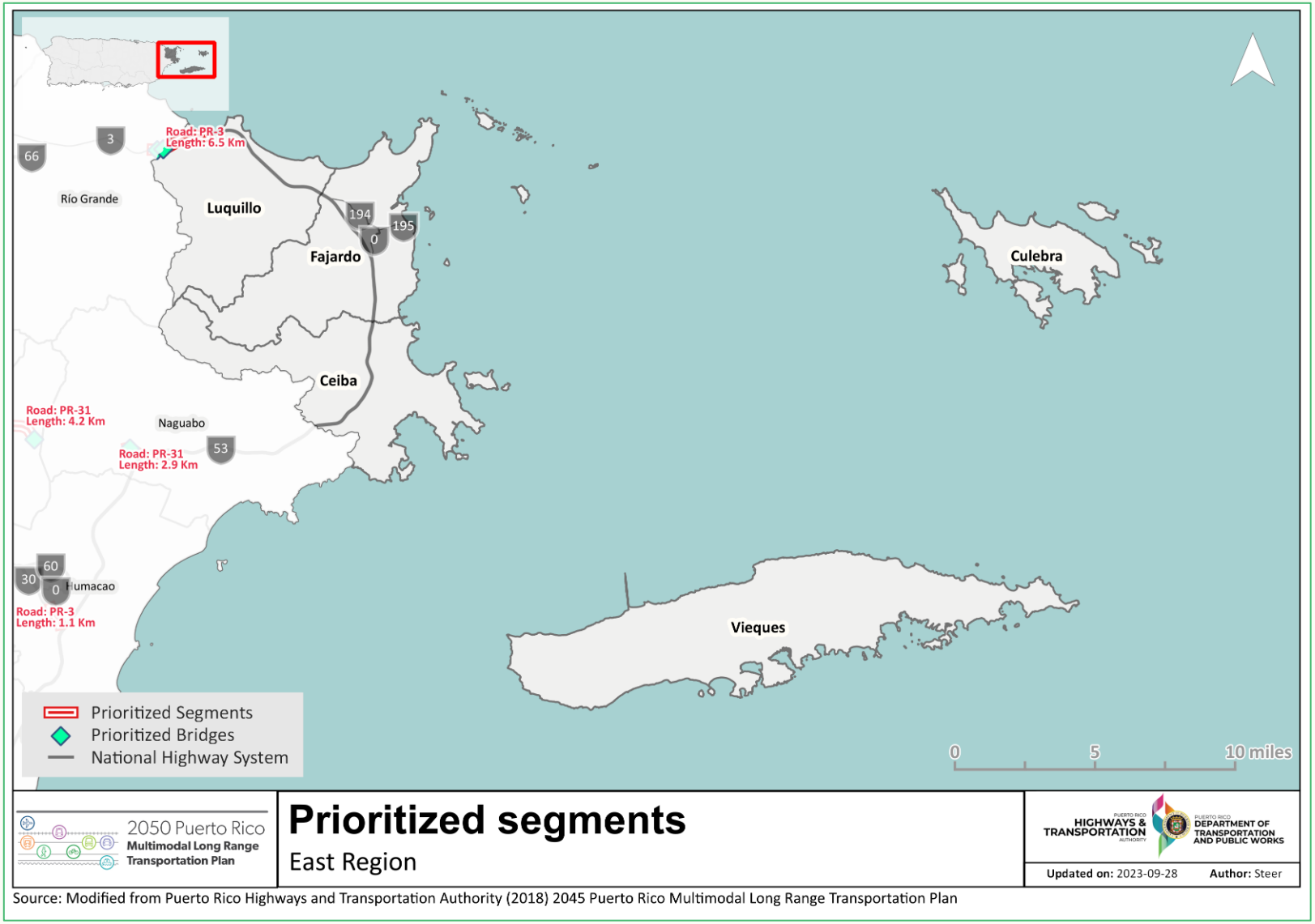
Figure 6.4 to Figure 6.8 show the location of each prioritized segments and bridges for the UZA regions. For all the identified segments a detailed study needs to be carried out to identify the appropriate adaptation option.

Figure 6.4: Prioritized Segments in the North TPR



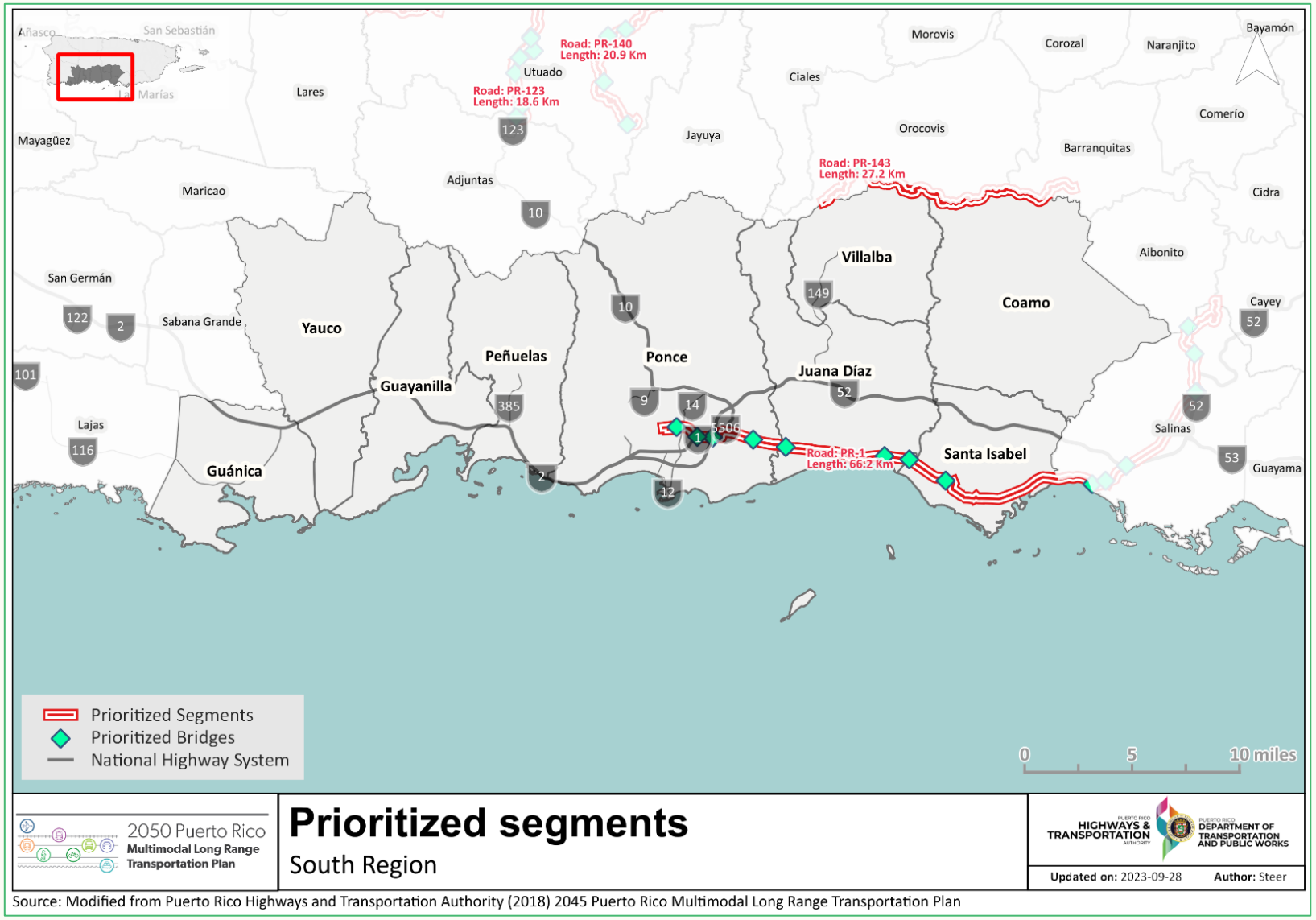
Source: Modified from Puerto Rico Highways and Transportation Authority (2018) 2045 Puerto Rico Multimodal Long Range Transportation Plan

Figure 6.5: Prioritized Segments in the East TPR



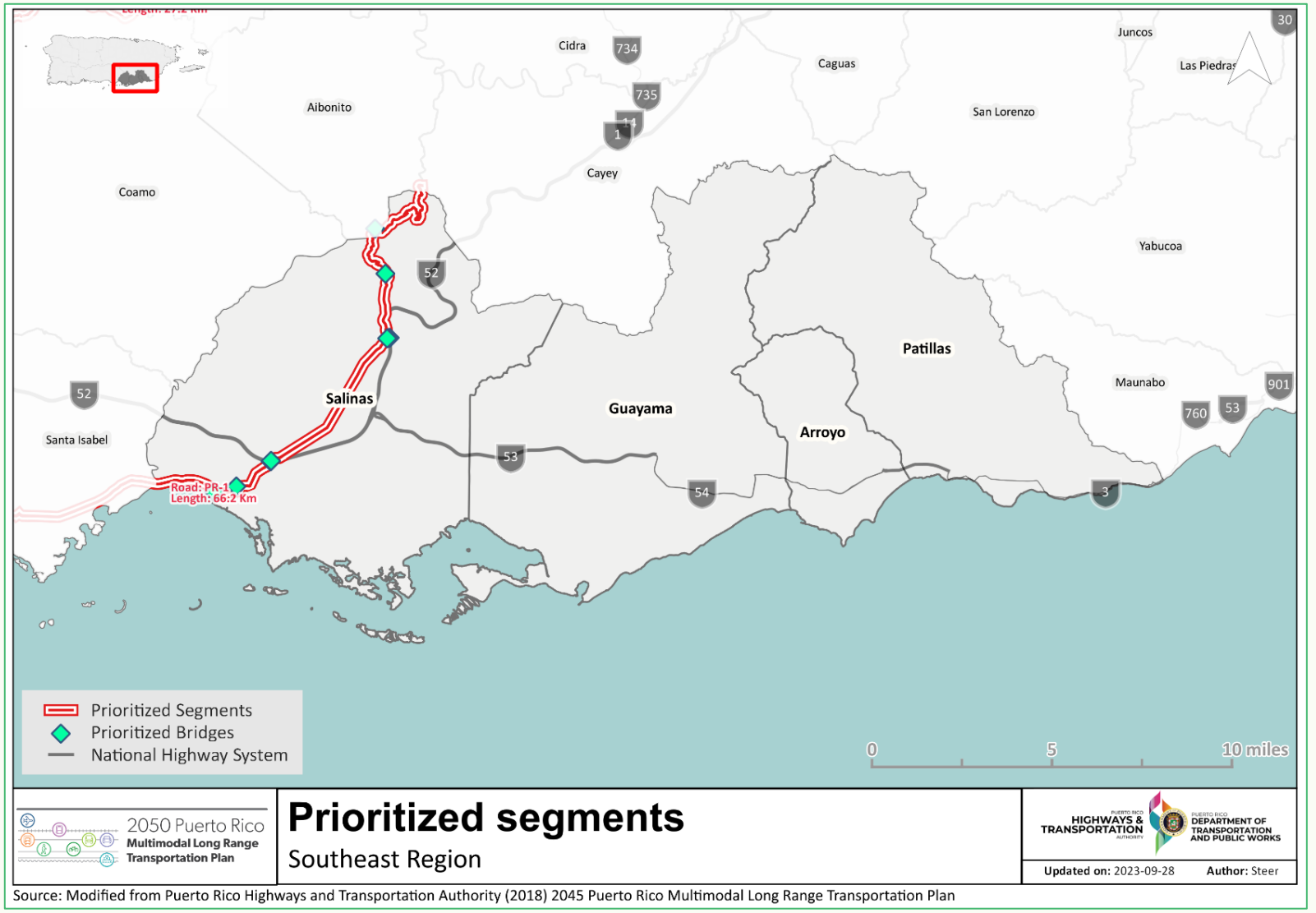
Source: Modified from Puerto Rico Highways and Transportation Authority (2018) 2045 Puerto Rico Multimodal Long Range Transportation Plan

Figure 6.6: Prioritized Segments in the South TPR



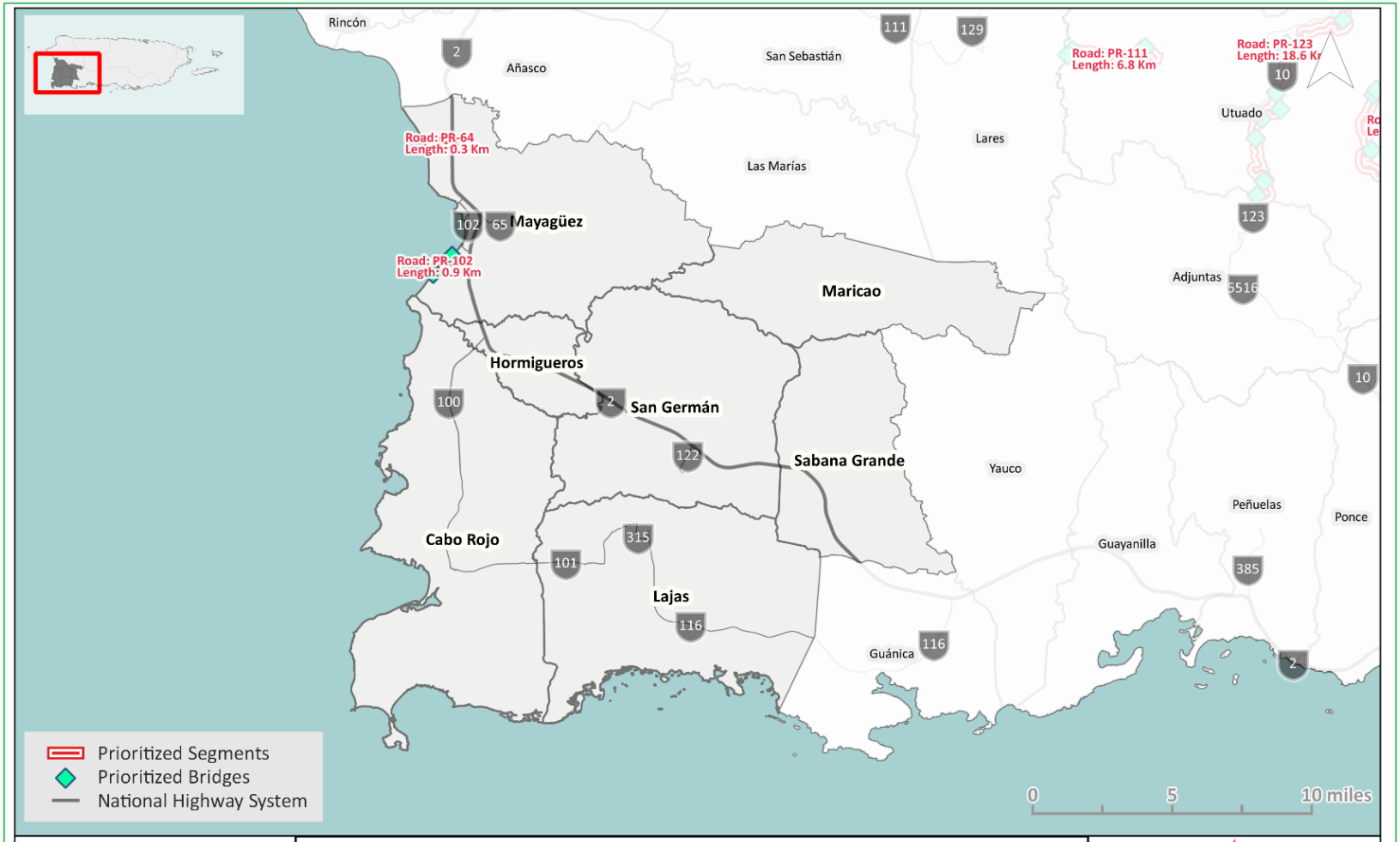
Source: Modified from Puerto Rico Highways and Transportation Authority (2018) 2045 Puerto Rico Multimodal Long Range Transportation Plan

Figure 6.7: Prioritized Segments in the Southeast TPR



Source: Modified from Puerto Rico Highways and Transportation Authority (2018) 2045 Puerto Rico Multimodal Long Range Transportation Plan

Figure 6.8: Prioritized Segments in the Southwest TPR



Source: Modified from Puerto Rico Highways and Transportation Authority (2018) 2045 Puerto Rico Multimodal Long Range Transportation Plan

Table 6.12 shows a description of the prioritized segments in the UZA region.

Table 6.12: Prioritized Segments Assessment

Road Name	Location	AADT	Length (km)	Hazard	Vulnerability Index
PR-123	Utuado	9,139	19	Landslides	4
PR-3	Luquillo	15,385	3.2	Floods	4
PR-1	Ponce, Juana Díaz, Santa Isabel, Salinas	1,420	58.8	Floods	4
PR-140	Utuado	2,181	20	Landslides	4
PR-64	Mayagüez	8,112	0.3	Floods	4
PR-102	Mayagüez	6,164	1.9	Floods	4
PR-111	Utuado	5,081	6.8	Landslides	4

Source: Steer, Note: The AADT presented for each segment was estimated using an annualization factor and it is shown in Passenger Car Unit (PCU). This factor converts toll revenue from the weekday values derived from the study area forecast models to an equivalent annual total. SDG set this factor based on available observed toll transaction data and SDG estimate of the number of weekdays, weekends, and a weekend day's share of weekday transactions in 2016. Assuming a weekend has one-third of a weekday's transactions, SDG Team estimated a revenue factor of 296 (261 weekdays plus 104 weekends * 1/3)

Resilience Component Update: Earthquake Vulnerability

Puerto Rico's location between two major tectonic plates makes it susceptible to the occurrence of telluric movements such as tremors and earthquakes. In the past, the Island has suffered the impact of high-magnitude earthquakes such as the 1918 San Fermín earthquake which struck Puerto Rico with a magnitude of 7.1 on the Ritcher scale causing a lot of distress in the population and serious damage to the existing infrastructure. Several other minor earthquakes have taken place on the Island since then, showing that the risks associated with this type of natural disaster are always present.

In recent years there has been an increase in the activity of telluric movements that led to the occurrence of the 2020 earthquakes near the island's southern portion and has produced an elevated aftershock productivity that continues to this day. This recent increase in seismic activity brought to attention the necessity of analysing the resilience and vulnerability of the island infrastructure to this type of phenomenon, especially the connectivity and the capacity to ensure aid to every significant population center on the island in case of major disasters.

Based on this we have updated the resilience component of the MLRTP with the inclusion of Earthquake Vulnerability analysis. The goal of this analysis is to assess the system's vulnerability based on the knowledge gained after the 2020 earthquakes, as well as the connection or future connectivity difficulties based on the system's exposure. This would help to identify where these risks exist and where the PRHTA should strengthen or offer alternative infrastructure to ensure that all communities remain accessible after a major disaster.

The data used for this earthquake vulnerability update is the field observations of ground failures such as cracks, damage, falls, lateral spread, liquefaction and other damages caused by the Puerto Rico earthquake sequence of 2020 according to the United States Geological Survey (USGS).

The main damage caused by the earthquakes is found towards the south and west of Puerto Rico, mainly affecting the following UZA regions:

Southwest TPR

- Hormigueros, and Cabo Rojo municipalities. It's worth noting that this municipalities in this region were mostly affected by liquefaction.

South TPR

- Guánica, Yauco, Guayanilla, Peñuelas and Ponce municipalities

According to the USGS damage information, liquefaction and landslides were the most frequent type of ground failure observed in the aftermath of 2020 Earthquakes. Figure 6.10 shows the location of the damages triggered by the 2020 Puerto Rico earthquake sequence as reported by the USGS.

Also, as part of the evaluation, it was analysed the impact that the 2020 earthquakes had on the road network and the service infrastructure. Is worth clarifying that in the road network, only primary and secondary roads were considered, since these would address logistical issues and the distribution of essential goods and services in the event of a disaster. Figure 6.11 and Figure 6.12 show the location of the damages triggered by the 2020 Puerto Rico earthquake sequence and its relationship with the road network and service infrastructure.

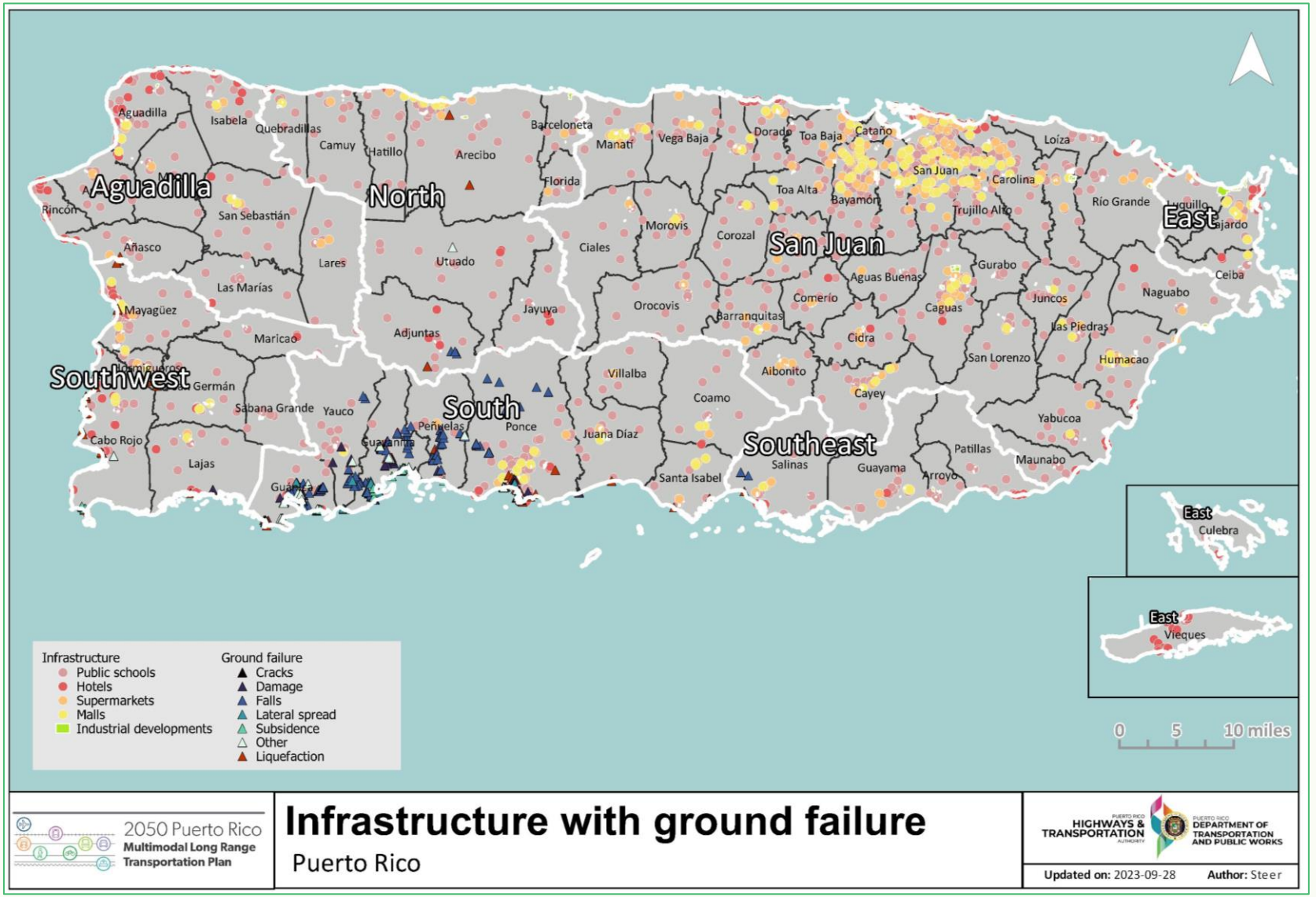
Also, Figure 6.10 to Figure 6.12 show that the ground failures reported have proximity to major roads and important service infrastructure in the southwestern section of the island, especially around Ponce, Peñuelas, Yauco, and Mayagüez. Indicating that any major roads or vital service infrastructure could be affected by the occurrence of another earthquake of similar magnitude.

Figure 6.9: Principal Ground Failure Affectations due to 2020 Earthquakes

Source: United States Geological Survay (USGS), Field observations of ground failure triggered by the 2020 Puerto Rico earthquake sequence.

Figure 6.10: Principal Ground Failure Affectations due to 2020 Earthquakes and Puerto Rico Road Network (Primary and Secondary Roads)

Figure 6.11: Principal Ground Failure Affectations due to 2020 Earthquakes and Service Infrastructure



Even though it was examined the ground failures caused by the 2020 earthquake, it is important to note that the location of these failures is linked to the earthquake's epicenter, i.e., the absence of ground failures in other sections of the Island does not necessarily mean that those sectors are not susceptible to earthquakes, nor that only the southwest section of the Island is vulnerable to this type of disaster. Because the location of the earthquake may be the primary driver of where the damage occurs on the Island, it is important to consider the big picture and comprehend Puerto Rico's vulnerability as a whole.

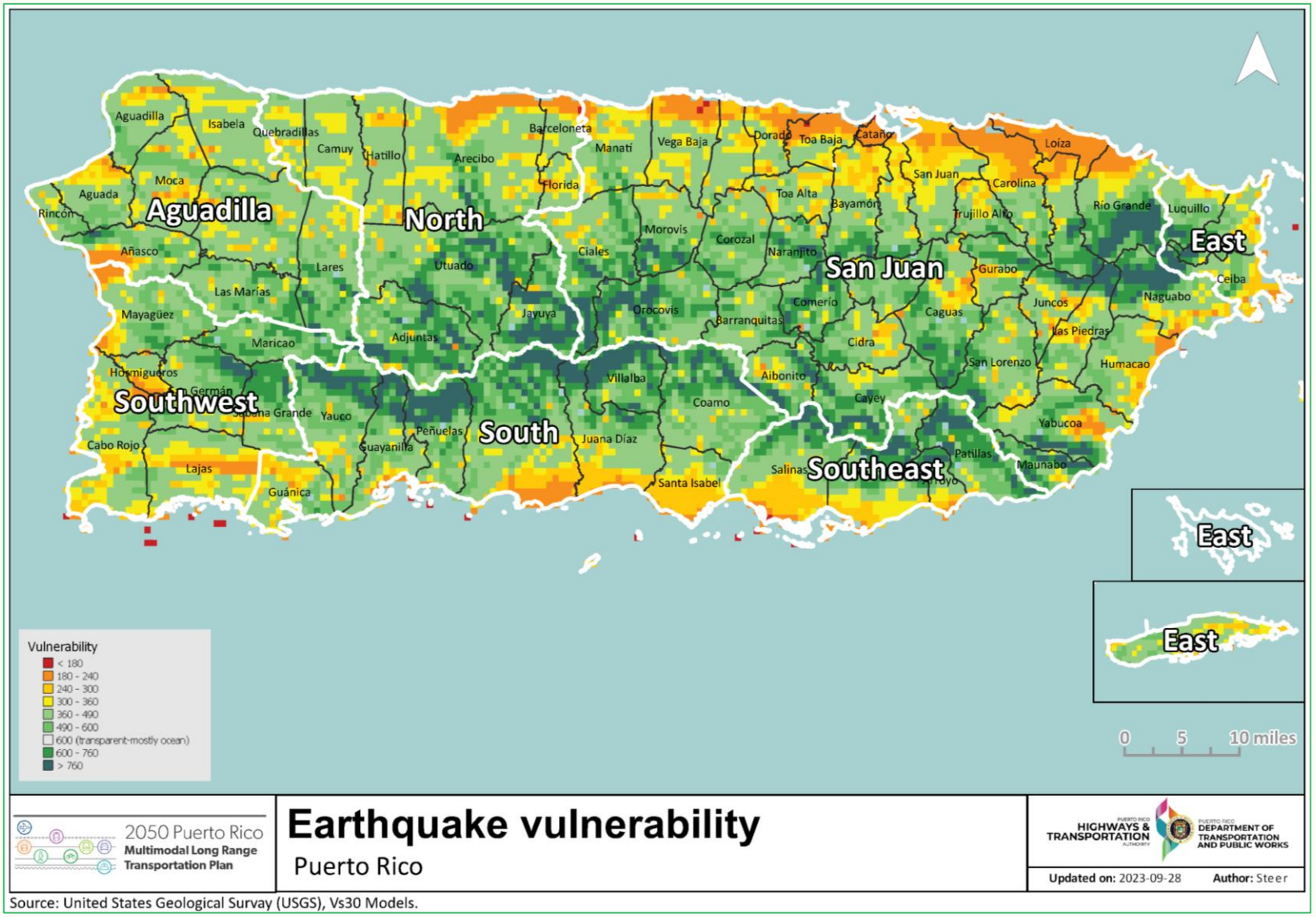
For this purpose, it was considered in our analysis the Earthquake vulnerability Vs30 model developed by the USGS for Puerto Rico. This model classified the land according to their earthquake vulnerability on a scale from 100 to 760, where the numbers closer to 100 have a higher vulnerability and the values closer to 760 have less of it.

According to this Puerto Rico Vs30 model the most vulnerable areas are the North and South coast of the country, affecting the municipalities of Arecibo, Vega Baja, Toa Baja, Cataño, San Juan, Carolina, Loíza, Ponce, Lajas, Santa Isabel and Salinas. It is also presented that the interior of the island has a low vulnerability to earthquakes, within this area are the municipalities of Jayuya, Orocovis, Villalba, among others (Figure 6.13).

When comparing, the earthquake damage recorded in 2020 and the vulnerable areas according to the Vs30 model in Figure 6.13, there is a correspondence between the areas with the greatest vulnerability and those with the greatest damage due to an earthquake (see Figure 6.9). However, the northern part of the country has a high vulnerability but has not reported damage from the 2020 earthquake. As mentioned earlier, this could be presumed due to the location of the 2020 earthquake epicenter at the southern of the Island.

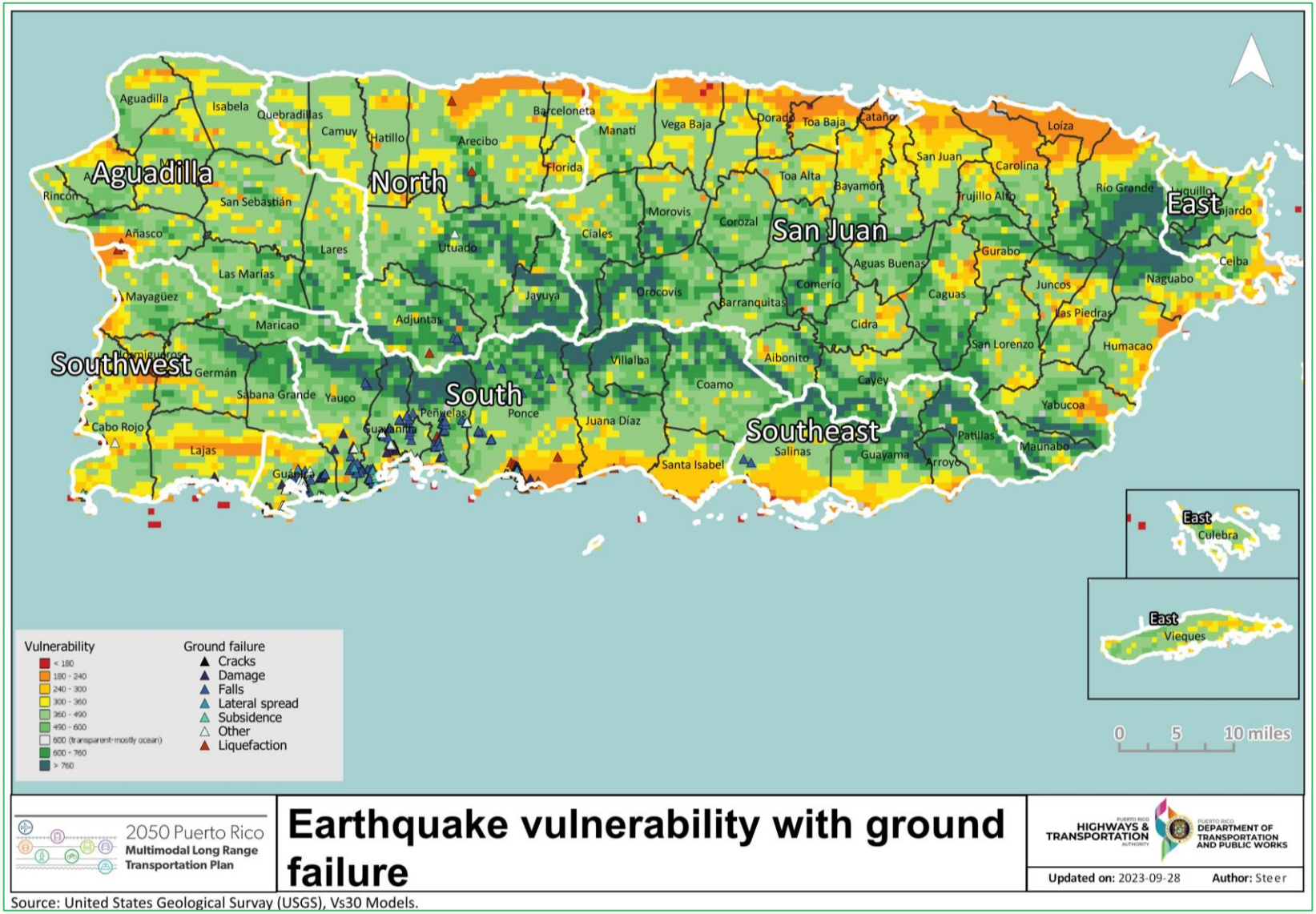
Figure 6.12 shows the Earthquake Vulnerability according to Vs30 USGS Model and Figure 6.13 shows the Puerto Rico Earthquake Vulnerability according to Vs30 USGS Model and Principal ground failure affectations due to 2020 Earthquakes.

Figure 6.12: Puerto Rico Earthquake Vulnerability According to Vs30 USGS Model



Source: United States Geological Survay (USGS), Vs30 Models.

Figure 6.13: Puerto Rico Earthquake Vulnerability According to Vs30 USGS Model and Principal Ground Failure Affectations Due To 2020 Earthquakes



Source: United States Geological Survay (USGS), Vs30 Models.

Once it was analysed the earthquake vulnerability throughout the Island the next step is to understand the connectivity around the different locations. With this we could compare which zones in Puerto Rico that have poor road connectivity and infrastructure are located within an earthquake vulnerable area, this could lead us to potential areas of conflict where there could be potential access problems in case of an earthquake.

We used the road network to determine the connectivity indicator for each of the census blocks of Puerto Rico. The connectivity indicator is presented as the ratio of the number of primary or secondary roads, which connect the centroid of a census block area and the total number of roads, including the tertiary roads, that are related to the centroid of the census block. With this definition, it was constructed the connectivity indicator. A number close to 0 means that that census block has low connectivity in terms of road networks while a number close to one (1) has high connectivity in the road network within that census block.

Figure 6.15 shows the average connectivity indicator of every census block in Puerto Rico. The darker colours indicate a weaker connectivity indicator while the lighter colours indicate a stronger one. We could see in Figure 6.10 some census blocks near the some UZA municipalities that shows a higher and weaker connectivity indicator. Table 6.13 shows the results by UZA Region.

Table 6.13: Connectivity Indicator - UZA

Regions	Municipality	Connectivity Indicator
South	Ponce	Higher
South	Yauco	Weaker
Southwest	Mayagüez	Higher
Southwest	Maricao	Weaker

Source: Steer, 2023

When comparing, the earthquake damage recorded in 2020 and the connectivity indicator in Puerto Rico it could be seen that in the municipalities of Peñuelas, Guayanilla, Ponce, and Guánica, all located in the UZA South Region, and Cabo Rojo, located in the UZA Southwest Region, there is a high incidence of earthquake damage and at the same time a low connectivity indicator, implying that in the event of any damage that affects the primary or secondary roads of these municipalities, the distribution of goods and services would be more complex to carry out.

On the contrary, in the municipality of Hormigueros, in the UZA Southwest Region, where the greatest damage occurs, there is an average connectivity indicator, making it easier to distribute goods or services within this area if a disaster occurs (see Figure 6.14).

Likewise, when comparing the location of the service infrastructure and the connectivity indicator, there is the highest concentration of infrastructure where there are medium and high connectivity indicators. On the other hand, it can be observed that the areas where earthquake damage has occurred, have a low concentration of infrastructure, therefore, there would be no major impact on reaching these facilities if an earthquake disaster were to occur (see Figure 6.15).

The connectivity indicator gave interesting insights into the relationship between observed 2020 earthquake damages to the road network and the service infrastructure. However, the comparison between the earthquake vulnerability and the connectivity situation in the whole island is key to identifying potential areas of conflict in the event of future earthquakes.

Figure 6.16 shows the comparison between the earthquake vulnerability map and the connectivity indicator. In this figure it could observe that the northern area of Puerto Rico presents a high earthquake vulnerability however it has a high connectivity index, especially near San Juan. Meanwhile, in the south and west areas of the island, there are high levels of earthquake vulnerability accompanied by low connectivity indicators. This could represent a potential area with high risk to ensure accessibility in case of an earthquake disaster.

Figure 6.14: Puerto Rico Connectivity Indicator

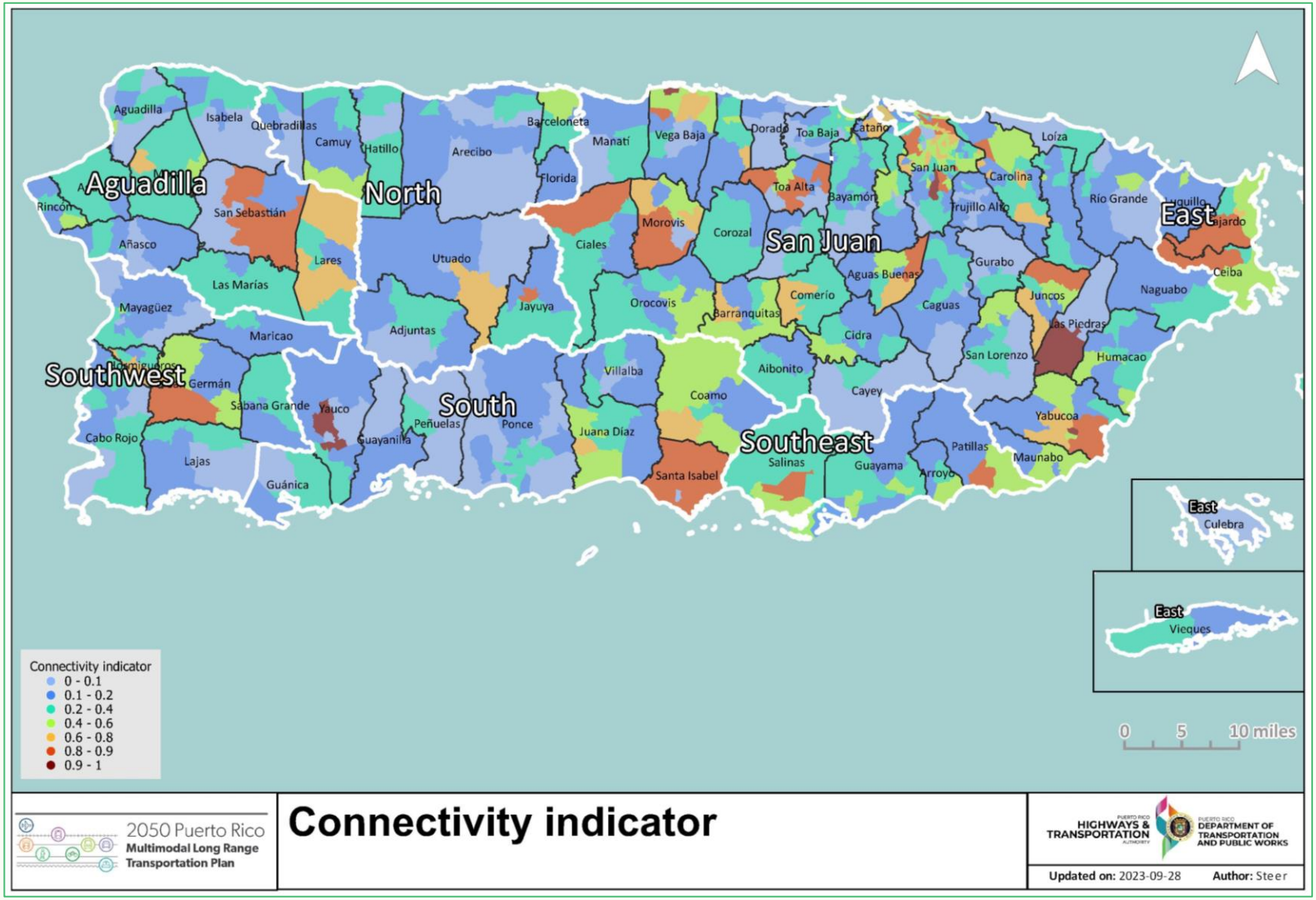
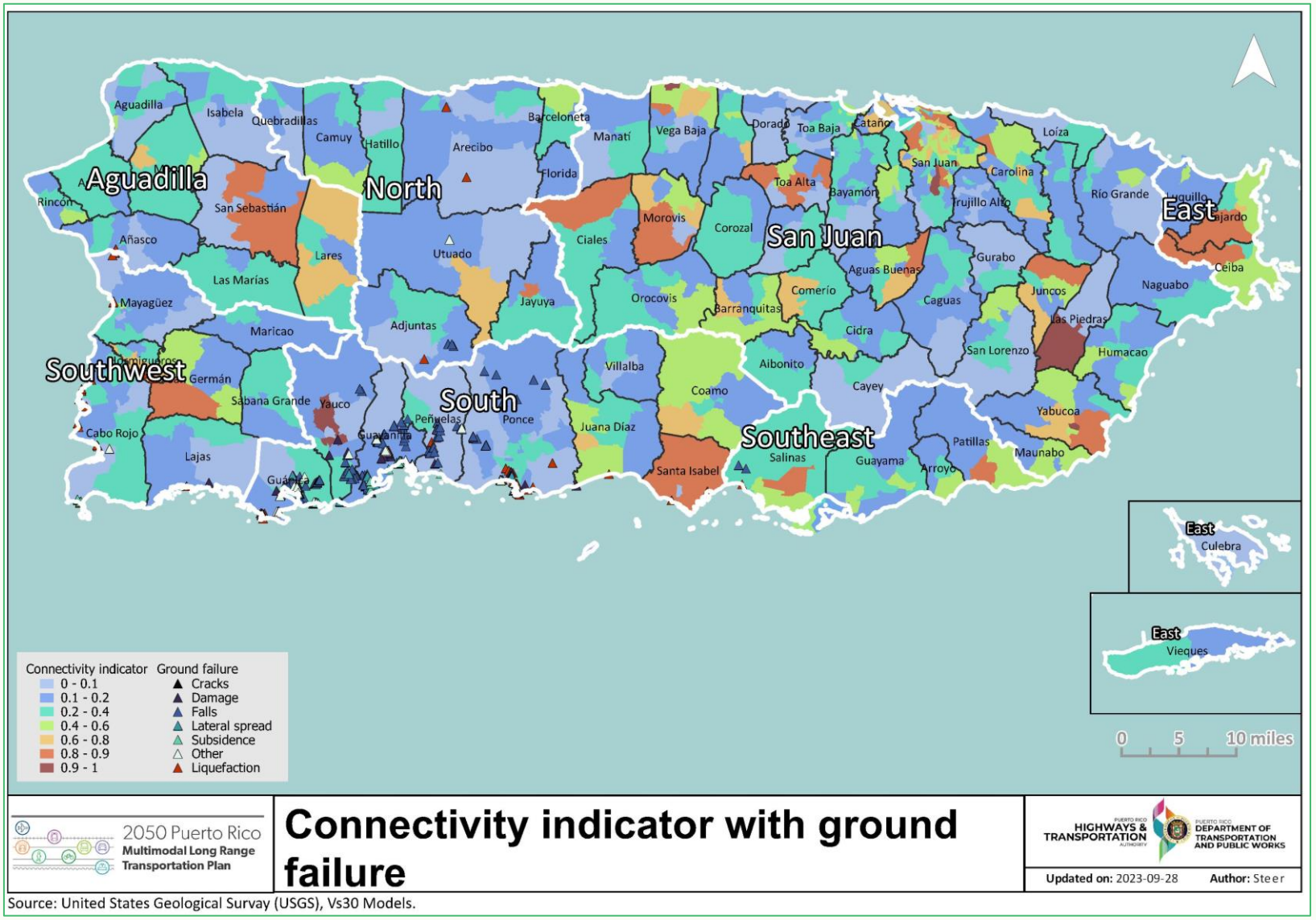
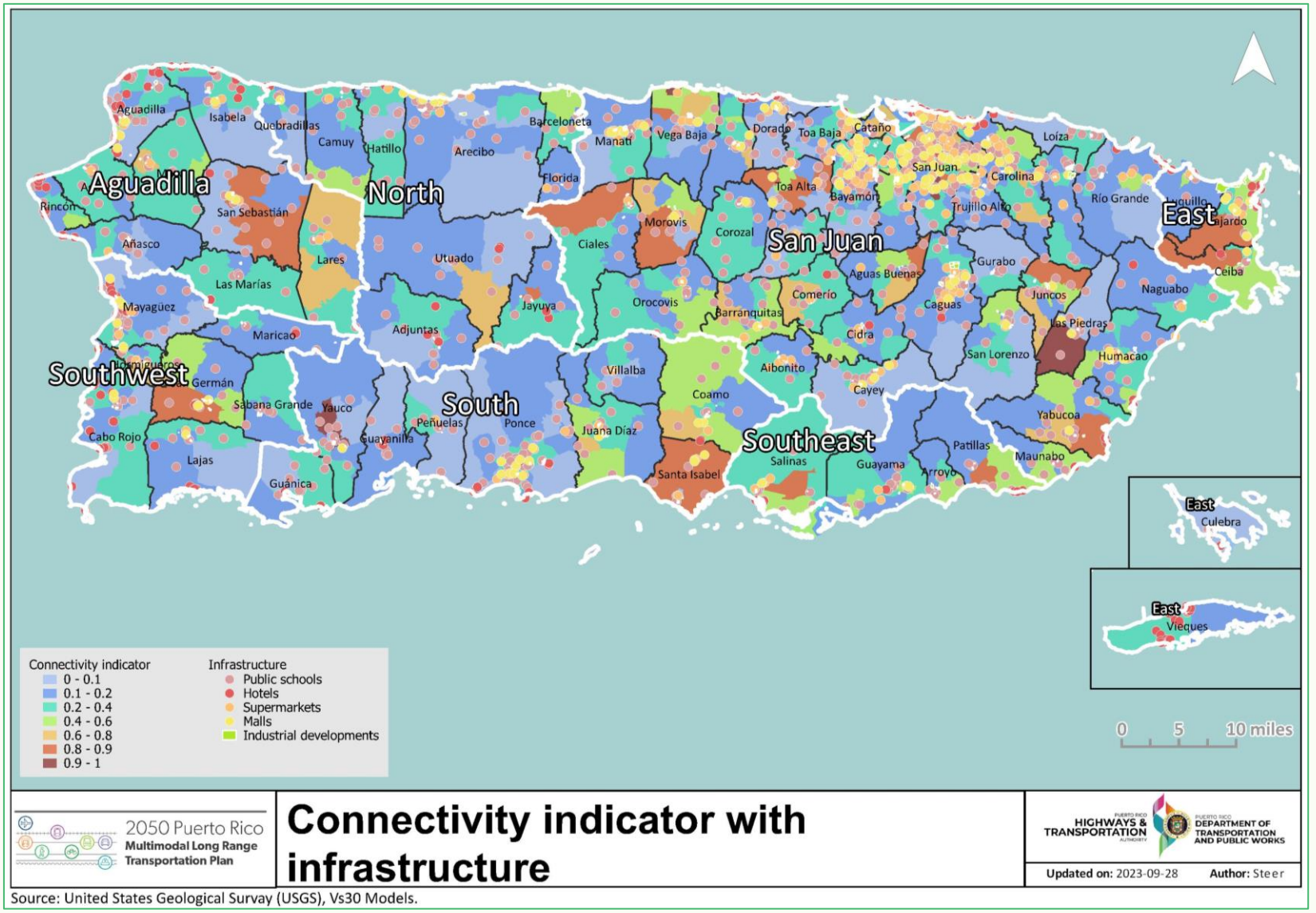


Figure 6.15: Puerto Rico Connectivity Indicator and Principal Ground Failure Affectations Due to 2020 Earthquakes



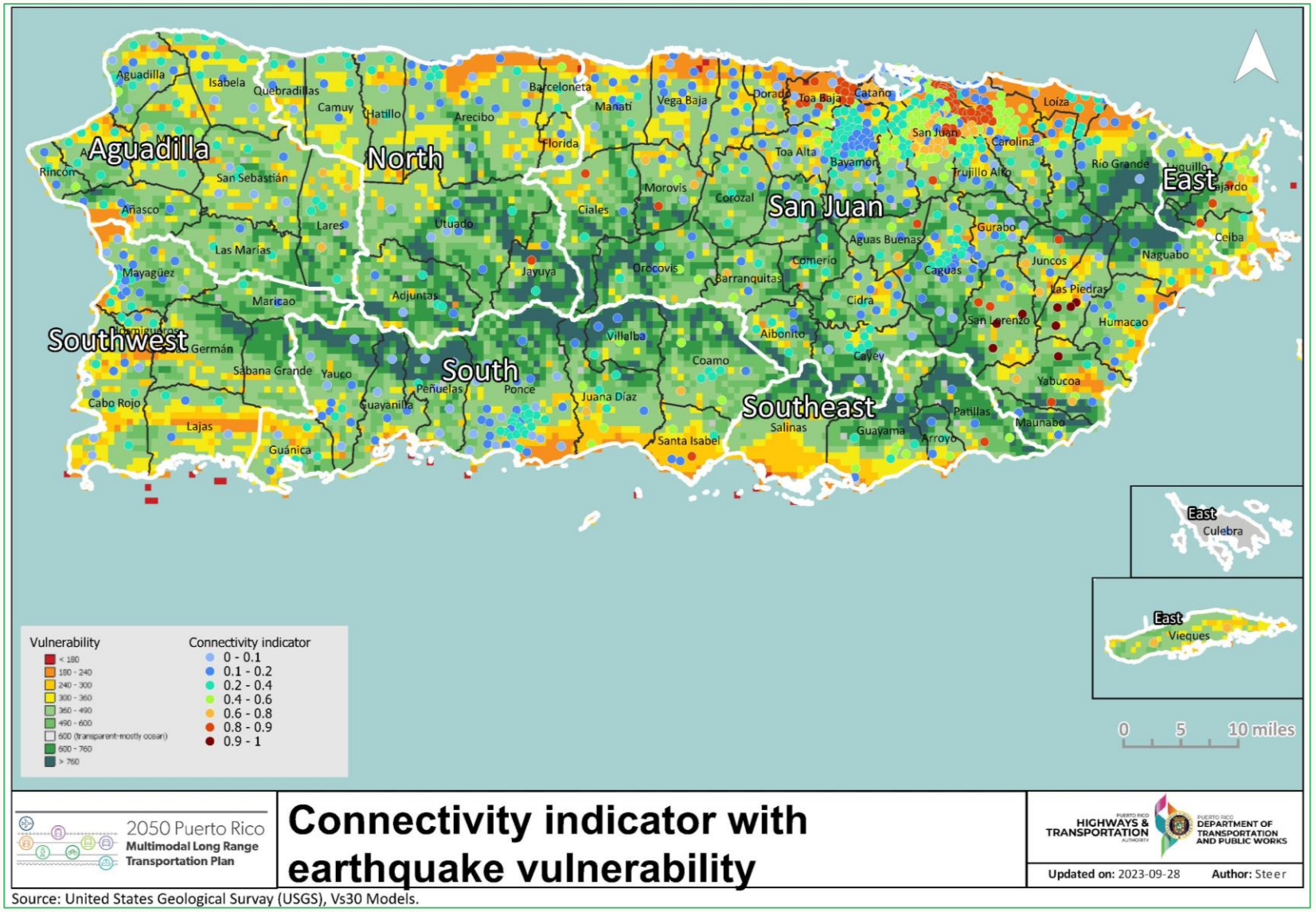
Source: United States Geological Survay (USGS), Vs30 Models.

Figure 6.16: Puerto Rico Connectivity Indicator and Service Infrastructure



Source: United States Geological Survay (USGS), Vs30 Models.

Figure 6.17: Puerto Rico Earthquake Vulnerability According to Vs30 USGS Model and Connectivity Indicator



Source: United States Geological Survay (USGS), Vs30 Models.

The comparisons made above gave a better understanding of how the interaction of potential vulnerability to earthquakes, the observed damages due to 2020 seismic activity, and the existence of actual road and service infrastructure could set the conditions for the resilience of a determinate region at the occurrence of earthquakes. However, the social aspect is as crucial as the physical conditions of the island. In order to understand the potential vulnerability of a determinate region to natural disasters is key to know how the population that lives on the Island is prepared as a society for the impact of natural inclemency, in this case, earthquakes.

Therefore, we used the Social Vulnerability Index (SVI) to link the social aspect of variables such as Socioeconomic status and household characteristics, among others, found in each region to help us characterize the social vulnerability to the occurrence of natural disasters in the Island.

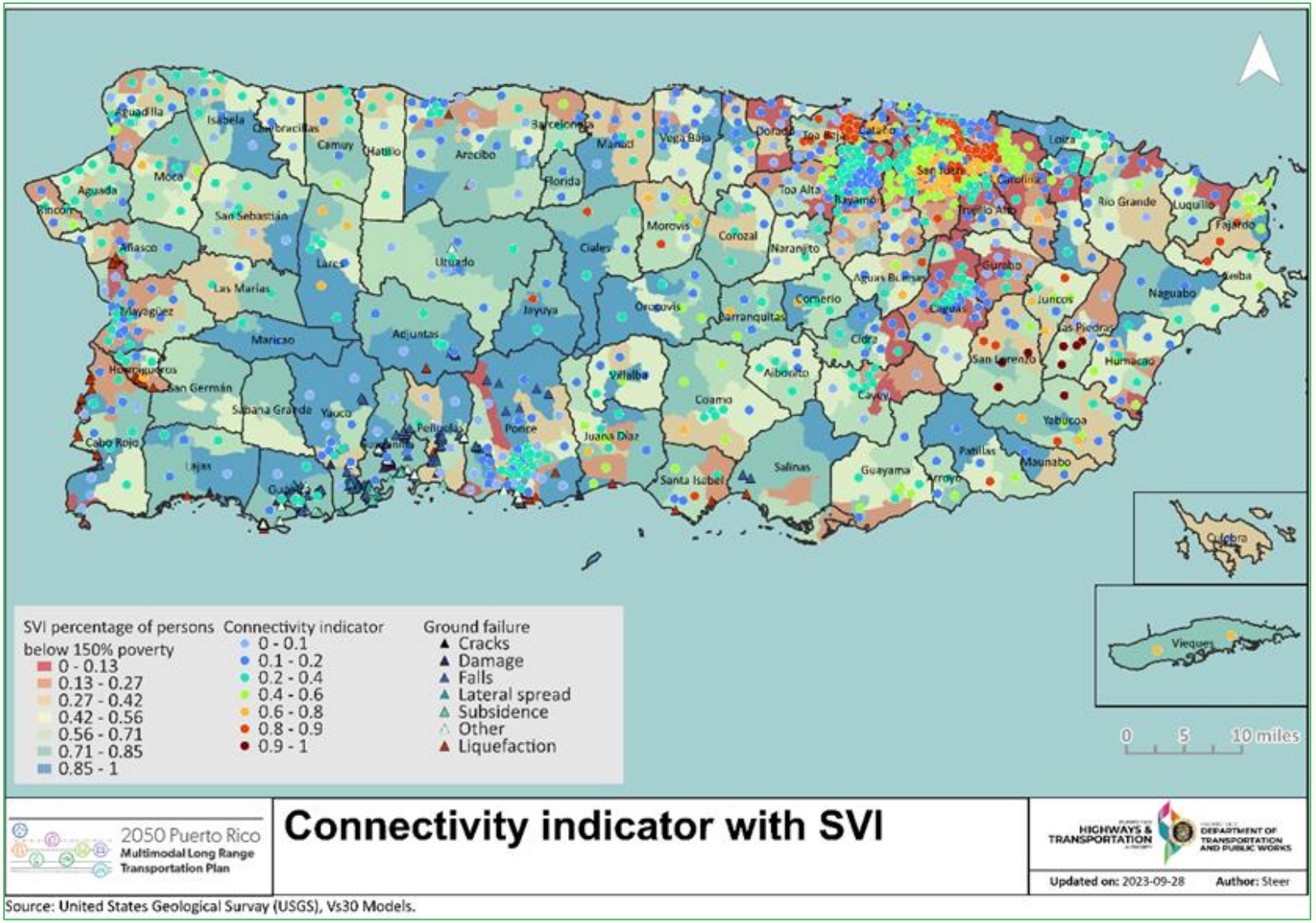
Figure 6.18 shows the SVI percentage of people below 150% poverty within the island as well as the connectivity indicator and the ground failures triggered by the 2020 earthquake. In this figure, it can observe that most regions with the highest proportion of their population below the 150% poverty threshold (portrayed in the map with sky blue colours) are located on the western side of the island. However, there are also some regions outside the western area of the Island presenting high proportions of inhabitants below the 150% poverty threshold such as Naguabo, Patillas, and Loíza. Municipalities such as Loíza, Cabo Rojo, and Lajas present a combination of high poverty levels and high vulnerability to earthquakes.

Figure 6.19 shows the SVI percentage of civilians (age 16+) unemployed within the Island as well as the connectivity indicator and the ground failures triggered by the 2020 earthquake. Municipalities such as Loíza, Lajas, Mayagüez, and Yabucoa present high unemployment rates while being within the high vulnerability for earthquakes spectrum.

Figure 6.20 shows the SVI percentage of persons aged 65 or older within the island as well as the connectivity indicator and the ground failures triggered by the 2020 earthquake. Municipalities such as Cabo Rojo, Mayagüez, and Ceiba present a high proportion of elderly people as well as high vulnerability to earthquakes.

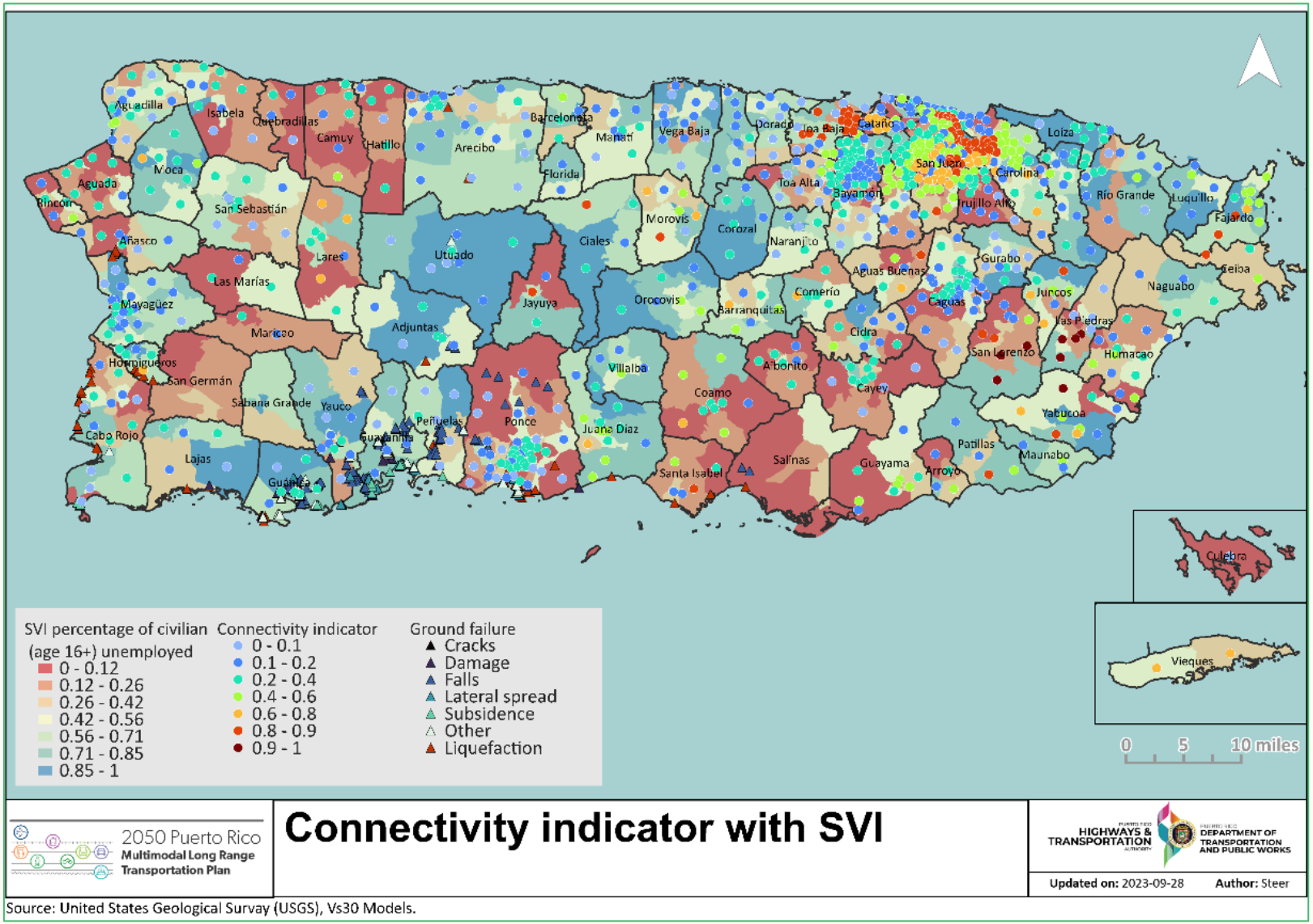
As part of the analysis, it was found that some municipalities such as Cabo Rojo, Loíza, Lajas, and Mayagüez present some social characteristics, on top of the already established earthquake vulnerability, that could affect the resilience of these municipalities in the case of an Earthquake. Also, these municipalities have sections with poor connectivity and, in some cases, the presence of ground failures such as cracks and liquefaction on previous occurrences. Therefore, these municipalities vulnerabilities should be addressed in order 0o build their resilience, or the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions that could provoke the occurrence of an earthquake.

Figure 6.18: Puerto Rico SVI Percentage of Persons Below 150% Poverty, Puerto Rico Connectivity Indicator and Principal Ground Failure Affectations Due to 2020 Earthquakes



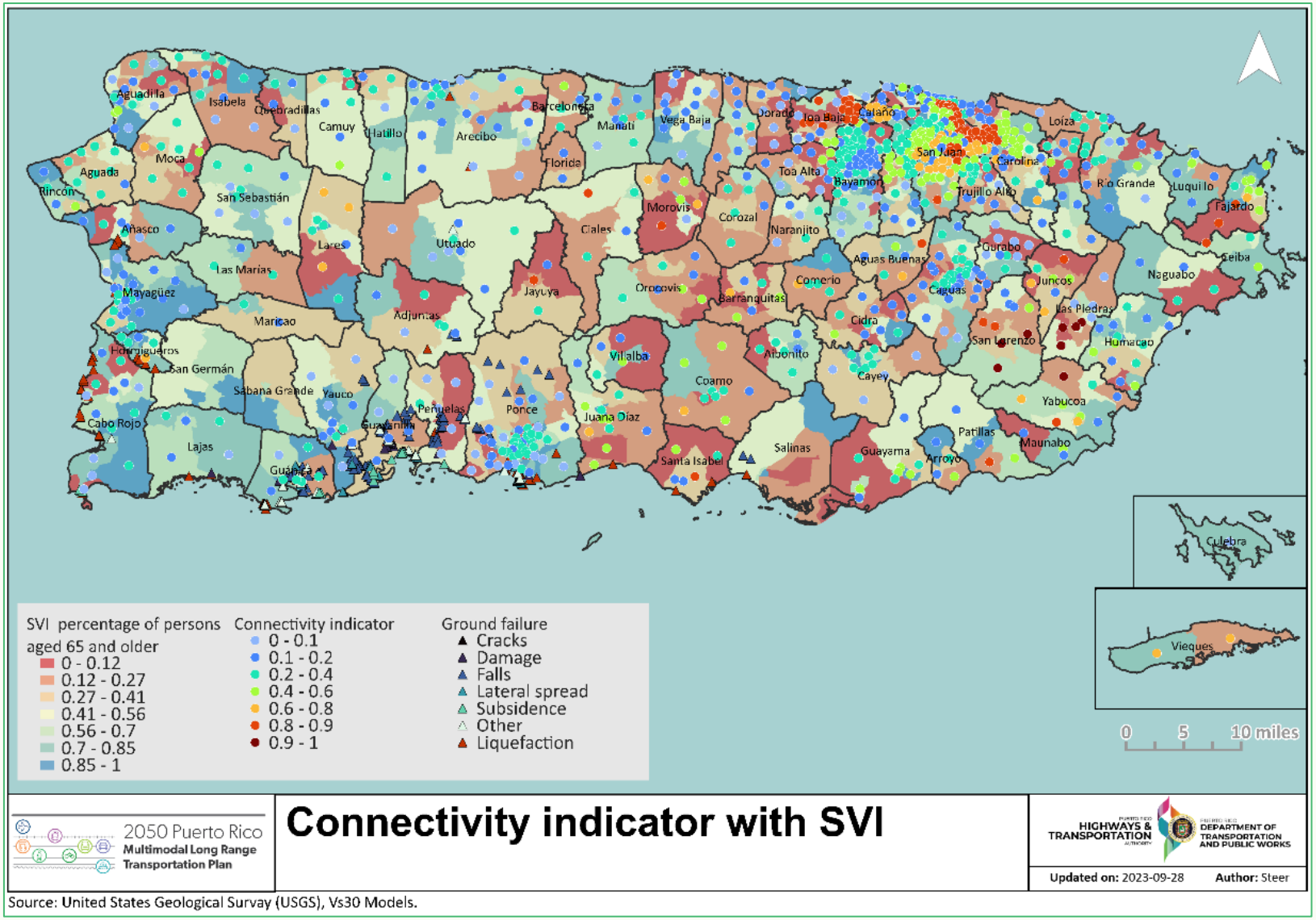
Source: United States Geological Survay (USGS), Vs30 Models.

Figure 6.19: Puerto Rico SVI Percentage of Civilian (Age 16+) Unemployed, Puerto Rico Connectivity Indicator and Principal Ground Failure Affectations Due to 2020 Earthquakes



Source: United States Geological Survay (USGS), Vs30 Models.

Figure 6.20: Puerto Rico SVI Percentage of Persons Aged 65 And Older, Puerto Rico Connectivity Indicator and Principal Ground Failure Affectations Due to 2020 Earthquakes



Source: United States Geological Survay (USGS), Vs30 Models.

Bottleneck Analysis

Within the planning factors is included the priority of supporting the economic vitality (global competitiveness), productivity, and efficiency as well as promoting efficient system management and operation. The congestion management and reduction are an important factor to consider within this 2050 MLRTP.

The road congestion is typically associated with speed, level of service (LOS), and traffic volume. Those are indicators that can be measured considering the following Key Performance Indicators (KPIs): Delay, Queue, LOS, Volume to Capacity Ratio (V/C), Speed, Travel Time, or Density.

A bottleneck analysis based delay-identification for the NHS was performed as part of the 2050 MLRTP. For this analysis, data from NPMRDS for the year 2022 was utilized for extracting speed and distance of TMC segments coded segments, in order to calculate travel time. The variable delay was obtained through comparing travel time at reference speed and travel time at traffic speed, to assess the time of delay for all segments, per period of day.

Travel Time Reliability

UZA's have some urban areas and those are the ones that generally face congestion during peak hours. Having as result that citizens are required to adjust the travel time to ensure arriving at their destination on time, accounting for the estimated delay on their trip. That reliability of the travel time adjustment is important as it determines the user's options on whether to leave early to account for that delay or risk it to being late to their destination. Value of time, quality of life and well-being are all affected by the travel time reliability.

Bottleneck Analysis

Bottlenecks are recurring congestion events and considered "a critical point of traffic congestion evidenced by queues upstream and free flowing traffic downstream[110]" according to FHWA. The bottlenecks are predictable in location, cause, time of the day and approximate duration, contrary of non-recurring congestion events normally attributed to traffic anomalies such as car crashes This bottleneck analysis is specifically focused on the identification of segments with major delays along the NHS in UZA's. From the identification of those segments, there can be a determination of specific locations where congestion is highest along a road and the daily period of occurrence.

Methodology

Segment Identification

It is necessary to consider the segments with travel times higher than the expected at referenced speed for a road segment or TMC to identify possible bottlenecks. Subsequently, subtracting the average travel and reference travel time give us the vehicle delays per segment. Possible bottleneck segments and roads can be identified as those with higher delays on traveling time by measuring delay.

To conduct the bottleneck analysis, it was performed in each Region, per period of the day (AM, PM, MD) during the months of March, April, and May of 2022. The data used for this analysis is the same used for the travel time and speed data in the model calibration, just to keep congruence within that data and as mentioned before already having that those locations will have a predictable congestion.

Once all the Regions were analysed by period, a recurrence assessment was made to identify the top ten (10) worst segments of the UZA's in terms of delays. These are presented in the following section.

110. U.S. Department of Transportation Federal Highway Administration. 2017. Recurring Traffic Bottlenecks: A Primer Focus on Low-Cost Operational Improvements. Fourth Edition. fhwahop18013.pdf (dot.gov)

Analysis of Results

In the UZA's, road segments with maximum delays per road and per period of the day were identified. The locations of the segments identified are highlighted according to delay in minutes as shown from Figure 6.21 to Figure 6.25.

North TPR

At the top ten (10) segments with highest delays within the North TPR are the municipalities of Camuy, Barceloneta, and Arecibo reporting delays between 4.8-8.9 minutes. Camuy and Barceloneta presents the highest delays within the periods evaluated: AM, PM, and MD. The municipalities of Camuy, Arecibo and Barceloneta are the ones presenting segments with highest congestion at the different periods evaluated. In relation to the roads affected by the highest delays at the North TPR we can see how PR-22 and PR-2 are the roads showing the major number of segments with maximum delays.

Throughout the study period, the top ten (10) segments of the North TPR with worst delays were identified within the municipalities of Adjuntas, Camuy, Barceloneta, Arecibo, and Hatillo, along PR-2 (Northbound/Southbound), PR-10 (Northbound/Southbound), and PR-129 (Northbound). For the different periods evaluated:

- For the AM period, the average daily for worst segments was between 2.9-4.9 minutes, within the municipalities of Adjuntas, Camuy, Arecibo, Barceloneta, and Hatillo at segments along PR-2 (Northbound/Southbound), PR-10 (Southbound), and PR-129 (Northbound).
- For the PM period, the average daily for worst segments was between 2.6-8.9 minutes, within the municipalities of Camuy, Arecibo, Barceloneta, and Hatillo at segments along PR-2 (Northbound/Southbound).
- For the MD period, the average daily for worst segments was between 2.8-8.8 minutes, within the municipalities of Adjuntas, Camuy, Barceloneta and Arecibo at segments along PR-2 (Northbound/Southbound), and PR-10 (Northbound/Southbound).

East TPR

At the top ten (10) segments with highest delays within the East TPR are the municipalities of Luquillo and Fajardo reporting delays between 1.6-3.2 minutes. Luquillo and Fajardo presents the highest delays within the periods evaluated: AM, PM, and MD. The highest delays presented at the periods evaluated experiences traffic congestion for all periods at the municipalities of Fajardo and Luquillo. In relation to the roads affected by the highest delays we can see how PR-3 is the road showing the major number of segments with maximum delays.

Throughout the study period, the top ten (10) segments of the East TPR with worst delays were identified within the municipalities of Fajardo and Luquillo along PR-3 (Eastbound/Westbound). For the different periods evaluated:

- For the AM period, the average daily for worst segments was between 1.1-2.9 minutes, within the municipalities of Fajardo and Luquillo at segments along PR-3 (Eastbound/Westbound).
- For the PM period, the average daily for worst segments was between 1.1-3.1 minutes, within the municipalities of Fajardo and Luquillo at segments along PR-3 (Eastbound/Westbound), and PR-194 (Northbound/Southbound).
- For the MD period, the average daily for worst segments was between 1.2-2.9 minutes, within the municipalities of Fajardo and Luquillo at segments along PR-3 (Eastbound/Westbound), PR-194 (Northbound/Southbound) and Unión Street (Westbound).

South TPR

At the top ten (10) segments with highest delays within the South TPR are the municipalities of Ponce and Juana Díaz reporting delays between 3.3-4.1 minutes. Ponce presents the highest delays within the periods evaluated: AM, PM, and MD. In relation to the roads affected by the highest delays we can see how PR-1, PR-2, and PR-14 are the road showing the major number of segments with maximum delays.

Throughout the study period, the top ten (10) segments of the South TPR with worst delays were identified within the municipalities of Ponce and Juana Díaz along PR-2, PR-1, PR-14, PR-10, and PR-52. For the different periods evaluated:

- For the AM period, the average daily for worst segments was between 1.5-3.9 minutes, within the municipalities of Ponce and Juana Díaz at segments along PR-2 (Eastbound/Westbound), PR-1 (Eastbound/Westbound), PR-14 (Eastbound/Westbound), and PR-52 (Northbound/Southbound).

- For the PM period, the average daily for worst segments was between 1.3-4.1 minutes, within the Municipality of Ponce at segments along PR-2 (Eastbound/Westbound), PR-1 (Eastbound/Westbound), PR-14 (Eastbound/Westbound), and PR-10 (Northbound).

- For the MD period, the average daily for worst segments was between 1.4-4.1 minutes, within Municipality of Ponce at segments along PR-2 (Eastbound/Westbound), PR-1 (Eastbound/Westbound), PR-14 (Eastbound/Westbound), and PR-10 (Northbound).

Southeast TPR

At the top ten (10) segments with highest delays within the Southeast TPR are the municipalities of Arroyo, Patillas, and Guayama reporting delays between 1.6-2.4 minutes. Patillas, Arroyo and Guayama presents the highest delays within the periods evaluated: AM, PM, and MD. Some segments of roads at the municipalities of Guayama and Arroyo experiences traffic congestion for all periods, while some other segments of the municipalities of Guayama, Arroyo and Patillas experiences congestion between the different periods evaluated. In relation to the roads affected by the highest delays we can see how PR-3 and PR-54 are the roads showing the major number of segments with maximum delays.

Throughout the study period, the top ten (10) segments of the Southeast TPR with worst delays were identified within the municipalities of Arroyo, Patillas, Guayama and Salinas along PR-3 and PR-54. For the different periods evaluated:

- For the AM period, the average daily for worst segments was between 0.8-1.9 minutes, within the municipalities of Arroyo, Patillas, Guayama and Salinas along PR-3 (Westbound), PR-52 (Northbound/Southbound) and PR-54 (Eastbound/Westbound).

- For the PM period, the average daily for worst segments was between 1.2-2.4 minutes, within the municipalities of Arroyo, Patillas, and Guayama along PR-3 (Eastbound/Westbound) and PR-54 (Eastbound/Westbound).

- For the MD period, the average daily for worst segments was between 1.4-2.1 minutes, within the municipalities of Arroyo, Patillas, and Guayama along PR-3 (Eastbound/Westbound) and PR-54 (Eastbound/Westbound).

Southwest TPR

At the top ten (10) segments with highest delays within the Southwest TPR are the municipalities of Mayagüez and San Germán reporting delays between 3.8-7.6 minutes. Mayagüez and San Germán presents the highest delays within the periods evaluated: AM, PM, and MD. In relation to the roads affected by the highest delays we can see how PR-2 is the only the road showing the major number of segments with maximum delays.

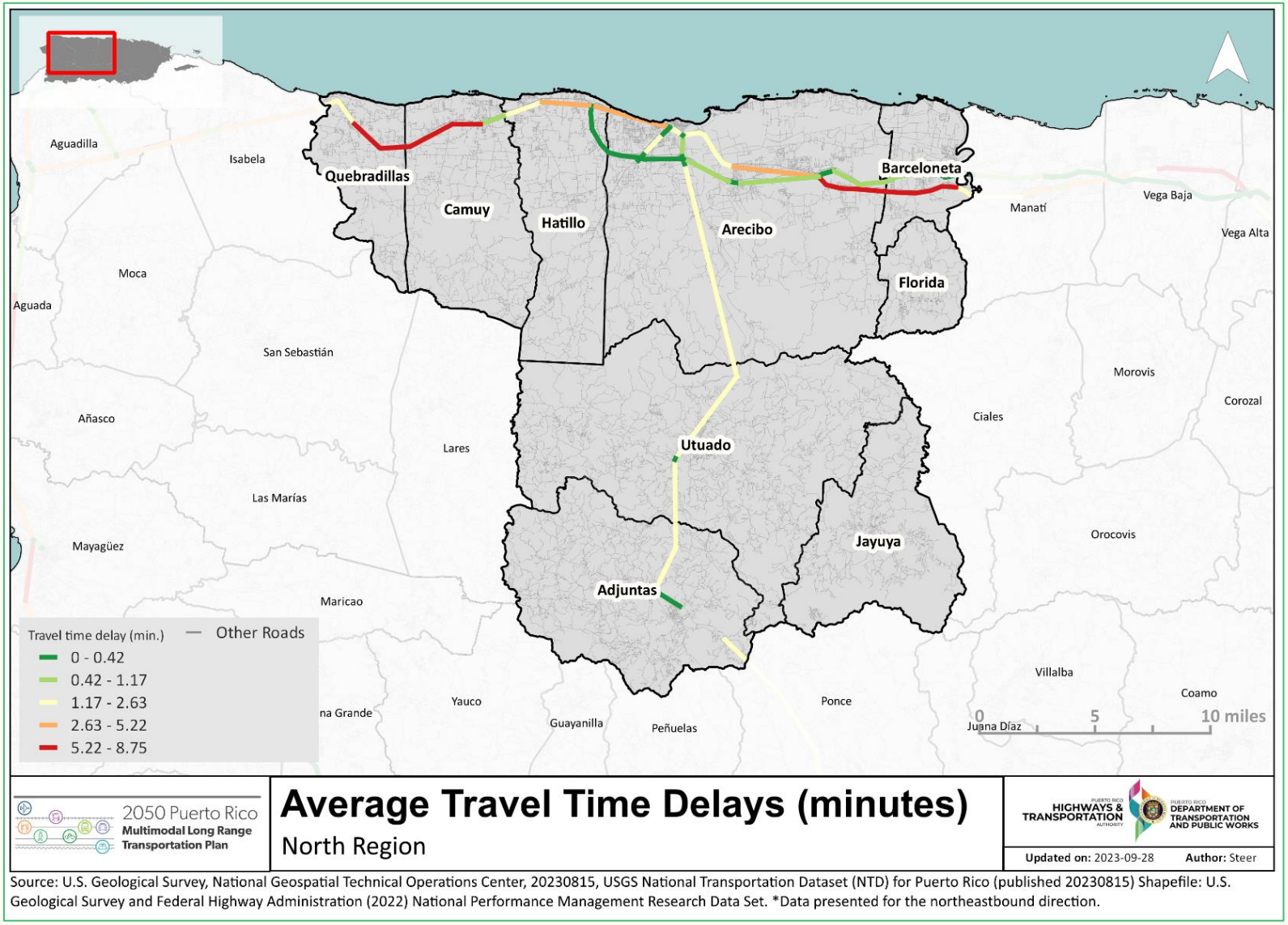
Throughout the study period, the top ten (10) segments of the Southwest TPR with worst delays were identified within the municipalities of Mayagüez and San Germán along PR-2. For the different periods evaluated:

- For the AM period, the average daily for worst segments was between 3.8-6.7 minutes, within the municipalities of Mayagüez and San Germán along PR-2 (Northbound/Southbound).

- For the PM period, the average daily for worst segments was between 1.3-7.6 minutes, within the municipalities of Mayagüez and San Germán along PR-2 (Northbound/Southbound).

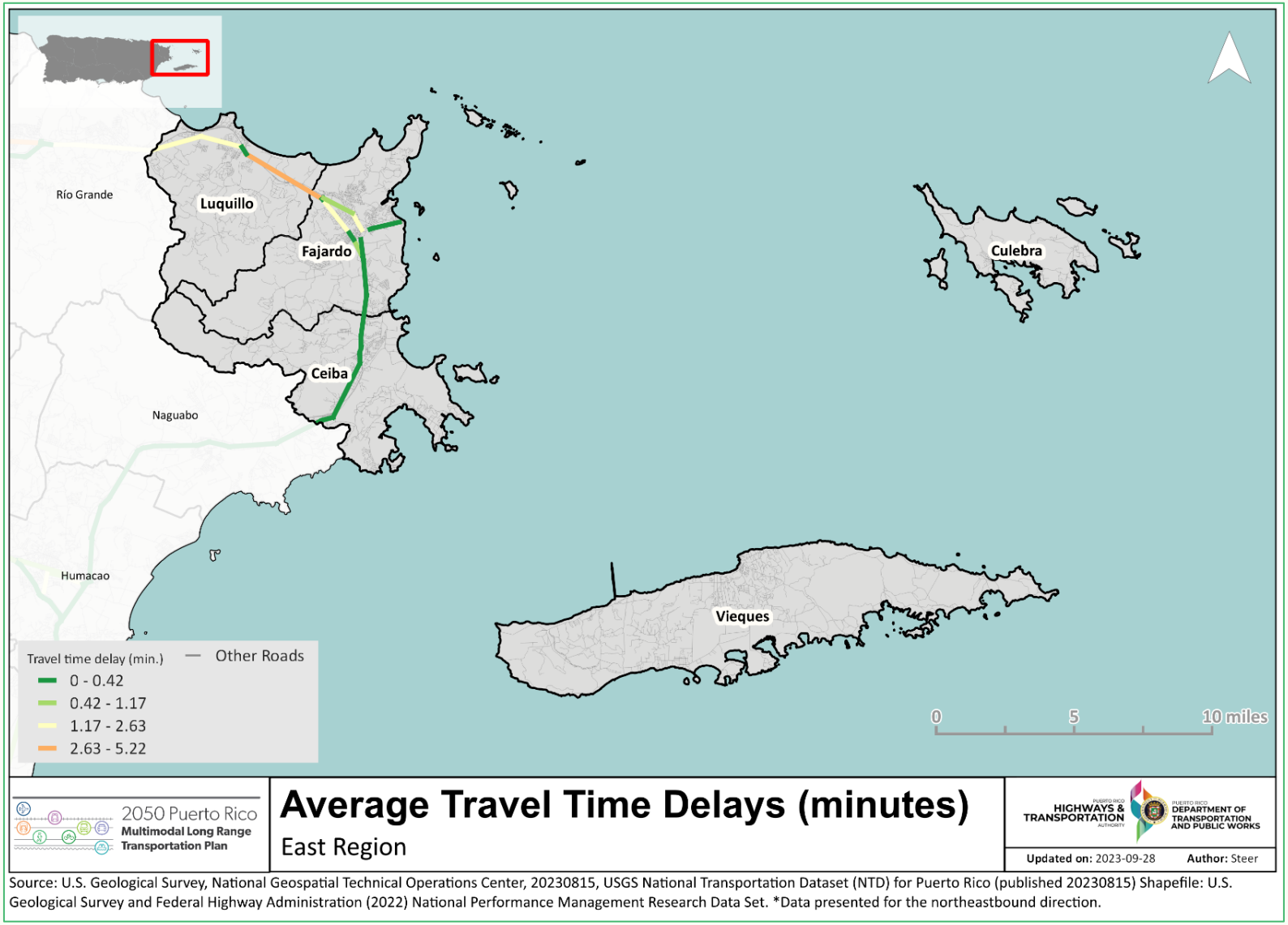
- For the MD period, the average daily for worst segments was between 1.3-5.4 minutes, within the municipalities of Mayagüez and San Germán along PR-2 (Northbound/Southbound).

Figure 6.21: Average Travel Time Delays in Minutes for the North TPR



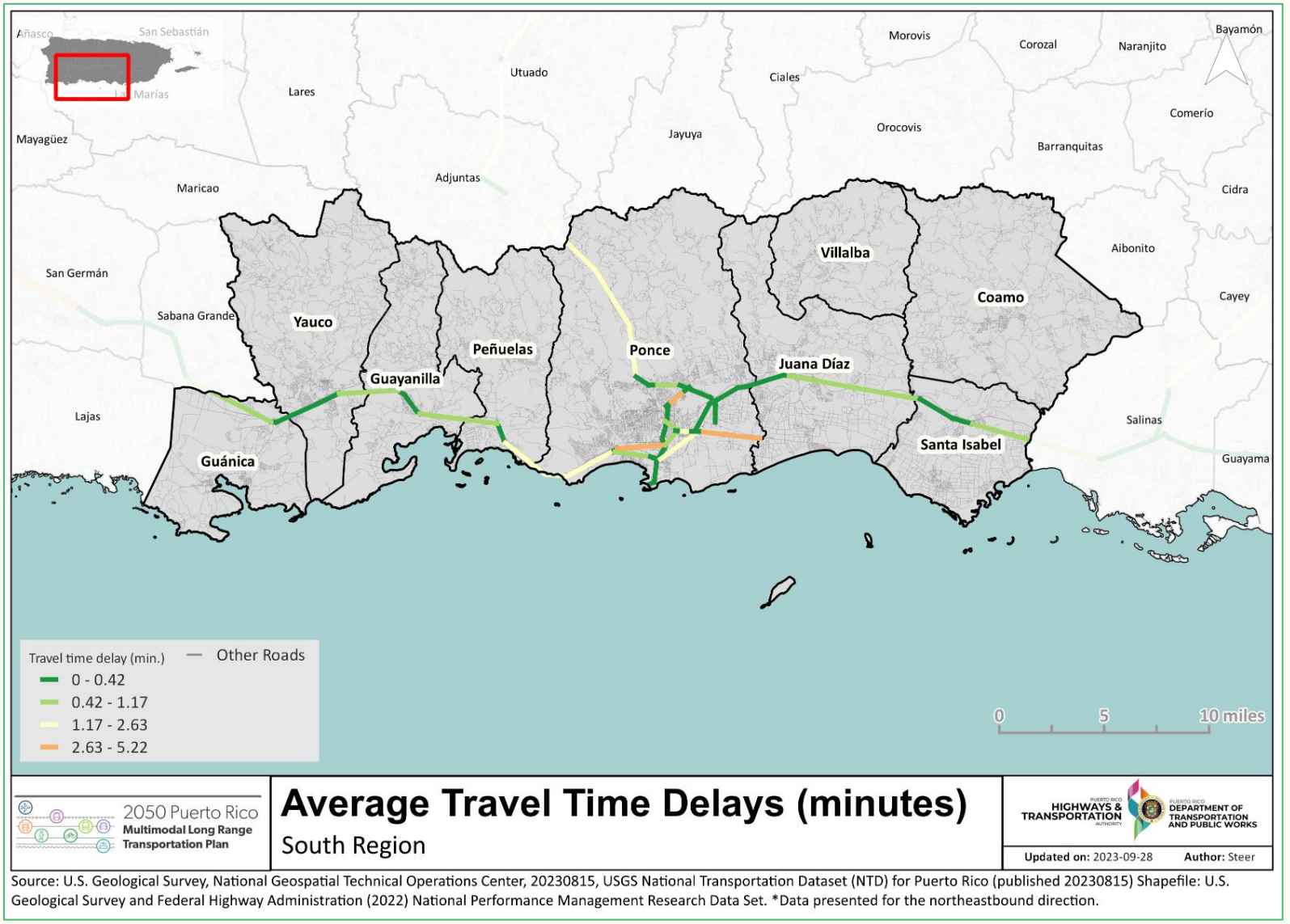
Source: U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey and Federal Highway Administration (2022) National Performance Management Research Data Set. *Data presented for the northeastbound direction.

Figure 6.22: Average Travel Time Delays in Minutes for the East TPR



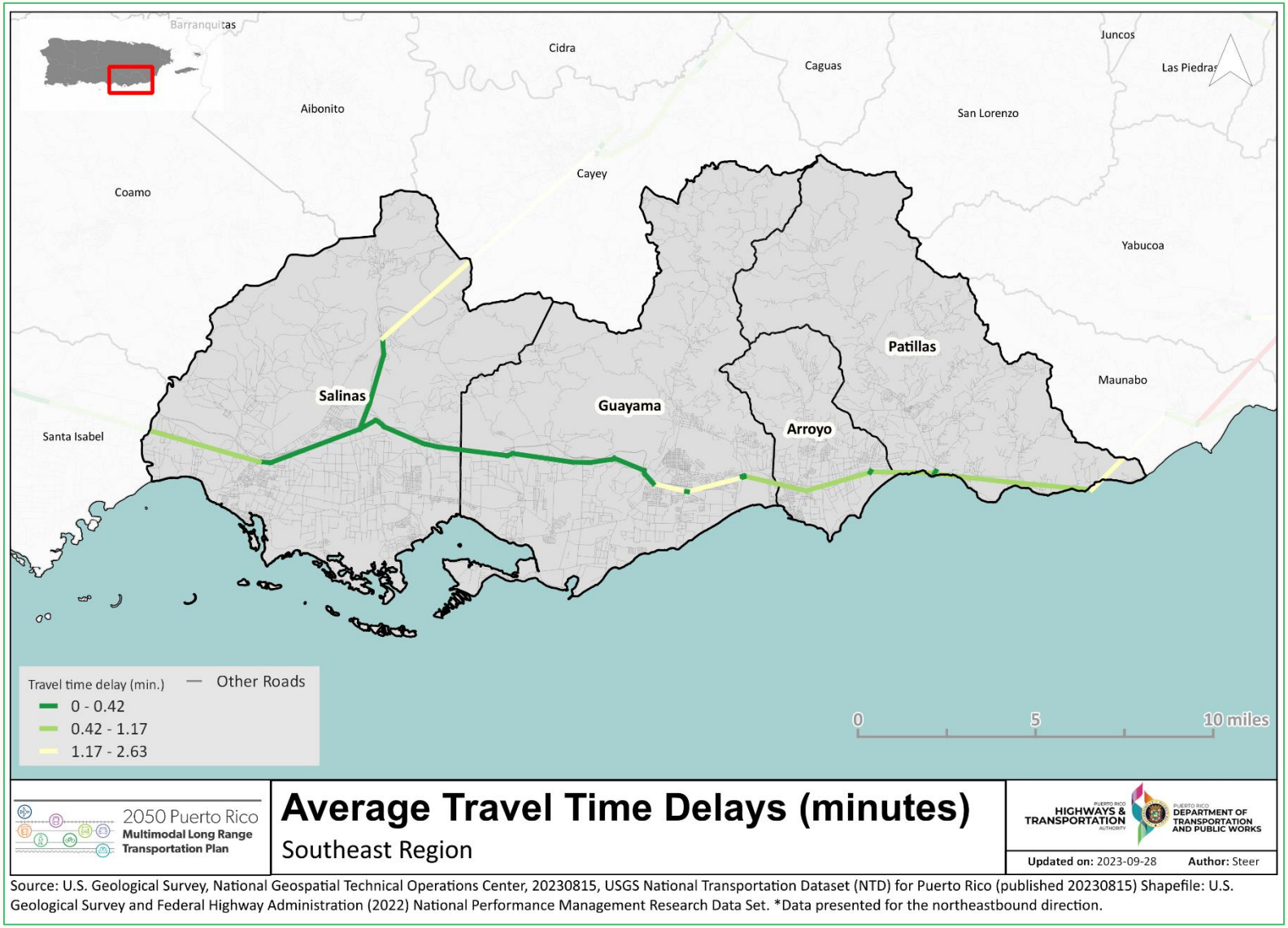
Source: U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey and Federal Highway Administration (2022) National Performance Management Research Data Set. *Data presented for the northeastbound direction.

Figure 6.23: Average Travel Time Delays in Minutes for the South TPR



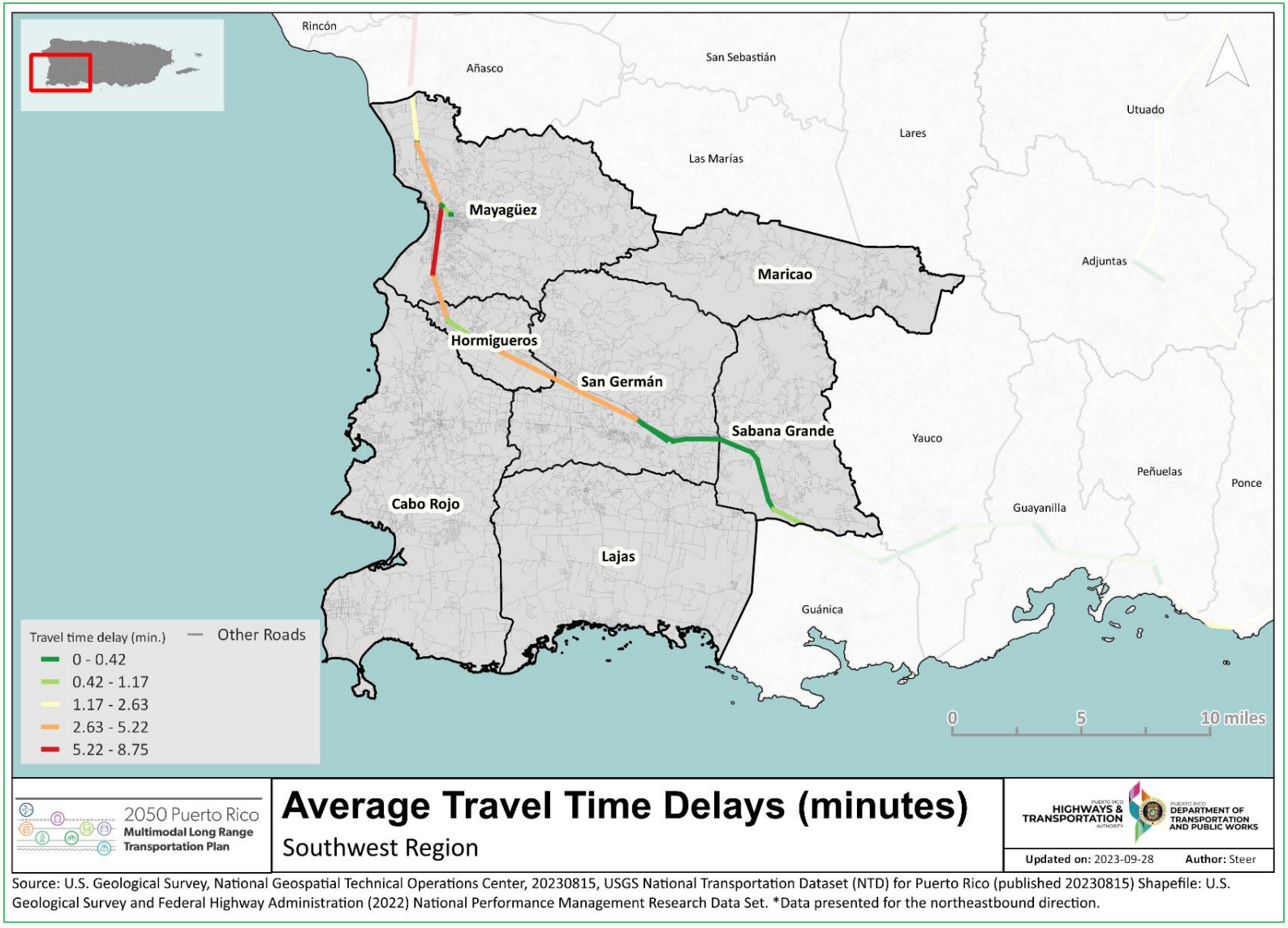
Source: U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey and Federal Highway Administration (2022) National Performance Management Research Data Set. *Data presented for the northeastbound direction.

Figure 6.24: Average Travel Time Delays in Minutes for the Southeast TPR



Source: U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey and Federal Highway Administration (2022) National Performance Management Research Data Set. *Data presented for the northeastbound direction.

Figure 6.25: Average Travel Time Delays in minutes for the Southwest TPR



Source: U.S. Geological Survey, National Geospatial Technical Operations Center, 20230815, USGS National Transportation Dataset (NTD) for Puerto Rico (published 20230815) Shapefile: U.S. Geological Survey and Federal Highway Administration (2022) National Performance Management Research Data Set. *Data presented for the northeastbound direction.

7

Other Urbanized Areas Under 200,000 Population (UZA)

Cost Feasibility Plan Scenarios

Transportation Funding Summary

This section describes the cost-feasibility plan recommendations based on the projects prioritized and analyzed through the development of the demand model.

As outlined in a previous chapter, the funding and financing sources are forecasted up until 2050, the horizon year of this plan. The MLRTP should be developed fiscally constrained and only recommend the investment of funds in the projects that generate the most cost-effective outcomes for the Island. Also, the plan only recommends projects and improvements where there is an identified funding or financing source to provide useful guidance on the implementation of the plan.

As it was described before, a big part of the funding available for transportation infrastructure comes from disaster- or reconstruction-focused funding from the federal government. This is due to the large number of disasters that have happened in the Island. For this purpose, the ER funds from the FHWA and the ER funds from FTA are focused on this purpose.

Particularly for this MLRTP, there are new funding sources coming from the federal government given the Coronavirus Public Health Emergency and the economic impacts of this event. First, the CARES Act and the CRRSAA Act provide economic assistance to American workers and families. Specifically the FTA allocated resources to the transit industry, to all three (3) regions (San Juan, Aguadilla, and UZA).

Second, the Bipartisan Infrastructure Law is the largest long-term investment in infrastructure in the country's history and will provide funding for projects in Puerto Rico. These two, are very specific and will provide additional funds that were not available before. These new funding sources will be relevant when matched with existing funding sources such as toll credits, U.S. DOT grants, and state funds earmarked for Capital Expenditure (CAPEX).

Finally, the Capital Improvement Program (CIP) will cover anticipated revenues and capital and operating spending from FY2023 to FY2027. This program was produced by the PRHTA following the FHWA regulations and the strategies in the current TAMP.

The projects' programming addresses the various situations that PR has faced, such as hurricanes, earthquakes, pandemics, and severe rainfall events. As a result of these events, the agency is in a reactive mode, rebuilding the existing infrastructure.

Furthermore, the list of projects identifies those that seek to keep infrastructure in good repair in order to meet the targets of various federal requirements and align with the agency's fiscal adjustment. The projects are planned in three stages: short, medium, and long term. They are also organized by project category:

- Safety Improvements;
- Bridges;
- Transit; and
- ITS.

Short-term projects are consistent with the projects in the current STIP. The medium-term projects are linked to the projects needed to bring the infrastructure to SOGR. Furthermore, there is an item that, while it is programmed in the various temporary cuts as projects that contemplate financing with discretionary funds, is subject to the specific requirements of each available fund.

The projected funding streams are presented in Table 7.1 below.

Table 7.1: Funding Streams 2017- 2050

Agency	Fund Stream	Total (2017-2050)
FHWA	ER Funds	$ 42,759,113
	BIL	
	Bridges	$ 225,000,000
	Puerto Rico Highway Program	$ 180,000,000
	NEVI	$ 2,020,490
	Toll Transportation Development Credits	$ 30,000,000
	State funds earmarked for Capex	$ 334,000,000
US DOT	MEGA projects	$ 5,000,000,000
	Nationally Significant Multimodal Freight and Highways Projects	$ 8,000,000,000
	Rural Surface Transportation	$ 2,000,000,000
FTA	ER funds	$ 802,293,719
	CARES	$ 206,829,249
	American Rescue Plan	$ 120,385,293
PRHTA	Local taxes dedicated	$ 5,291,000,000
		$ 2,007,000,000
	Toll revenues (for roads managed by the Authority)	$ 1,193,000,000
	Toll Highway Administration and Maintenance	$ 232,000,000
PRHTA	CIP	
	FHWA Funds	$ 7,563,691
	Commonwealth appropriations	$ 2,500,124
	Other Commonwealth State Funds	$ 173,139
	FTA funds	$ 940,047
	Emergency funds	$ 446,100
	Transit funds and Capex	$ 93,325,428
Total		$25,771,236,393

Source: Steer, 2023 based on fiscal information from National and State agencies.
Note: Information from 2017 until 2022 is presented to avoid mistakes in the calculation of annual funds

Projects Considered

The projects considered for the 2050 MLRTP are detailed in the Appendix section. This list of projects was decided on different committees and discussions with the relevant agencies and authorities. There are projects that, even though they are very relevant for the transportation sector in Puerto Rico, already have other funding streams.

There is a series of projects to be considere for CDBG'DR funding that will potentially have access to additional funds in the short- to mid-term, there are:

1. PR-10 (AC-100069, AC-100071, AC-100055, AC-100076) Adjuntas-Utuado;
2. San Lorenzo South Bypass, from PR-183/ PR-181 to PR-745 (AC-918101) San Lorenzo;
3. Aguas Buenas North Bypass, from PR-156 East to PR-156 West (AC-020802, AC-020803) Aguas Buenas;
4. PR-158 Connector, Phase I and Phase II from PR-52 to PR-1, (AC-015802) Cayey;
5. PR-122, Lajas-San German Connector from PR-321 to PR-166, (AC-012201) Lajas-San German;
6. PR-18N to PR-21E ramp and Medical Center Connector San Juan;
7. Extension PR-5, from PR-199 to PR-167, Bayamón-Toa Alta;
8. Isabela Connector, from PR-472 to PR-112 (AC-047205) Isabela;
9. Expressway Conversion of PR-2 Ponce-Mayagüez;
10. Higuilar Avenue from PR-696 to PR-22/PR-694 Dorado;
11. PR-22 extension, Hatillo- Aguadilla from PR-22/PR-2 to PR-2/PR-111Hatillo-Aguadilla;
12. Cidra Connector, from Avenida Industrial to PR-184 (AC-017242, AC-017246, AC-017247) Cidra;
13. Relocation of PR-111 from PR-111/PR-448 to PR-111/PR-111R San Sebastián-Lares;
14. Barranquitas Bypass from PR-156 to PR-759 (AC-010194) Barranquitas;
15. Villalba Bypass, from PR-151 to PR-150, (AC-556103) Villalba;
16. Improvements to Aguadilla's Airport Access, from PR-110 to PR-107, includes Burns Street Connector (AC-000218) Aguadilla;
17. Loíza Bypass, from PR-188 to PR-187, (AC-018760) Loíza;
18. Widening PR-845, from PR-844 to PR-199, (AC-084511) San Juan-Trujillo Alto;
19. Widening PR-545, from PR-52 to PR-14, Coamo; and
20. Peñuelas South Bypass (PR-3132) from its intersection with PR-3132 (Northwest limit) to existing PR-3121 (Northeast Limit) Peñuelas.

The demand model serves as a tool for decision-making. In the case of Puerto Rico, it helps public authorities see how different projects add or offer better transportation services to citizens. The model allows the quantification of benefits and impacts that each project will have on the Island. Currently, in Puerto Rico, the committed projects are the same as in previous iterations and those were the ones included in the demand modeling for this iteration.
Based on a meeting with the Authority on October 5, 2023, it was agreed that some projects will require an increased capacity. For this purpose, additional analysis will be required. For this purpose, these projects will be analyzed and included in the Appendix section. This will allow constant review and further modification when the context requires changes.

Table 7.2: UZA's: Safety – List of Projects in STIP Short Term (2023-2026)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
TBD	Safety Improvements PR-2 From Km. 214.5 To Km. 216.5	FHWA	Peñuelas	$ 5,566,161.00
	Safety Improvements PR-385 From Km. 0.0 To Km. 5.6	FHWA	Peñuelas	$ 6,000,000.00
AC-230023	Safety Improvements PR-2 From Km. 67.0 To Km. 76.30	FHWA	Arecibo-Hatillo	$ 8,175,328.00
	Traffic Lights System PR-640 Ave. Domingo Ruiz	FHWA	Arecibo	$ 1,275,000.00
	Safety Improvements PR-2 From Km. 204.0 To Km. 208.0	FHWA	Guayanilla	$ 5,000,000.00
	Safety Improvements PR-2 From Km. 82.40 To Km. 90.0	FHWA	Hatillo-Camuy	$ 10,000,000.00
	Safety Improvements PR-54 From Km. 0.0 To Km. 6.0	FHWA	Guayama	$ 8,116,085.00

Source: Collaboration PRHTA technical team and Steer, 2023

Safety improvement projects should be evaluated and considered in the decision-making process according to the Comprehensive Bicycle and Pedestrian Plan recommendations, if applicable.

Table 7.3: UZA's: Bridges – List of Projects in STIP Short Term (2023-2026)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
	Bridge #158, PR-123, Km. 59.30, Depression		Utuado	$ 1,742,000.00
AC-800473	Bridge #1133, Off PR-200, Km. 0.01, Creek		Vieques	$ 3,800,000.00
AC-010612	Bridge #217, PR-106, Km. Km. 2.50, Gandel Creek		Mayaguez	$ 3,550,000.00
AC-010313	Bridge #1381, PR-103, Km. 3.60, Channel		Cabo Rojo	$ 1,550,000.00
AC-230014	Bridge #162, PR-123, Km. 66.70, El Jobo Creek		Arecibo	$ 970,000.00
AC-068112	Bridge #702, PR-681, Km. 0.10, Caño Tiburones		Arecibo	$ 8,000,000.00
AC-230015	Bridge #809, PR-348, Km. 17.20, Nueve Pasos River		San German	$ 2,000,000.00
AC-230011	Bridge #1086, PR-163 Eastbound, Km. 1.30, Portugues River		Ponce	$ 4,000,000.00
AC-230014	Bridge #1465, PR-150, Km. 0.20, Jacaguas River		Villalba	$ 2,180,737.00
AC-210004	Bridge #1695, PR-123, Km. 55.10, Grande De Arecibo River		Utuado	$ 1,642,000.00
AC-220060	Bridge #1326, Local Road, Km. 0.10, Majagual Creek		Arroyo	$ 1,000,000.00
AC-220056	Bridge #1976, Off PR-377, Km. 0.10, Consejo Creek		Guayanilla	$ 964,364.00
AC-800595	Bridge #2472, PR-2, Km. 197.30, Berenchin Creek		Yauco	$ 2,000,000.00
AC-220043	Bridge #2899, PR-2, Km. 173.65, Hospital Concepcion Access		San German	$ 2,172,000.00
AC-230014	Bridge #2944, Off PR-511, Km. 12.70, Inabon River		Ponce	$ 2,100,000.00
AC-800595	Bridge #2962, PR-372, Km. 16.50, Duey River		Yauco	$ 1,000,000.00
TBD	Bridge #1325, PR-757, Km. 4.00, Del Apeadero River		Patillas	$ 2,050,000.00
AC-230015	Bridge #790, PR-2, Km. 166.80, Rosario River		Hormigueros	$ 2,000,000.00
AC-800586	Bridge #1114, PR-2 Eastbound, Km. 204.00, Guayanilla River, Local Road		Guayanilla	$ 2,000,000.00
AC-800586	Bridge #1115, PR-2 Westboundkm. 204.00, Guayanilla River, Local Road		Guayanilla	$ 2,000,000.00
AC-800589	Bridge #1192, PR-2 Northbound, Km. 71.40, PR-543 And Jueyes River		Santa Isabel	$ 6,000,000.00
AC-800589	Bridge #1193, PR-2 Southbound, Km. 71.40, PR-543 And Jueyes River		Santa Isabel	$ 6,000,000.00

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
AC-230015	Bridge #1390, PR-303, Km 0.10, Platina Creek		Lajas	$ 2,000,000.00
TBD	Bridge #2482, Off PR-355, Km. 0.90, Yauco River		Yauco	$ 2,956,802.00
AC-065404	Bridge #670, PR-654, Km. 0.20, Grande De Arecibo River		Arecibo	$ 1,994,794.00
AC-220061	Bridge #1597, Local Road, Km. 0.10, Jobitos Creek		Villalba	$ 1,750,000.00
AC-220061	Bridge #1598, Local Road, Km. 0.05, Caricaboa River		Jayuya	$ 1,750,000.00
AC-333601	Bridge #734, PR-336, Km. 0.68, La Manuela Creek		Guayanilla	$ 1,577,189.00
AC-220039	Bridge #1883, PR-114, Km. 4.00, Guanajibo River		Hormigueros	$ 1,161,940.00
AC-220036	Bridge #1941, PR-52 Southbound, Km. 100.80, PR-1		Ponce	$ 3,450,000.00
AC-220036	Bridge #1942, PR-52 Northbound, Km. 100.80, PR-1		Ponce	$ 3,400,000.00
AC-800585	Bridge #1956, PR-52 Eastbound, Km. 90.80, PR-706		Salinas	$ 1,960,000.00
AC-800585	Bridge #1957, PR-52 Westbound, Km. 90.80, PR-706		Salinas	$ 1,920,000.00
AC-012333	Bridge #156, PR-123, Km. 56.20, Salto Abajo Creek		Utuado	$ 2,000,000.00
AC-065403	Bridge #1638, Victor Rojas Ave, Km. 0.10, Grande De Arecibo River		Arecibo	$ 9,055,535.00
AC-230031	Bridge #2464, Off PR-747, Km. 0.10, Trinidad Creek		Guayama	$ 1,500,000.00
AC-230013	Bridge #2588, Off PR-184, Km. 0.10, Grande De Patillas River		Patillas	$ 3,500,000.00
AC-220056	Bridge #2763, Off PR-332, Km. 0.60, Loco River		Guanica	$ 450,000.00
	Bridge #2877, PR-2, Km. 162.85, PR-319		Hormigueros	$ 5,564,413.00
AC-230011	Bridge #1085, PR-163 Westbound, Km. 1.30, Portugues River		Ponce	$ 4,000,000.00
AC-230012	Bridge #1730, Local Road, Km. 0.30, Descalabrado River		Coamo	$ 2,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.4: UZA's: Pavement - List of Projects in STIP Short Term (2023-2026)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
AC-230024	Pavement Reconstruction PR-100 From Km. 0.0 To Km. 9.5	FHWA	Cabo Rojo	$ 1,838,998.72
AC-230027	Pavement Reconstruction PR-53 From Km. 69 To Km. 71	FHWA	Patillas	$ 2,998,591.75
AC-230021	Pavement Reconstruction PR-52 From Km. 106 To Km. 108.79	FHWA	Ponce	$ 2,430,943.90
AC-240017	Pavement Reconstruction PR-3 From Km. 37.37 To Km. 42.49	FHWA	Luquillo-Fajardo	$ 19,180,000.00
TBD	Pavement Reconstruction PR-129 From Km. 0.10 To Km. 3.10	FHWA	Arecibo	$ 4,000,000.00
TBD	Pavement Reconstruction PR-2 From Km. 158 To Km. 171	FHWA	Mayaguez-Hormigueros-San German	$ 14,733,008.00
TBD	Pavement Reconstruction PR-111 From Km. 23.38 To Km. 31.85	FHWA	San Sebastian-Lares	$ 11,800,000.00
TBD	Pavement Reconstruction PR-2 From Km. 156 To Km. 158	FHWA	Mayaguez	$ 10,108,000.00
TBD	Pavement Reconstruction PR-2 From Km. 173 To Km. 180	FHWA	San German	$ 9,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.5: UZA's: Non-SOGR - List of Projects in STIP Short Term (2023-2026)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
AC-010029	Widenning PR-100 From PR-308 To PR-101	FHWA	Cabo Rojo	$ 100,000.00
AC-010029	Widenning PR-100 From PR-308 To PR-101	FHWA	Cabo Rojo	$ 35,000,000.00
AC-230036	Extension PR-22 From PR-22/PR-2 To PR-2/PR-111-Financial Plan	FHWA	Hatillo-Aguadilla	$ 1,000,000.00
TBD	PR-2 La Vita	FHWA	Mayaguez	$ 1,000,000.00
TBD	Urban Interchange At PR-2 & PR-114	FHWA	Mayaguez	$ 1,000,000.00
TBD	Connector Phase 2 PR-122 From PR-321 To PR-166	FHWA - EARMARK	Lajas-San German	$ 3,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.6: UZA's: Transit - List of Projects (2024-2029)

Projects	Description	Priority	Length (months)	Cost Estimate ($)	Funding source	Fiscal Year
ENHANCE THE TRANSIT NETWORK AT THE METROPOLITAN, REGIONAL, AND MUNICIPAL LEVEL: RELIABILITY AND INTEGRATION						
Ceiba San Juan Intercity Bus	Viability, planning and design of new Intercity route between Ceiba Ferry Terminal to Tren Urbano Station in San Juan (YEARLY)	High	12	$1,000,000	Rural 5311	2024
Study for the new transit routes for the users of the maritime system - island service	Study to develop new transit routes for the users of Ceiba Ferry system in the region	Medium	12	$300,000	UPWP 5303/5304	2024
Bus Network Redesign Plan	Plan for the transit network design in the San Juan Metropolitan Zone	Medium	12	$475,000	UPWP 5303/5304	2025
On Demand service study for the Metropolitan Area of San Juan	Assessment for the development opportunities of the On Demand Service in the Metropolitan Area of San Juan	High	6	$125,000	UPWP 5303/5304	2024
Study for the development of "On Demand" service at the Municipal level	Study to identify the opportunities and scheme requiered for the development of "On Demand" service at the Municipal level	Low	6	$125,000	UPWP 5303/5304	2025
On Demand Pilot Project linked to Train Station Area	On Demand Pilot project Linked to Train Stations	High	12	$1,300,000	SJ 5307	2024
Rehabilitation of the Mosquito Terminal and Ticketing Area.	New Route for Vieques - "Short Route" from Ceiba to Mosquito. Rehabilitation of the Mosquito Terminal and Ticketing Area.	High	30	$16,000,000	Rural 5311	2024
Puerto Rico Regional Transit Plan	A comprehensive analysis of key regional corridors and/or areas that could be transit ready in the next ten years.	Medium	12	$625,000	UPWP 5303/5304	2026
New Regional North-Central Route	Plan & Design of New Regional North-Central Route	Medium	12	$300,000	UPWP 5303/5304	2027
New Regional East Route	Plan & Design of New Regional East Route	Low	12	$300,000	UPWP 5303/5304	2028
New Regional South Route	Plan & Design of New Regional South Route	Low	12	$300,000	UPWP 5303/5304	2029

Projects	Description	Priority	Length (months)	Cost Estimate ($)	Funding source	Fiscal Year
IMPROVE TRANSIT ACCESSIBILITY AND EQUITY: MOBILITY FOR ALL						
Analysis for the extension of exclusive bus lanes in the San Juan Metro Zone	New dedicated bus lane to reduce congestion impacts, improve on-time performance, and expand transit ridership in the main corridors of the San Juan Metro Zone	Medium	6	$175,000	UPWP 5303/5304	2025
Purchase and instalation of bus shelters. Phase 1	Shelter instalation for "Troncal" Routes	Medium	9	$2,500,000	SJ 5307	2025
Purchase and instalation of bus shelters. Phase 2	Shelter instalation for "Troncal" Routes	Medium	10	$2,500,000	SJ 5307	2026
Purchase and instalation of bus shelters. Phase 3	Shelter instalation for "Troncal" Routes	Medium	11	$2,500,000	SJ 5307	2027
Purchase and instalation of bus shelters. Phase 4	Shelter instalation for "Troncal" Routes	Medium	12	$2,500,000	SJ 5307	2028
Rehabilitation of Convadonga Terminal	Design, permits and construction of the Covadonga Terminal Remodelation	High	24	$10,000,000	SJ 5307	2025
Rehabilitation of Iturregui Terminal	Design, permits and construction of the Iturregui Terminal Remodelation	Medium	24	$10,000,000	SJ 5307	2027
Acquisition of four New Cargo/Passenger Vessels	Acquisition of four New Cargo/passenger Vessels for the Island Service. 300 + passenger capacity. Replacement of vessels in process of disposition.	High	36	$79,889,000	Rural 5311	2024
Acquisition of one New Passenger Vessel	Acquisition of New Passenger Vessel. 300 + passenger capacity. Scheduled for FY24	Medium	18	$15,841,000	Rural 5311	2024
Acquisition of one New Electric Vessel (Passengers only)	Acquisition of one New Electric Vessel (Passengers only). Scheduled for FY26	Medium	18	$5,000,000	SJ 5307	2026
New Ceiba Terminal for the Island Service	New Ceiba Terminal for the Island Service	High	30	$30,000,000	Rural 5311	2024
Rehabilitation and Maintenance of the Island Service Terminals (Ceiba, Vieques and Culebra)	Rehabilitation and Maintenance of the Island Service Terminals (Ceiba, Vieques and Culebra)	Medium	12	$2,000,000	Rural 5311	2026
Rehabilitation of the Metro Service Terminals (Cataño and San Juan)	Rehabilitation of the Metro Service Terminals (Cataño and San Juan)	Medium	12	$960,000	SJ 5307	2026
Rehabilitation of the Maintenance Base and pier for Marine Hoist	Rehabilitation of the Maintenance Base and pier for Marine Hoist	High	34	$8,976,000	SJ 5307	2024
Acquisition of a Marine Hoist	Acquisition of a Marine Hoist	High	15	$5,200,000	SJ 5307	2024
Acquisition of New Barge for the Island Service	Acquisition of New Barge for Vieques and Culebra	High	14	$4,000,000	Rural 5311	2024
Preventive Maintenance and drydock activities for the Island Service	Preventive Maintenance and drydock activities for Authority owned vessels	High	-	$33,603,619	Rural 5311	2025
Preventive Maintenance and drydock activities for the Metro Service	Preventive Maintenance and drydock activities for Authority owned vessels	High	-	$2,548,010	SJ 5307	2025
New integrated transit fare collection system	New fare collection for the train and buses.	High	24		SJ 5307	2024
Functional Land Scaping Project	Bioswale, flood control	Low	36	$3,000,000	SJ 5307	2027
Automatic bus location announcement systems			12	$1,000,000		2026
New PRITA Office Building	Design and construction of new administration building	High	36	$15,000,000	ER 5324	2024

Projects	Description	Priority	Length (months)	Cost Estimate ($)	Funding Source	Fiscal Year
INCREASE THE EFFICIENCY, EFFECTIVENESS, AND RELIABILITY OF THE TRANSIT SYSTEM: CULTURE OF EXCELLENCE						
Operation & Maintenance contract for 8 routes	New O&M contract for the 8 intermodal routes	High	12	$12,000,000	SJ 5307	2024
Bus service and users profile study (Data Collection and analisis activities) yearly	Field study to identify the actual bus user profile	High	3	$150,000	UPWP 5303/5304	2024
Train service and users profile study (Data Collection and analisis activities) yearly	Field study to identify the actual bus user profile	High	3	$150,000	UPWP 5303/5304	2024
Ferry service and users profile study (Data Collection and analisis activities) yearly	Field study to identify the actual bus user profile	High	3	$150,000	UPWP 5303/5304	2024
Transit Marketing Campaing yearly	Educational and marketing campaing of the transit system	High	12	$150,000	SJ 5307	2024
Website	Creation and Maitenance of Website to provide information, service and support of all transit related activity in Puerto Rico.	High	6	$100,000	SJ 5307	2024
Trip Planner	Create and Maitenance of a web tool to help clients make transit travel arrangements of existing operation	High	6	$100,000	SJ 5307	2024
New transit system maps	Map update for the transit sistem including train, bus and ferry.	High	6	$90,000	SJ 5307	2024
Online engagement surveys (Data collection and analisis activities) yearly	Online engagement surveys for public participation in transit planning	High	12	$150,000	UPWP 5303/5304	2024
Transit Terminal Way Finding Design	Design and instalation of new information and location signs on transit stations or facilities.	Medium	6	$400,000	SJ 5307	2025
Transit Terminal Way Finding Implementation	Design and instalation of new information and location signs on transit stations or facilities.	Medium	6	$4,600,000	SJ 5307	2026
Real-Time Transit Data	Provide users with transit data updates in real time to enhances their experience of the transit services. Providing up-to-date information about current arrival and departure times allows users to smoothly plan their trips.	High	6	$125,000	SJ 5307	2024
Study of new technologies and new mobilities for the Metropolitan Area of San Juan	Identify new tecnology and mobility patterns in the San Jua Metropolitan area	Low	3	$300,000	UPWP 5303/5304	2026
Transit Vehicle Signal Priority & Preemption system. Phase 1	Traffic signals equipped with technology to prioritize transit vehicles and allow emergency vehicles to request preemption at intersections and bypass stopped vehicles or congestion.	Medium	24	$500,000	SJ 5307	2025
Transit Vehicle Signal Priority & Preemption system. Phase 2	Traffic signals equipped with technology to prioritize transit vehicles and allow emergency vehicles to request preemption at intersections and bypass stopped vehicles or congestion.	Medium	24	$500,000	SJ 5307	2025
Transit Vehicle Signal Priority & Preemption system. Phase 3	Traffic signals equipped with technology to prioritize transit vehicles and allow emergency vehicles to request preemption at intersections and bypass stopped vehicles or congestion.	Medium	24	$500,000	SJ 5307	2025
Transit Vehicle Signal Priority & Preemption system. Phase 4	Traffic signals equipped with technology to prioritize transit vehicles and allow emergency vehicles to request preemption at intersections and bypass stopped vehicles or congestion.	Medium	24	$500,000	SJ 5307	2025
Transit Economic Sustainability Plan	Economic sustainability study to identify challenges and oportunities for the financial stability of the transit system.	High	6	$300,000	UPWP 5303/5304	2026
Employee Technical Training	Technical Capacity Tranning for PRITA Employees	Medium	36	$250,000	SJ 5307	2024

Projects	Description	Priority	Length (months)	Cost Estimate ($)	Funding source	Fiscal Year
STRENGTHEN MOBILITY TO SUPPORT THE THE ENVIRONMENT AND THE ECONOMY: CLIMATE ACCTION						
Zero-emission Transit Plan	Research, development and deployment plan of cleaner, more efficient public transit vehicles to scale up the electrification program to meet its zero-emission targets.	Medium	6	$300,000	UPWP 5303/5304	2026
Study of energy alternatives with solar panels in the facilities of the Train	Assessment of energy alternatives for the Train using existend ROW and Infrastructure	Low	6	$300,000	UPWP 5303/5304	2028

Source: Collaboration PRITA technical team and Steer, 2023

The PRITA team produced and analyzed this list of projects. The criteria for priority were based on the agency's priorities, goals, and 2050 MLRTP goals.

Table 7.7: UZA's: Safety - List of Projects in STIP Mid Term (2027-2036)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
AC-811660	Highway Network Reconstruction - Safety	DISCRETIONARY	Islandwide	$ 50,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Safety improvement projects should be evaluated and considered in the decision-making process according to the Comprehensive Bicycle and Pedestrian Plan recommendations, if applicable.

Table 7.8: UZA's: Bridges - List of Projects in STIP Mid Term (2027-2036)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
AC-230032	Bridge #505, PR-603, Km. 0.07, Grande De Arecibo River	FHWA	Utuado	$ 2,391,000.00
AC-800562	Bridge #1531, PR-141, Km. 10.00, Unnamed Creek	FHWA	Jayuya	$ 50,000.00
	Bridge #631, PR-200 R, Km. 0.10, Cofresi Creek	FHWA	Vieques	$ 5,100,000.00
AC-520125	Bridge #2039, PR-52 Southbound, Km. 49.50, PR-714 And La Palma Creek	FHWA	Salinas	$ 2,529,000.00
AC-055511	Bridge #2681, PR-555, Km. 9.30, Coamo River	FHWA	Coamo	$ 530,000.00
AC-230042	Bridge #548, Rural Local Road, Km. 2.40, Yauco River	FHWA	Guayanilla	$ 1,750,000.00
-	Bridge #1683, Off PR-603, Km. 0.01, Guaonica River	FHWA	Utuado	$ 1,750,000.00
-	Bridge #647, PR-102, Km. 28.20, Mercado Creek	FHWA	San German	$ 1,500,000.00
-	Bridge #781, PR-975, Km. 6.70, Rio Abajo Creek	FHWA	Ceiba	$ 350,000.00
-	Bridge #1379, PR-651, Km. 0.85, Creek	FHWA	Arecibo	$ 420,000.00
-	Bridge #1945, PR-114, Km. 5.60, Guanajibo River	FHWA	Hormigueros	$ 1,000,000.00

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
-	Bridge #2200, PR-250, Km. 0.10, Ensenada Channel	FHWA	Culebra	$ 3,000,000.00
-	Bridge #155, PR-123, Km. 56.00, Cambalache Creek	FHWA	Utuado	$ 2,000,000.00
AC-012333	Bridge #157, PR-123, Km. 59.10, El Muerto Creek	FHWA	Utuado	$ 2,000,000.00
TBD	Bridge #181, PR-15, Km. 1.04, Guamani River	FHWA	Guayama	$ 1,507,275.00
TBD	Bridge #1073, PR-52 Northbound, Km. 95.20, PR-506 Km. 1.5	FHWA	Ponce	$ 1,662,392.22
TBD	Bridge #1074, PR-52 Southbound, Km. 95.20, PR-506 Km. 1.5	FHWA	Ponce	$ 1,662,392.22
TBD	Bridge #1112, Off PR-4484, Km. 0.20, Depression	FHWA	Quebradillas	$ 4,640,000.00

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
TBD	Bridge #1125, Off PR-372, Km. 0.30, Duey River	FHWA	Yauco	$ 3,960,000.00
TBD	Bridge #1140, PR-52 Northbound, Km. 92.50, Jacaguas River	FHWA	Juana Diaz	$ 5,450,457.34
TBD	Bridge #1141, PR-52 Southbound, Km. 92.50, Jacaguas River	FHWA	Juana Diaz	$ 5,450,457.34
-	Bridge #1227, PR-52 Northbound, Km. 66.60, Nigua River	FHWA	Salinas	$ 3,264,000.00
TBD	Bridge #1225, PR-52 Northbound, Km. 67.00, Local Access Road	FHWA	Salinas	$ 425,318.40
-	Bridge #1226, PR-52 Southbound, Km. 67.00, Local Access Road	FHWA	Salinas	$ 425,318.40
TBD	Bridge #1228, PR-52 Southbound, Km. 66.60, Nigua River	FHWA	Salinas	$ 3,264,000.00
TBD	Bridge #1232, PR-52 Northbound, Km. 66.20, PR-1	FHWA	Salinas	$ 1,591,833.60
TBD	Bridge #1233, PR-52 Southbound, Km. 66.20	FHWA	Salinas	$ 1,611,302.40
TBD	Bridge #1951, Off PR-704, Km. 2.00, Obispo Creek	FHWA	Coamo	$ 3,300,000.00

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
TBD	Bridge #2059, PR-52 Northbound, Km. 57.40, Majadas River And PR-712	FHWA	Salinas	$ 5,000,000.00
TBD	Bridge #2249, PR-149, Km. 67.50, La Joya Creek	FHWA	Ponce	$ 2,021,760.00
TBD	Bridge #2269, PR-52, Km. 106.10, Portuguez River	FHWA	Ponce	$ 21,997,440.00
TBD	Bridge #2550, Off PR-535, Km. 0.10	FHWA	Juana Diaz	$ 2,000,000.00
TBD	Bridge #2573, Off PR-372, Km. 0.20, Duey River	FHWA	Yauco	$ 1,650,000.00
TBD	Bridge #2631, Off PR-123, Km. 48.10, Adjuntas River	FHWA	Utuado	$ 2,000,000.00
TBD	Bridge #2709, Off PR-348, Km. 1.20, Brujo River	FHWA	San German	$ 2,000,000.00
TBD	Bridge #2860, Las Lozas Street, Km. 0.20, Camuy River	FHWA	Utuado	$ 3,960,000.00
TBD	Bridge #3015, Off PR-157, Km. 153.20, Unnamed Creek	FHWA	Salinas	$ 1,040,000.00
NEW AC-810660	Highway Network Reconstruction - Bridges	DISCRETIONARY	Islandwide	$ 100,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.9: UZA's: Pavement - List of Projects in STIP Mid Term (2027-2036)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
AC-230028	Pavement Reconstruction PR-333 From Km.0.0 To Km. 10.1	FHWA	Guanica	$ 1,655,004.00
AC-809660	Highway Network Reconstruction - Pavement	DISCRETIONARY	Islandwide	$ 130,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.10: UZA's: Non-SOGR - List of Projects in STIP Mid Term (2027-2036)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
AC-800660	PR-52 Highway Capacity Enhancement / Congestion Reduction Juana Díaz - Ponce	DISCRETIONARY	Ponce / Juana Díaz	$ 176,900,000.00
AC-808660	Tolling System Infrastructure Improvement (Including Partial Toll Canopy Demolition, Optimization)	DISCRETIONARY	Islandwide	$ 15,000,000.00
AC-807660	Roosevelt Road Access Road Widening, Ceiba	DISCRETIONARY	Ceiba	$ 4,300,000.00
AC-200200	PR-2 And Corazones Ave Interchange, Mayaguez	DISCRETIONARY	Mayaguez	$ 42,000,000.00
AC-813660	Highway Network Reconstruction - Roadway Enhancement	DISCRETIONARY	Islandwide	$ 50,000,000.00
	Access Improvements To PR-2, PR-680, PR-681,PR-6681	DISCRETIONARY	Arecibo	$ 62,800,000.00
	Expressway Conversion Of PR-2	DISCRETIONARY	Ponce-Mayaguez	$ 230,000,000.00
	Feasibility And Environmental Study PR-2 Km 145 To Km 152 Road Improvements And Congestion Management	DISCRETIONARY	Mayaguez	$ 60,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.11: UZA's: Non-SOGR (other) - List of Projects in STIP Mid Term (2027-2036)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
	Landslides - Reconstruction PR-111 Kms. 10.8, 5.7, 12.50	FHWA	Utuado	$ 2,600,00.00
AC-812660	Highway Network Reconstruction - Landslides	DISCRETIONARY	Islandwide	$ 50,000,000.00
	Vulnerability Study Islandwide	FHWA	Islandwide	$ 1,000,000.00
	Construction Of An Overpass At The Intersection Of PR-2 With PR-114, Includes The Channelization Of Merle And Pulida Creek And The Construction Of A North - South Frontage Road At PR-114	FHWA	Mayaguez	$ 28,620,000.00
	Feasibility Study PR-140 And PR-681 (Connector From Highway PR-140 To PR-681)	FHWA	Barceloneta	$ 200,000.00
	PR-545 Widening From PR-52 (Km. 1.03) To PR-14 (Km. 6.03)	FHWA	Coamo	$ 6,500,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.12: UZA's: Non-SOGR– List of Projects in STIP Long Term (2037-2050)

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
	Completing PR-10	DISCRETIONARY	Utuados - Adjuntas	$ 600,000,000.00
	PR-3132 South Detour	DISCRETIONARY	Peñuelas	$ 11,500,000.00
	Feasibility Study PR-7751 Connector De Arroyo From PR-753 To PR-3, Km 132.4	DISCRETIONARY	Arroyo	$ 40,000,000.00
	Villalba Bypass - from PR-560 To PR-151 (Sta. 24+82 To Sta. 31+64) Length 0.68	DISCRETIONARY	Villalba	$ 31,000,000.00

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.13: UZA's: Unfunded Projects

Region	Location	Proposed Improvement and Timeframe
East TPR	PR-194 (Fajardo)	**Short-Medium Term:** Signage warning drivers about presence of cyclists. **Medium-Long Term:** Analyze the feasibility and implement where possible a continuous Class II Bicycle Lane or Class IV Bikeway.
North TPR	PR-129 (Hatillo and Arecibo)	**Short Term:** Maintenance to keep the roadway and shoulder clear of debris **Short to Medium Term:** Signage warning drivers about presence of Cyclist **Medium to Long Term**: Analyze the feasibility and implement where possible a continuous Class II Bicycle Lane or Class IV Bikeway or traffic calming interventions to reduce speeds.
South TPR	PR-1 (Santa Isabel to Ponce)	**Short Term**: Maintenance to keep the roadway and shoulder clear of debris. **Short to Medium Term:** Signage warning drivers about presence of cyclists.
Southeast TPR	PR-3 (Patillas, Arroyo, Guayama except along city center and Salinas)	**Short-Medium Term**: Signage warning drivers about presence of cyclists. **Medium-Long Term**: Analyze the feasibility and implement where possible a continuous Class II Bicycle Lane or Class IV Bikeway.
Southwest TPR	PR-324 (Lajas)	**Short- -Medium Term:** Signage warning drivers about presence of cyclists. **Medium-Long Term:** Undertake proposed cycling infrastructure project for share the road.

Source: Collaboration PRHTA technical team and Steer, 2023

Table 7.14: UZA's: ITS Projects

AC-Number	Project Description	Funding Category	Municipality	Cost Estimate
	ITS Implementation PR-52, from Caguas Sur Toll Plaza to Ponce	FHWA	CAGUAS TO PONCE	$ 27,256,980.00
	ITS Implementation on PR-53 (All concesion segments)	FHWA	FAJARDO-CEIBA-NAGUABO-HUMACAO-YABUCOA-MAUNABO-PATILLAS	$ 14,709,248.75

Source: Collaboration PRHTA technical team and Steer, 2023

8

Other Urbanized Areas Under 200,000 Population (UZA)

Finance Chapter

The purpose of this chapter is to provide the cost-effective plan proposals for the 2050 MLRTP. This chapter is divided into two (2) sections: the prioritization strategy, which includes high-level project prioritization that adheres to PRHTA's objectives, and the capital cost estimates, which include the prioritization approach and funding allocation for specific projects.

The Puerto Rico Highways and Transportation Authority (PRHTA) continues the implementation of an aggressive plan to extend the life cycle of their highway assets and to expedite the reconstruction effort associated to multiple disasters. Achieving State of Good Repair (SOGR) after many years of minimum to non-reconstruction work, and considering the very limited resources of the agency, requires detailed planning and conscious prioritization. SOGR projects focus on the preservation and/or rehabilitation of pavements and bridges (including full replacement) and safety improvements. The selection of SOGR projects and prioritization follow the Federal Highway Authority (FHWA) regulations (i.e., SHSP, TAMP, NBIS), based on data-driven decisions that allow for higher benefit/cost ratios and consider net present values of the life cycle costs.

Federal funds are complemented by state funds programmed for capital improvements and included in the PRHTA Fiscal Plan. The PRHTA fiscal plan allows for using state funds primarily for SOGR projects, while other non-SOGR initiatives (i.e., Completing PR Strategic Highway Network, highway network capacity enhancement, bypasses, and interchanges, among others) are fully dependent upon discretionary grant awards. Hence, financing for non-SOGR projects depends upon the allocation of discretionary funds from USDOT, as well as from special assignments from the Puerto Rico Central Government.

The critical nature of the local economic situation requires economic/financial analysis to help define the available budget and minimum spending obligations, prior to defining the alternatives to be modelled. A strategic review of funding and financing options has been prepared to provide a sensible and realistic assessment of potential financial resources, likely to be accessible to PRHTA over the coming years. The financial team has identified and reviewed the availability and eligibility of various capital grants and loan programs available for transportation infrastructure and transit initiatives, including both apportionment and discretionary/competitive funds.

The PRHTA and the Department of Transport and Public Works (DTPW) jointly prepared a Statewide Transportation Improvement Program (STIP), which sets out the proposed distribution of federal funds assigned to Puerto Rico by project, covering highways and transportation-related funding from the FHWA, and transit-related funding from the FTA.

PRHTA also generates a 5-year Capital Improvement Program (CIP), which is the basis for the preparation of TIP for FHWA federal aid projects. PRHTA has evaluated the condition of its highway assets, allowing it to identify and prioritize major needs, given the limitations of resources and the associated construction costs. The CIP is subject to approval by the Financial Oversight and Management Board for Puerto Rico.

The CIP estimates the steady state costs for FY22+ amounting to $274M per annum (2021), including $153M for pavement, $86M for bridges, and $35M for safety. These CIP figures exclude soft costs (in the range of 15-18.5% of capital expenditure; to be funded using state Capex). There is a separate budget for transit CIP projects. The level of projected costs implies more than doubling the expenditure on pavement and a three-fold increase in the amount allocated for bridges compared with prior 2018, and an allocation of approximately $45M for the toll roads and $229M for the non-toll roadways. Other highway network capacity enhancement initiatives will be funded using earmarked discretionary grants, or special assignments from the Central Government. The objective is to maximize federal funding by identifying, applying for, and pursuing additional discretionary Federal funds. The importance of these efforts has been magnified by the availability of discretionary grants under the Infrastructure Bill, which increases the available pool of discretionary grants funding for which PRHTA can compete.

Other financing opportunities will result from Public Private Partnerships (P3), including greenfields and brownfields. P3s are effective strategies to attract private investment into the transportation network. The PRHTA is currently concessioning the operation and maintenance of toll roadways PR-20, PR-52, PR-53 and PR-66. This transaction will result in a reduction in capital expenditures from the PRHTA on the toll roads, as the concessionaire will be responsible for any reconstruction work, as well as the operation and maintenance projects. However, it will also mean a reduction in toll revenues, which will require an adjustment in the Central Government transfer of funds to the PRHTA for the operational and capital expenditures of the remaining non-toll roads. Additionally, depending upon the magnitude of the upfront payment for the brownfield P3 transaction, some funds may become available for SOGR projects, as well as for highway network capacity enhancement and congestion relief initiatives. It should be noted that there is a large uncertainty in the execution of the P3 and the resulting funds, if any.

Many federal programs require some degree of local match. This could be provided by drawing on toll revenue credits, although there will also be a need for actual funding to achieve key targets for state of good repair.

In view of the lack of access to bond markets (due to default on existing bond issues), combined with the government's clawback arrangements for tax streams previously dedicated to transportation, there is no alternative source of funds to provide the local contribution other than specific government transfers.

Demand for construction and project management resources is likely to drive up costs in the short term. This is already being reflected in levels of construction costs inflation, which will inevitably reduce the amount of work possible within a fixed, finite budget. Timescales for project start dates may therefore be extended.

Prioritization Strategy

The high-level prioritization of projects, follows PRHTA's objectives detailed next (1, with the highest priority):

1. Completing Emergency Repair projects
2. Safety Projects (per SHSP strategies)
3. Achieving State of Good Repair (per TAMP strategies)
4. Highway Congestion Relief Program
5. Completing the PR Strategic Highway Network
6. Other CIP Projects

The initial focus is on emergency repairs and developing resilient infrastructure to modern standards. Safety projects will remain one of the top priorities of the PRHTA, with a focus on reducing fatalities and serious injuries in the highway network. It will also prioritize projects based on the FHWA guidelines and target high-crash locations. Extending the life cycle of the highway assets by preservation and reconstruction work will allow to meet FHWA targets for the condition of interstate and NHS pavements and bridges. Meanwhile, the PRHTA will identify P3 opportunities for other Non-SOGR initiatives, such as items 4 thru 6.

Financial support for disaster recovery

ER Funding from FHWA

Since 2017, the PRHTA has been immersed in the reconstruction efforts for multiple disaster events, including:

- 2017 Hurricanes Irma and María
- 2018 Tidal Waves
- May 2019 Heavy Rain
- 2019 Tropical Storm Karen
- January 2020 Earthquakes
- 2020 Tropical Storm Isaias
- 2022 Tropical Storm Fiona

Legislation from US Congress, under the terms of the Bipartisan Budget Act of 2018, allows for 100% federal share for Hurricanes Irma and Maria permanent repairs. For other disasters, the 100% federal share applies only for emergency repairs. The Emergency Relief funding is obtained from quick releases and ER assignments.

For the recovery efforts associated with hurricanes Irma and María, the PRHTA and Eastern Federal Land Highway Division (EFLHD) signed multiple Memorandums of Agreements (MOAs) for EFLHD to support the agency in the emergency repairs, as well as for the procurement, construction management and inspection of landslide projects, likewise to signage and safety projects and bridge replacement. Per the signed MOA, EFLHD is receiving partial allocations of ER funds directly from FHWA. Other permanent repair work, including improvements to traffic signals, lighting, communications, and some bridges, will still be executed by the PRHTA. The following table depicts the funding allocation, obligation, and funding availability for the previously mentioned disaster events. Available funding sources from FHWA are set out in Table 8.1.

Table 8.1: FHWA ER Funding Allocation and Obligations

Funding Allocation	Date	Funding	Transferred to EFLHD	Balance	Obligated in FMIS	Funds Available
Hurricanes Irma/María		**$707,563,670.84**	**$398,380,000.00**	**$309,183,670.84**	**$291,491,244.53**	**$14,784,191.31**
Quick Release 1	September 14, 2017	$2,500,000.00		$2,500,000.00		
Quick Release 2	September 28, 2017	$40,000,000.00		$40,000,000.00		
Quick Release 3	November 22, 2017	$30,000,000.00		$30,000,000.00		
ER Assignment 1	April 13, 2018	$70,000,000.00	$8,100,000.00	$61,900,000.00		
ER Assignment 2	February 5, 2019	$130,000,000.00	$79,500,000.00	$50,500,000.00		
ER Assignment 3	September 5, 2019	$208,195,000.00	$150,000,000.00	$58,195,000.00	$291,491,244.53	$14,784,191.31
ER Assignment 4	February 27, 2020	$22,065,474.00	$4,200,000.00	$17,865,474.00		
ER Assignment 5	November 2, 2020	$2,171,728.63	$580,000.00	$1,591,728.63		
ER Assignment 6	December 21, 2021	$45,482,968.76		$45,482,968.76		
ER Assignment 7	August 31, 2022	$156,000,000.00	$156,000,000.00	$0.00		
ER Assignment 8	May 19, 2023	$1,148,499.45		$1,148,499.45		
Tidal Waves		**$1,788,025.00**	**$0.00**	**$1,788,025.00**	**$0.00**	**$1,788,025.00**
ER Assignment 1	February 5, 2019	$300,000.00	$0.00	$300,000.00		
ER Assignment 2	February 27, 2020	$1,488,025.00	$0.00	$1,488,025.00	$0.00	$1,788,025.00

Funding Allocation	Date	Funding	Transferred to EFLHD	Balance	Obligated in FMIS	Funds Available
May 2019 Heavy Rains		**$6,378,488.52**	**$0.00**	**$6,378,488.52**	**$5,363,543.44**	**$1,014,945.08**
ER Assignment 1	February 27, 2020	$5,462,209.00	$0.00	$5,462,209.00	$5,363,543.44	$1,014,945.08
ER Assignment 2	November 2, 2020	$916,279.52	$0.00	$916,279.52		
Tropical Storm Karen 2019		**$3,858,736.00**	**$0.00**	**$2,883,736.00**	**$667,949.35**	**$3,190,786.65**
ER Assignment 1	February 27, 2020	$2,883,736.00	$0.00	$2,883,736.00	$667,949.35	$3,190,786.65
ER Assignment 2	December 21, 2021	$975,000.00		$975,000.00		
Earthquakes Event 2020		**$35,778,361.20**	**$0.00**	**$35,778,361.20**	**$14,070,979.43**	**$20,777,347.11**
Quick Release 1	January 14, 2020	$5,000,000.00	$0.00	$5,000,000.00	$14,070,979.43	$20,777,347.11
ER Assignment 1	February 27, 2020	$9,000,000.00	$0.00	$9,000,000.00		
ER Assignment 2	November 2, 2020	$70,979.43	$0.00	$70,979.43		
ER Assignment 3	December 21, 2021	$21,707,381.77		$21,707,381.77		
Hurricane Fiona 2022		**$34,850,000.00**	**$0.00**	**$34,850,000.00**	**$0.00**	**$0.00**
Quick Release 1	September 27, 2022	$8,000,000.00	$72,358.00	$7,927,642.00	$35,152,912.77	$0.00
ER Assignment 1	May 19, 2023	$34,850,000.00	$0.00	$34,850,000.00		
Total		**$829,143,719.06**	**$398,380,000.00**	**$429,788,719.06**	**$314,466,336.37**	**$42,759,113.03**

Source: FHWA, 2023

FTA ER Funds

The FTA program (Section 5324) assists States and public transportation systems with emergency-related expenses for which the governor of Puerto Rico has declared an emergency, and the U.S. Secretary of Department of Transportation has concurred, or the President of the EEUU has declared a major disaster. The program funds capital projects to protect, repair, reconstruct, or replace transit assets, including equipment and facilities. It also funds transit agencies operating costs related to evacuation support, rescue activities, and temporary public transportation service. FTA covers those expenses not reimbursed by the Federal Emergency Management Agency (FEMA).

The Federal share is 90% of permanent or emergency repairs, incurred more than 270 days after the disaster declaration date. The funds can also be applied to 100% of transit operating costs of evacuation services and temporary emergency services in the area affected by the emergency.

Under Section 5324, Puerto Rico allocated the following funds for several agencies and municipalities, as shown on Table 5.2.

Table 8.2: Emergency Relief Fund under Section 5324

Emergency Relief Fund (Section 5324)	
Recipient	**Funding**
Autoridad Metropolitana de Autobuses	$13,599,000
Barceloneta	$901,000
Bayamón	$164,000
Caguas	$1,116,000
Camuy	$159,000
Carolina	$414,000
Cataño	$928,000
Cayey	$2,452,000
Ciales	$708,000
Cidra	$193,000
Dorado	$49,000
Fajardo	$77,000
Guaynabo	$482,000
Hatillo	$306,000
Hormigueros	$29,000
Humacao	$1,823,000
Juncos	$311,000
Manatí	$233,000
Ponce	$906,000
Puerto Rico Highways and Transportation Authority	$169,412,000
San Juan	$2,701,000
San Lorenzo	$258,000
Toa Baja	$131,000
Vega Alta	$230,000
Vega Baja	$148,000
Yauco	$59,000

Source: FTA, 2023

Coronavirus Aid, Relief, and Economic Security (CARES) Act of 2020 and the Coronavirus Response and Relief Supplemental Appropriations Act (CRRSAA) of 2021

The Coronavirus Aid, Relief, and Economic Security (CARES) Act (2020) and the Coronavirus Response and Relief Supplemental Appropriations (CRRSAA) Act (2021) provide a variety of programs to provide fast and direct economic assistance for American workers, families, small businesses, and industries related to the onset of the COVID-19 pandemic. The Coronavirus Response and Consolidated Appropriations (CRCA) Act continued many of these programs by adding new phases, new allocations, and new guidance to address issues related to the continuation of the COVID-19 pandemic.

Under CARES, FTA allocated $25 billion to recipients of urbanized area and rural area formula funds, with $22.7 billion to large and small urban areas and $2.2 billion to rural areas. Funding provides a 100-percent federal share, with no local match required, and support capital, operating, and other expenses generally eligible under those programs to prevent, prepare for and respond to COVID-19.

Also, FTA allocated $14 billion in supplemental appropriations for COVID-19 relief to support the transit industry during the COVID-19 public health emergency, under the Coronavirus Response and Relief Supplemental Appropriations Act of 2021 (CRRSAA).

Under Section 5307 (Urbanized Areas) and 5311 (Rural) Formula Programs, FTA allocated the following funds to Puerto Rico, as shown in Table 8.3.

Table 8.3: Coronavirus Aid, Relief and Economic Security under Section 5307

Coronavirus Aid, Relief, and Economic Security (CARES) Act (Section 5307)

Recipient	Funding
San Juan Urbanized Area (SJUA)	$96,100,590
Aguadilla Urbanized Area (AUA)	$7,475,140
Urbanized Area Under 200,000 (UZA)	$58,250,078

Coronavirus Aid, Relief, and Economic Security (CARES) Act (Section 5311)

Recipient	Funding
Rural Area	$6,847,672

Coronavirus Response and Relief Supplemental Appropriations (CRRSA) Act (Section 5307)

Recipient	Funding
San Juan Urbanized Area (SJUA)	$29,105,286
Urbanized Area Under 200,000 (UZA)	$9,050,483

Source: FTA, 2023

American Rescue Plan Act of 2021

The American Rescue Plan (ARP) Act of 2021, provides federal funding to support the nation's public transportation systems for continue the respond to the COVID-19 pandemic, among others. Under ARP, FTA allocates $26.6 billion to urbanized and rural areas and $50 million under the Enhanced Mobility of Seniors and Individuals with Disabilities formula programs. Funding provides a 100-percent federal share, with no local match required.

FTA program looks to improve mobility for seniors and individuals with disabilities throughout by removing barriers to transportation services and expanding the transportation mobility options. Section 5310 program provides financial assistance for transportation services planned, designed, and implemented to meet these special transportation needs for seniors and individuals with disabilities in all areas—large urbanized, small urbanized, and rural.

Under Section 5307 (Urbanized Areas), 5311 (Rural), and 5310 (Enhanced Mobility of Seniors and Individuals with Disabilities) Formula Programs, FTA allocated the following funds to Puerto Rico.

Table 8.4: American Rescue Plan Act Funds

American Rescue Plan Act (Section 5307)

Recipient	Funding
San Juan Urbanized Area (SJUA)	$95,156,466
Aguadilla Urbanized Area (AUA)	$424,535
Urbanized Area Under 200,000 (UZA)	$22,460,897

American Rescue Plan Act(Section 5311)

Recipient	Funding
Rural Area	$1,050,111
Rural Transportation Asistance Program (RTAP)	$76,631
Intercity	$353,071

American Rescue Plan Act (Section 5310)

Recipient	Funding
San Juan Urbanized Area (SJUA)	$444,028
Aguadilla Urbanized Area (AUA)	$68,774
Urbanized Area Under 200,000 (UZA)	$350,780

Source: FTA, 2023

FEMA Public Assistance Grants

Public Assistance (PA) grants tend to be the largest disbursement of federal funds or both short- and long-term disaster recovery. These funds are focused on repairing, replacing or restoring public infrastructure that might have been affected during a natural disaster. The funds are disbursed on a project-based detailed cost estimated from each of the damaged infrastructure. For example, for the emergencies related to Hurricane Maria FEMA's PA program had allocated $2.6 billion in total funding (up to July 16, 2018).

FEMA usually provides 75% of the estimated costs, requiring that 25% be covered by local funding sources from local governments. These contributions from local governments can also be covered by other federal grant programs.

PA funds are intended to restore facilities to their pre-disaster state and only allow upgrades to meet applicable codes and standards. Nevertheless, local governments can solicit hazard mitigation add-on funding (designated as PA-406 program funds) to improve facilities so they are more resilient and able to withstand future hazardous events. These additional funds are subject to a cost-benefit analysis to demonstrate their cost-effectiveness.

Sources of Capital Improvement Program Funds

There are several sources of funds available to the PRHTA:

- Federal Funds (Regular and Discretionary);
- Tolls credits;
- State Funds earmarked for CAPEX;
- Toll Rates and Additional Tolling Opportunities; and
- P3 project Investment.

The formal documents that define the shorter-term investment strategies regarding the PRHTA available funds are:

- The Capital Improvement Plan (CIP);
- The Statewide Transportation Improvement Program (STIP);
- The TAMP; and
- The SHSP.

Federal Funds

FHWA Infrastructure Investment and Jobs Act – Bipartisan Infrastructure Law (BIL)

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA) (Public Law 117-58, also known as the Bipartisan Infrastructure Law) into law. The Bipartisan Infrastructure Law is the largest long-term investment in our infrastructure and economy in our Nation's history. It provides $550 billion over fiscal years 2022 through 2026 in new Federal investment in infrastructure, including in roads, bridges, mass transit, water infrastructure, resilience, and broadband.

The BIL provides apportioned funding to states/territories for Federal-aid highway programs over a 5-year period (at the time FY-2022 through FY-2026). Although Puerto Rico is included in the definition of "state" for most purposes under Title 23, it is not eligible to receive funds apportioned among states. Specific authorization for the Puerto Rico Highway Program (PRHP) is provided, with an allocation varying from $173M to $187M for fiscal years 2022 through 2026. Penalties are imposed because of the lower minimum drinking age and minimum penalties for repeat offenders due to driving while intoxicated, reducing the available funds to an average of $159M.

The lump sum payments for each year cover all the apportioned highway programs combined, including the following pre-defined allocations:

- At least 50% are available only for purposes eligible under the National Highway Performance Program (NHPP),
- At least 25% are available only for purposes eligible under the Highway Safety Improvement Program (HSIP),
- And any remaining funds may be used on any activity eligible under Chapter 1 of Title 23, United States Code (U.S.C.) and preventative maintenance on the National Highway System [§ 11126(2); 23 U.S.C. 165(b)(2)(C)(iii)].

The BIL also allocates $45M to Puerto Rico per annum for 5 years under the Bridge Formula Program and $2,020,490 under the National Electric Vehicle Infrastructure (NEVI) Program.

Federal grant funding typically falls into two categories: Apportioned and allocated, depending on the way the funds are distributed. The Federal aid provided to Puerto Rico is not determined by the standard formula apportionment (which applies to states), but instead by a fixed term allocation.

The FHWA requires a minimum 10-year financial plan to be developed, which sets out how the Authority expects to fund future work and investment, as set out in the asset management plan. The plan is to be based on funding levels that can be expected to be “reasonably available” by year, with the planning process required to address the anticipated sources of funding.

The FHWA acknowledges that future funding amounts may be uncertain, and in these circumstances, allows the financial plan to use estimates based on historical values. In the case of apportionment, the potential variance is reasonably limited, with the base allocation to each state typically reflecting their respective share of the prior year's funding. With a fixed allocation, rather than a formula-based apportionment, it is extremely difficult to predict the future level of funding beyond the current commitments. The fiscal plan assumes that funding for the period up to 2026 will continue at the current level, with the exception of the $45M for the Bridge Formula Program and the $2M for NEVI, which will remain only during the 5-year period defined in the BIL.

For the 2050 MLRTP Financial Plan, it has been assumed that the level of funding will be maintained at its current level in real spending terms. Nevertheless, the surge in construction prices due to Hurricanes Irma and María and the COVID-19 pandemic is adversely affecting the capacity to execute SOGR projects and reach KPI objectives. Hence, an adjustment in levels of investments in the near future shall not be discarded. In terms of state matching requirements, the available toll revenue credits would be adequate to provide the required 20% local match, allowing projects to be fully federally funded.

US DOT Discretionary Federal Grants

The BIL provided funds to the US Department of Transportation across three programs to invest in projects of national or regional significance – (1) the National Infrastructure Project Assistance grants program, found under 49 U.S.C. § 6701 (Mega), (2)the Nationally Significant Multimodal Freight and Highways Projects grants program, found at 23 U.S.C. § 117 (Infrastructure for Rebuilding America or INFRA), and (3) the Rural Surface Transportation Grant program, found at 23 U.S.C. § 173 (Rural). The BIL makes available up to $5 billion for the Mega program for Fiscal Year (FY) 2022 through 2026; up to $8 billion to the INFRA program for the period of FY 2022 through 2026; and up to $2 billion for the Rural program for the period of FY 2022 through 2026, for a combined total of up to $15 billion for FY 2022 through 2026.

The funding opportunities are awarded on a competitive basis for surface transportation infrastructure projects. The infrastructure projects include highway and bridge, intercity passenger rail, railway-highway grade crossing or separation, wildlife crossing, public transportation, marine highway, and freight projects, or groups of such projects. All the projects need to have a significant national or regional impact or to improve and expand the surface transportation infrastructure in rural areas.

Toll Transportation Development Credits (Formerly Toll Revenue Credits) – Matching Contribution

Section 120(i) of Title 23 of the United States Code permits states to substitute certain previous toll-financed investments for state matching on current Federal-aid projects. The non-Federal share of a project's cost may be met through a "soft match" of toll credits. This means the Federal share can effectively be increased to 100 percent of the total project cost. The credits can be applied for the construction of new infrastructure, or the maintenance or improvement of existing public highways, including those which have received federal-aid funding in the past.

It should be noted that although these credits are often referred to as a source of funding, they do not represent actual available funding. They are typically applied to free local funds that would otherwise need to be committed, allowing the flexibility to fund other transportation projects that may not themselves be eligible for federal funds, or to support operating costs.

Toll credits may be claimed only for the share of a project's capital expenditures, which are supported by toll revenues accruing to a toll authority (public agency or private entity). The allowable credit excludes revenues needed for debt service, returns to investors, or the operation and maintenance of toll facilities.

In addition, an annual Maintenance of Effort (MOE) test is applied, which must certify that the toll facilities are being properly maintained in the year to which the credit relates before excess revenues can be credited. The actual level of maintenance spent in relation to initial estimates is also monitored, and any shortfall will result in a requirement to replace federal funds with local funds on projects where the credit was applied. Future ability to accrue additional credits will therefore depend on meeting the MOE requirements.

The amount of credit earned equals the amount of excess toll revenues spent on Title 23 highway capital improvement projects. However, if Federal funds were used for the project that generates the tolls, then the available credit is reduced by the percentage of the total project cost sourced from federal funds; i.e., if 80% of the original project was federally funded, the toll credit is reduced by 80%. Once approved, the credit remains available until used.

In December 2021 the SOP 09-11-06 “Procedures for the Use of Toll Credits” was approved by the PRHTA. This procedure is aligned with FHWA guidelines. The use of these credits as matching contributions is estimated at approximately $30M per year, based on the current level of allocated funding, implying the potential for these credits to be applied over the next 20 years.

Local Taxes Dedicated to Transportation and Government Transfers

The Authority’s funding originally included a range of pledged tax and license revenue streams. However, starting in 2016 these revenues have been subject to government clawback, being used instead to make payments on bonds of the Government Development Bank (GDB), guaranteed by the government. The clawback covers Taxes on Gasoline; Diesel; Petroleum and derived products; vehicle license fees, and cigarettes.

However, in Puerto Rico these allocations are not constitutionally dedicated, and the funds can be re-purposed by the government, as is the case under the "clawback" arrangement now applied. At the present time, there is no end date for the clawback and, as a prudent and conservative approach, it has been assumed that these funds will not be available over the term of the 2050 MLRTP.

The net result of the clawback to date is that PRHTA has been unable to make interest or principal payments on bonds, or interest payments due to the former GDB. PRHTA initially continued to make bond payments using reserve funds, but they were unable to do so beginning in July 2017. The result has been PRHTA filing for bankruptcy under Title III of PROMESA.

The clawback has also resulted in an overall shortfall against approved expenditures. To address the shortfall, transfer payments are expected from the Commonwealth in the form of Capex appropriations and Commonwealth Transfers, totalling $5,291M, from FY2023 through FY2051, which is the term of the current Fiscal Plan.

State Funds Earmarked for Capex

As per the approved fiscal plan, there is $334M in Capex appropriations from FY2023 through FY2027, and $2,007M from FY2023 through FY2051. With the additional Commonwealth transfer ($3,284M from FY23 through FY51) to cover both Capex and OPEX. Additional funds may be available depending upon the P3 ongoing brownfield transaction.

Toll Rates and Additional Tolling Opportunities

Toll Revenues

As per the current approved fiscal plan, toll revenues contribute 72% of PRHTA's total operating revenue baseline, including both PRHTA and concessionaire-operated roads. Toll fares for the toll roads operated by the PRHTA (i.e., PR-20, PR-52, PR-53, and PR-66) have not been adjusted since 2005. Future toll revenues were estimated in the Fiscal Plan using actual toll revenues and toll transactions from FY19 (pre-pandemic) and then adjusted each year based on the Commonwealth's real GNP projections. Additionally, the Fiscal Plan's projections adjusted upward PR-53's baseline to reflect the fact that both the North and South Humacao toll plazas were closed during FY19, used as a base year and unaffected by COVID, but reopened in August 2019.

Toll revenues estimates included in the Fiscal Plan are $975M from FY23 through FY27, plus $218M from toll fines from the same period.

Toll Highway Administration and Maintenance

Toll highway administration and maintenance costs are estimated at $232M from FY23 through FY27, averaging around $46.4M per year. It should be noted that the toll revenues and the administration and maintenance expenditures may be modified in the near future, depending upon the undergoing P3 transaction for the PRHTA toll roads not previously concessioned.

Potential for Additional Tolling

Federal law limits the imposition of tolls on existing highways that have been built or maintained using federal funds. Tolls can be imposed for single-occupant use of HOV lanes or with the objective of congestion pricing. In other circumstances, tolls can only be levied on existing roads following reconstruction (e.g., for capacity expansion or other improvements).

If the Authority certifies that the facility is being adequately maintained, and generating sufficient revenue to pay for operations, the surplus can be applied to contribute to the cost of other highway activities. It can also be used to support public transportation operations, provided that the application would not be in violation of the authority's bond covenants.

P3 Project Investment

Encouraging private sector capital investment would appear to offer a means of implementing projects whilst minimizing the dependence on government funding. The Puerto Rico Government is proposing to further strengthen the P3 legal framework to facilitate critical infrastructure investments.

The P3 Authority is focused on developing critical infrastructure projects, and unsolicited private sector proposals can be submitted. The success of toll road concessions for PR-22 and PR-5 would appear to provide a successful precedent. Current priority projects in development include a concession to modernize, operate and maintain government-owned parking facilities.

New Projects

Any investor in a P3 will have expectations of a return over the duration of a concession, either from user fees or availability or service fees payable by PRHTA or the PR Government. A complicating factor is that there is considerable uncertainty associated with forecasts of future usage of any infrastructure, given the outlook for the macroeconomic environment and a decline in population through continued net migration.

At the same time, PRHTA is unlikely to be able to provide cast-iron assurances with regards to providing either a minimum revenue guarantee or making availability and service payments without access to additional funds. The Government is equally unlikely to be able to offer such guarantees as a backstop, given other demands on its finite resources. Similarly, there may be concern about the ability of PRHTA to fund the construction or maintenance of essential related infrastructure (e.g., roads that feed or distribute traffic using the tolled facilities).

The potential return for investors could be improved by an upfront government contribution to offset capital costs. This might be recovered in the longer term by a revenue-sharing mechanism. In these circumstances, it may be possible to apply for a discretionary TIFIA loan during construction, with an appropriate grace period and a 35-year repayment term, as discussed earlier. The credit contribution from a TIFIA loan is typically limited to 33% of eligible project costs which may prove a significant constraint, given the relatively low levels of revenue generated by potential highway projects identified by PRHTA.

In these circumstances, the potential to secure P3 investment is likely to be a binary option, depending on whether an application for a TIFIA loan is granted or not. Given the time required to make an application, and for its evaluation, it is suggested that any associated projects cannot begin before FY2024.

P3 Covering Existing Assets

The option of transferring existing highway infrastructure assets with a proven history of toll revenue generation is subject to uncertainty. This is based on considering the associated direct loss of a revenue stream supporting PRHTA's activities, and the corresponding adjustments in Central Government transfer to maintain in SOGR the Non-Toll System. The PRHTA is in the advanced stages of procuring the concession of the toll roads not previously concessioned (i.e., PR-20, PR-52, PR-53, and PR-66). However, there is uncertainty regarding the financial elements of the transaction at this point in time. It would be more certain if the proposed transactions and associated asset transfers, as part of a P3, were to be included in a fiscal plan certified by the PROMESA Board. The PRHTA is currently developing an updated Fiscal Plan that will include the P3 transaction, as well as the Transportation Sector Reform.

Capital Improvement Program (CIP) Funding Allocation

The Fiscal Plan approved and certified by the Financial Oversight and Management Board (FOMB) on October 14, 2022, covers anticipated revenues and capital and operating spending from FY 2023 through FY 2027. It includes the completion of current projects based on the projected level of transfers from the Government, in addition to state funds already earmarked for Capex.

The construction program reflects the Capital Improvement Program (CIP) budget produced by PRHTA. The projected "steady state" run rate of $253M in hard costs per year, which reflects a reduction from the goal of $274M in spending level deemed necessary to keep the National Highway System (NHS) and Interstate system in a state of good repair compliant with federal standards, but only a minimal level of intervention on non-NHS roads. An additional annual reduction in state Capex for hard costs is observed after FY2030. On average, 49.5% of the funding is allocated to pavement work, 32.7% to bridges, 12.8% to safety, and 5% to traffic signaling. Nevertheless, the priorities and final distribution of funds are obtained following the FHWA regulation, applying penalties, and the strategies within the current TAMP.

Allocation of Funds

The 2050 MLRTP assumes that the first priority, post-disaster recovery, will be to meet federal targets for the interstate and NHS bridges. Failure to meet the targets will, in any case, oblige all Federal funding to be directed toward these efforts. The assumed spending profile is based on PRHTA's "balanced" scenarios, which seek to apply a realistic approach to a ramp-up of work. A 25% of the available FHWA funds also need to be committed to safety projects.

There are sufficient toll revenue credits available as local matches over the next 20 years, so the available level of federal funding should not be available in full, irrespective of the level of local contribution. However, the level of funding currently provided by FHWA is below the level of expenditure required to deliver the State of Good Repair (SGR) program over the next 10 years. This means there will be a continuous need for the Government of Puerto Rico to transfer funds to balance the books, beyond the period covered by the present fiscal plan.

Source and Allocation of Capital: Highways and Bridges Projections FY-2023-2051

Table 5.3 sets out the anticipated level of funding and capital expenditure during the period of the current fiscal plan (from FY2023 through FY2051), with greater granularity during the first 5 years. This level of expenditure was considered during the development of the TAMP. It should be noted that the targets established in the TAMP may be affected by the increase in construction costs experienced during recent years locally.

The projections shown in Table 5.3 considers a 5-year year allocation of $225M for the bridge program, from FY 2023 thru FY2027. After FY 2027, if additional funding is not allocated for the Bridge Program, state Capex funds shall be identified to replace the $45M per annum investment in bridge program under BIL to maintain the SOGR projected investments.

The sources of capital revenue for the CIP are:

- FHWA Funds;
- Commonwealth Appropriations;
- FTA funds; and
- Emergency Funds

Meanwhile the capital expenditures are grouped into the following categories:

- Right of Way;
- Local Construction;
- Federal Hard Costs;
- Non-Federal Hard Costs;
- Federal Soft Costs;
- Non-Federal Soft Costs;
- Discretionary Federal Soft Costs;
- Federal Emergency Repair Program;
- Local Emergency Repair Program;
- Toll Optimization CIP;
- Transit CIP;
- Construction salaries and related benefits; and
- Other construction program expenses.

Table 8.5: Highways – Source and Application of Funds 2023-2051 (All Figures in $000 at 2022 Prices)

In $ Thousands	FY2023	FY2024	FY2025	FY2026	FY2027	FY2023-27	FY2023-51
FHWA Funds	269,734	224,923	238,964	203,750	186,328	1,123,699	5,316,293
Main CW Capex Appropriation	53,761	54,370	55,027	55,797	56,600	275,555	1,949,014
Other CW State Funds	57,713	-	-	-	-	57,713	57,713
Federal Emergency Revenues	33,666	73,734	33,300	8,000	-	148,700	148,700
Capex FTA funds	39,353	20,640	17,100	43,362	17,646	138,101	663,845
Capital Contribution - Federal	309,087	245,563	256,064	247,113	203,974	1,261,801	5,980,138
Capital Contribution - State	111,474	54,370	55,027	55,797	56,600	333,268	2,006,727
Capital Contribution - Emergency	33,666	73,734	33,300	8,000	-	148,700	148,700
Capital Contribution	454,227	373,667	344,391	310,910	260,574	1,743,768	8,135,564
Right of Way	(6,200)	(4,013)	(4,013)	(4,013)	(4,076)	(22,316)	(143,223)
Local Construction	(1,000)	(9,500)	(9,500)	(9,500)	(9,647)	(39,148)	(325,339)
Federal Hard Costs	(245,239)	(204,968)	(219,749)	(185,068)	(167,357)	(1,022,380)	(4,652,174)
Non-Federal Hard Costs	(35,129)	(58,475)	(69,444)	(97,042)	(117,066)	(377,156)	(3,391,269)
Federal Soft Costs	(24,495)	(19,955)	(19,216)	(18,682)	(18,971)	(101,319)	(664,119)
Non-Federal Soft Costs	(44,051)	(54,384)	(59,756)	(58,607)	(41,842)	(258,639)	(1,238,489)

In $ Thousands	FY2023	FY2024	FY2025	FY2026	FY2027	FY2023-27	FY2023-51
Discretionary Federal Soft Costs	(2,386)	-	-	-	-	(2,386)	(2,386)
Federal Emergency Repair Program	(33,666)	(73,734)	(33,300)	(8,000)	-	(148,700)	(148,700)
Local Emergency Repair Program	(7,431)	(4,400)	(1,400)	-	-	(13,231)	(13,231)
Toll Optimization CIP	(23,429)	(30,979)	-	-	-	(54,408)	(54,408)
Transit CIP	(39,753)	(21,040)	(17,500)	(43,762)	(18,046)	(140,101)	(675,445)
Construction Salaries and Related Benefits	(27,635)	(23,170)	(23,166)	(23,485)	(23,816)	(121,273)	(815,658)
Other Construction Program Expenses	(4,075)	(4,102)	(1,627)	(1,652)	(1,678)	(13,134)	(62,907)
Total Capital Expenses - Federal	(269,734)	(224,923)	(238,964)	(203,750)	(186,328)	(1,123,699)	(5,316,293)
Total Capital Expenses - State & Local	(109,810)	(157,351)	(142,713)	(169,162)	(172,631)	(751,667)	(5,152,729)
Total Capital Expenses - Transit	(39,753)	(21,040)	(17,500)	(43,762)	(18,046)	(140,101)	(675,445)
Total Capital Expenses - Emergency	(41,097)	(78,134)	(34,700)	(8,000)	-	(161,931)	(161,931)
Total Capital Expenses	(494,490)	(508,720)	(458,671)	(449,812)	(402,498)	(2,314,191)	(12,187,349)

Source: 2022 PRHTA Fiscal Plan (Approved on October 14, 2022)

Transit Funds and Capex

Under BIL, US Congress establishes the funding for FTA programs through authorizing legislation by amending Chapter 53 of Title 49 of the U.S. Code. The BIL authorizes up to $108 billion to support federal public transportation programs, including $91 billion in guaranteed funding. It largely maintains current program structures and funding shares between highways and transit.

BIL transit program established several important goals, including safety, state of good repair, performance, and program efficiency. It also provides the Federal Transit Administration (FTA) significant resources to strengthen the safety of public transportation systems throughout the United States. The Act also establishes a new needs-based formula program and new asset management requirements.

Under BIL, the following programs were established:

- All Stations Accessibility Program,
- Electric or Low Emitting Ferry Pilot Program,
- Ferry Service for Rural Communities, and
- State of Good Repair and Rail Vehicle Replacement Program.

FTA funding allocations to grantees in Puerto Rico are from the following sections:

- Metropolitan Planning and Statewide Planning and Research Programs (Section 5305(d) and (e) to implement Section 5303 and Section 5304) - These programs provide federal assistance to support cooperative, continuous, and comprehensive planning for making transportation investment decisions in metropolitan areas and statewide.
- Urbanized Area Formula Program (Section 5307), including a Passenger Ferry Grant Program (Section 5307(h)). The Urbanized Area Formula Program makes federal resources available to urbanized areas for transit planning, capital, and operating assistance in urbanized areas. An urbanized area is an area encompassing a population of not less than 50,000 people that has been defined and designated in the most recent decennial census as an “urbanized area” by the Secretary of Commerce.
- Enhanced Mobility of Seniors and Individuals with Disabilities Formula Program (Section 5310). The goal of the Section 5310 program is to improve mobility for seniors and individuals with disabilities throughout the country by removing barriers to transportation services and expanding the transportation mobility options available.
- Rural Areas Formula Program (Section 5311). The Rural Areas Formula Program is a formula grant program that provides capital, planning, and operating assistance to states and Indian tribes to support public transportation in rural areas with populations of less than 50,000, where many residents often rely on public transportation to reach their destinations.
- Public Transportation Safety Program (Section 5329). The Public Transportation Safety Program, Section 5329, requires DOT to create and implement a national safety plan for all public transportation system recipients of 49 U.S.C. Chapter 53 funds.
- State of Good Repair Formula Program (Section 5337). The State of Good Repair Grants Program is authorized by 49 U.S.C. 5337. The Secretary may make grants under this section to assist state and local governmental authorities to develop and implement a transit asset management plan (TAM).
- Buses and Bus Facilities Program (Section 5339). The Grants for Buses and Bus Facilities program (49 U.S.C. § 5339) makes federal assistance available to states and eligible recipients to replace, rehabilitate and purchase buses and related equipment and to construct bus-related facilities including technological changes or innovations to modify low or no-emission vehicles or facilities.

The information in the following table includes the most recent apportionments for formula programs (FFY23) published on January 27, 2023 from FTA, totalling $93,325,428.

Table 8.6: Most Recent Apportionments for Formula Programs (FFY23)

FTA Section	Description	Apportionment
5303	Metropolitan Planning	$ 2,293,525
5304	Statewide Planning	$ 468,948
5307 + 5340	Urbanized Area Formula	$ 62,946,636
5310	Enhanced Mobility for Older Adults and People with Disabilities	$ 7,277,091
5311 + 5340	Nonurbanized Area Formula	$ 2,834,011
5311(b)(3)	RTAP	$ 110,910
5337	State of Good Repair	$ 11,101,170
5339	Bus and Bus Facilities Formula	$ 5,677,464
5329	State Safety Oversight	$ 615,673

Source: FTA, 2023

Capital Cost Estimates

A list of potential projects for inclusion in the MLRTP was prepared based on:

- Municipalities needs to comply with their land use and transport plans;
- Rehabilitation of highway infrastructure needs in coordination with TAMP strategies;
- Existing projects requiring further investments; and
- Projects included in 2045 LRTP that are in the pipeline.

Approach

The prioritization approach and the funding allocation for specific projects follow two trends: one for SOGR projects and another for Non-SOGR projects. As previously indicated, the priority of the PRHTA, documented in the current STIP and Fiscal Plan, is to assign available federal and state funds for SOGR initiative. In that regard, priorities are established based on asset conditions and strategies to extend the life cycle of those assets, as indicated in the TAMP. Additionally, the following federal requirements apply:

- Of allocated funds, 25% shall be assigned to Safety Projects. Project selection is based on SHSP strategies, the high crash location identification, and the benefit/cost ratio;
- Pavement and Safety Penalties – Not meeting the objectives included in the TAMP or SHSP results in set-asides for specific federal fund use in certain corridors;
- Of allocated funds, 50% shall be assigned to projects in the NHS; and
- And the Priorities for SOGR and Non-SOGR, based on priorities from USDOT in the case of discretionary grants from USDOT. For non-SOGR, the prioritization process will be to select candidates for discretionary grant applications.

The PRHTA continuously monitors and updates its plans and strategies to optimize the use of federal and state funds for SOGR (i.e., SHSP, TAMP, NBIS), and project priorities are modified accordingly. Strategies include preservation interventions, as well as reconstruction. The TAMP includes deterioration models to predict the remaining service life of the assets and to better forecast future priorities and KPI results. Nevertheless, priority shall be given to infrastructure in critical conditions (i.e., Bridge with Critical findings).

The list of non-SOGR potential projects was analyzed based on the priorities defined for the Goals and Objectives of this 2050 MLRTP, giving higher priority to projects already programmed in the STIP. The projects were then ranked (the methodology applied is described in Appendix H). The project identification and ranking process were discussed in detail with the Technical Committee and the leadership of the PRHTA. For those projects not programmed in the STIP, the prioritization process will be used for assigning soft costs for pre-construction efforts (Feasibility Study, environmental document, preliminary PE, etc.). The final selection of those projects will be directly dependent upon the P3 feasibility, as well as the requirements from the agency providing the discretionary grant opportunity. With the objectives of maximizing the award of discretionary grants, the PRHTA will continuously evaluate the available sources of discretionary grant and the eligibility requirements to submit grant applications for projects that better match the grant objectives.

Source Data

Project Details

A wide range of projects have been included in the MLRTP, covering investments in the following categories:

- SOGR (including preservation, reconstruction or replacement) related to pavement, bridges and highway safety;
- Non-SOGR, including:
    - Highway Capacity Enhancement or New Construction;
    - Highway Congestion Management; and
- Complete Street Initiatives

In each case, information is provided including a description of the project, and key statistics regarding the scale and scope of the project.

Costs

Estimated costs associated with the project metrics have been developed based on:

- Costs associated with project metrics included within the PRHTA current Transportation Asset Management Plan (TAMP);
- Estimates of capital costs associated with projects included within the Statewide Transportation Improvement Program (STIP), Fiscal Years 2023-2026, Amendment #1 report, April 20, 2023; and
- Estimates of capital costs from recent bids within the PRHTA Capital Improvement Program (CIP) database.

The reference costs are intended to reflect the latest estimates at 2022 prices, recognizing that, in that regard, there is high volatility in the construction industry due to the lack of materials and resources, as well as the increase in cost for imported materials. Additionally, there is a high demand for construction services from non-transportation related ER programs, which are ramping up quickly.