

NARRAGANSETT BAY WATERSHED ECONOMY

The ebb and flow of natural capital

Geography and Demographics of the Narragansett Bay Watershed

The Narragansett Bay watershed (NBW) is the area of land that drains water into Narragansett Bay, including all the rivers and streams that eventually flow into it (Figure 1). The NBW covers more than 1,700 square miles, with 60% of the watershed located in Massachusetts (MA) and the remaining 40% in Rhode Island (RI). There are ten counties and 105 cities and towns that are partially or entirely located in the watershed.



Figure 1: Watersheds of the Narragansett Bay

Source: Watershed Counts Annual Report, 2014

Located at the heart of the watershed is the 200 square mile Narragansett Bay, with a saltwater coastline approximately 420 miles long (about the distance of a car ride from Providence to Washington, D.C.).ⁱ The bay extends 28 miles into the interior of RI and is considered the state’s chief geographic feature, often referred to as the Grand Canyon or Niagara Falls of the region.¹ The bay is an estuary, a semi-enclosed body of water where freshwater from rivers mixes with and dilutes saltwater of the sea. The estuarine features of the NBW—including over 100 distinct bays, islands, points, rivers, coves, and harbors—attract residents and over 1.9 million visitors annually to the region for a variety of recreational and commercial purposes.² The estuarine rivers that feed the Narragansett Bay are the Seekonk, Palmer, Pawtuxet, Warren, Lee, Cole, and Taunton. The major basins that flow into the Narragansett Bay and are part of the NBW are the Blackstone River Basin, the Taunton River Basin, the Pawtuxet River Basin, and the Narragansett Bay Basin (Table 1).³

Table 1: Major Basins in the Narragansett Bay Watershed

	Blackstone River	Taunton River	Pawtuxet River	Narragansett Bay
Square miles	475.6	474.6	231.9	524.1

Source: State of Our Watershed, 2017

Within these major basins are smaller watersheds. These include the Hunt River Basin, Moshassuck River Basin, Ten Mile River Basin, Woonasquatucket River Basin, and Warren River Basin.⁴ In total, these rivers input approximately 2.4 billion gallons of freshwater daily to the Narragansett Bay. This amount of freshwater input has led to low salinity levels in the Narragansett Bay, creating an ideal habitat for organisms such as quahogs, crabs, shrimps, and lobsters.⁵

The fertile soil and relatively moderate coastal climate of the NBW have supported agriculture throughout history, including the robust livestock operations in colonial times to vineyards, horticulture, and other agricultural activities today.⁶ In total, there are more than 1,090,000 acres of land in the NBW: nearly 380,000 acres are urban lands (35%), 425,000 acres are forested (39%), and over 150,000 acres are impervious such as buildings, roads, parking lots, and paved surfaces (14%). Between 2001 and 2011, almost 30,000 acres (nearly 8%) of the NBW were developed, while forested lands decreased by nearly 19,000 acres (4%) during the same time period.⁷

The biological and geographical richness and diversity of the NBW have played an important role in supporting the evolution of vibrant economies in RI and southern MA since the time of the earliest settlers. Early natives settled on the shores of the upper bay in summers, where they would feed off of the shellfish and find the needed resources for transportation, shelter, and heat in the region’s forests. Early European settlers took advantage of the lower bay’s islands and protected harbors with access to the open sea to create a vibrant colonial economy around a leading colonial port in Newport.

ⁱ The coastline is 560 miles long including islands - farther than a car ride from Providence to Richmond, VA.

Activity would later shift to the upper bay and beyond—to Providence, Pawtucket, Fall River, Worcester, Taunton, and Brockton—where the watershed would power the beginning of the nation’s Industrial Revolution.

The impact that economic activity has had on the watershed is evident in the pattern of land development (Figure 2). In the older industrial centers (Worcester, Fall River, Taunton, and Providence), the intensity of impervious surfaces is highest, and it tapers off as you move away from those cities.

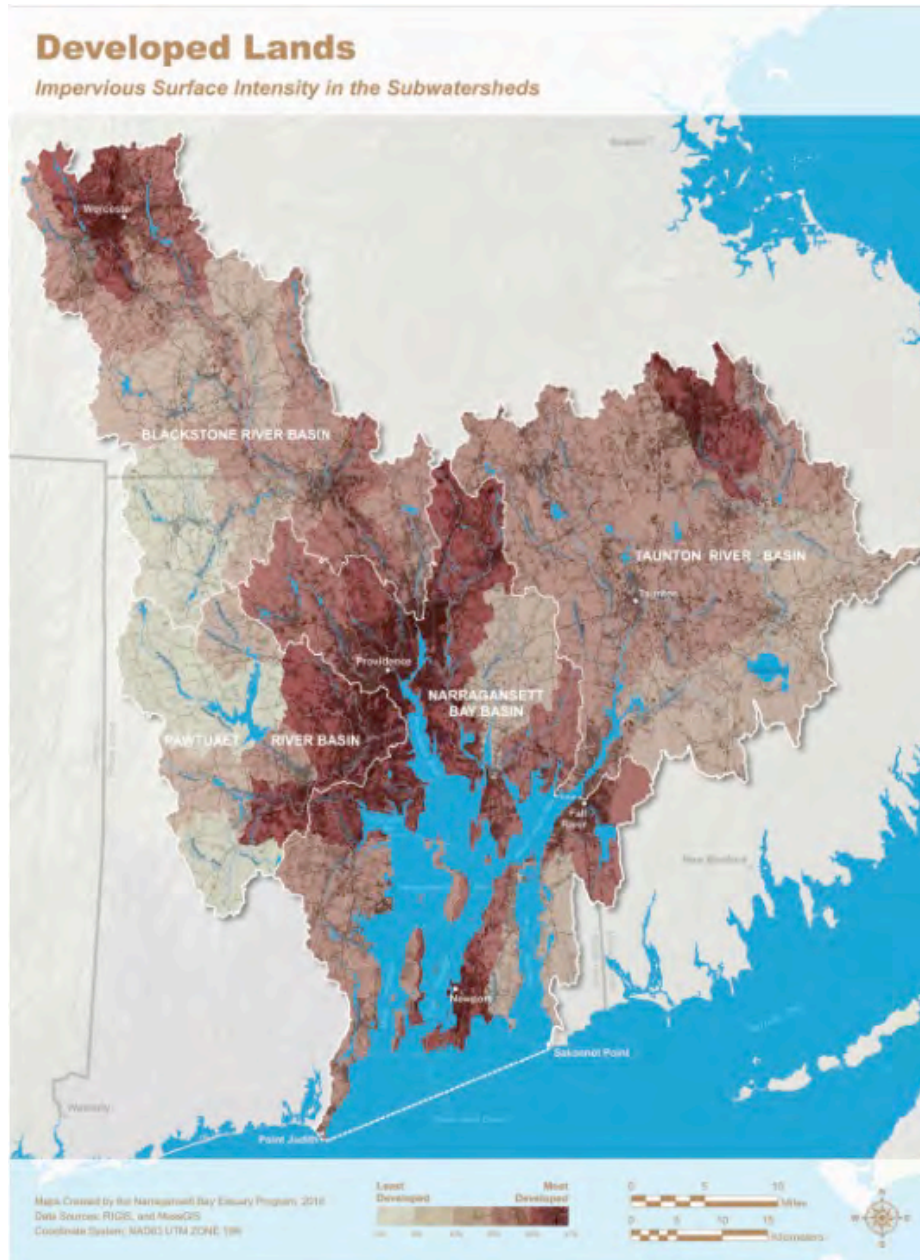


Figure 2: Impervious Surface Intensity in the NBW
Source: Narragansett Bay Estuary Program (NBEP), 2017

There are some notable areas, however, where the intensity of the impervious cover is unexpectedly low. For example, the western Pawtuxet River Basin is substantially less developed despite the close direct distance to Providence. Data shows that there is protected open space, even in areas close to Providence (Figure 3). This preservation of open space has increased in recent years, largely due to state, local, and non-profit efforts.



Figure 3: Protected and Unpreserved Natural Lands in the NBW
Source: NBEP, 2017

The People

Like many places in the United States, the NBW is home to a large and diverse population. Coastal areas such as the NBW have long been home to a disproportionate share of the nation's population. Shoreline counties in the U.S. account for less than 10% of the nation's land area yet are home to nearly 40% of the nation's population.⁸ This can be seen in population distribution in MA and RI where nearly 60% of the population in the states' 2015 population of 7,850,720 lived in shore-adjacent counties.ⁱⁱ

An exact number for the population of the NBW does not exist. The watershed's boundaries do not match political boundaries that are the basis of all demographic and economic data. This presents a problem when estimating either the population or the level of economic activity within the watershed because economic and demographic data are available only at the state, county, and community levels. At the county level, all five of RI's counties—Bristol, Kent, Newport, Providence, and Washington—plus five of MA's counties—Bristol, Middlesex, Norfolk, Plymouth, and Worcester—have land in the NBW. At the community level, there are 105 cities and towns with varying amounts of land within the watershed (Figure 4). In RI, 34 of its 39 cities and towns are at least partially within the watershed, while in MA, 71 of its 351 cities and towns are in the NBW.

ⁱⁱ The shore-adjacent counties concept is used by NOEP in their estimates of the coastal and marine economies.

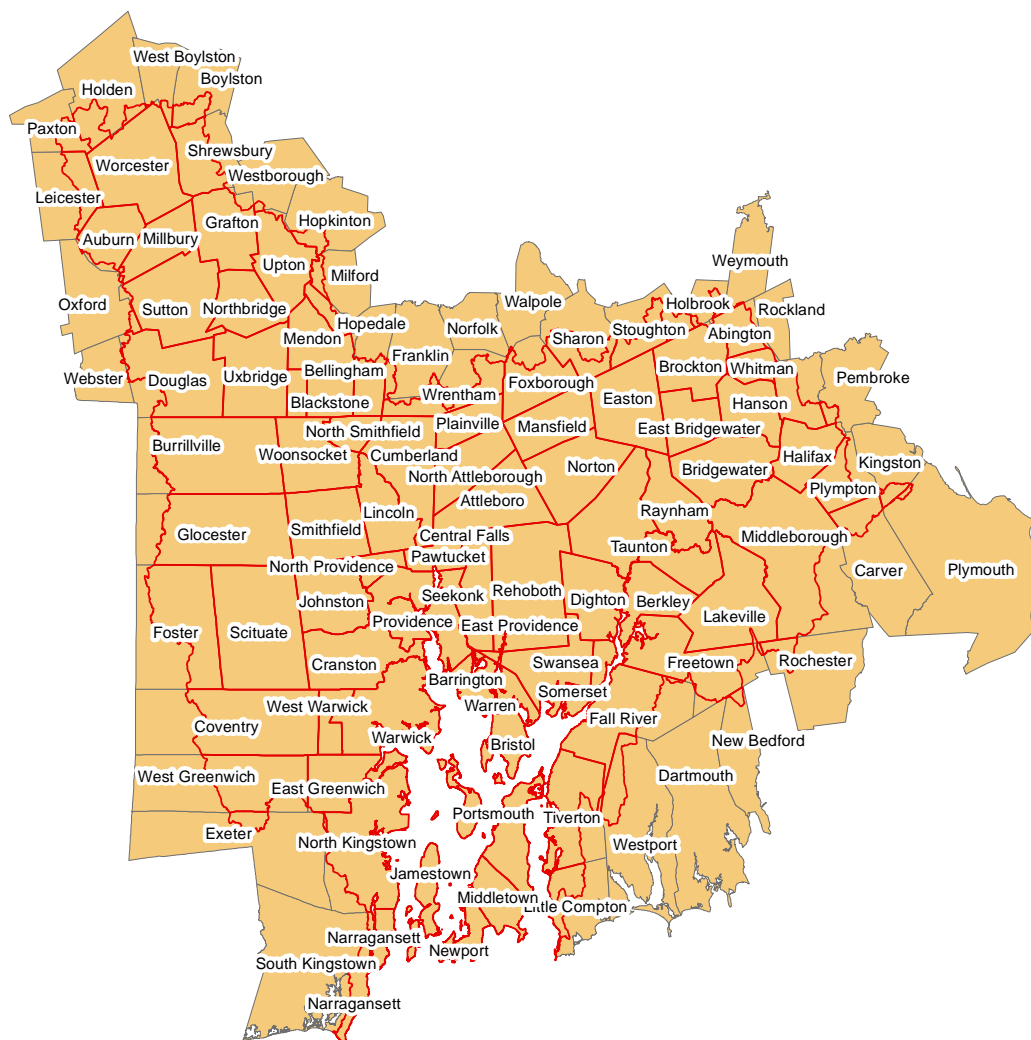


Figure 4: Cities and Towns in the NBW

Source: NBEP, 2017

Scituate, RI and Swansea, MA are two examples of cities/towns whose boundaries fall completely within the watershed, while South Kingstown, RI is only partially in the watershed and New Bedford, MA is barely in the watershed (Figure 4). By adding together the communities' land that fall within the watershed, we estimate the percentage of a county's land that fall in the NBW. For example, all of the land in Bristol County, RI is within the watershed, while 36% of the land in Plymouth County, MA is within the watershed.

To convert these land percentages into demographic and economic percentages, the assumption is made that within the communities, population and economic activity are distributed evenly across the city or town. For example, in West Greenwich, RI, 47% of the land is in the watershed, so 47% of the population is assumed to be in the watershed. Once these numbers have been computed at the city

and town level, we have an estimate of the percentage of population in a county that is in the NBW (Table 2). There are substantial differences in some of these numbers; for example, in Washington County, RI the percentage of the population in the watershed (29%) is substantially higher than the share of land (16%). This differential exists because the more populous communities within the county are within the watershed. These percentages will be used consistently in the report, and in some instances when data are available only at the state level, the same approach is taken when aggregating the county data to the state level. In RI, 88% of the population is in the watershed, and in MA it is 15%.

Table 2: Land and Population Within Watershed

Counties	Area	Population
Bristol, RI	100%	100%
Kent	74%	91%
Newport	82%	93%
Providence	96%	99%
Washington	16%	29%
Bristol, MA	72%	66%
Norfolk	19%	10%
Plymouth	36%	44%
Worcester	20%	42%

Source: NBEP, 2017

In 2015, the population of the two states was nearly 7.9 million, with 86% in MA (Table 3). Within just the 105 cities and towns in the NBW, the 2015 population was 2.6 million, with 71.5% in MA. Not all of the land in these 105 cities and towns is within the watershed, as some cities and towns only lie partially within the NBW, so the population estimate for the watershed is nearly 2 million, with 52% of the people living in MA.ⁱⁱⁱ

Table 3: Population in 2015

	Massachusetts	Rhode Island	Watershed
Population States	6,794,422	1,056,298	7,850,720
Population in Watershed Cities & Towns	1,610,256	1,009,041	2,619,297
Population in Watershed	1,004,959	938,526	1,943,485

Source: U.S. Census Bureau

The NBW's population is highly concentrated, especially in RI where 67% of the watershed's population is in Providence County, which is slightly more than the combined share of Bristol and Worcester counties in MA (Figure 5). Within these counties, population is concentrated in the eight core cities (Worcester, Brockton, Fall River, Taunton, Providence, Pawtucket, Woonsocket, Central Falls). These cities represent less than 8% of the watershed communities but are home to 28% of the watershed's population. Within these core cities, the concentration is substantially higher in RI. The

ⁱⁱⁱ The estimates are computed by assuming that the population is distributed evenly across land, so if 3% of the land is in the watershed, the 3% of the population is in the watershed.

City of Providence accounts for 57% of all core population in RI, while cities of Fall River and Worcester combined account for 64% of the MA core.

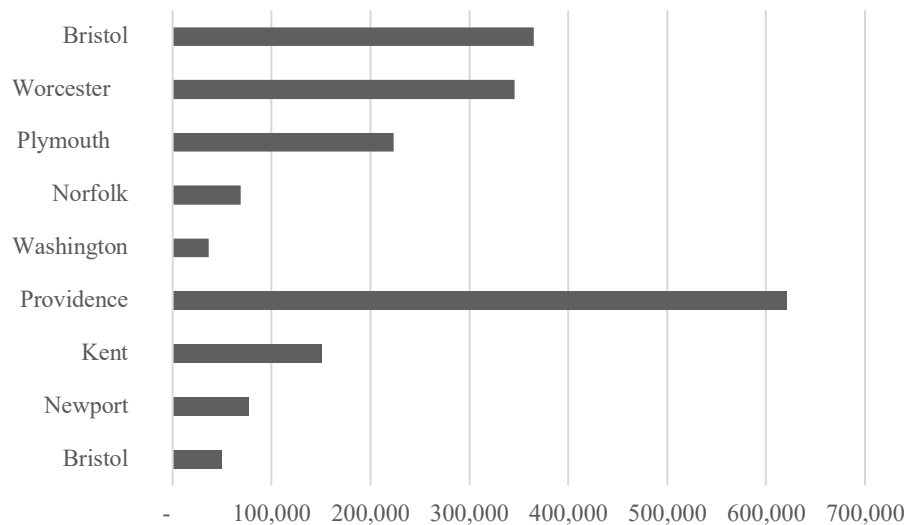


Figure 5: NBW Population in 2015

Source: U.S. Census Bureau

The 7.9 million people in the two states are packed into a relatively small area of about 8,900 square miles (RI and MA ranked 2nd and 3rd in the country in terms of population density). Within the watershed, this squeeze is even tighter, and the population density is higher than the whole of the two states. In RI there are 1,376 people per square mile in the watershed, which is four times higher than the density in cities/towns in the state that are not in the NBW. In the MA portion of the watershed, the population density is 953 people per square mile, slightly higher than the average overall density of 839 people per square mile in MA (including watershed and non-watershed counties).

There is also considerable variation of population density within the watershed, especially in RI where densities range from sparsely populated communities such as Foster and West Greenwich, with densities below the New Hampshire average of 148 people per square mile, to congested cities of Providence and Central Falls, with densities of nearly 10,000 and 16,000 people per square mile. In MA the range is narrower, extending from densities of nearly 4,000 and 3,000 people per square mile in Brockton and Fall River to less than 200 people per square mile in Plympton (Figure 6).⁹

Population Density in the Narragansett Bay Watershed

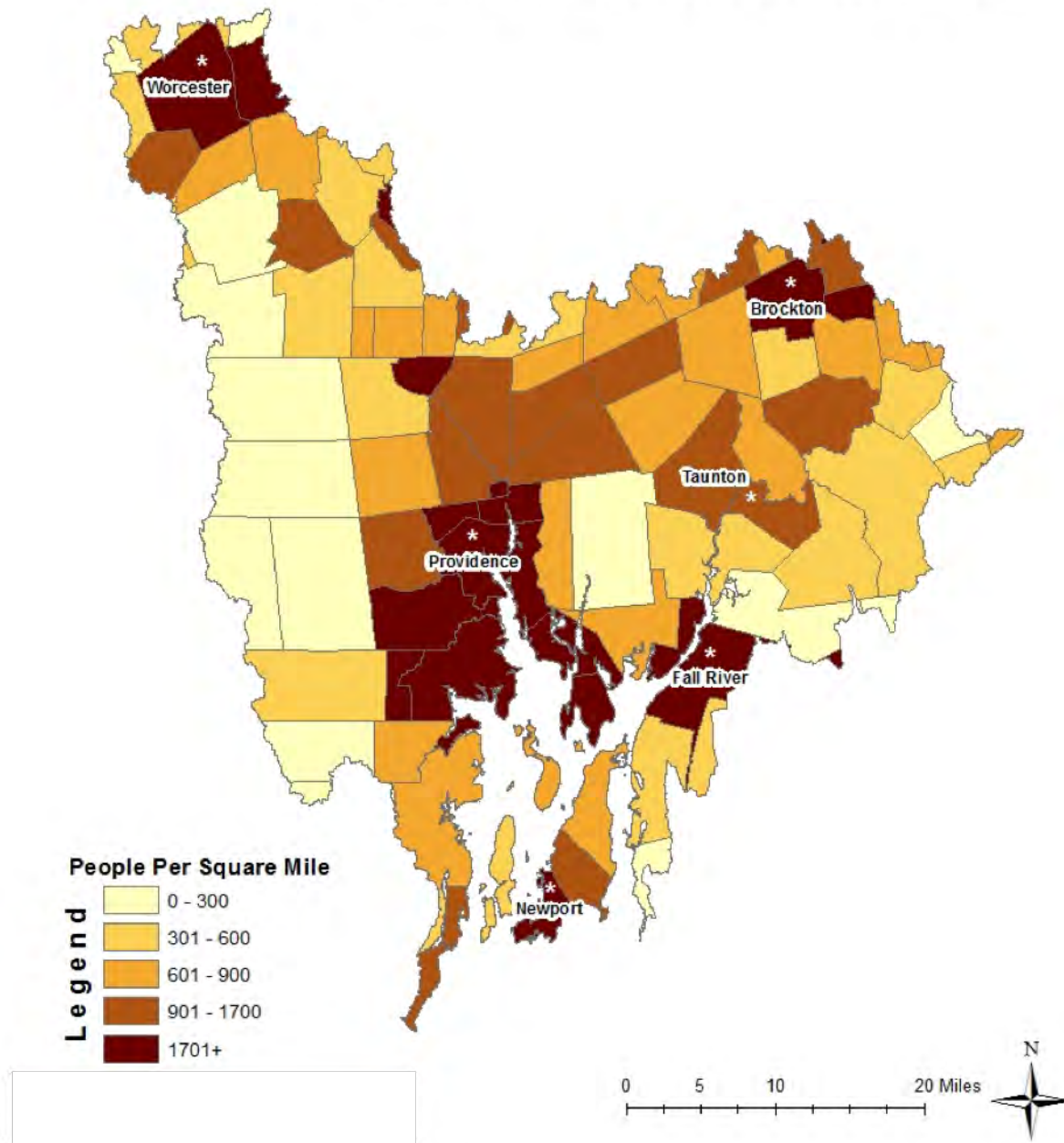


Figure 6: Population Density in the NBW

These densities can be expected to increase with projected population growth, although growth in RI and MA is expected to remain well below the national average. Between 1970 and 2010, population in coastal MA and RI increased substantially slower than in most shoreline areas except those in the Midwest along the Great Lakes, which experienced declines.¹⁰

In MA and RI, between 1990 and 2015, the population increased by 830,831—an increase of 11.8% (Table 4). In MA, the population was growing more than twice as fast as in RI, and it accounted for 94% of the combined RI/MA growth. In the 105 cities and towns within the NBW, the population increased by 254,115, nearly 30% of total growth in the two states. Growth in the watershed, which is the city and town data adjusted for area in the watershed, was a bit slower. In those 25 years, the NBW population increased by 173,262, with approximately 21% of the growth in RI.¹¹

Table 4: Population Change: 1990- 2015^{iv}

	Rhode Island		Massachusetts		Watershed	
	Change	% Change	Change	% Change	Change	% Change
Population in States	52,834	5.3%	777,997	12.9%	830,831	11.8%
Population in Watershed Communities	46,720	4.9%	207,395	14.8%	254,115	10.7%
Population in Watershed	35,728	4.0%	137,534	15.9%	173,262	9.8%

Source: NOAA, 2013

This disparity in population growth is also seen at a smaller scale in the NBW (Figure 7). At the county level, only one county experienced population declines—Newport, RI—which was still feeling the effect of the Navy’s relocation of the Cruiser Destroyer Force Atlantic from Newport and Middletown to Norfolk, VA (Table 5). Among the other four counties in RI, growth rates ranged from less than 1% in Bristol and Kent Counties to nearly 9% in Washington County. Growth was concentrated in Providence, however, where more than 90% of all growth occurred. In MA, there was little variation in growth rates, with the highest rate in Worcester County.

Table 5: Watershed Population Change: 1990-2015

Rhode Island	Change	% Change	Massachusetts	Change	% Change
Bristol	225	0.46%	Bristol	46,202	14.50%
Kent	941	0.63%	Norfolk	9,696	16.40%
Newport	-5,210	-6.37%	Plymouth	28,503	14.70%
Providence	36,882	6.25%	Worcester	52,192	17.80%
Washington	2,890	8.71%			
RI Watershed	35,728	3.96%	MA Watershed	136,593	15.90%

Source: NOAA, 2013

At the community level in RI, eight cities and towns experienced population declines between 1990 and 2015, with the biggest losses on Aquidneck Island where the county experienced a 6.4% decline. More recently, from 2010-2015, these losses became more widespread with 14 of the state’s cities and towns experiencing population decline. The biggest gains, meanwhile, were in the non-NBW communities in the state. This is especially true in Washington County where population expanded faster than in the NBW. In MA, population growth was faster and also more widely dispersed. There

^{iv} At the national level, in 2010 35% of the White population lived in coastal communities, while for Black or African Americans, Hispanics, and Asians the numbers were 47%, 49% and 60%.

were only three communities that lost population, with Fall River accounting for over 90% of the loss. Meanwhile, growth was centered in the smaller towns with a 1990 population of less than 10,000, with one cluster south of Worcester and one cluster around Taunton. The population in these towns increased 33%, about twice the overall rate of increase.

Population Growth Rate in the Narragansett Bay Watershed by Cities/Towns, 1990-2015

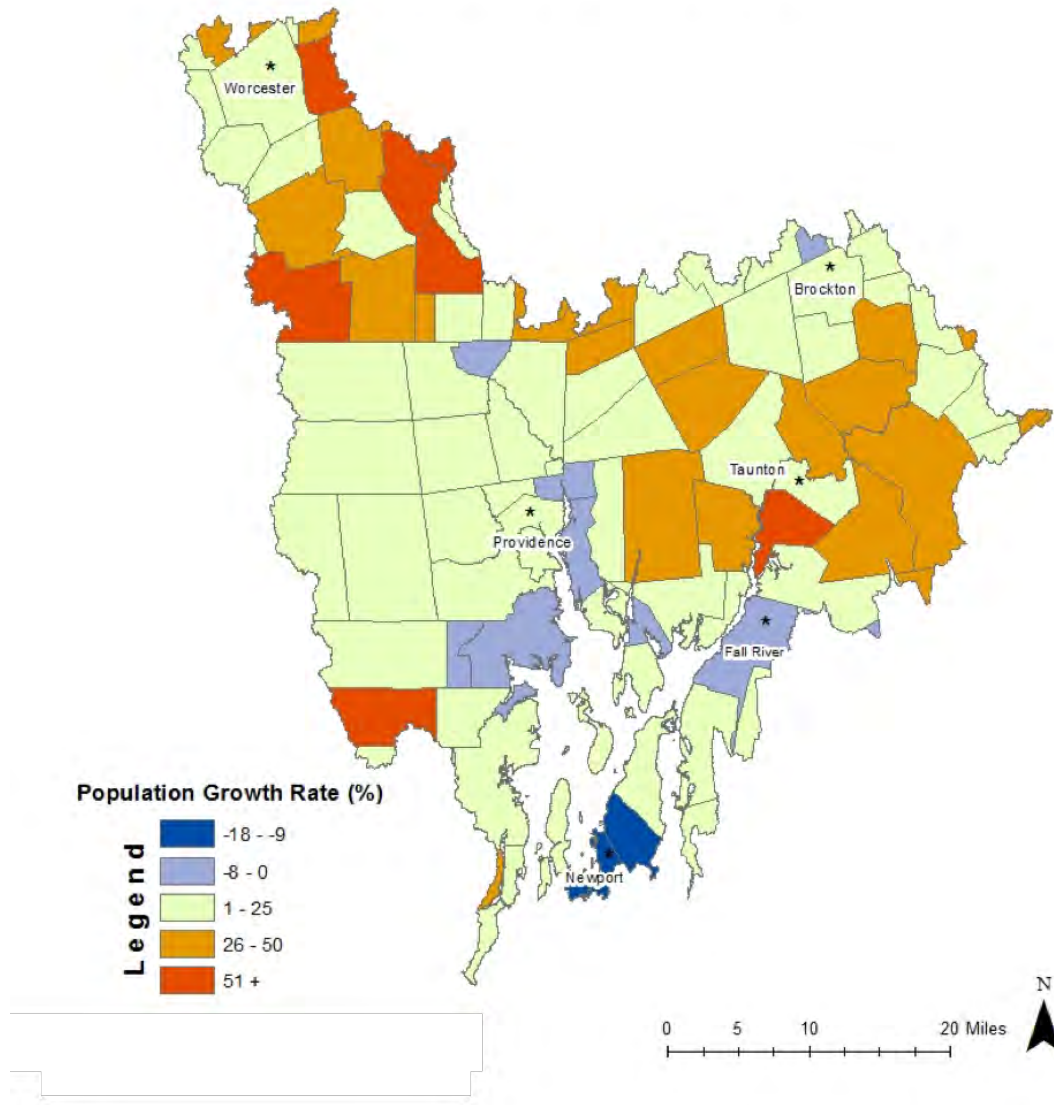


Figure 7: Population Growth in the NBW by Cities/Towns, 1990-2015

As a result of this growth, population within the NBW remains highly concentrated—a pattern reminiscent of the Industrial Era. In RI in 2015, 67% of the watershed’s population was in Providence County and more than 33% was in the cities of Providence, Cranston, and Warwick. This reflects the

highly concentrated growth between 1990 and 2015. Providence County accounted for 85% of the state's population growth in this period, and more than 33% was in the City of Providence. In MA, about 70% of the 2015 population was in Worcester and Bristol Counties,^v and more than 33% of the million people living in the MA watershed lived in the cities of Worcester, Brockton, and Fall River.^{vi}

The people that comprise the population in the NBW are also quite diverse. In the NBW, significant differences exist between the demographic profiles of the industrial cities of Providence, Pawtucket, Woonsocket, and Central Falls in RI and Worcester, Brockton, Fall River, and Taunton in MA and the rest of the watershed. These eight cities were the core of the region's manufacturing sector 100 years ago, and their profile today is a legacy of their history as primary destinations for nonwhites and immigrants who settled in the area to work in the region's factories. Today, these core cities are home to slightly over 1/3rd of the watershed's population but nearly 2/3rd of the watershed's nonwhite population. In those core cities, 36% of the population is nonwhite, and in Brockton and Providence, the share is over 50%. In the remaining communities, 92% of the population is white, and in 1/4 of these communities, it is greater than 96% (Figure 8).^{vii}

^v These figures are based on U.S. Census data that have been adjusted by the area of each city and town that is in the watershed. For example, West Greenwich in RI is 47 % within the watershed, so the town's 2015 watershed population is 47% of the total population of 6,134.

^{vi} The population figures here are not the actual population because they have been adjusted to reflect the share of the land in the watershed. For example, New Bedford had a population of 94,958, but only 4% of the land was in the watershed so in our numbers New Bedford's population is 3,762. All of the demographic data for the cities and town are from the Census using Quick Facts <http://www.census.gov/quickfacts/table/PST045215/00>. There are no data for communities with population of 5,000 or more. This gives U.S. info on most of the cities & town – but not all. The web site city-data.com has extensive data on even the small one so this was used for the missing demographic data except for aged 65+. For this variable, the closest town was used.

^{vii} The city and town population shares are from the 2010 Census. The watershed data, meanwhile has been adjusted to reflect only the population in the watershed so the not in watershed includes shares of the watershed cities and towns not in the watershed plus the cities & towns not in the watershed.

Percentage of White Population in the Narragansett Bay Watershed by Cities/Towns (2010)

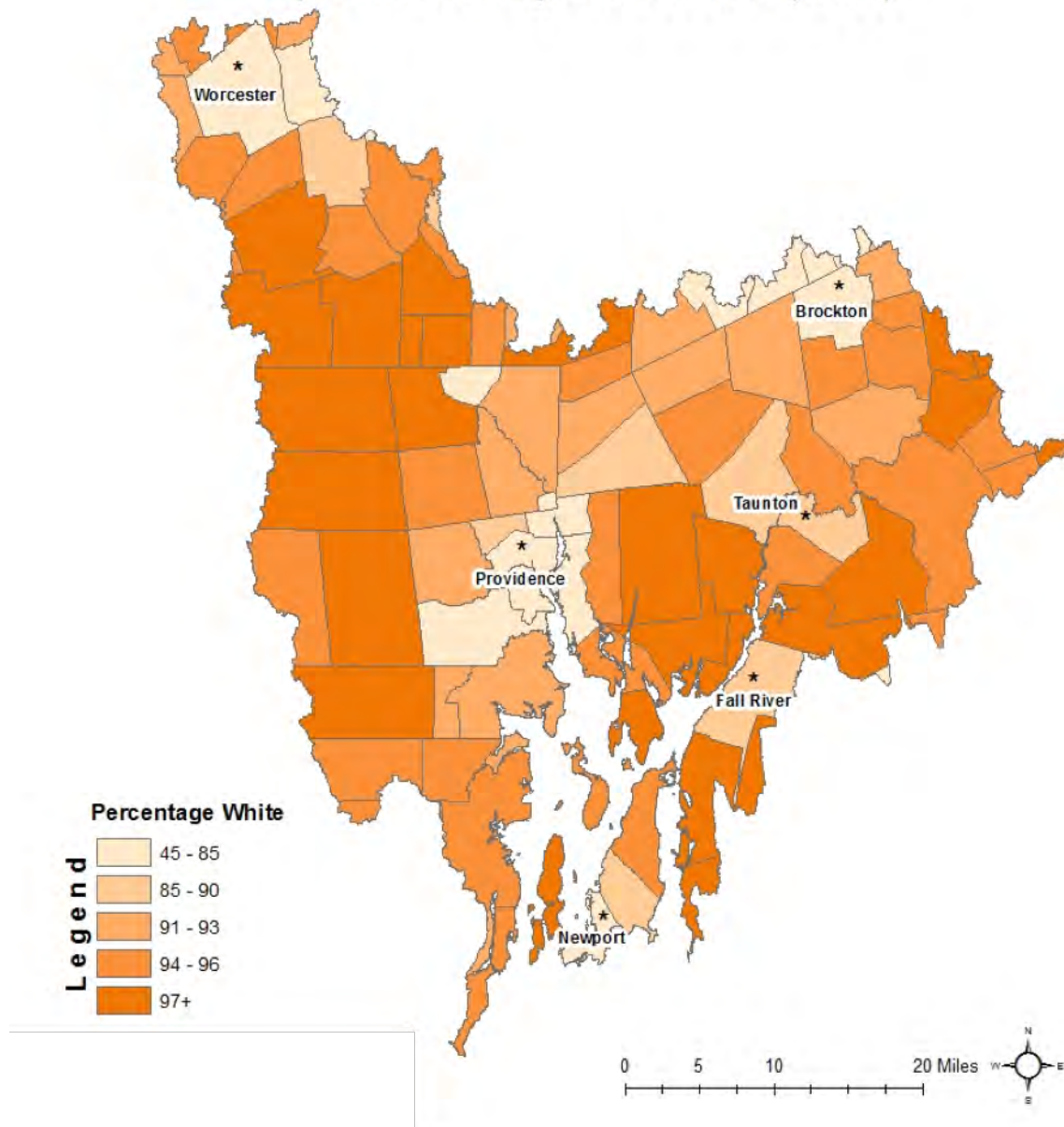


Figure 8: Percentage of White Population in the NBW by Cities/Towns, 2010

A similar pattern exists with the foreign-born population—the core cities with high concentrations of nonwhites also have high concentrations of foreign-born individuals. About one of every eight residents in the NBW is foreign-born, but in the core cities where nearly 2/3rds of the watershed’s foreign-born population live, the number is closer to one of every four. The highest concentrations are in Central Falls (38%) and Providence (30%) (Figure 9).

Percentage of Foreign Born Population in the Narragansett Bay Watershed by Cities/Towns (2010)

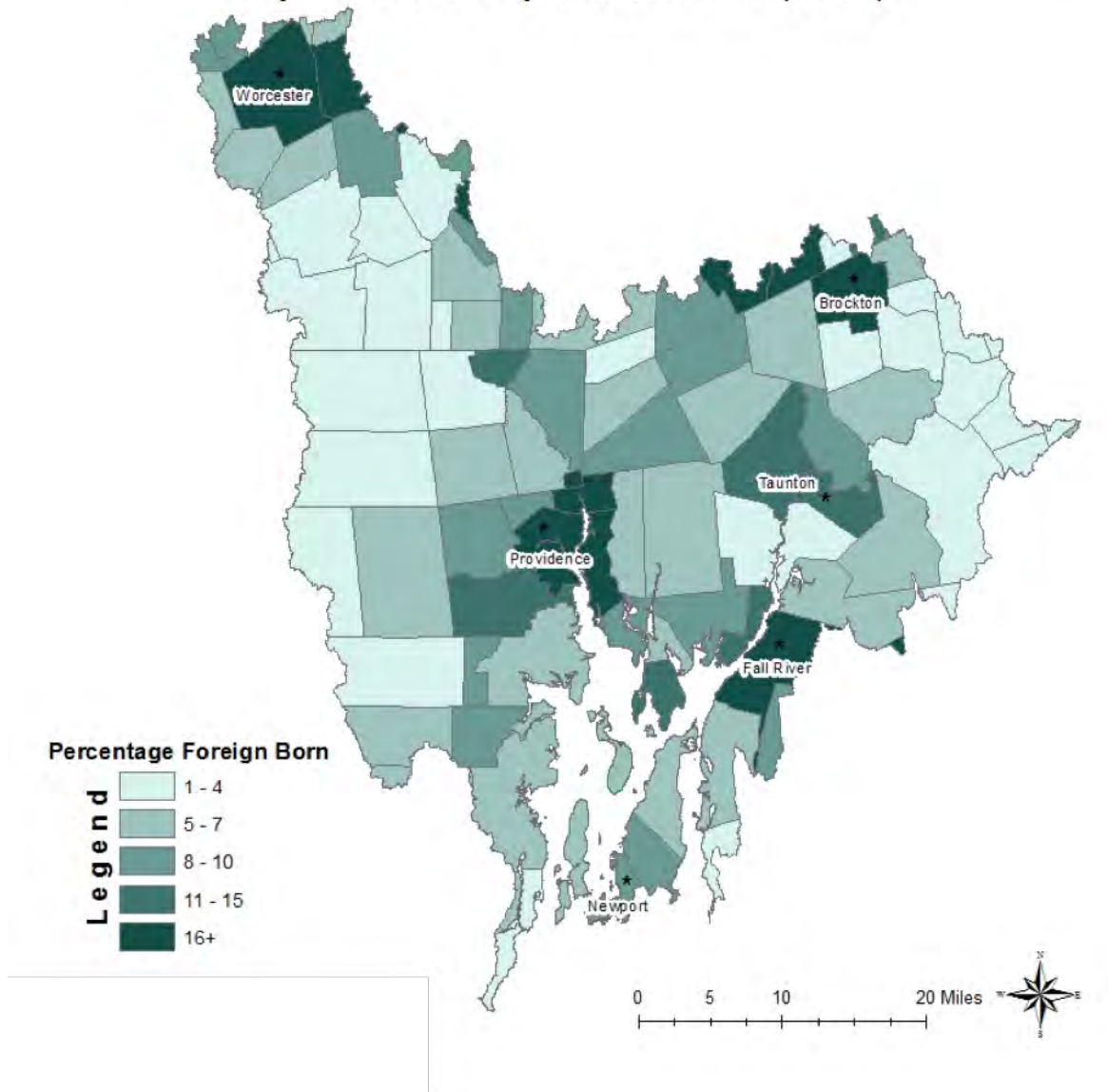


Figure 9: Percentage of Foreign Born Population in the NBW by Cities/Towns, 2010

The legacy of the manufacturing sector in these core cities is also evident in education levels (Figure 10). The indicator is the percentage of those 25 years of age or older who have at least a bachelor's degree; in the watershed, 31% of people have a bachelor's degree. In the areas outside of the core cities, 35% of the population has a bachelor's degree. This is 50% higher than the rate in the core cities. There are, however, a few "outliers"—communities with high levels of foreign-born population and high education levels. In the NBW, there are 15 communities where more than 50% of the population has a bachelor's degree, and in 12 of them, the share of foreign-born individuals in the population averages 6.5%. In Sharon, Westborough, and Shrewsbury, however, the foreign-born

share averages 20%. This suggests there are two waves of foreign-born individuals in the region—those related to the first wave of immigrants that ended about a century ago who worked in factories, and those in the second wave who began arriving in large numbers in the 1980s who work in the tech sector. In each of those three towns, the Asian share of the population is substantially higher than the state average—twice the rate in Sharon and three times in Shrewsbury and Westborough.

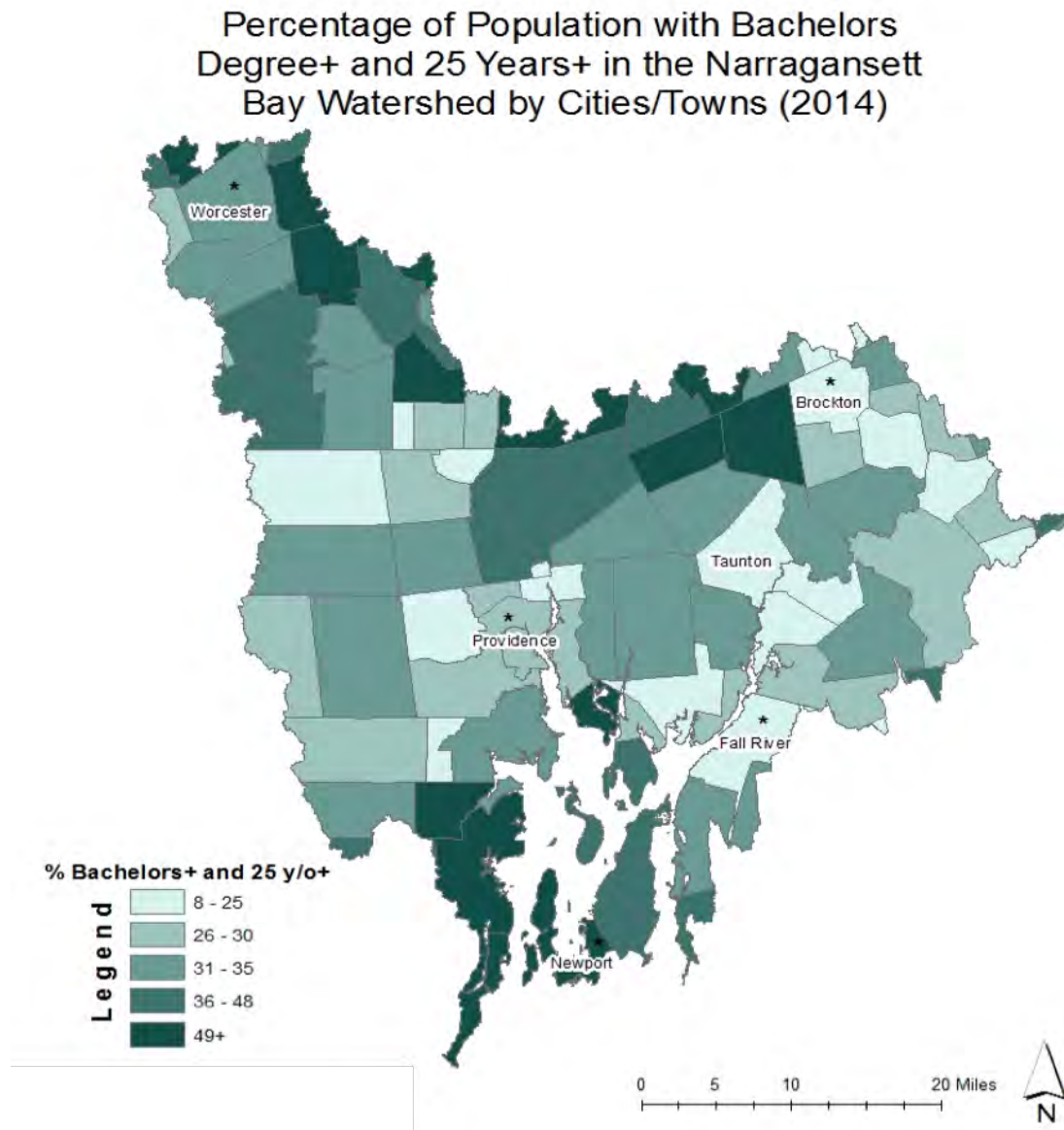


Figure 10: Percentage of Population with Bachelor’s Degree+ and 25 Years+ in the NBW by Cities/Towns, 2014

There are also significant differences in age across the watershed, and here we use the share of the population 65 or older as the metric (Figure 11). With that metric, MA and RI are both older than the U.S. average, and within the watershed, RI is slightly older than MA, and the core cities are slightly younger than the remainder of the watershed. There is, however, quite a bit of variance in both groups.

The elderly's share of the population in the densely populated core cities of Providence and Central Falls is among the lowest in the watershed, as well as in some of the most sparsely populated towns, such as West Greenwich and Douglas. The older communities, meanwhile, are all relatively small communities. In RI, the communities with the highest percentage of those over 65 are North Providence (19.5%), Tiverton and Little Compton (19.4%), and Johnston (19%), while in MA, the oldest is Somerset (21.5%).

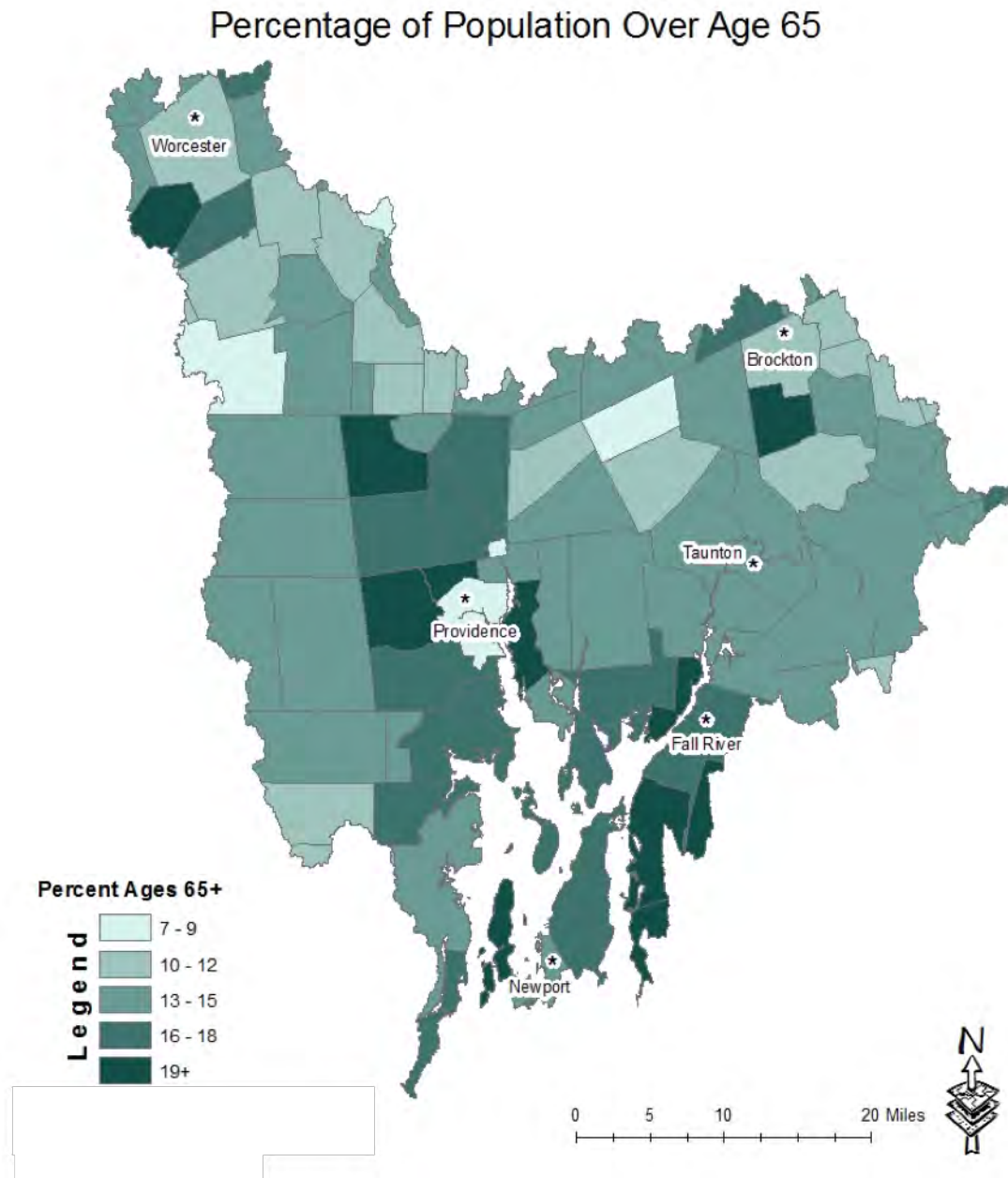


Figure 11: Percentage of NBW Population Over Age 65

These demographical differences across the NBW are also reflected in income and poverty statistics (Figure 12). The poverty rate is higher in RI (14.3%) than in MA (11.6%), although both states are

below the U.S. average of 14.8%. Within the watershed, however, there are six communities in RI and five in MA with poverty rates above the U.S. average. Poverty rates are highest in the core cities where all rates were in double-digits. The highest rates in MA were in Fall River (23%) and Worcester (22%), while in RI the rates in all four core cities exceeded 20%, and in Providence and Central Falls the rate was 30% or higher. At the other end of the scale, there were 29 cities and towns in MA and four in RI with poverty rates below 5%. In MA, these communities were spread across the watershed, while in RI they were in the areas surrounding Providence, Barrington, Gloucester, Smithfield, and North Smithfield.

**Poverty Rates in the Narragansett Bay Watershed
by Cities/Towns**

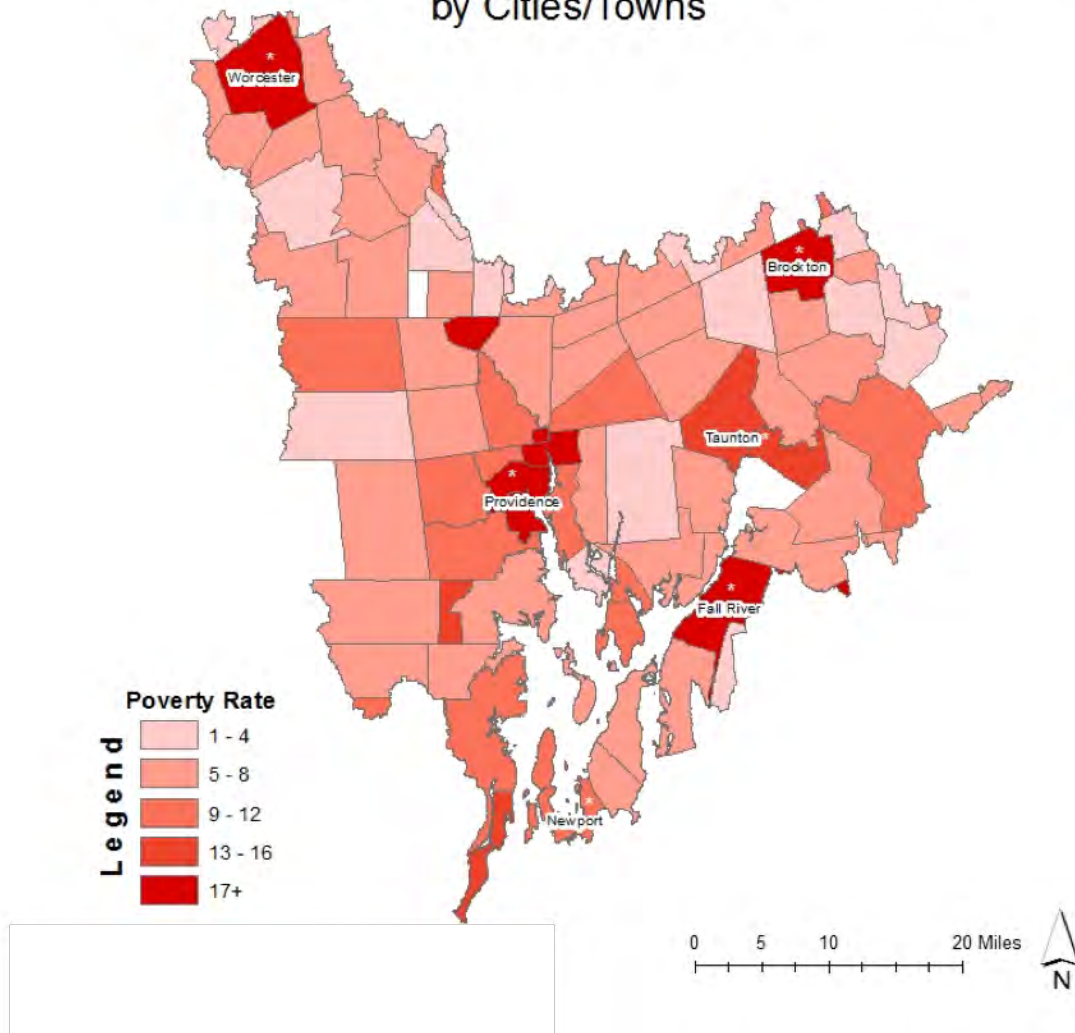


Figure 12: Poverty Rates in the NBW by Cities/Towns

Income distribution follows a pattern similar to the poverty rate distribution in the NBW (Figure 13). In both MA and RI, median family income is above the U.S. average (\$53,482), although it is 21%

higher in MA (\$67,846) than in RI (\$56,423).^{viii} Within the NBW, there are 13 communities—six in MA and seven in RI – with median incomes below the national average. Included in this 13 are all of the eight core cities and New Bedford, plus Webster, MA, and West Warwick, and East and North Providence, RI. The high-income communities, meanwhile, have well-above state averages for homeownership rates and are within commuting distance of Providence, Boston, or Route 495 in MA. In MA there are six communities with median incomes more than twice the national average and only one in RI with a median income above \$100,000.^{ix}

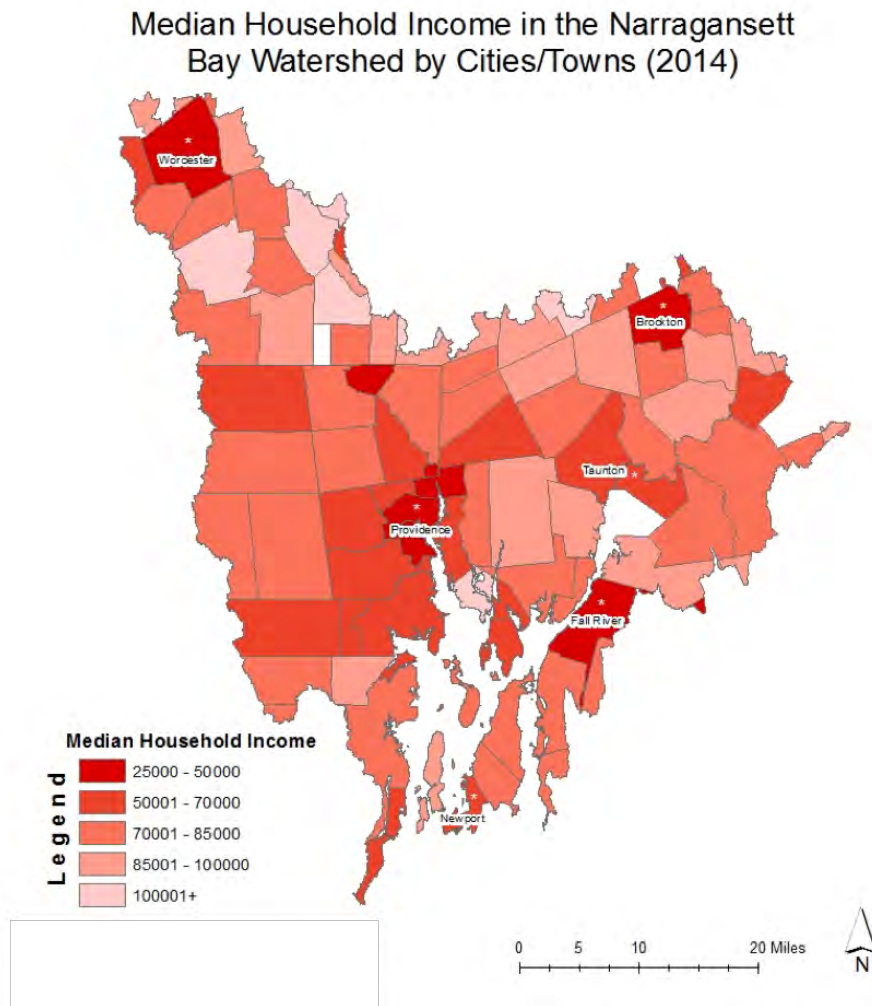


Figure 13: Median Household Income in the Narragansett Bay Watershed by Cities/Towns, 2014

It is also possible to examine, at least at the county level, the sources of income based on Bureau of Economic Analysis (BEA) data on the composition of income and wages. The largest component of income in all counties is net earnings from work, which ranged from 69% in Providence, RI to 58% in Norfolk, MA. At the state level, this share was substantially higher in RI than MA, suggesting more

^{viii} These figures are from the U.S. Census and they are for the years 2010-2014.

^{ix} The communities in MA are Mendon, Upton, Hopkinton, Norfolk, Sutton, and Sharon, and in RI it is Barrington.

Rhode Islanders depend on their paycheck as a main source of income. A second source of income is dividends, interest, and rent, with large variations across counties. In Bristol and Providence counties in RI, less than 15% of income comes from dividends, interest and rent, while in Washington and Norfolk counties, they account for more than 25% of income. This is consistent with the fact that these are the watershed counties with the highest median family income, and therefore experience the highest returns to capital (interest).

Table 6: Composition of Net Earnings: 2015

	Dividends, Interest, and		
	Net Earnings	Rent	Transfers
Bristol	65%	13%	22%
Kent	68%	22%	9%
Newport	68%	16%	16%
Providence	69%	14%	17%
Washington	60%	27%	12%
Bristol	66%	16%	19%
Norfolk	58%	26%	16%
Plymouth	61%	15%	24%
Worcester	64%	21%	15%

Source: BEA

It is more difficult to interpret the transfer component of income because it includes sources that reflect age (Social Security and Medicare) and sources that reflect the lack of earnings (unemployment benefits, workers' compensation, and Medicaid). Within the NBW, more than 1/5th of income comes from transfers in Bristol, RI and Plymouth, MA, both of which have lower than average poverty rates and above average elderly shares of the population. The county with the smallest share from transfers is Kent, RI with 9%.

The watershed is clearly a diverse region, with significant variations in the demographics between the two states and across the cities and towns. There are especially large differences between the demographics of the region's older, core cities and the more sparsely populated communities distant from these cities. At the state level, RI's population is growing slower, more ethnically diverse, a bit older, more likely to be foreign-born, and more concentrated in the older urban core. Rhode Islanders also have higher rates of poverty, lower incomes, and more of that income comes from wages and salaries, although these differences are smaller than the core-noncore differences.

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¹ Sources: NBEP, 2017; RIDEM, 2009.

² Sources: Raposa & Schwartz, n.d.; RIDEM, 2009.

³ Source: NBEP, 2017.

⁴ Source: Raposa & Schwartz, n.d.

⁵ Sources: Chintala, et al., 2016.

⁶ Source: NBEP, 2017.

⁷ Source: NBEP, 2017.

⁸ Source: NOAA, 2013.

⁹ Source: Carroll, M., 2013.

¹⁰Source: NOAA, 2013.

¹¹ Source: NOAA, 2013.

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