Princeton's Sustainability Progress Report:

Where do we stand and where do we go from here?

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Executive Summary

Meeting the needs of the present without compromising the ability of future generations to meet their own needs is the standard definition of sustainable development. The sustainability movement is a response to the imbalance between human activity and natural systems – an imbalance that is stressing the earth's resources and its ecosystems to life-threatening limits. Many forces – including dramatic increases in population growth, urbanization, industrialization, consumption, and energy use – are polluting our air and water, denuding forests, destroying wetlands, and diminishing habitats. We are off-kilter, and the future looks foreboding. It's up to each of us, in whatever spheres we live and work, international, national, and local, to change our course. To accomplish that, we need to take action to strike a healthy balance between the Earth and its inhabitants, an equilibrium between human activity and nature in ways that are both economically sound and socially just. As members of communities and families, as policymakers, industrialists, business owners, financiers or schoolteachers, we must take stock of how our behaviors at home, at work, on the road, and in the marketplace impact the earth so that human activities and natural systems become sustainable.

The best place to start is where we live – our own community. Take Princeton's carbon footprint, for example. Our emissions inventory takes into account carbon emissions from the use of gas and electricity only. A more comprehensive emissions inventory that will include emissions from oil, transportation, and solid waste operations will be done in the near future. Nevertheless, what we know in 2009 is that Princeton's businesses emit about 70 percent of our overall carbon emissions from using electricity and gas, while households emit about 28 percent, and local government buildings emit about three percent. Even with this partial inventory of carbon dioxide (CO_2) emissions, however, this plan is a blueprint for action that will help all sectors reduce emissions, reduce energy costs, and become more energy efficient.

How successfully we will meet our goals depends on the commitment of each and every member of our community. It will be through the collective sum of all the actions taken by the people who govern our township and borough; who build, redevelop and use each building and home; who run each place of business; who teach in each school; who buy each product and service; who worship in each congregation; and who play in each playground that we secure a brighter, greener future. This plan is Princeton's contribution to helping that future unfold.

Why and how was the Sustainable Princeton Community Plan developed?

The Sustainable Princeton Community Plan was the result of a community-wide effort to develop a long-term vision, an action plan, and a way to track progress towards achieving sustainable communities in the former Princeton Township and Princeton Borough. Working with the Princeton community's local and school officials, businesses, community organizations, academic institutions, and residents, Sustainable Princeton created a sustainable community plan that includes goals, indicators (ways to measure progress), and actions for four sectors of the community:

Municipal Government
Schools
Businesses & Non-profit Organizations
Residents

The plan was an initiative of the Princeton Environmental Commission (PEC) to develop a strategic sustainability plan for both the former Princeton Borough and Princeton Township. On behalf of the municipalities, the commission submitted a proposal to and received a grant from the New Jersey Municipal Land Use Center (MLUC) at The College of New Jersey. The grant enabled the municipalities to develop the plan with the expertise of the staff at the New Jersey Sustainable State Institute (NJSSI) at the Bloustein School for Planning and Public Policy located at Rutgers, The State University of New Jersey.

Who was involved in developing the Sustainable Princeton Community Plan?

The former Princeton Township Committee and Princeton Borough Council passed a resolution creating the Sustainable Princeton Steering Committee to oversee the development of the plan. The Steering Committee was made up of key officials, including the Mayors of both communities, and local leaders from the Princeton Environmental Commission, the business community, the school district, civic organizations, congregations, and other stakeholders. The Steering Committee held two public workshops, in October 2007 and March 2009, to gather input on the plan. In March, community members joined one of four groups headed by members of the Sustainable Princeton Steering Committee as noted below.

Municipal Working Group Lee Solow, Chair
Wendy Kaczerski, Chair, Princeton Environmental Commission

Business and NonProfit Working Group
Matt Wasserman, Chair

Schools Working Group
Liz Cutler and Steve Carson, Co-Chairs

Resident Working Group
Heidi Fichtenbaum and Bobby Parmet, Co-Chairs Diane Landis, Sustainability Coordinator

These groups were tasked with implementing the action plans for their respective groups. In addition, to keep the community well-informed, a web site --sustainableprinceton.org -- was intended to serve as a clearinghouse for information and activities related to Sustainable Princeton.

What did the Sustainable Princeton Community Plan expect to accomplish?

The Plan was a call to action by each of the sector working groups to integrate sustainable practices into our homes, places of business, schools, and local government to reach six goals:

- Goal 1: Greening the Built Environment
- Goal 2: Improving Transportation and Mobility
- Goal 3: Building a Strong Local Green Economy
- Goal 4: Protecting Environmental Health and Natural Resources
- Goal 5: Curbing Greenhouse Gas Emissions and Climate Change through Energy Conservation and Renewable Energy
- Goal 6: Fostering an Educated, Engaged, Vibrant, and Socially Responsible Community

Introduction

Princeton at a Glance

Princeton Borough and Princeton Township were the two municipalities that made up "Princeton," New Jersey, in Mercer County prior to 2013. They were consolidated into the Municipality of Princeton on January 1st, 2013.

The consolidated Princeton, highlighted in red below, is a 18 square mile area. The Princeton community, which is equidistant to Philadelphia and New York City, is conveniently located in close proximity to major train lines and highways that serve dozens of commuting residents.

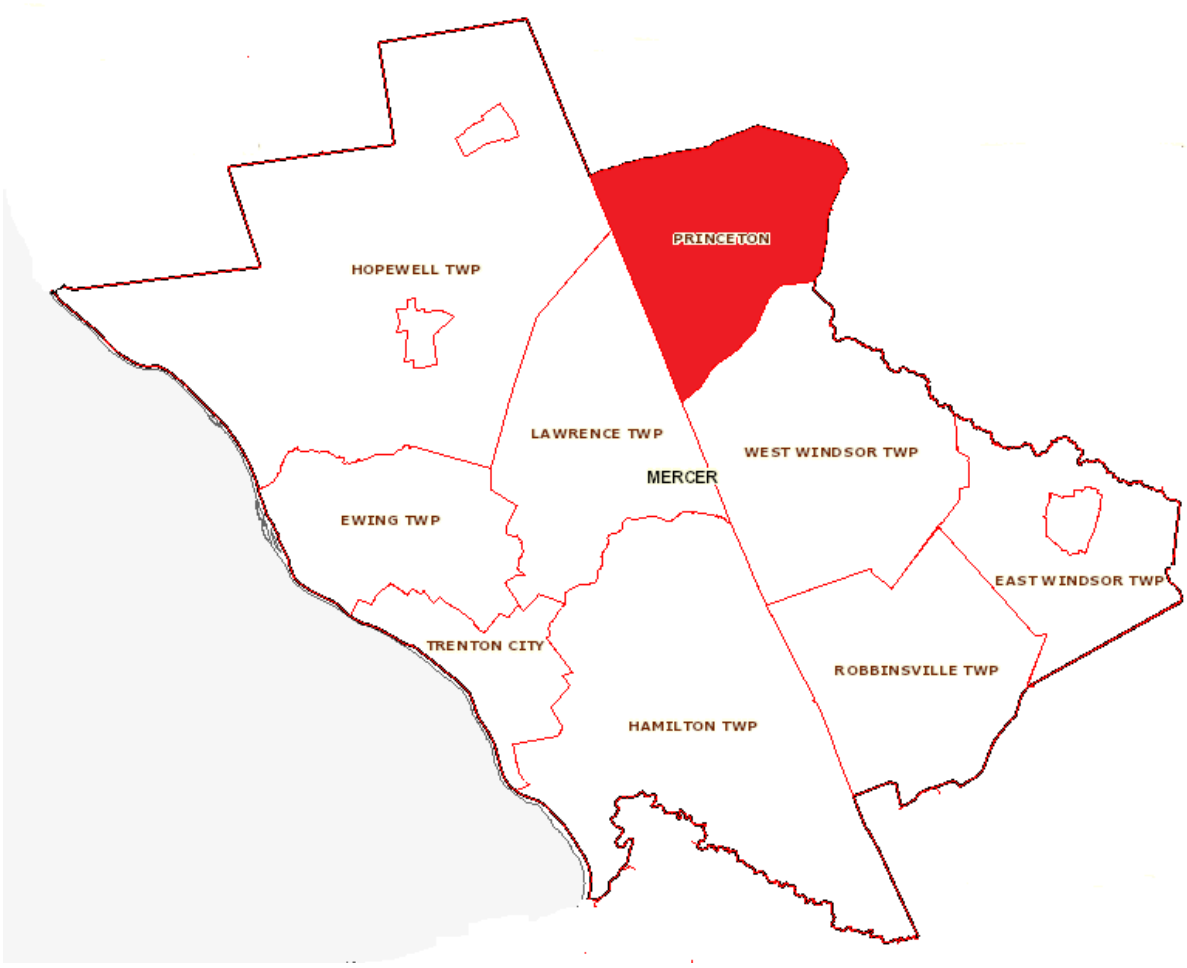


Figure 1.11 Map of Mercer County

In this map of Mercer County, New Jersey, the Municipality of Princeton is highlighted in red. The inset highlights Mercer County on a map of New Jersey.

Quick Facts [1]	2017
Size	18.1 square miles
Population	28,936
Population Density (approx)	1,599 people/sq mile
Median Household Income	$114,645
Median Property Value	$780,300
Median Age	32.4
Poverty Rate	5.97%

Table 1 Demographic Information about Princeton

[1] Source: https://datausa.io/profile/geo/princeton-nj/

Progress on Indicators

Goal 1: Greening the Built Environment

What do we want to achieve?

Visions for the future

Our vision for Princeton is a place that utilizes green building, sustainable landscaping, and green 'housekeeping' practices that not only minimize the consumption of energy, water, and materials and minimize waste and emissions but also help to regenerate the natural environment and create healthier living places for residents.

What do we see?

Current trends and new approaches

Buildings affect our health and environment in countless ways. The design, construction, operation, maintenance, and removal of buildings takes enormous amounts of energy, water, and materials, and generates large quantities of waste, air and water pollution, as well as creating stormwater runoff and heat islands. Where and how they are built

[1] Source: U.S. Census 2007 Population Estimates and 2000 Demographic Profiles
town size from Princeton's website at http://www.princetontwp.org/profile.html

affects wildlife habitat and corridors and the hydrologic cycle, while influencing the overall quality of human life.

According to the U.S. Green Building Council, buildings in the U.S. are responsible for one third of all greenhouse gas emissions, two thirds of electricity use, a third of the solid waste stream, and one eighth of potable water consumption. They contribute to climate change by releasing carbon dioxide into the atmosphere through the use of electricity generated from non-renewable and carbon-based fuels. A typical home emits nearly 9,000 pounds of carbon dioxide per person per year; altogether, residences make up about 17% of the nation's carbon dioxide emissions.[2] Moreover, according to the Environmental Protection Agency, Americans spend 90% of their time indoors, where concentration of pollutants are often much higher than outside. Therefore, furthering "green" in the built landscape is important for both the environment and human health. Though it may seem implied that our lawns are "green," many homeowners over apply pesticides and fertilizers, which leads to pollution through contaminated stormwater runoff. In addition, the energy and resources needed to maintain a yard -- including the use of leaf blowers and costly municipal leaf collection services -- can be put to more efficient use that complements the natural environment.

As the health and environmental impacts of development become more apparent, the field of "green building" is gaining momentum. Green or sustainable building is the practice of creating healthier and more resource-efficient models of construction, renovation, operation, maintenance, and demolition. Research and experience increasingly demonstrate that when buildings are designed and operated with their lifecycle impacts in mind, they can provide significant environmental, economic, and social benefits. Elements of green building include:

- Appropriate siting of structures to maximize sunlight
- Energy efficiency and renewable energy
- Water stewardship
- Environmentally preferable building materials (renewable, abundant, and local)
- Waste reduction
- Avoidance of toxics
- Healthy indoor environmental quality
- Sustainable landscaping
- Maximize existing infrastructure

Green design reduces energy use and material consumption not only to mitigate environmental impacts but also to decrease construction and operation costs as well as to decrease demand on infrastructure. Additionally, sustainable landscaping increases native

[2] Alex Hutchinson, "Know Your Footprint: Energy" Popular Mechanics. June 2007.

plant diversity, provides food, cover, and nesting areas for wildlife, and reduces stormwater runoff that washes sediment and pollutants into local rivers and streams. As a result, the community benefits by avoiding environmental degradation, enjoying healthier indoor environments, and taking advantage of the amenities resulting from development at lower costs.

In Princeton Township, green cleaning products are used in municipal buildings and facilities to eliminate hazardous materials being flushed into the natural environment. Princeton University has established sustainable building guidelines that employ the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) criteria, while public schools in the Princeton area have conducted energy audits on buildings and facilities and are developing energy action plans accordingly. Princeton community leaders have established sustainable landscaping guidelines. Princeton hopes to encourage green building through the creation and training of a Green Building Taskforce and development of green building guidelines and policies.

How are we doing?

Indicators of success

1.1: Green Buildings
1.2: NWF Certified Wildlife Habitats
1.3: Impervious Surfaces
1.4: Water Consumption

What are we doing?

Actions to achieve this goal

- For Municipal Government (MG) actions, see page 96
- For School (S) actions, see page 136
- For Business & Non-profit (BN) actions, see page 157
- For Residential (R) actions, see page 178

1.1. Indicator: Green Buildings

Project Name	Owner	Rating System
Studio 860	Lasley Brahaney Architect and Construction	LEED NC v 2.2 Certified
Nassau Inn Addition	Nassau Inn	LEED NC v 2.2 Certified
45 Linden Lane	Homeowner	LEED Homes v 2008 Platinum
WCC New Academic Hosuing	Princeton University	LEED Core and Shell v 2009 Certified
Short Term Academic Housing	Princeton University	LEED Homes v 2008 Silver

Table 2 Certified LEED Projects in Princeton

Source: U.S. Green Building council- New Jersey Chapter. http://www.usgbcnj.org/page2.php?id=8

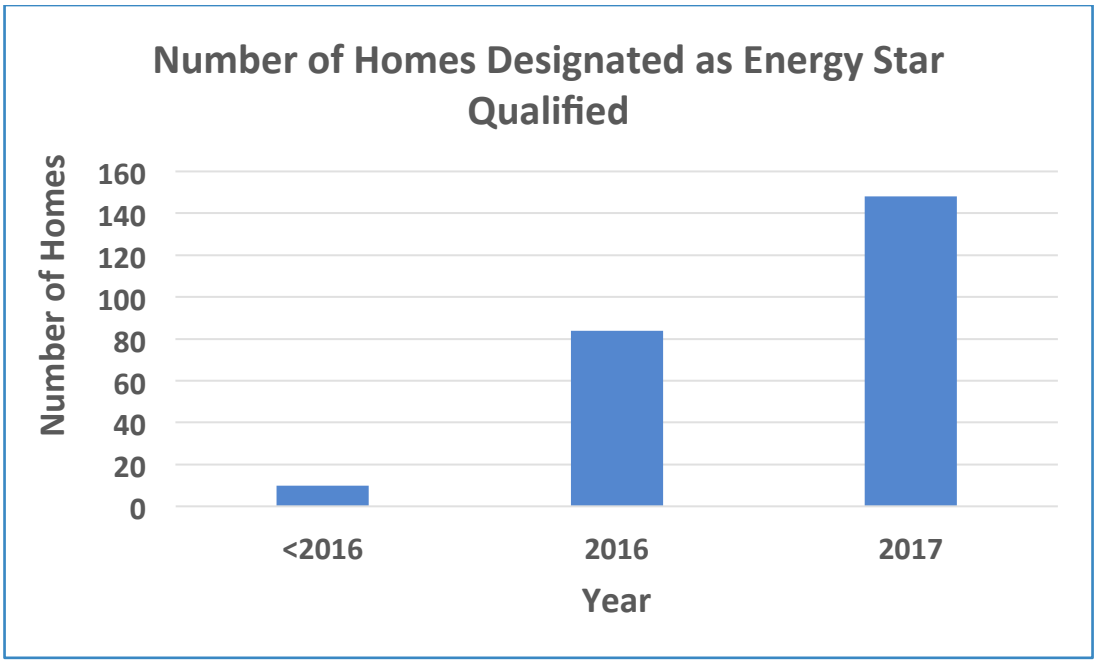


Figure 1.11 Number of Homes Designated as ENERGY STAR in Princeton

Source: Jonathan Passe, EPA, Partner Support Coordinator ENERGY STAR for Homes

Why do we care?

Green or sustainable building is the practice of creating and using healthier and more resource-efficient models of construction, renovation, operation, maintenance, and demolition. The United States Green Building Council's Leadership in Energy and Environmental Design (LEED©) Green Building Rating System is currently the nation's most widely used standard for green building. LEED is a third-party certification program that rates green building design in five key areas: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. Promoting green building practices in Princeton helps to further several green building and energy efficiency goals of the State. In 2000, the New Jersey State Legislature enacted the Educational Facilities Construction and Financing Act, which includes support for energy-efficient design. In 2002, the State came under an Executive Order requiring all new school designs to incorporate the LEED rating system so that the facilities achieve maximum energy efficiency and environmental sustainability. Additionally, as a result of the 2007 Global Warming Response Act, New Jersey has committed to reducing greenhouse gas emissions to 1990 levels by 2020 and 80% below 2006 levels by 2050. Green building will help the state achieve this ambitious goal.

Differing from LEED, the ENERGY STAR program does not attempt to address every component of green building and focuses on designing practices to increase energy efficiency that are cost-effective for the consumer and builder. New Jersey ENERGY STAR®

qualified home standards, set by the Environmental Protection Agency (EPA), require that homes be at least 15% more energy efficient than homes adhering to the 2006 International Energy Conservation Code (IECC)[3]. Components of a New Jersey ENERGY STAR® home can include improved insulation, ENERGY STAR lighting and appliances, high efficiency heating equipment and water heaters, as well as properly installed and high efficiency cooling equipment. The NJ ENERGY STAR program allows Princeton residents as well as building owners and operators to build greener even if they are unable to certify their building by LEED standards. The New Jersey Clean Energy Program also offers incentives through the Customer On-Site Renewable Energy Rebate Program. The program provides incentives to residents for installing renewable energy systems, including wind, solar, sustainable biomass, and fuel cell, to power their homes.

How are we doing?

As of 2008, it was estimated that there were 247 registered LEED projects in New Jersey, 37 of which are actually undergoing the certification process. In 2008, there were four commercial buildings registered with LEED. In 2017, there are four certified commercial buildings and one certified home.

The number of ENERGY STAR ® qualified homes identified in 2008 in Princeton Borough and Princeton Township was overstated. The data included housing that was not truly located within the former Borough and Township. Figure 1.1 shows a more accurate number of ENERGY STAR ® homes being assessed and qualifying as being 15% more efficient than most homes each year. and in the case of the Princeton community, nearly every home being assessed is a new home. Incentive programs and other governmental schemes can be established to encourage ENERGY STAR and LEED building methods in new developments and redevelopments in the Borough and Township.

[3] NJCEP Residential - http://www.njcleanenergy.com/residential/home/home

1.2. Indicator: NWF Certified Wildlife Habitats

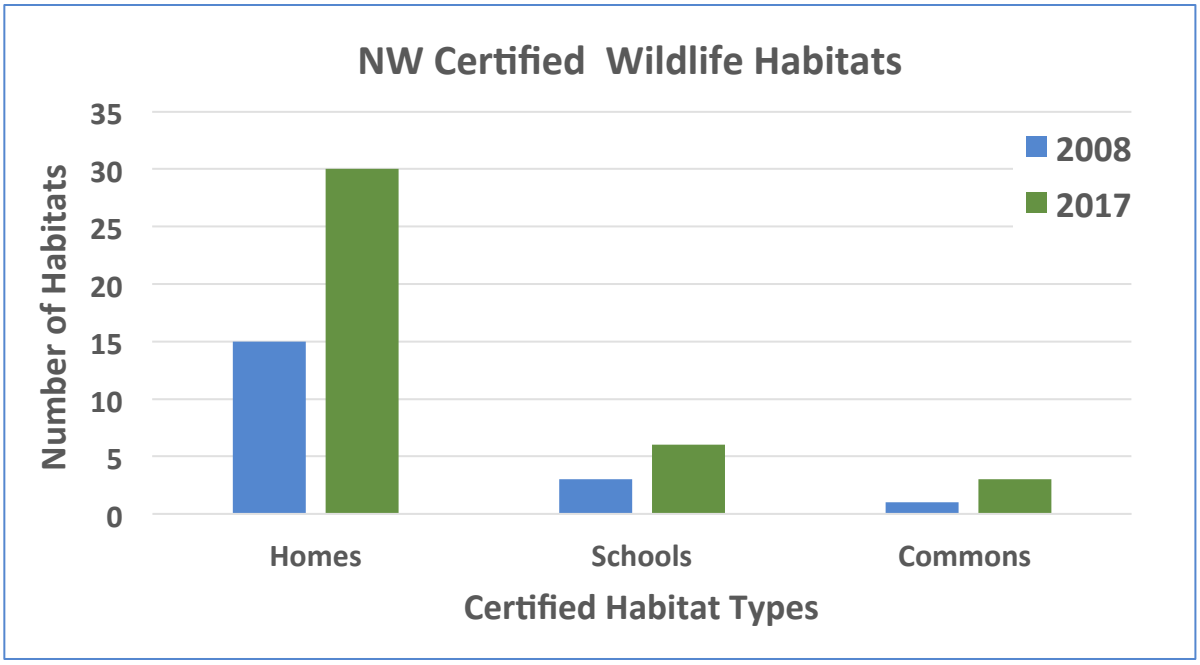


Figure 1.21 National Wildlife Federation Certified Habitat Program

Source: National Wildlife Federation Certified Habitat Program http://www.nwf.org/gardenforwildlife/

Why do we care?

Loss and fragmentation of habitat is the primary cause of species decline, and human behaviors greatly impact wildlife by altering available resources. The use of conventional pesticides, inappropriate fertilizers, traditional road salt, and other maintenance materials degrades habitat quality and poisons wildlife. As commercial and residential development replaces natural plant and animal habitats, it further jeopardizes the continued existence of many wildlife species. The environment surrounding homes and other buildings often fails to provide features of native wildlife habitats and instead contains high-maintenance or water-intensive landscapes or impervious cover. Replacing exotic grass lawns with native wild flowers, shrubs, and trees will provide shelter and food resources for a variety of wildlife species. Additionally, the planting of trees around development decreases energy usage and stormwater run off while providing a more pleasing human environment. By creating small islands of habitat around development, we offer a benefit to our native wildlife and also reap benefits ourselves.

How are we doing?

The National Wildlife Federation (NWF) certifies habitats in four areas: homes; businesses, places of worship, community gardens and parks; at educational settings or schools; and at balconies or roofs. The Princeton community has a total of 39 certified

wildlife habitats up from 19 in 2008. According to the NWF, the habitat certification program began in 1973, and two-thirds of all certifications in American have been issued in the past five years. Princeton is home to 16 backyard wildlife habitats at people's homes, three certified habitats at schools, and one certified habitat at a business. There are no certified community gardens in Princeton, nor any certified roof or balcony gardens. Many communities in New Jersey are working towards certification for a community wildlife habitat, where a collective effort by residents, businesses, schools and the town will earn points for creating habitat areas, designing and completing environmental projects and hosting educational workshops that eventually lead to a community-wide certification.

1.3. Indicator: Impervious Surfaces

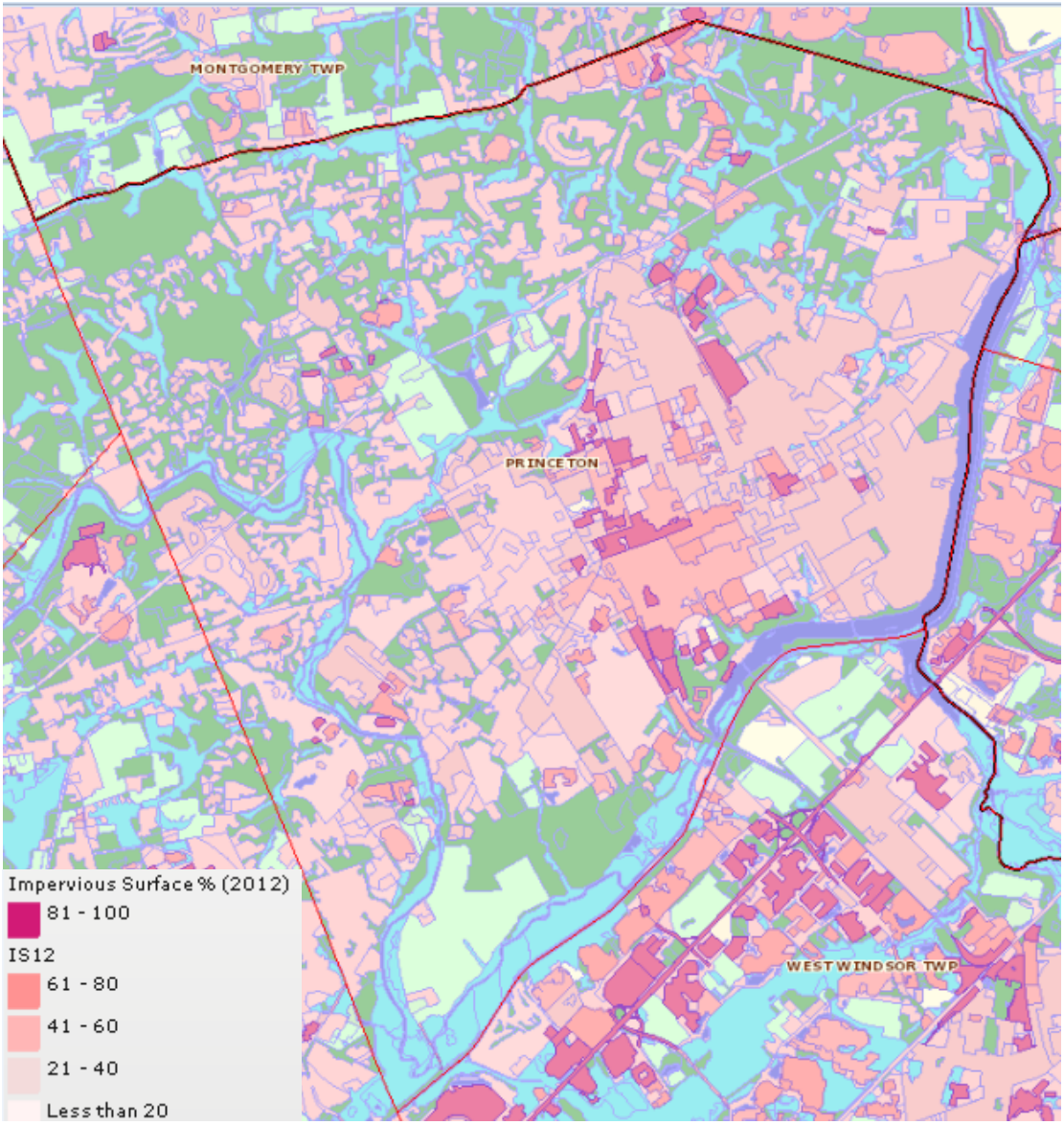


Figure 1.31 Impervious Surfaces in Princeton Area

Source:
http://njwebmap.state.nj.us/NJGeoWeb/WebPages/Map/FundyViewer.aspx?THEME=Sapphire&UH=True&RIDZ=63648762074239469 6/NJGeoWeb/WebPages/Map/MapViewer.aspx?THEME=Sapphire&UH=True&RIDZ=63648762074239 4696

Year	Acres	Percent (of land area)
1986	428,617	8.97
1995	458,548	9.59
2002	490,000	10.25
2007	508,681	10.66
2012	515,085	10.79

Table 3 Total Impervious Surface Coverage in Princeton

Source: The 2017 New Jersey Sustainability State of the State Report

% impervious surface.	Effect on streams

Table 4 The effect of streams and impervious surface percentage in Princeton

Source: Assistant Director of Science and Stewardship, Watershed association
https://thewatershed.org/staff/

Why do we care?

This indicator measures the percentage of Princeton land area that is covered by constructed surfaces such as rooftops, sidewalks, roads, and parking lots. Impervious surface is land that does not allow water to drain through it into soil. Large areas of asphalt and other impervious surfaces force rainwater to rush off the land, instead of soaking into the soil, sweeping all of our pollution into local waterways. It creates a wide range of environmental problems including polluted stormwater runoff, flooding, soil erosion, decreased water quality and availability, and decline of biodiversity in local ecosystems. Impervious surfaces restrict vegetation that slows down rainwater water with leaf friction and root absorption, allowing time for dust collection by foliage, the binding of potential pollutants to clay and organic matter and the breakdown by microorganisms in the soil matrix. In addition, the dark surface color of most impervious cover absorbs heat and contributes to the "urban heat island effect" where urban areas can be as much as a $5^{o}F$ warmer than surrounding areas. According to the U.S. Environmental Protection Agency, elevated temperatures can impact communities by increasing energy use for air conditioning, which in turn leads to air pollution, greenhouse gas emissions, and heat-related illness.

How are we doing?

Like many communities in New Jersey, the landscape in Princeton is changing. Princeton Borough and Princeton Township consist of approximately 11,700 acres, and new development between 1995 and 2002 increased the average percentage of impervious

surface from 11.50% to 15.13%. This is a 31% increase and equates to just over 100 acres combined of increased impervious surfaces in the Borough and Township. The Borough has a great deal of its area already developed and remained stable in its impervious surface acreage. The Township has accounted for the majority of the increase.

Studies show that at 10% impervious surface coverage or more, water quality declines significantly. This suggests that the land use pattern in Princeton and new development has a potentially significant negative impact on local water quality. Increased urbanization in Princeton since 2002 suggests increased impervious surface coverage in the community. Measures that promote greening the built environment can mitigate some of the impacts caused by impervious surfaces. Such measures include implementing sustainable building practices, installing green roofs, introducing green parking lots in existing areas, and limiting new development in undeveloped areas.

1.4. Indicator: Water Consumption

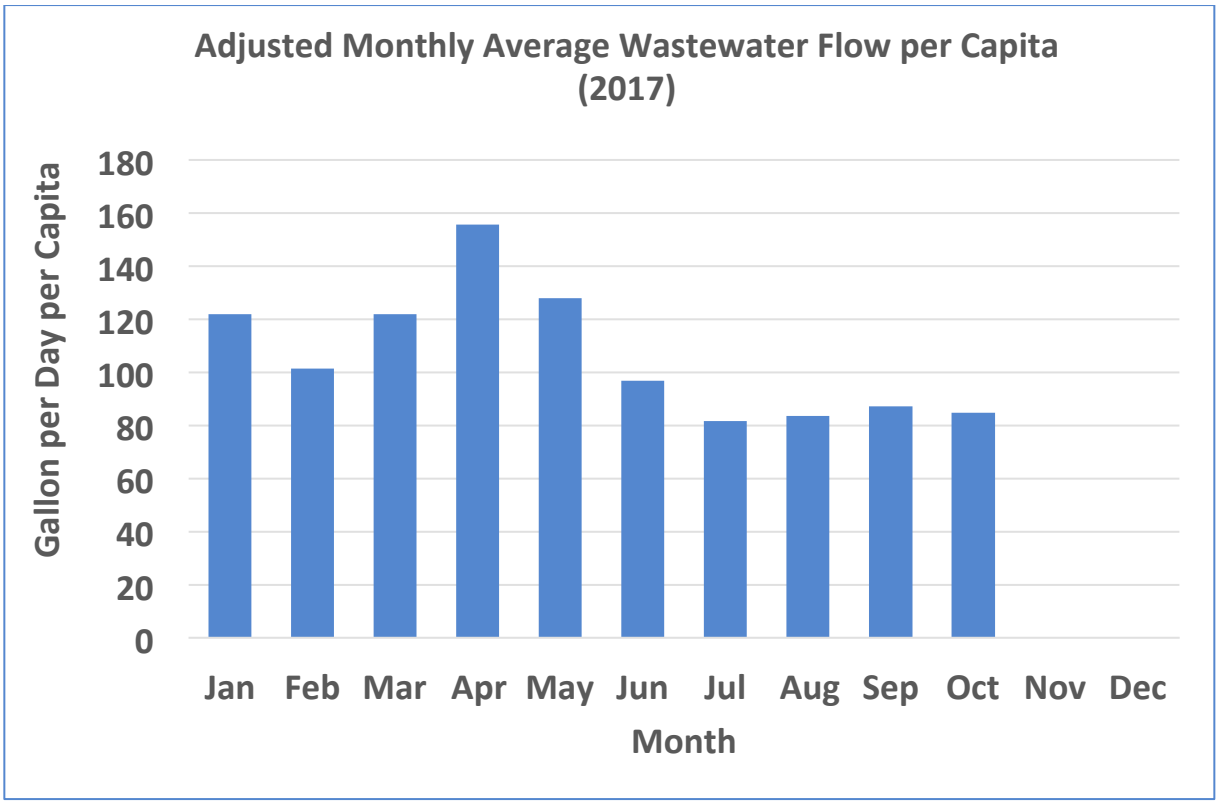


Figure 1.41 Monthly Average Wastewater Flow per capita

Source: Stony Brook Regional Sewage Authority

Why do we care?

This indicator shows the annual gallons of wastewater processed for Princeton Borough and Township per person (at the Stony Brook Regional Sewer Authority). Therefore, this

indicator indirectly measures potable water use because once fresh water is consumed or used, it must be processed as wastewater before it can be used again or released into the environment. Creating and pumping potable water and treating wastewater require intensive use of energy and chemicals that negatively impact the environment. Since clean, potable water is a limited resource, efforts must focus on the conservation and efficient use of water as the regional population continues to grow.

How are we doing?

The Borough and Township have followed very similar water use patterns over the years. Moreover, the municipalities were responsive to state and local water shortages that occurred in 1980, 1985, and the early 2000s. An historical high water use period occurred in the late 1990s reaching approximately 170 gallons per day per capita of wastewater for a three-year span. Again, the Borough and Township have responded with considerable lower average daily water usage in subsequent years. Over the past 28 years, the average wastewater usage for the Borough and Township were 156 gallons per capita and 139 gallons per capita, respectively. Alternative methods and innovations are available to reduce water use. Some of these conservation methods for municipalities include subsidizing use of water-efficient faucets, toilets, and showerheads, public education and voluntary use reduction, billing practices that impose higher rates for higher amounts of water use, smart metering, building codes that require water-efficient fixtures or appliances, leak detection surveys, and meter testing, repair, and replacement.

2. Goal 2: Improving Transportation and Mobility

What do we want to achieve?

Visions for the future

A Sustainable Princeton reduces dependence on gas cars in favor of convenient, affordable, and more sustainable modes of travel such as walking, bicycling, and public transit (jitney, bus, or rail). It supports clean fuels and low emission/alternative fuel vehicles as a strategy to reduce emissions and pollution, and advocates walking and biking to increase physical activity and health.

How are we doing?

Current trends and new approaches

While only 30% of the world's automobiles are in the United States, our country contributes 48% of the world's automotive CO_2 emissions. As new technologies are created to lower automobile impacts, individuals are also realizing that they can make lifestyle changes to adapt to the environment in which they live. Town centers and small communities such as Princeton can put destinations closer together, which increases the possibility that trips can be taken on foot or by other non-motorized means and reduces travel distances for those trips that are still taken by car.

In Princeton, a mix of land uses—with residences, offices, public buildings, and shopping all located in close proximity— translates into fewer and shorter automobile trips, or using biking, walking or public transit as a means of transportation. Lower automobile usage means less traffic and congestion in the community as well as reduced CO_2 emissions being released into the atmosphere, and also promotes healthy lifestyles in an everyday routine. The Free-B provides Princeton residents with free bus service around the community and to major commuter stops like the Dinky station. Zipcars are currently available for rent to Princeton residents who do not own a car or opt to leave it home. Princeton businesses are sponsoring the installation of several new bike racks in the community, and both the Borough and Township have made plans to improve bike and pedestrian mobility through the improvement of sidewalks and creation of designated safe bike routes and bike lanes. At Princeton Day School, the Environmental Club offers incentives and rewards for carpooling and has enacted a no-idling policy. Furthermore, Princeton's municipal governments have purchased five hybrid vehicles to replace higher fuel usage vehicles in their municipal fleet, which saves money in reduced fuels costs and reduces the overall impact on the environment. Residents must be willing to make minor adjustments in their lifestyle that complement the surrounding environment and thus support the actions being taken by the municipal government.

2.1. Indicator: Transportation Choices

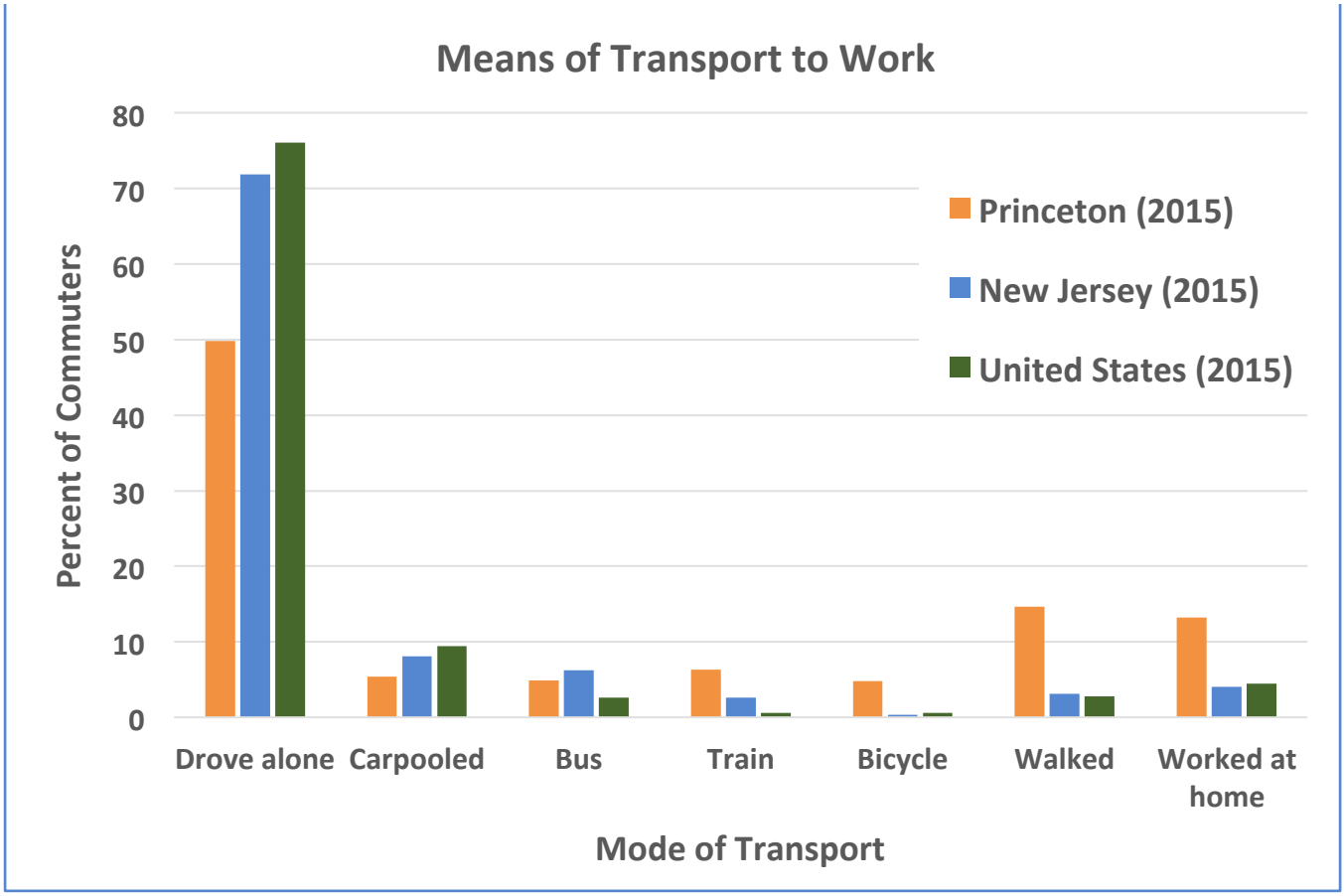


Figure 2.11 Means of Transportation to Work in Princeton, New Jersey and the United States.

Source: US Census Bureau Reports: ACS_10_5YR_B08301, ACS_10_5YR_B08301, DEC_00_SF3, DEC_00_SF4_PCT055

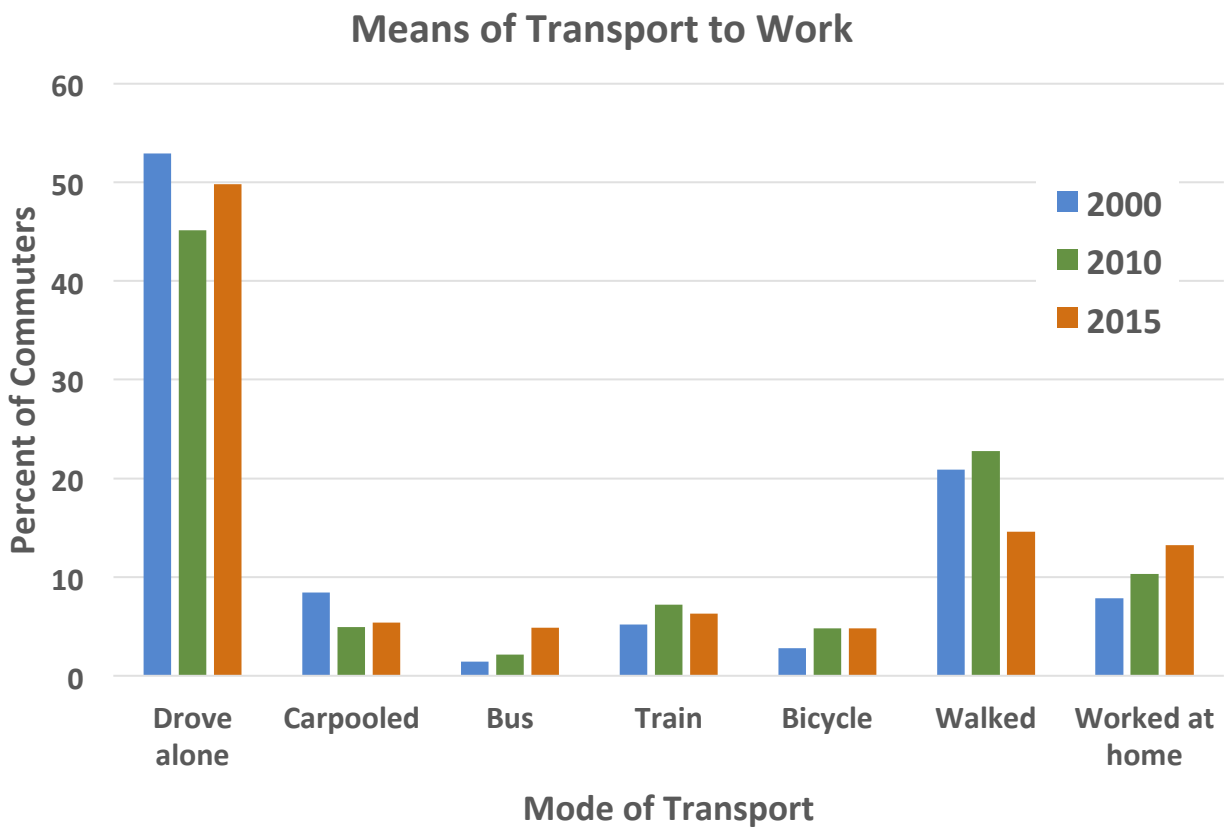


Figure 2.12 Means of Transportation. Changes between 2000 to 2015.

Source: US Census Bureau reports: ACS_10_5YR_B08301, ACS_10_5YR_B08301, DEC_00_SF3, DEC_00_SF4_PCT055

Why do we care?

This indicator shows the percentage of Borough and Township residents that use various means of transportation to reach work. It is an indication of the degree to which the land use pattern and transportation system supports a green and healthy lifestyle. Driving contributes to traffic congestion, and the consumption of gasoline contributes to global warming and local air and water pollution. Mass transit, bicycling, and walking are good for the environment and good for people's health. To support alternative forms of transportation requires development patterns that put jobs and services close to where people live and provide easy access to trains and buses. In the future, this indicator can show if policies aimed at increasing alternative transportation options and creating a walkable mixed-use community have been effective.

How are we doing?

Indicator 2.1 shows that the majority of Princeton residents still drive alone to work however slightly more are working from home.

Automobiles dominate the transportation scene in Princeton and will continue to dominate it until cost effective, convenient, and reliable forms of alternative transportation are made available or new development or redevelopment enables more residents to live in mixed-use, walkable neighborhoods.

2.2. Indicator: Time Spent Commuting

Figure 2.21 Commute Time to work in Minutes (one Way) between 2000 and 2015.

Figure 2.2a Source: US Census Bureau Reports: ACS_10_5YR_B08303, ACS_15_5YR_B08303, DEC_00_SF4_PCT056

Why do we care?

This indicator tracks the commute times to work of Princeton residents. Lengthy commutes reduce the quality of life of residents and are indicative of an inefficient transportation and land use system. Furthermore, lengthy commutes increase the burning of fossil fuels and associated pollutants. Providing jobs close to residential areas and making public transit more accessible reduces commute times, improves air quality, and makes alternative means of transportation feasible. Review of this indicator allows Princeton to evaluate the effectiveness of programs aimed at promoting walking, bicycling, local economic development, public transportation, and reducing traffic congestion.

How are we doing?

The distribution of time spent commuting has not changed much since 2000.

The persistence of residents that commute to work alone in automobiles since 2000 suggests a need to review local and regional transportation and land use systems to identify opportunities for improvement. In addition to encouraging use of alternative transportation and public transit, carpooling, flex-time, and telecommuting can be encouraged among residents and employees.

2.3. Indicator: Public Transportation

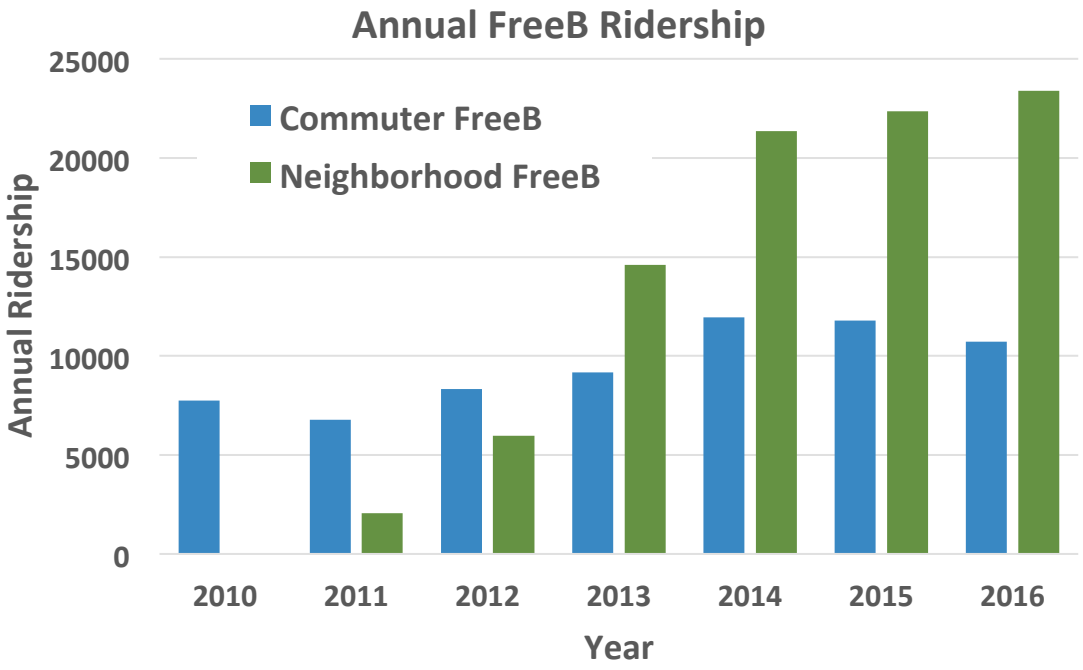


Figure 2.31 Total Annual Ridership of the FreeB

Source: Princeton Engineering Department.

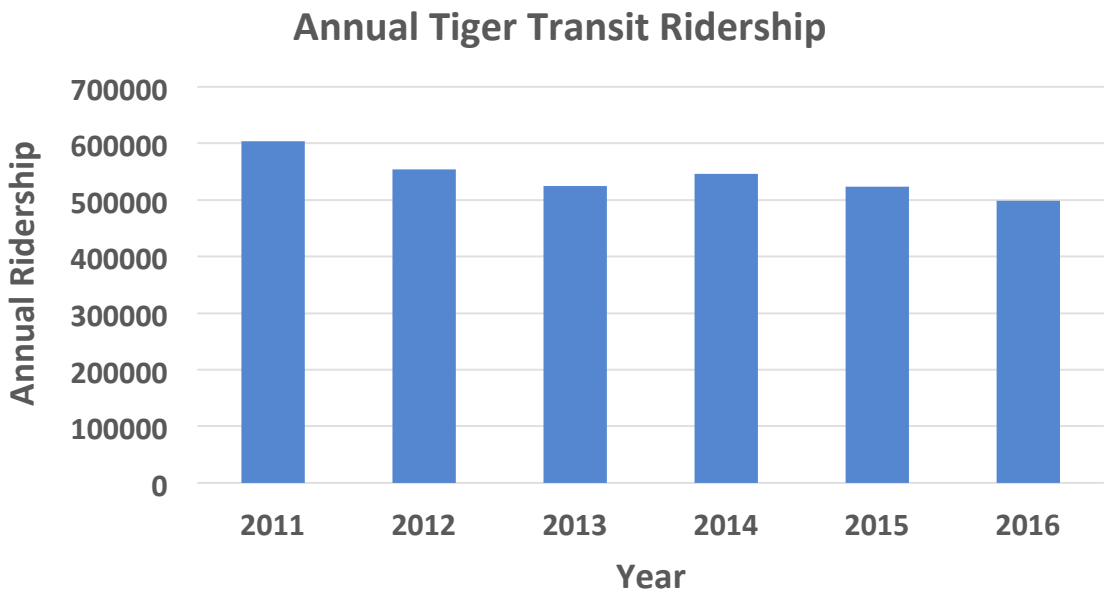


Figure 2.32 Total Annual Ridership of Tiger Transit

Source: courtesy of Charles Tennyson of Princeton University's transportation department.

Figure 2.33 Total Annual Ridership of Crosstown

Source: http://www.princetonsenior.org/crosstown.cfm. The data is provided by Susan Hawkins (November 2017)

Why do we care?

A free jitney service and door-to-door transportation service demonstrates the community's commitment to providing convenient alternatives to the individual automobile. Public transportation helps to reduce traffic congestion, greenhouse gas emissions, and air pollution related to single vehicle travel. The Princeton Free B service is a pilot project sponsored by Princeton University, Princeton Borough Council, and New Jersey Transit. In the future, the service will be funded entirely by NJT's Community Shuttle Service Program. The Crosstown 62 is a transportation service offered to Princeton residents who are age 62 and older or disabled and do not drive.

How are we doing?

Since its inception in April 2008, the Free B has shown a steady increase in monthly ridership, from 151 riders in April to 411 riders in July 2009. The service is offered during peak commuter morning and evening hours Monday through Friday. The graph shows that ridership increased only slightly in August.

The Free B provides transportation to and from the Princeton train station, which is serviced by the Dinky Line. The Dinky, another term for a small locomotive, runs from Princeton to Princeton Junction, where people are able to connect to the Northeast Corridor train line which offers service to New York City. An active Free B service can reduce the need for parking and reduce traffic congestion near the train station by providing an inter-modal service that connects passengers to the existing public transportation system in the community. Plans are underway to extend the Free B's hours throughout the day to expand its use to residents and daytime visitors .

Crosstown 62 riders register for the service and make appointments for rides at least two days in advance. The service operates Monday through Friday from 8 a.m. to 5 p.m., and the cost is $2 per ride one way. The graph above shows that ridership has been much higher overall for 2008 than in 2007.

2.4. Indicator: Bicycle Networks

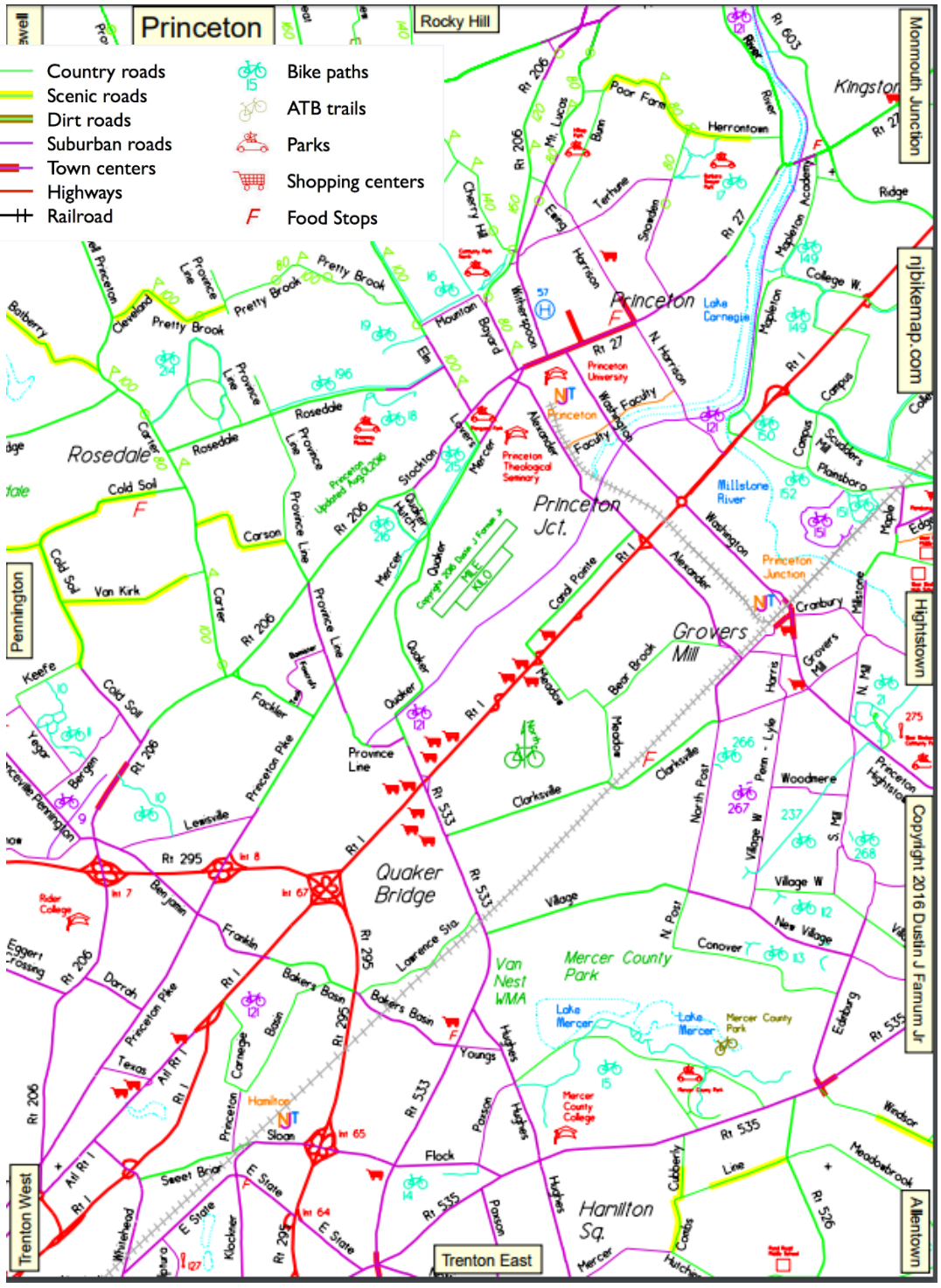


Figure 2.41 Bicycle lanes and paths in the Princeton Community in 2016

Source: Data for this map was collected from the website http://www.njbikemap.com/njmap/7-maps/princetn.pdf, a site for recreational cyclist seeking routes all around the state of New Jersey

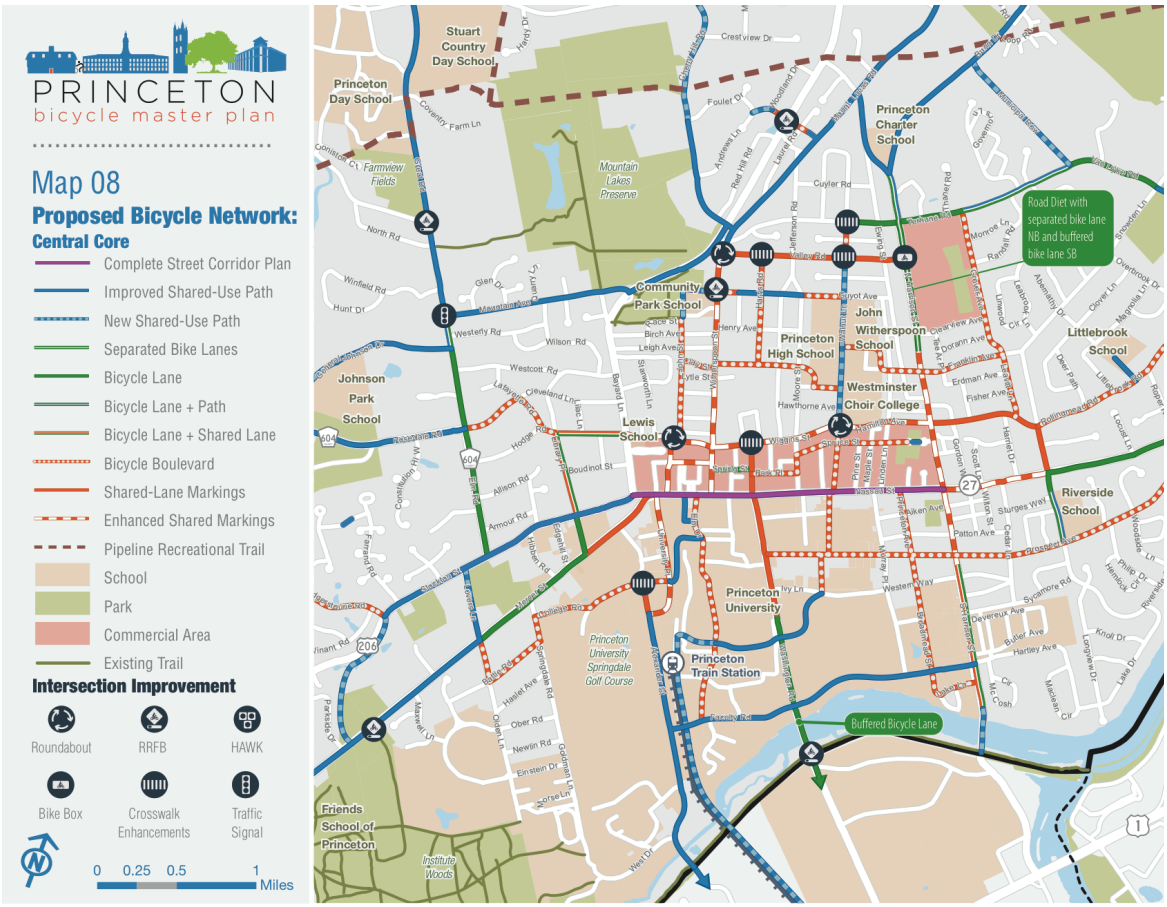


Figure 2.42 Proposed Bicycle Mobility Plan for Princeton Community

Source: Source: Bicycle Master Plan as proposed by Parsons Brinckerhoff http://princetonnj.gov/BPAC/bicycle-master-plan.html

Why do we care?

The Princeton community provides many of the resources necessary to meet the daily needs of its residents such as schools, businesses, and local services. Due to the community's small footprint, bicycling is a potentially viable form of transportation to commute to work and school or to run daily errands. In order to encourage bicycling as a healthy lifestyle choice for residents to incorporate into daily routines, safe and contiguous bicycle lanes and paths must be provided. By creating such a network, bicycling may become more popular among a range of residents and not just serious bicyclists.

How are we doing?

There are many paved bicycle paths in the Princeton community that provide opportunities for recreational bicycling. However, most of them are in scenic areas and do not provide safe bicycle access to downtown, shopping centers, or other destinations. In the map above, the bike paths marked with a number and light blue bicycle also qualify as scenic routes when depicted with a light

green line outlined in yellow. In the map, roads represented by thin lines are less busy than thick lines, and green roads are safer than purple, which are safer than red. Thin green lines are generally suitable and relatively safe for experienced bicyclists. Purple and red lines indicate high traffic roads without bike lanes that are not designed to be a safe route for riders. For a more detailed view, see the original at http://www.njbikemap.com/njmap/7-maps/princetn.pdf

The total mileage of paved bicycle lanes is approximately 8 miles, however this figure does not represent the total miles of contiguous bicycle lanes. This mileage also does not include other bicycle paths and unofficial lanes (wide shoulder of the road). Surrounding bicycle networks for Mercer County can be viewed on the map provided by the Greater Mercer Transit Authority at http://www.gmtma.org/GMTMA_BikeMap_frnt.pdf.

2.5. Indicator: Bicycle and Pedestrian Safety

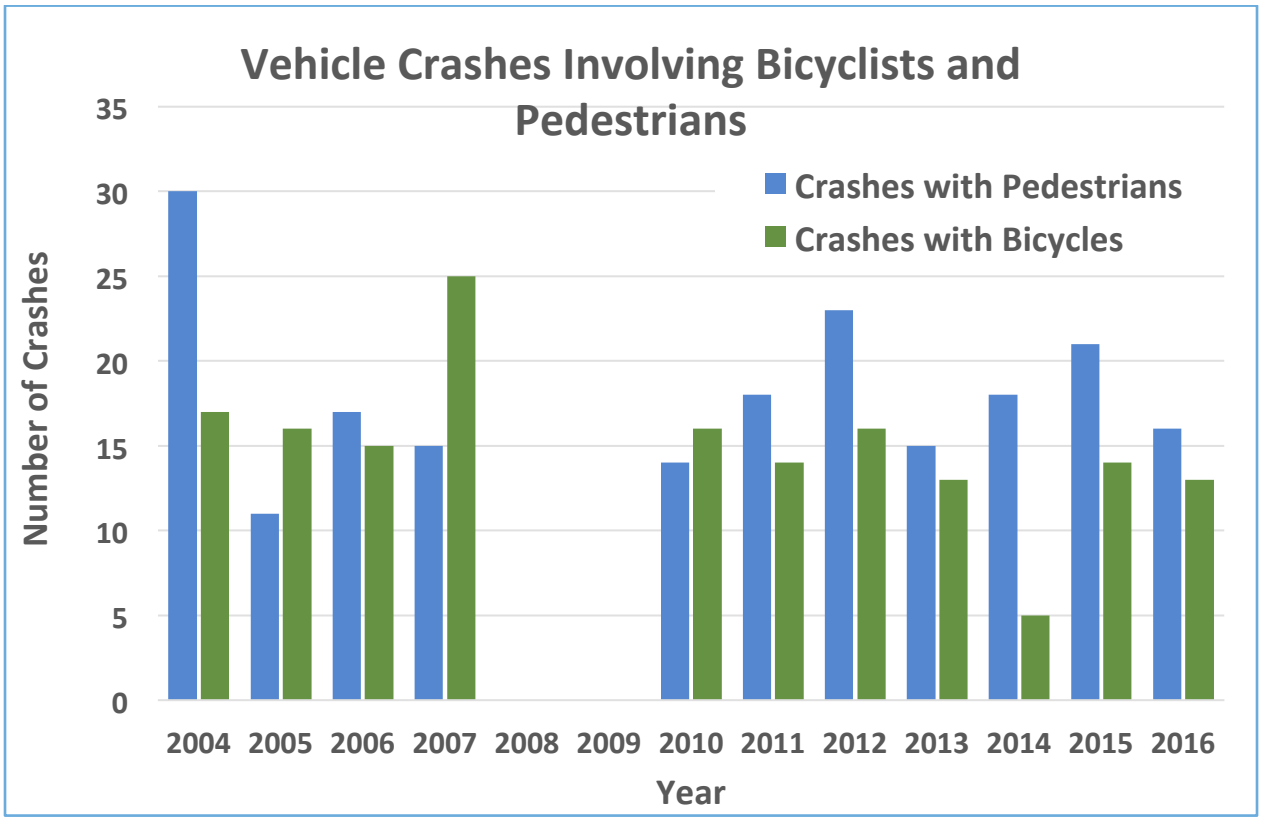


Figure 2.51 Bicycle and Pedestrian Accidents Involving Motor Vehicle

Source: 2010 - 2016 from Princeton PD annual reports, 2004-2007 from Sustainability Plan 2009, Figure 2.5 No accident data was retained during 2008-2009 period.

Why do we care?

This indicator displays the number of pedestrian and bicycle accidents involving motor vehicles in the Borough and Township, as reported by the police records departments of the respective municipalities. Bicycling and walking offer a viable alternative to driving an individual automobile when concerns for safety and convenience are met. Bicycling and walking provides a means to increase physical activity and health and to reduce the negative impacts of transportation related air and noise pollution and greenhouse gas emissions. Providing safe routes and fostering safety awareness among bicyclists, pedestrians, and motorists can help to reduce the annual number of incidents and injuries.

How are we doing?

Although the data is limited, the graph shows a dramatic increase in bicycle incidents involving motor vehicles in the year 2007. This may be a coincidence or it may suggest an increase in the number of bicyclists overall due to concerns about global warming and rising gas prices or as a result of local efforts to promote healthy active lifestyles. In contrast, the number of incidents involving pedestrians

and motor vehicles decreased dramatically after 2004 and has remained fairly consistent in subsequent years. This may also be an anomaly or may reflect the success of the many traffic calming efforts made by the Borough and Township. Princeton can continue to improve and maintain the visibility of existing bicycle lanes and pedestrian paths with clearly marked signage. Expanding the size of the bicycle and pedestrian friendly networks will also help to protect the safety of bicyclists and pedestrians in the community when combined with bicycle and pedestrian safety education programs.

3. Goal 3: Building a Strong Local Green Economy

What do we want to achieve?

Visions for the future

Our vision for Princeton is a place which nurtures a diverse, stable, local green economy that supports the basic daily needs of all segments of the community. It encourages businesses, organizations, and local government to adopt sustainable business practices and to conserve resources, reduce waste and pollution, recycle and purchase recycled products, implement green building, and source local materials. At the same time, it supports local sustainable agriculture and farmers markets and encourages residents to buy local goods and services.

What do we see?

Current trends and new approaches

Businesses around the world are investigating new practices that will reduce their impact on the environment as well as cut operational costs. Companies are realizing that using fewer resources and improving efficiency cuts costs and demonstrates their corporate social responsibility. Businesses recognize that today, the triple bottom line – people, planet, profits – along with having a vision for the future provide the foundation of a sustainable business. Major businesses such as PepsiCo, Johnson and Johnson, and Dell Inc. have committed to shift their operations to renewable energy sources[4], and as more energy and environmental regulations are developed, companies will be making even more changes to become "green businesses."

Businesses can help reduce human impact on the planet by adopting green practices and facilities as well as providing environmentally sound products to their customers. Many communities along the East Coast are forming networks for local businesses that support sustainable and green practices, such as the Sustainable Business Network of Greater Philadelphia[5] and the Chesapeake Bay Business Alliance[6]. All of these organizations share the common goal of uniting local businesses committed to sustainability and educating community members on the importance and benefits to shopping locally.

As a result of industrialization, food and other goods usually travel a great distance before they reach consumers, a practice that uses energy for transport and storage and often requires additional packaging for food to keep it fresh. Buying local ensures that your food is fresh and that the process of creating the product has used minimal resource inputs.

[4] EPA Green Power Partnership - http://www.epa.gov/greenpower/

[5] Sustainable Business Network of Greater Philadelphia-- http://www.sbnphiladelphia.org/

[6] Chesapeake Bay Business Alliance- http://www.csballiance.org/

Princeton businesses are creating a Green Purchasing program and network as a means to market their green products as well as purchase green products for their own operations.

Princeton businesses are supporting a “Buy Local” campaign that highlights and promotes local businesses through advertising and other outreach strategies. Many establishments in Princeton serve locally grown and produced food, and the community is trying to raise awareness of the benefits and provide incentives for restaurants. The community hopes to establish criteria and ranking for different levels of “green” in Princeton Businesses.

How are we doing?

Indicators of success

3.1: Income and Cost of Living
3.2: Local Food
3.3: Unemployment

3.1. Indicator: Income and Cost of Living

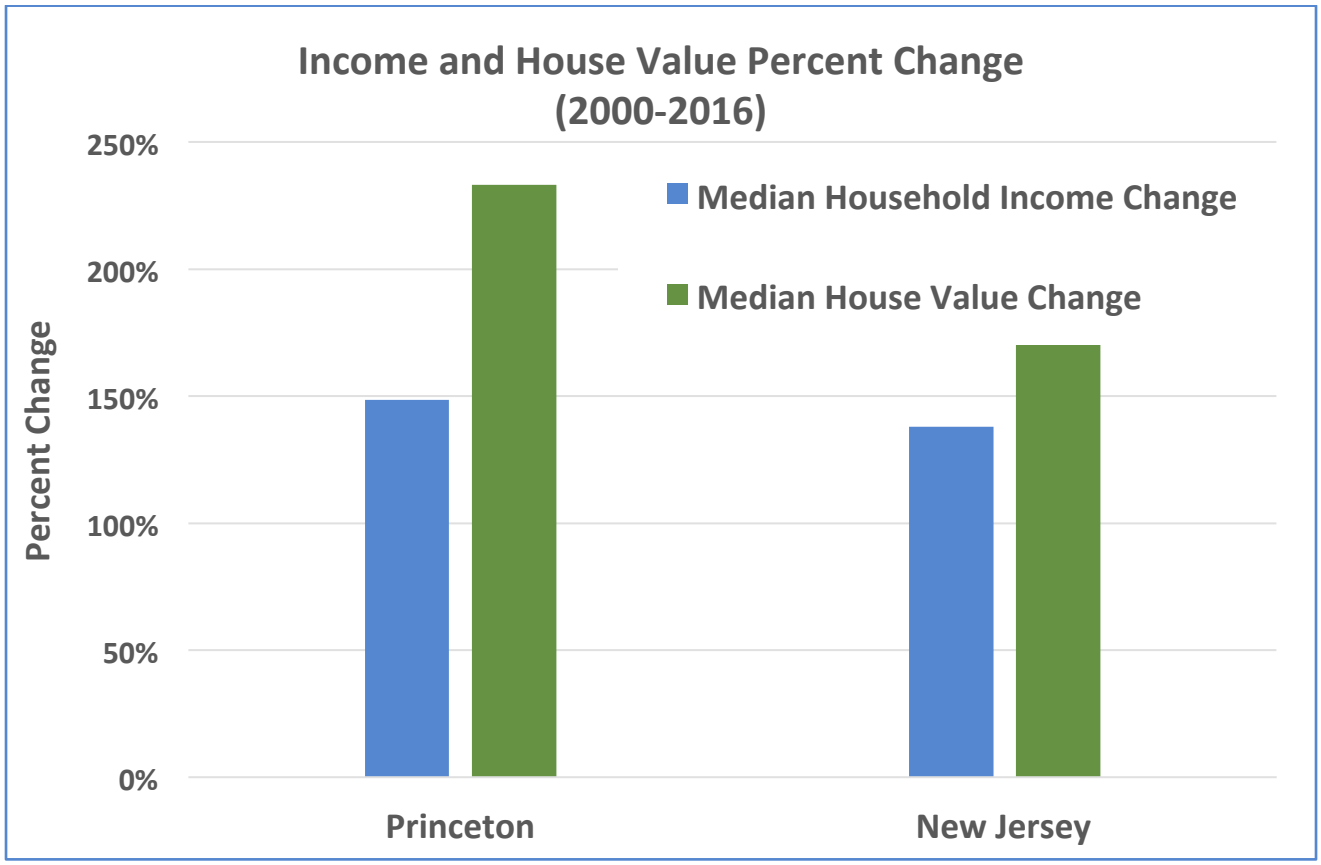


Figure 3.11 Income and House Value Percent Change (2000-2016)

Source: US Census Bureau Reports: ACS_16_1YR_S1901, ACS_16_SPL_K202510, DEC_00_SF3_DP3

Why do we care?

Homeownership is both a family and a social goal in the United States. For the family, homeownership offers a degree of security not usually available when renting. It helps families accumulate financial equity, which they might not otherwise be able to do. From the community perspective, homeownership establishes residents as long-term stakeholders in the area and contributes to a sense of civic responsibility. When people own their homes, they are more likely to invest funds in physical improvements and to invest time in social programs that help build cohesiveness in the community.

How are we doing?

The comparison between median home prices and household income offers an interesting way to evaluate the feasibility of home ownership. Median household income measures the amount of money the members of a household make each year. A sustainable community is one where the residents can afford to live. A local economy thrives when residents can afford their homes and still be capable of investing back into the local economy. While Princeton Township's median annual household income has been and continues to be significantly higher than that of the Borough, both

Princetons show significant increases in median household income between 1990 and 2000. The median income in the Township increased 51.8% over that period, while the Borough's increased 56.3%. The second graph shows that the Borough and Township also experienced increases in median housing values of 19.9% and 20.6% respectively. This data shows that incomes increased at a significantly higher rate than housing values. Improvements in the housing market and the housing "bubble" in the 1990s drove up the costs of homes statewide, which may have drawn in wealthier residents to the Princeton community and driven out those who could no longer meet the expense of rising house prices and associated taxes. Evidence of a strong economy is that as housing prices increase, median income also increases, which suggests that people choosing to live in the community can afford increasingly expensive homes as well as maintain their standard of living. Had housing prices gone up and income remained the same, residents living in the community would be much more financially strained.

3.2. Indicator: Local Food

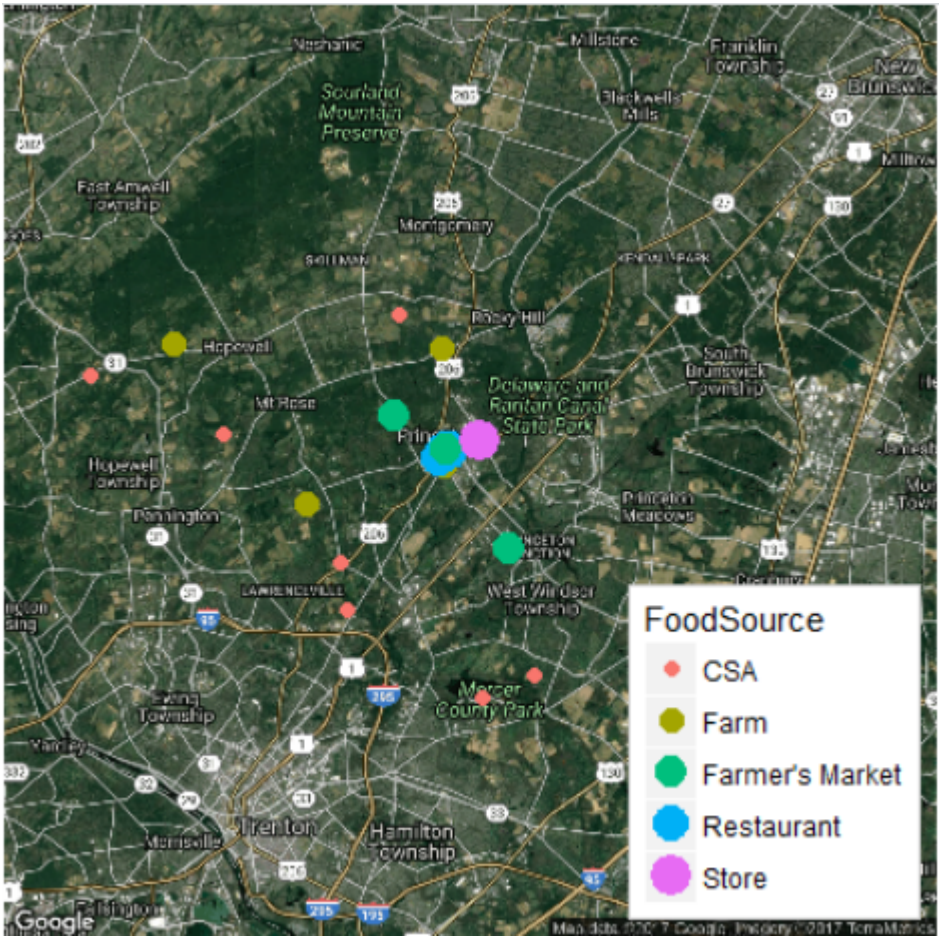


Figure 3.21 Local Food Sources

Source: Food sources location information is by Google map searches

Why do we care?

Buying locally grown and produced food means getting the freshest ingredients, supporting local agriculture, and reducing environmental impacts. The economic and environmental costs associated with transporting food increases exponentially as the distance from the source grows, and food travels approximate 27 times farther to get to our grocery store or restaurant than if brought from a local source[7]. Many people opting to eat "local" are sticking to a 100-mile diet. This is possible in the Garden State, and a Sustainable Princeton is one that fosters the livelihood of local farmers while minimizing transportation-related impacts.

[7] Pirog, Rich, and Andrew Benjamin. "Checking the Food Odometer: Comparing Food Miles for Local Versus Conventional Produce Sales in Iowa Institutions." Leopold Center for Sustainable Agriculture, July 2003

How are we doing?

The map shows various restaurants and markets within Princeton's borders where local food is sold. The map also shows several farms in the Princeton area where food is also sold on site. Several schools in Princeton also receive food from local sources, however these schools are not shown on the map as the public can not purchase local goods directly from them. A list of these locations can be found in Appendix A which is not a complete inventory of every location to purchase local food, nor does it imply that everything available at these establishments is from local sources. However, it is a first step to recognizing the availability of local food in the Princeton community. Over time, this list can be updated and expanded to reflect restaurants and markets that buy their ingredients locally, and qualifying establishments can be invited to become part of the "green map."

Princeton currently houses a wide variety and relatively large number of restaurants and businesses that support local food. The Princeton University farmer's market, the only one within the municipalities, is held at Firestone Plaza on the University campus in the late spring and fall on Tuesdays from 11 a.m. to 3 p.m. Mediterra, Teresa's, and Eno Terra, just outside of the Princeton Township Municipal boundaries in Kingston, are restaurants that embody the concept of "eat local," meaning many of their ingredients as well as their employees are locally sourced. The map also includes community supported agriculture (CSA) farms that operate with funding from businesses and individuals who purchase a share of the season's harvest. CSA members make a commitment to financially support farms, and in return, members receive a portion of the harvest. Honey Brook Organic Farm CSA, operating on the Stony Brook Millstone Watershed Reserve, is the largest CSA in the country. In the future, Princeton businesses and restaurants can become members of local CSAs and offer local fresh ingredients to consumers.

In the future, this map can be developed into an interactive web-based map that calculates how many miles the food travels from source to table. The map could also include a description of the types of local ingredients and food grown or sold at each location. This way, if someone knows what products they would like to purchase, they will be able to determine what businesses in the community supply them.

3.3. Indicator: Unemployment

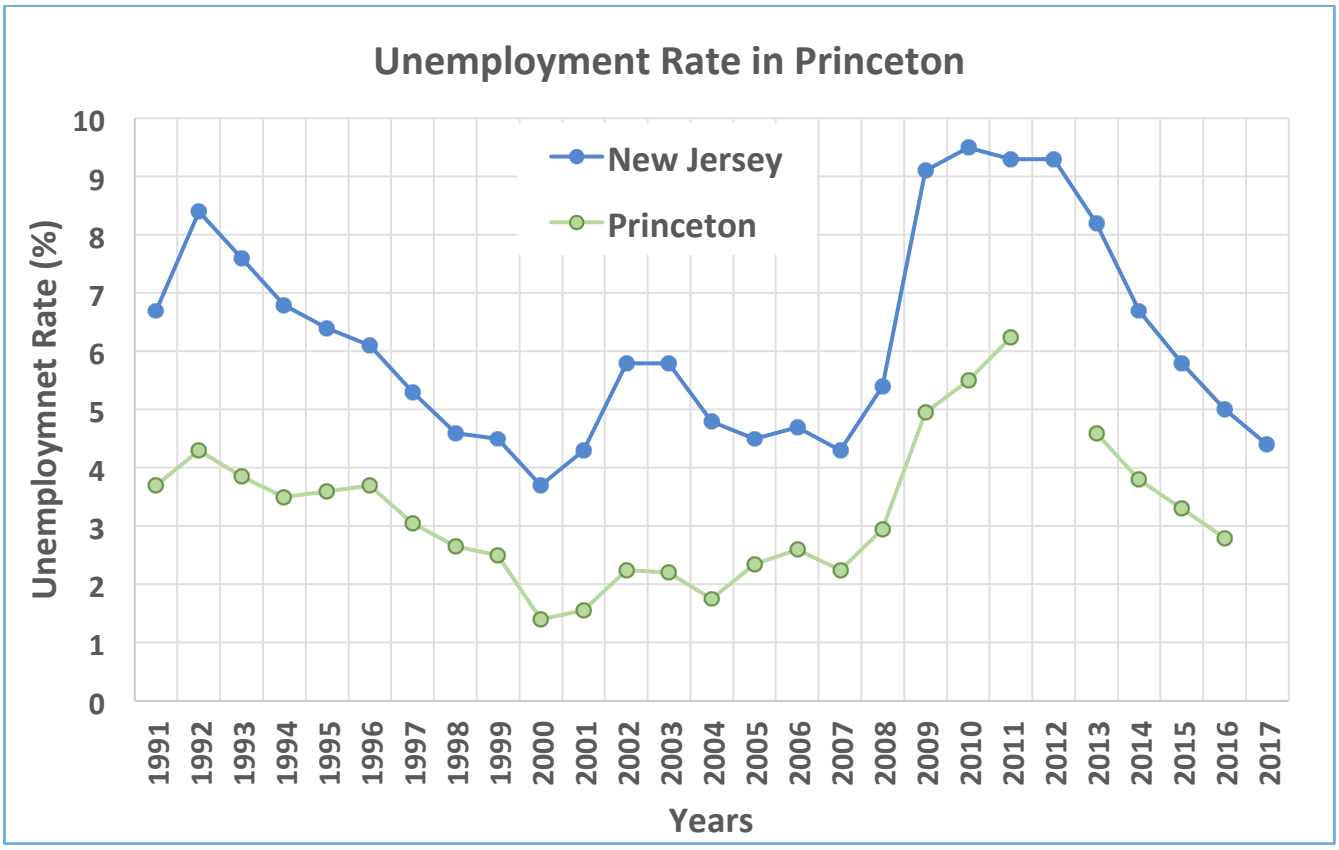


Figure 3.31 Unemployment Rate

Source: NJ Department of Labor and Workforce; http://lwd.dol.state.nj.us/labor/lpa/employ/uirate Data sources: mun_ann1990-1999, mun_ann2000-2009, and mun_ann2010-2016. 2009 data is missing for Princeton

Why do we care?

The local unemployment rate serves as a good indicator of the state of the local economy. Unemployment rates are determined by the percentage of those in the labor force that are without jobs. High unemployment means financial hardship for individuals and families. They, in turn, are less able to buy goods and services, which detracts from the strength of the economy. Communities with high unemployment often suffer from increased rates of crime, domestic violence, and substance abuse. Moreover, communities with high unemployment will collect less tax revenue, which hampers the government's ability to allocate resources to solving these social problems.

How are we doing?

Indicator 3.3 shows the unemployment rates of New Jersey, Mercer County, and Princeton Borough and Township. Between 1990 and 2007, the Borough and Township's unemployment rates have remained below County and State averages. In 2007, the Borough's unemployment rate rose above the State and County for the first time between 1990 and 2007. The sudden drop in Princeton

Township's unemployment rate starting in the late 1990s to the present can be attributed to the influx of jobs created by numerous pharmaceutical companies, including Bristol Myers Squibb, hightech companies, including the Sarnoff Center, and financial companies, such as Merrill Lynch and Bloomberg, expanding their presence and bringing more jobs to the area.

4. Goal 4: Protecting Environmental Health and Natural Resources

What do we want to achieve?

Visions for the future

Our vision for Princeton is a place that protects and enhances environmental and public health by using resources efficiently and by using products and materials that do not contain or emit hazardous or toxic substances into the air, soil, or water. It develops and maintains a sufficient open space system that balances efforts to enhance biodiversity, natural preservation, and both passive and active recreation opportunities with commercial and residential development and redevelopment throughout the community.

What do we see?

Current trends and new approaches

While New Jersey boasts a variety of landscapes and valuable natural resources, our high population density exerts significant pressure on our natural capital. Despite implementing aggressive policies to preserve land, development continues to outpace population growth. Waste generation also continues to grow per capita. The results of human consumption affect every aspect of the ecosystems on which we depend by degrading air and water quality, reducing wildlife habitat, and degrading the ability of our natural systems to provide services, such as sequestering carbon and recharging groundwater. Recognizing the value of maintaining a healthy environment, Princeton is committed to protecting and enhancing the natural systems that support our community and has already made strides to improve consumption habits.

The community has reached its target of preserving 25% of its land area as open space and recently completed an Environmental Resource Inventory to assess native plant and wildlife resources in order to prioritize preservation efforts. The Princeton Regional Planning Board will use the inventory as it reviews development proposals. Princeton also intends to further actions that focus on the reuse and recycling of materials, such as using rainwater for irrigation and promoting community composting for food waste, to eliminate waste and reduce consumption of virgin resources.

In addition to working with Mercer County to expand their recycling programs, the Borough and Township are developing polices that encourage residents to re-use yard waste by composting leaves in order to reduce the need for the transport and disposal of valuable natural waste. The Borough and Township are also working to reduce the amount of construction and demolition waste, encourage recycling and re-use of waste when possible,

develop more environmentally-friendly methods of hazardous waste collection, and increase the number of drop-off locations.

Some students in Princeton schools have enacted composting programs for cafeteria food waste to use in their schools' edible gardens. Most Princeton schools have recycling programs, but there is much room for improvement. Schools also encourage the use of reusable water bottles and lunchboxes. Additionally Princeton schools have created an oversight position to ensure compliance with recycling programs.

Businesses are also working on reducing waste. Some no longer offer plastic bags with a purchase to encourage patrons to bring reusable bags.

How are we doing?

Indicators of success

4.1: Land Use
4.2: Wildlife Corridors
4.3: Solid Waste and Recycling
4.4: Air Quality
4.5: Water Quality

What are we doing?

Actions to achieve this goal

- For Municipal Government (MG) actions, see page 114
- For School (S) actions, see page 142
- For Business & Non-profit (BN) actions, see page 168
- For Residential (R) actions, see page 189

4.1. Indicator: Land Use

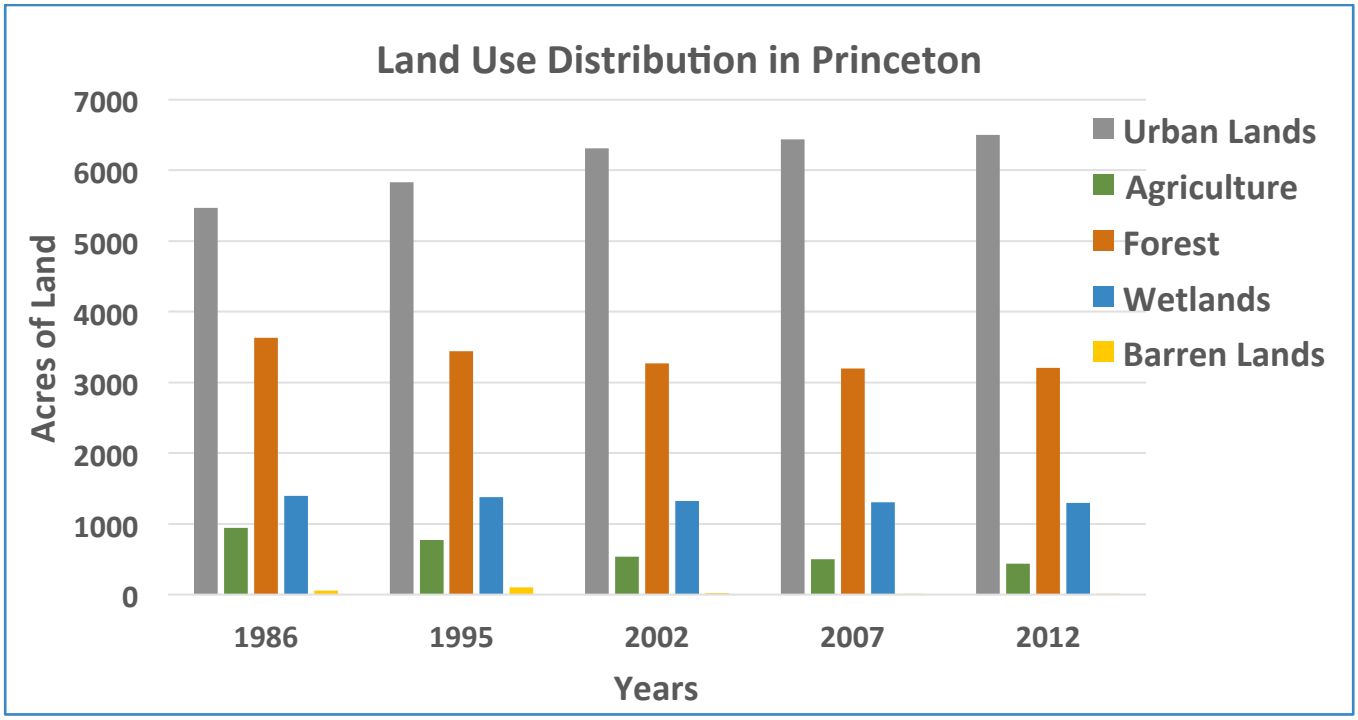


Figure 4.11 Land Use Distribution

Figure 4.1 Source: Rutgers CRSSA Measuring Urban Growth in Municipalities
http://crssa.rutgers.edu/projects/lc/urbangrowth/index.html

Why do we care?

The distribution of land use over time depicts the subtle changes in the physical makeup of the Borough and Township, but more significantly, land use is directly related to several quality of life factors. While compact urban development supports public transit opportunities and creates walkable communities, it replaces acreage that may provide other valuable functions as agriculture, wildlife habitat, or flood control. In recent decades, urban development has led to the decline of vital natural habitats and agricultural lands in New Jersey. Urbanization also increases impervious surface area which reduces groundwater recharge and increases stormwater run off which erodes our soils and washes pollutants into our waterways. Preserving land in a natural state will reduce these negative impacts, however it is important for communities to strike a balance between land uses in order to meet all of their needs in a sustainable way.

How are we doing?

Land use change in the Princetons has greatly reflected trends throughout the country as natural landscapes are lost to urbanization. This development trend is present over the past two decades as urban land coverage increased by approximately 1000 acres. The direct effect

of this urban growth over the last 20-plus years has been at the expense of forests and agriculture lands with decreases of approximately 600 acres and 400 acres, respectively.

4.2. Indicator: Wildlife Corridors

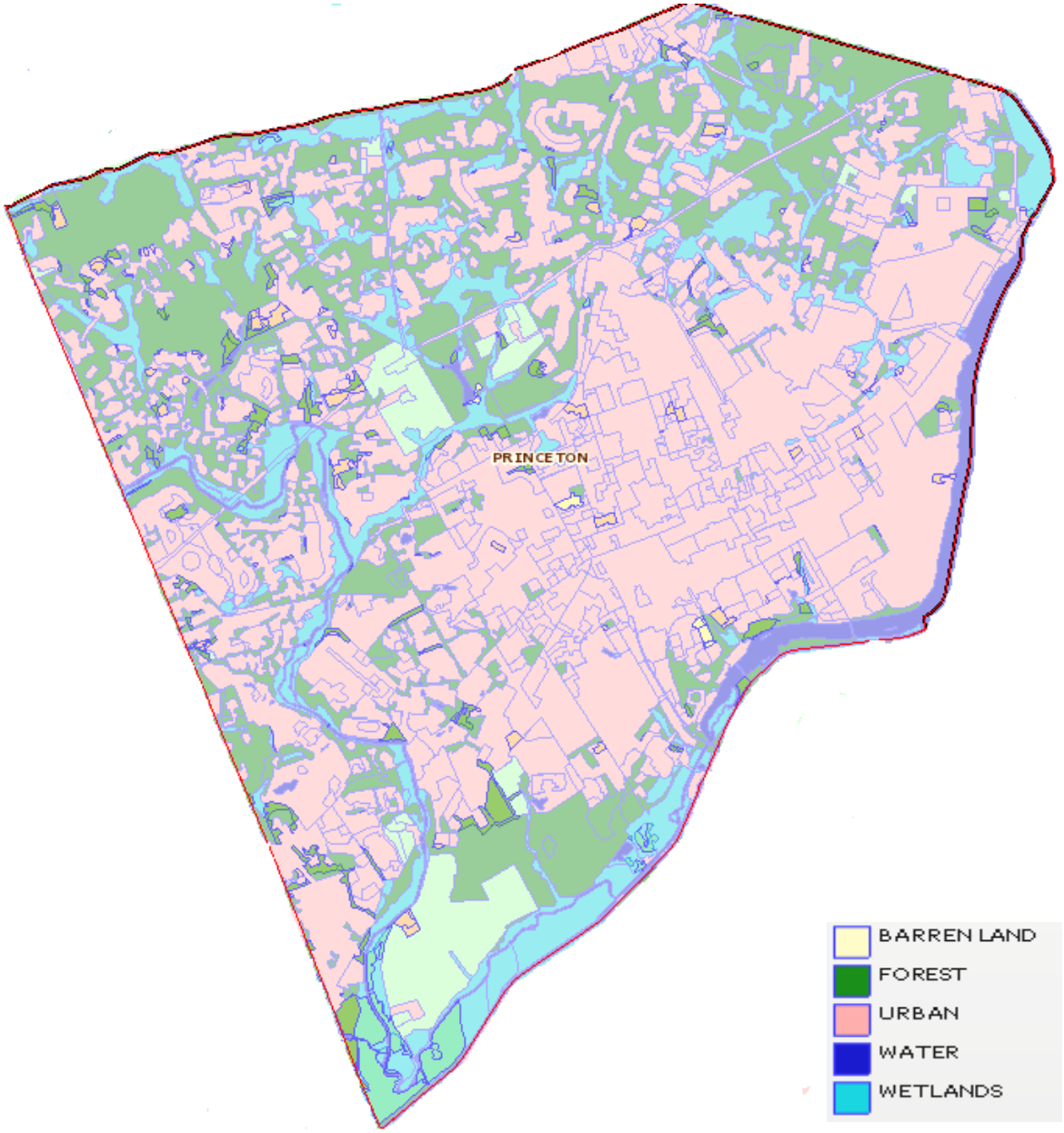


Figure 4.21 Wildlife Corridors

Figure 4.2a Source: NJ DEP's Landscape Project Data 2008. Available for download at http://www.state.nj.us/dep/gis/depsplash.htm#

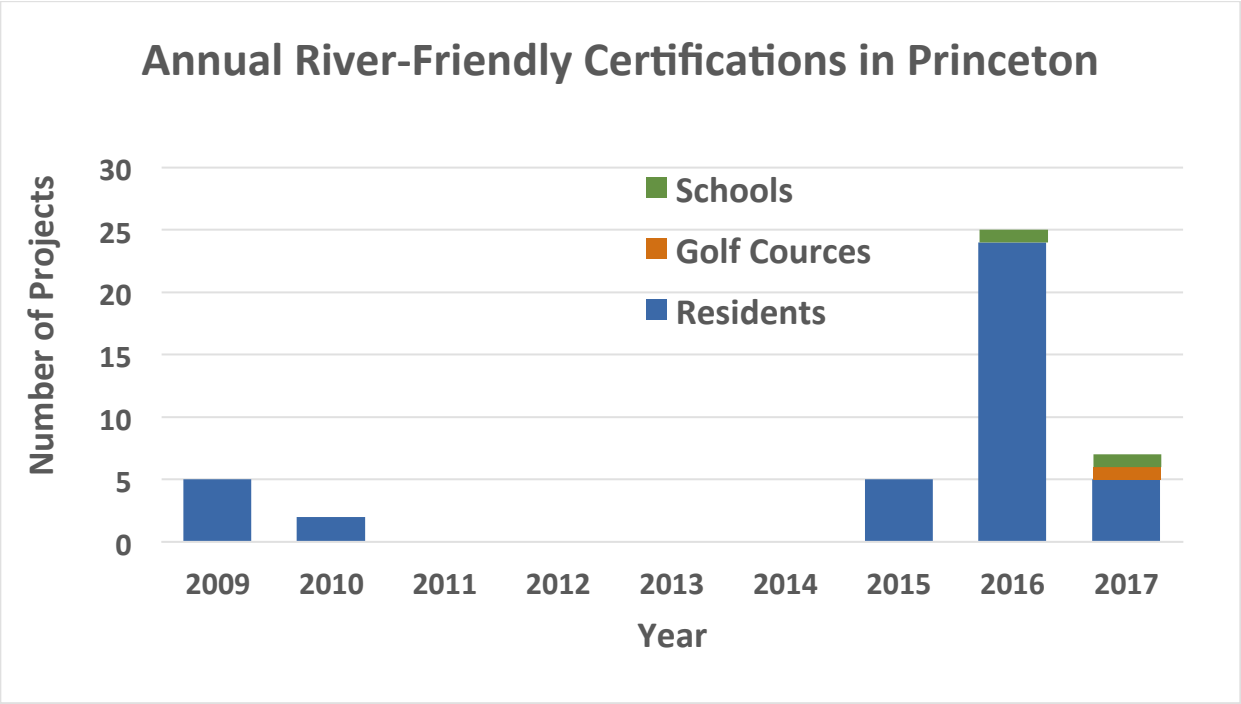


Figure 4.22 River Friendly Certified Projects

Source: Stony Brook Millstone Watershed Association

Why do we care?

The Borough and Township, located in the Central Piedmont area of New Jersey, are uniquely situated between the hardwood forests of the north and the deciduousconiferous forests of the Pinelands region. This area supports one federal endangered, one federal threatened, ten state endangered, 17 state threatened, and 69 special concern and regional priority species. As a result, preserving wildlife habitats in this transition area is a primary goal outlined the NJ State Wildlife Action Plan.[8] In addition to sustaining wildlife and providing natural services, such as carbon sequestration, climate control, and groundwater recharge, the condition of habitats in the region directly affects not only economic factors, such as tourism opportunities, but also the quality of life residents enjoy. Development should be planned to avoid degradation of the most critical resources.

How are we doing?

According to NJ DEP's Landscape Project Data,[9] Princeton Township contains a variety of wildlife habitat types in addition to a category one stream indicating high quality water. It supports critical resources, including wood turtle habitat in the north and bald eagle foraging

[8] NJ State Wildlife Action Plan. Available for download at http://www.state.nj.us/dep/fgw/ensp/wap/pdf/14.pdf

[9] NJ DEP's Landscape Project Data. Available for download at http://www.state.nj.us/dep/gis/depsplash.htm#

in the south. The Township also contains forests suitable for state endangered species and forested wetlands that support state threatened species. In addition to numerous wetlands, grasslands exist that support priority species of concern. While the Borough contains fewer habitats of notable quality, it does contain forest habitat suitable for species of priority concern in the state.

The Stony Brook Millstone Watershed Association's River-Friendly Program focuses on land use and environmental stewardship to reduce the amount of pollution reaching large bodies of water from nonpoint sources of pollution. Residents, businesses, and golf courses can achieve River-Friendly Certification by implementing projects that address wildlife habitat enhancement as well as water quality preservation, water conservation, and education and outreach. All projects undergo a certification process of 12 to 18 months from start to finish that includes individual goals and assessments for each site. The graph shows the number and type of River-Friendly projects certified each year since the program's creation. In addition to one golf course (TPC Jasna Polana) and one certified business (Stony Brook Regional Sewerage Authority), there are
17 total River-Friendly certified residences.

4.3. Indicator: Solid Waste and Recycling

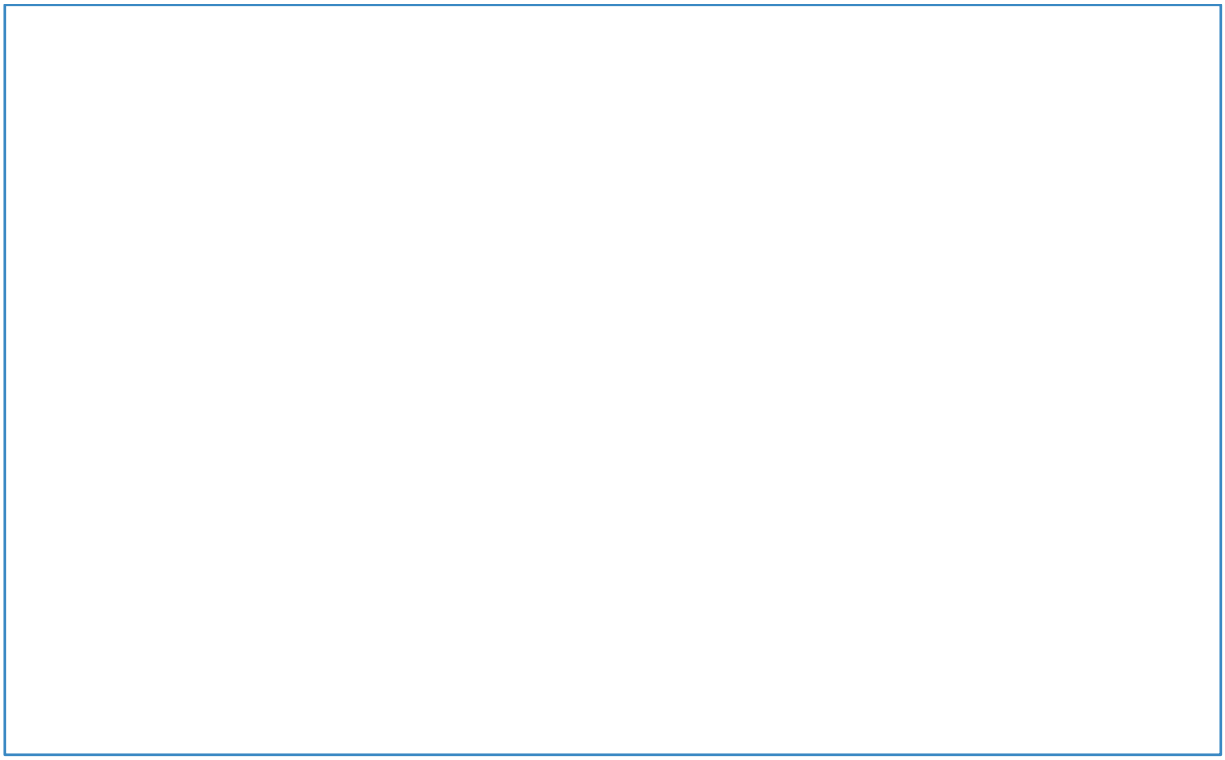


Figure 4.31 Recycling Rate in 2016

Source: 2016 tonnage report with recycling data

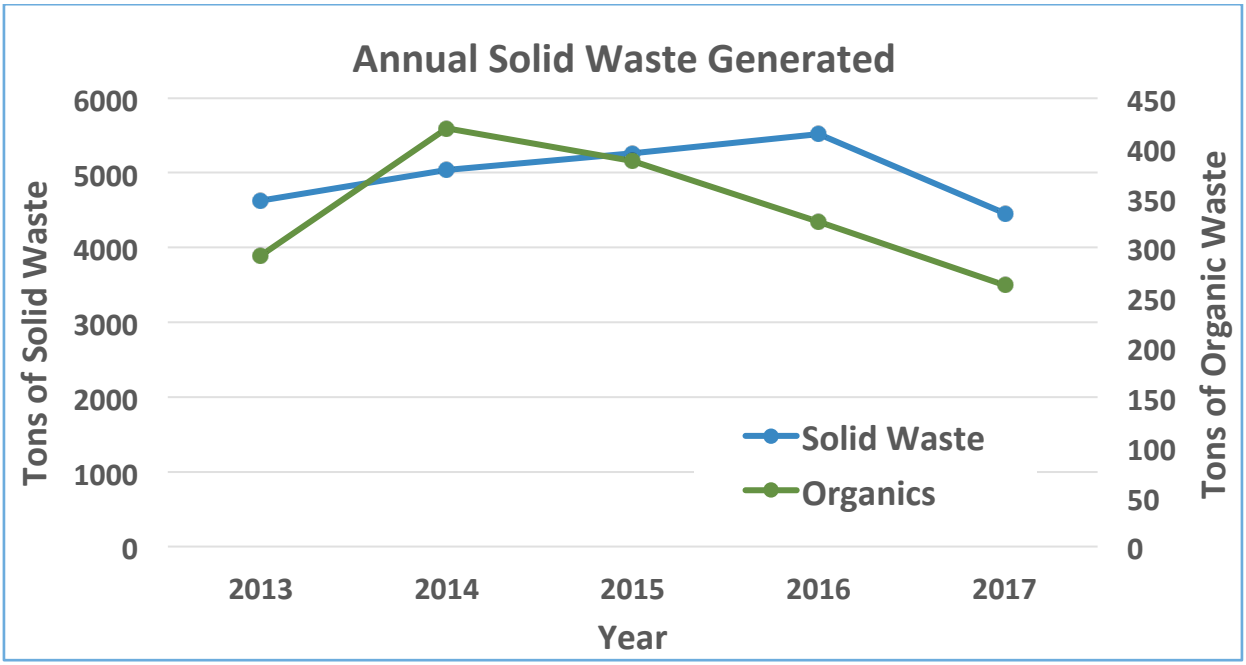


Figure 4.32 Annual Solid Waste Generated

Source: Princeton solid waste and organics tonnage 2013-2017

Why do we care?

One of the biggest impacts we as humans have on the environment is through consuming resources. Our consumption utilizes materials extracted from our environment, such as paper from trees and gasoline from oil. When we consume, we then dispose materials when we are done using them, which creates waste that must be transported to a landfill or to trash incinerators.

Recycling alleviates impacts by reducing the amount of new materials that must be extracted from the environment and the amount that must be disposed of. Increasing the amount of waste recycled is an important step for Princeton's efforts to maintain a healthy and sustainable natural environment, as non-recycled waste can generate land, water, and air pollution. Reducing the total amount of waste per capita is an ongoing challenge for the Princeton community. In addition, recycling is a New Jersey State Law. By tracking the annual recycling rate, the Borough and Township can monitor efforts to create a greener, more sustainable community through the conservation of limited natural resources.

How are we doing?

This indicator shows the percent of municipal solid waste (MSW) recycled annually by Borough and Township residents and businesses. The recycling rate is a ratio of total recycled material such as bottles, cans, and paper to the total municipal solid waste (MSW), including recycled material. This ratio does not account for yard waste. Since recycling rates for the County and State include bulky waste, it is not possible to directly compare these to the municipal recycling rates for Princeton Borough and Princeton Township. Figure 4.3a shows that Princetonians are recycling between 76 and 79 percent of Municipal Solid Waste.

Figure 4.3b shows the total pounds of solid waste generated by the average Borough and Township resident. Waste per capita is determined by the ratio of pounds of municipal solid waste (MSW), including recycled waste but excluding yard and construction waste, to the population. The data shows that Borough residents generate about half a pound less per day on average than Township residents. While the Borough's residents generated more waste than their Township counterpart through the mid 1990s, the total amount declined over that time. Since then, it has risen just as the Township's waste generation has increased, and residents from both Princetons now create similar amounts of waste per day.

4.4. Indicator: Air Quality

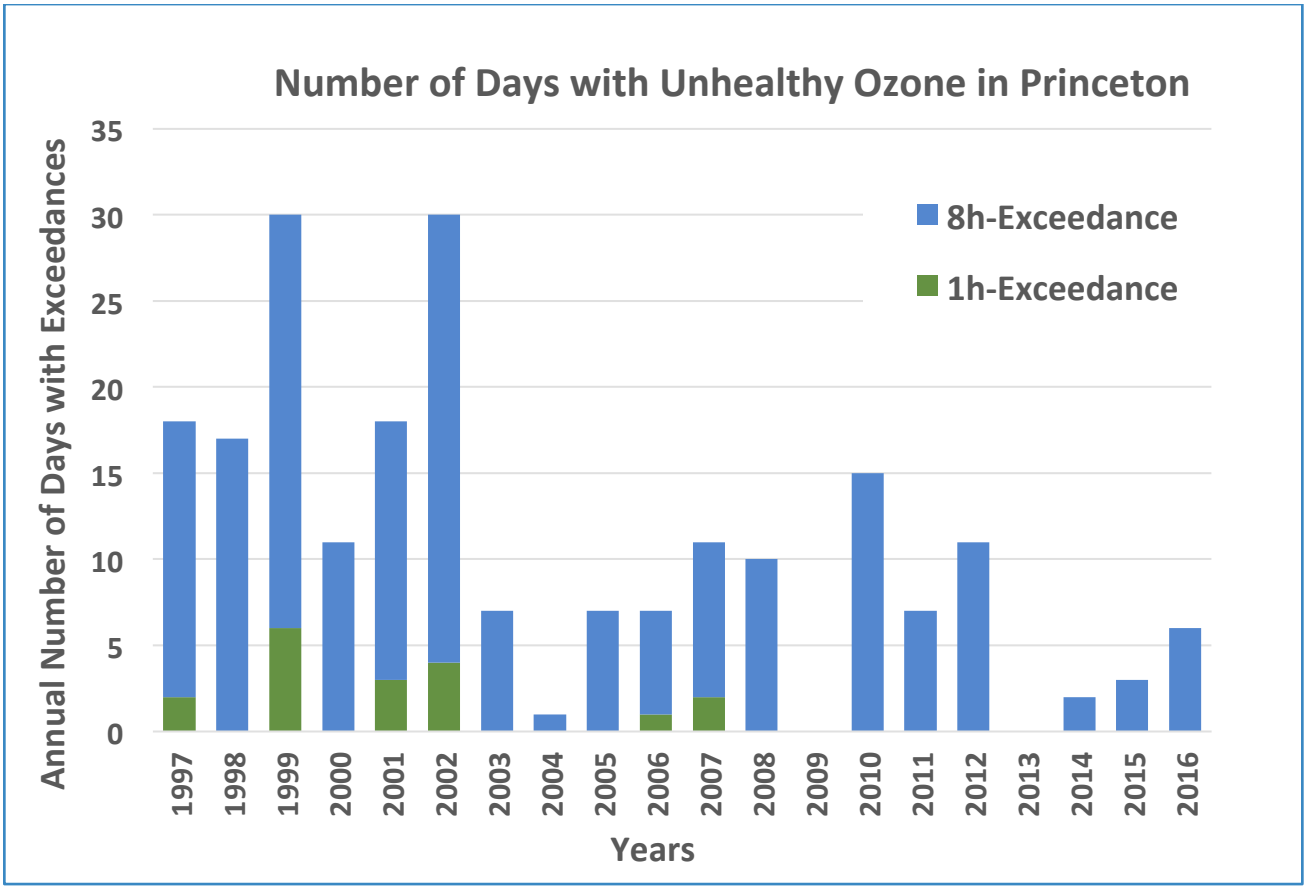


Figure 4.41 Number of Days with Unhealthy Ozone in Princeton

Source: Olga Boykov, New Jersey Department of Environmental Protection, Division of Air Quality, Bureau of Air Monitoring. USEPA has been operating an ozone monitor at Washington Crossing State Park, not too far from Rider University. Both the ozone and NOX data are taken from the Rider University monitor which is about 5 miles closer to Princeton. Also, the National Ambient Air Quality Standards for ozone have changed since 1997, so the definition of an "exceedance day" will also have changed. But the NAAQS have gotten more stringent. The 8-hour standard went from 0.08 ppm (1997) to 0.075 (2005) to 0.070 (2006). The 1-hour standard was revoked in 2005, but NJDEP still keeps track of exceedances

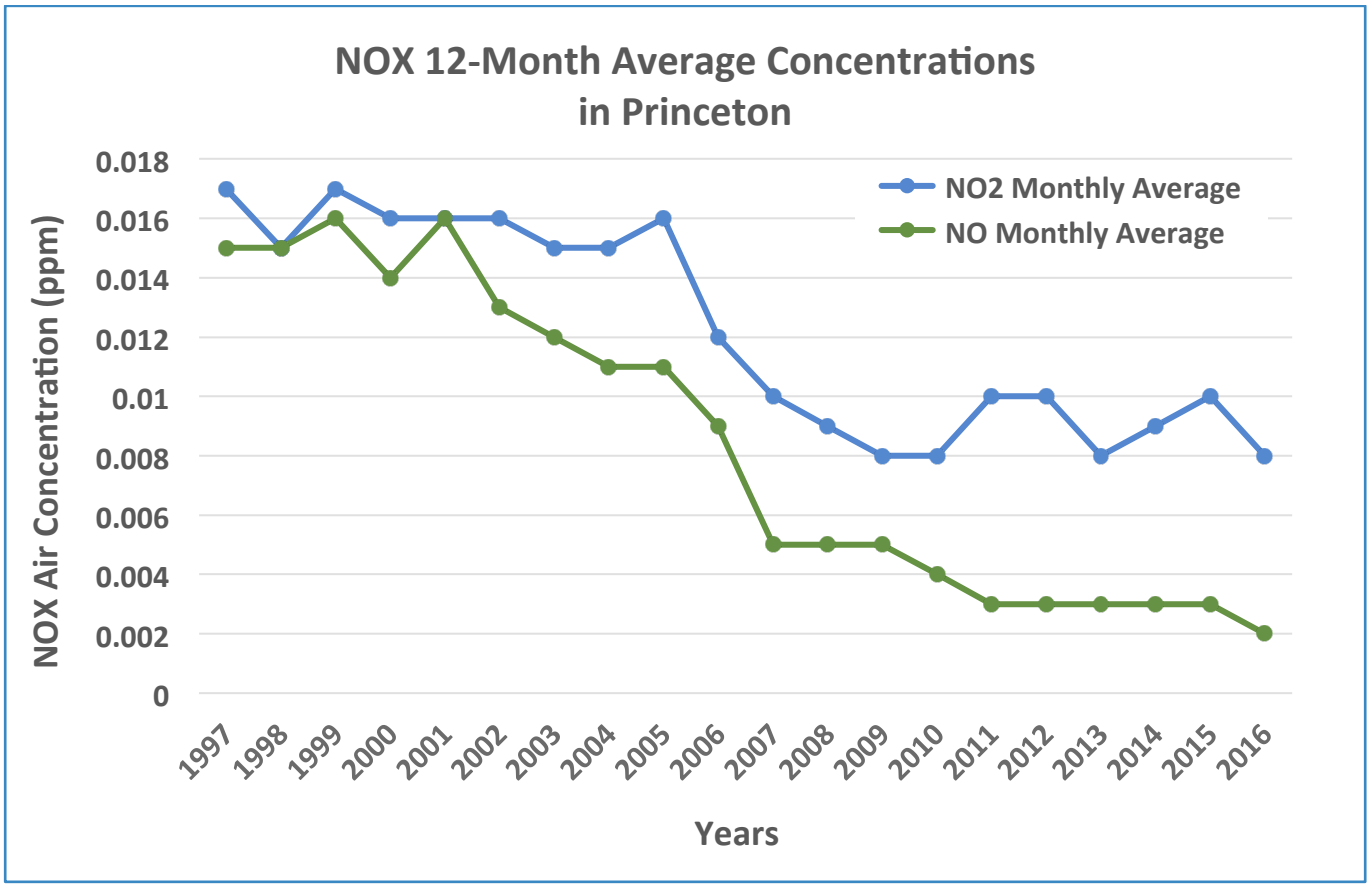


Figure 4.42 NOX 12-Month Average Concentration in Princeton

Source: Olga Boyko, New Jersey Department of Environmental Protection, Division of Air Quality, Bureau of Air Monitoring. The Allowed range for NOX emissions is 0.06 to 0.07 ppm.

Why do we care?

This indicator tracks local air quality by monitoring the presence of the harmful gases ozone and nitrogen oxides (NOx) in the lower atmosphere. Ozone and NOx are greenhouse gases that contribute to smog and cause a wide variety of health related problems, including eye irritations, asthma attacks, breathing and respiratory problems, loss of lung function, possible long-term lung damage, and lowered immunity to disease. When present in the lower atmosphere, they can lower agricultural yields and contribute to the breakdown of various other materials. Both ozone and NOx are created either directly or indirectly by the combustion of fossil fuels, and thus can be reduced in the atmosphere by limiting our reliance on automobiles and non-renewable energy sources.

How are we doing?

The New Jersey Department of Environmental Protection's (NJ DEP) air monitoring station at Rider University in Lawrence, which covers the Mercer County region including Princeton Borough and Township, tracks the number of times that ozone concentrations in the air exceed acceptable health standards for more than one hour and for more than eight hours. It also tracks the number of times that the component gases of NOx, nitric oxide and nitrogen dioxide, exceed an acceptable 12-month average of .053 ppm. Despite fluctuations from year to year, the data shows a general decline in both 1-hour and 8-hour ozone exceedances since 1985 and 1998, respectively. There have been no NOx exceedances in the years for which data is available. Since air quality is affected by regional non-point sources, the Princetons may not be able to significantly affect the trends for this region, however, the Borough and Township can look to partner with surrounding municipalities and the County to establish regional goals and strategies to maintain and enhance air quality.

1. 4.5 Indicator: Water Quality

			Stream Benthic Macroinvertebrate Impaction				
Water Body	**Sampling Location**		**1993/4 Impairment**	**1998/9 Habitat**	**1998/9 Impairment**	**2003/4 Habitat**	**2003/4 Impairment**
Stony Brook	Rt. 206 (Princeton Twp)		Moderate	Optimal	Moderate	Optimal	Moderate
Duck Pond Run	Rt. 1 (West Windsor Twp)		Severe	Suboptimal	Moderate	Suboptimal	Moderate
Millstone River	Carnegie Lake Rt 27 (S. Brunswick Twp)		Moderate	Suboptimal	Moderate	Optimal	Moderate
Heathcote Brook	Academy Street (S. Brunswick Twp)		Severe	Suboptimal	Non-Impaired	Optimal	Moderate

Table 5 Water Quality

Figure 4.5 Source: NJ DEP – Bureau of Freshwater and Biological Monitoring
http://www.nj.gov/dep/wms//bfbm/amnet.html

Why do we care?

Life as we know it depends directly on water. Contamination of this vital resource not only impairs wildlife habitat and degrades recreational opportunities but also increases the costs associated with treating water to create a potable supply for our communities. Some materials, such as phosphorus, occur naturally but can also contribute to poor water quality. Phosphorus is an essential nutrient for plant growth, but many human activities, such as fertilizing lawns, add excess phosphorus to the environment. Stormwater washes contaminants into our waterways where increased phosphorus leads to accelerated plant growth and algal blooms that result in reduced dissolved oxygen and death of aquatic species.

This indicator tracks local water quality by monitoring the communities of freshwater macroinvertebrates in Princeton and nearby streams that comprise the Raritan Valley Watershed. Freshwater benthic macroinvertebrates are small fauna that live in the substrate of freshwater streams and play an integral role in the aquatic food web. Since they are relatively immobile, they are unable to escape pollutants that impact water quality. Therefore their presence and diversity is a reliable indicator of water quality. Benthic macroinvertebrate impaction studies are conducted every five years by the New Jersey Department of Environmental Protection (NJ DEP) and provide data on the

conditions of streams ranging from non-impaired (healthy macroinvertebrate populations) to severe impairment.

Since the physical attributes of habitat significantly impact the health of the macroinvertebrate community and overall water quality, the second indicator analyzes the aquatic habitat of streams in the vicinity of Princeton. The Habitat Assessment for high gradient streams found in this region of New Jersey evaluates the sampling site as well as an area immediately upstream.

How are we doing?

In the last three sampling years, NJ DEP determined that all four sample sites in and around Princeton Borough and Township were either moderately or severely impaired. While two of the sampled water bodies have improved over that time period, the Habitat Assessment shows a more promising outlook. None of the assessed streams have decreased in quality, and three of the four sites have optimal habitat, the highest ranking designation.

This suggests that water quality will improve if Princeton focuses on controlling the pollutants that reach these freshwater streams. In order to meet NJ water quality standards, total phosphorus must not exceed 0.1ppm (parts per million). The Stony Brook Millstone Watershed Association StreamWatch program monitors levels of orthophosphate, a component of total phosphorus, at numerous sites in the Princeton area [10]. This data shows that phosphorus levels in Princeton streams often exceed the standard.

Considering that total phosphorus must exceed the standard when orthophosphate levels do, the following sites in the Princetons have frequently exceeded the standard. Detailed data can be viewed by following the corresponding links.

- Millstone River (site CL1)- levels have been high with a dip in 2004 and 2007 http://spreadsheets.google.com/pub?key=pewzju7ZTWYIQ0lA6fhloIw&gid=5
- Carnegie Lake (Site CL2)- levels have been particularly high in the past 3 years http://spreadsheets.google.com/pub?key=pewzju7ZTWYIunWOjY-oAAg&gid=5
- Stony Brook (site CL 3)- levels have generally increased with some variation http://spreadsheets.google.com/pub?key=pewzju7ZTWYJQ_6MZE1QrIg&gid=5
- Harry's Brook (site HA1)- 2007 levels doubled from previous year- http://spreadsheets.google.com/pub?key=pewzju7ZTWYI_1zu0zKdGPQ&gid=5

[10] Stony Brook Millstone Watershed Association StreamWatch Data - http://www.thewatershed.org/water_monitor_lvl2.php?id=C0_140_52

- Mountain Brook (site MB1) shows slightly high levels http://spreadsheets.google.com/pub?key=pewzju7ZTWYJAbpKfRYmFEw&gid=5
- Stony Brook (site SB1) shows increasing levels of orthophosphate http://spreadsheets.google.com/pub?key=pewzju7ZTWYJ8pAsWJQCdYg&gid=5
- Stony Brook (site SB2)phosphate levels are generally high with some variation http://spreadsheets.google.com/pub?key=pewzju7ZTWYLKHZ28kN_VSQ&gid=5

While the Princetons are part of a much larger watershed and cannot control the activities of everyone who impacts its environment, the Borough and Township can improve their own practices regarding stormwater management, landscaping, etc., by practicing low impact development, using a road salt alternative, constructing rain gardens, and implementing other best management practices. In this way, the Princetons can lead by example to encourage neighboring municipalities to become better stewards of water resources. As Princeton becomes a more sustainable community, we can continue to view the impact our actions have on water quality at these sites

5. Goal 5: Curbing Greenhouse Gas Emissions and Climate Change through Energy Conservation and Renewable Energy

What do we want to achieve?

Visions for the future

Our vision for Princeton is a place that is committed to doing its part to support New Jersey's goal of reducing local greenhouse gas emissions as stated in the Global Warming Response Act of 2007. The Act outlines progressive benchmarks that include reducing greenhouse gas emissions to 1990 levels by 2020, approximately a 20% decrease, and further reducing emissions to 80% below 2006 levels by 2050. It challenges all sectors of the community to reduce emissions through a combination of energy efficiency, carbon offsets, and renewable energy strategies.

What do we see?

Current trends and new approaches

Greenhouse gas emissions and the climate changes associated with their accumulation in the atmosphere pose serious concerns and challenges such as: rising sea levels, changes in rainfall patterns, more severe droughts and floods, harsher hurricanes and other windstorms, and new pathways for disease. With vast assets in facilities, parks, roads, bridges, waterfronts, and water and sewage networks, climate change creates significant risks for local governments. Strategies to reduce greenhouse emissions within a community include first to establish baseline carbon footprint and develop climate action plan to measurably reduce greenhouse gas emissions in all sectors of the community.

While greenhouse gas emissions arise from vehicles, heating oil, natural gas, electricity generation, and solid waste management, reliable data at local levels is not always available for all of these sources. By comparing data that is available to statewide greenhouse gas emissions by source, we can estimate the proportion of the overall carbon footprint accounted for. The chart below shows the greenhouse gas emissions for sectors that contribute significant amounts of emissions to New Jersey's overall carbon footprint.

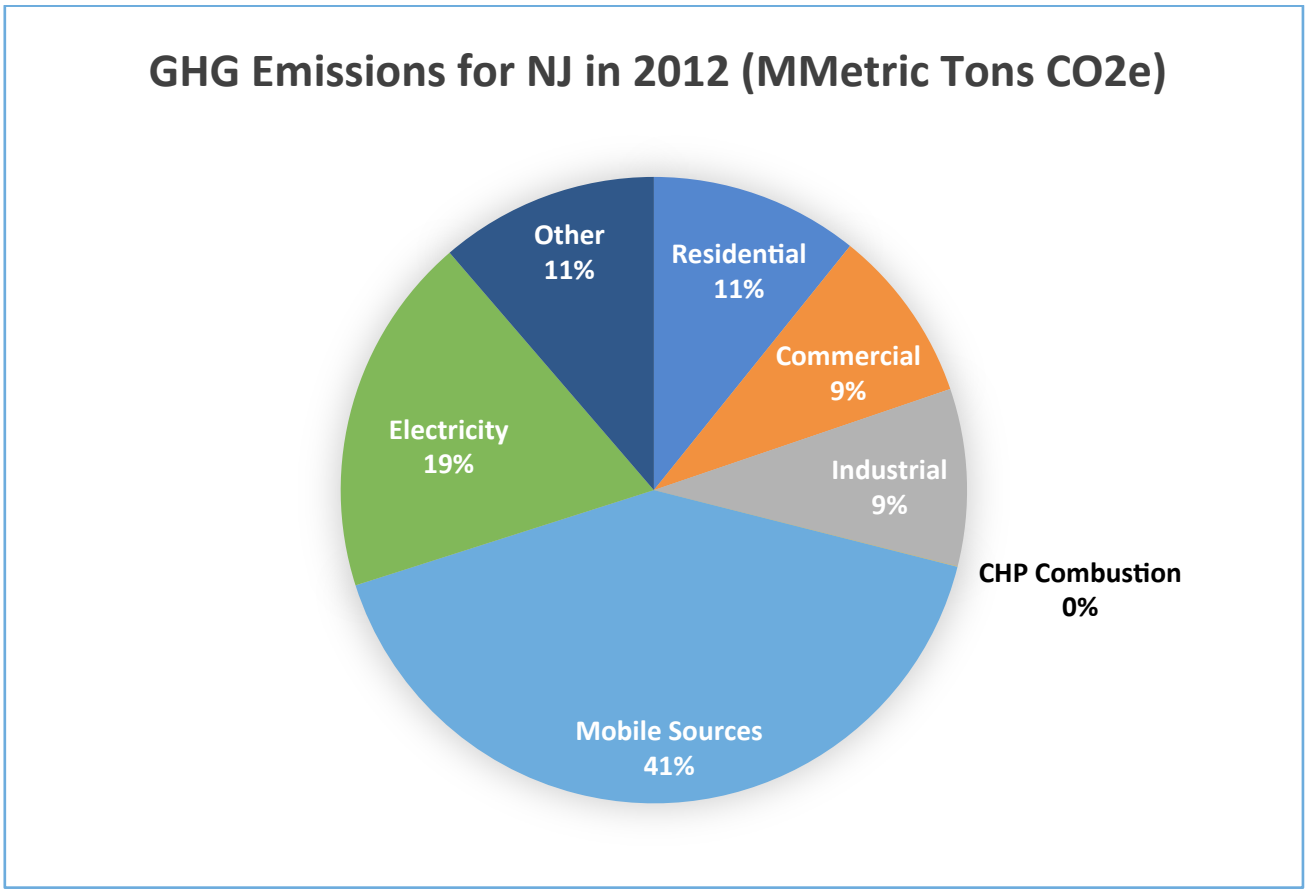


Figure 01 Greenhouse Gas Emissions by Source (2012)

Source : http://www.nj.gov/dep/aqes/sggi.html

Energy audits have been completed for The Borough and Township and school district facilities. All three have been and plan to continue implementing some of the audits' recommendations to become more energy-efficient within the confines of their budgets. A Sustainable Princeton will provide education and can offer incentives to promote energy conservation and the use of renewable energy sources and technologies.

How are we doing?

Indicators of success

5.1: Greenhouse Gas Emissions from Electricity and Natural Gas
5.2: Clean and Renewable Energy

What are we doing?

Actions to achieve this goal

- For Municipal Government (MG) actions, see page 124

- For School (S) actions, see page 147
- For Business & Non-profit (BN) actions, see page 172
- For Residential (R) actions, see page 193

5.1. Indicator: Greenhouse Gas Emissions from Electricity and Natural Gas

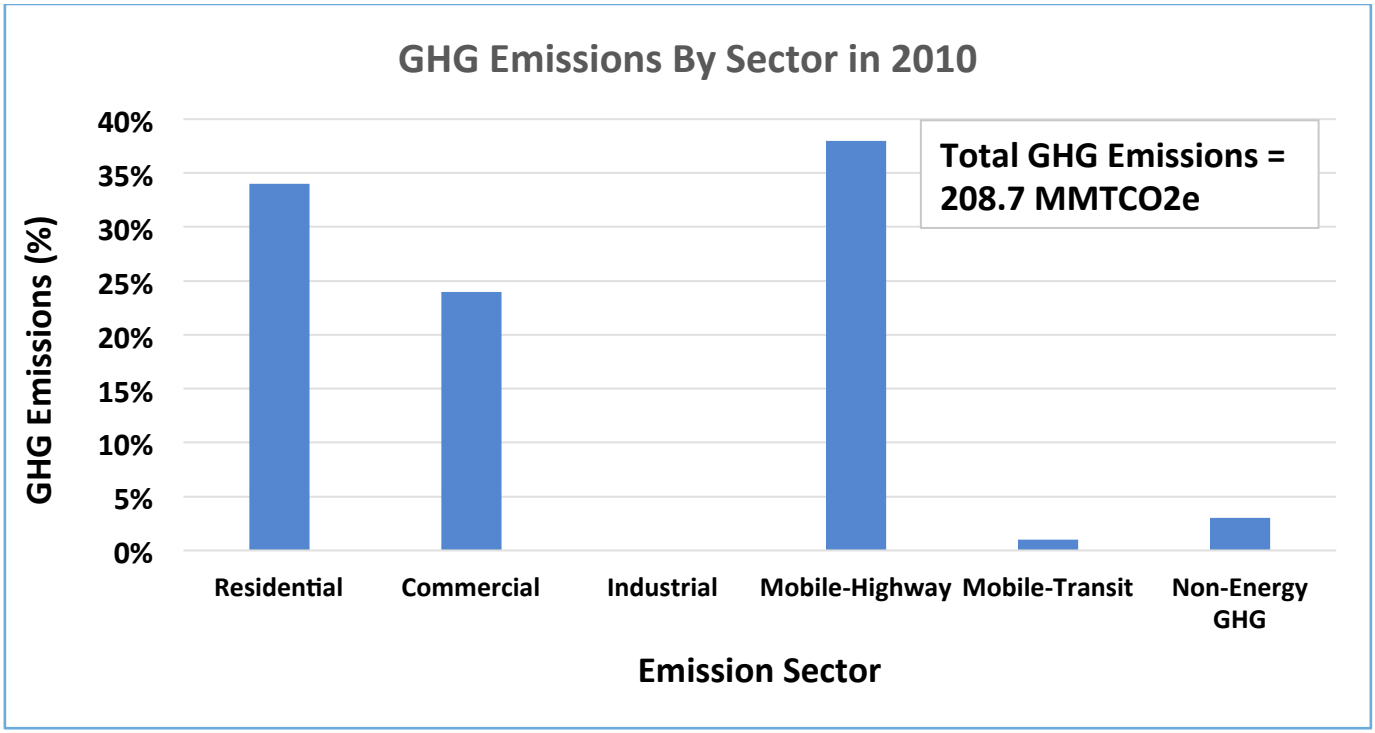


Figure 5.11 Greenhouse Gas Emissions by Sector (2010)

Source: DVRPC Energy and Emissions Profile for Princeton Township, Mercer County, NJ, https://www.dvrpc.org/webmaps/municipalenergy/mcdDetail.aspx?mcdcode=3402160915

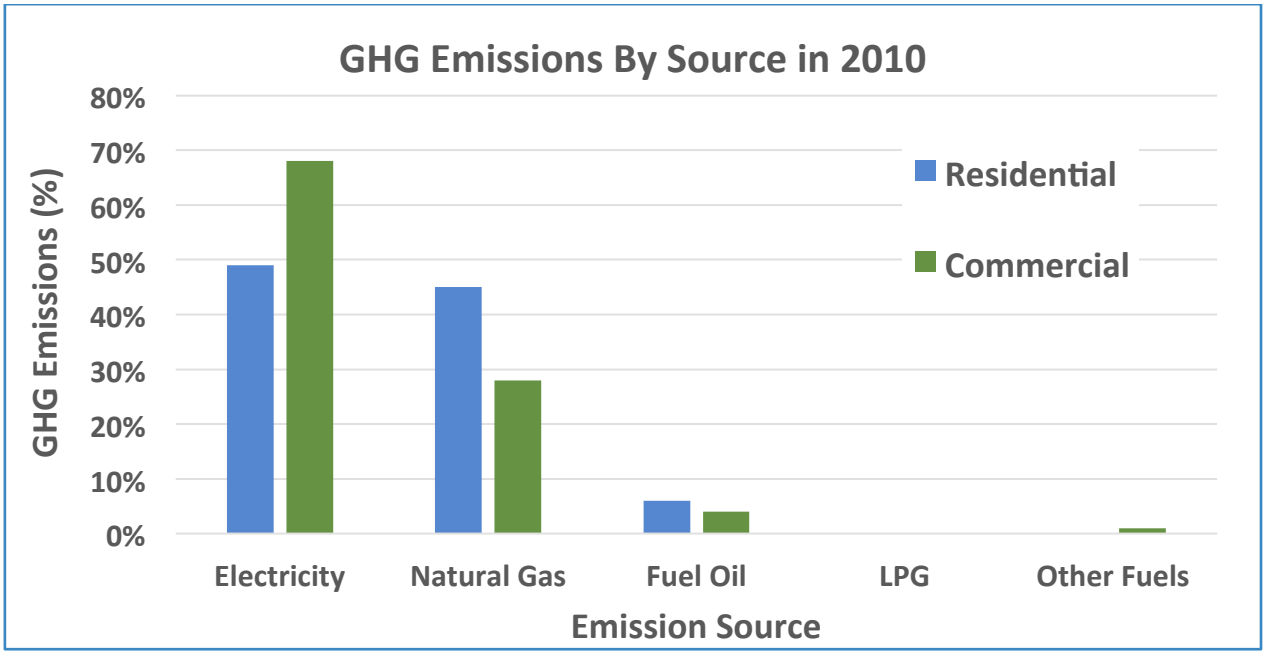


Figure 5.12 Greenhouse Gas Emissions by Source (2010)

Source: DVRPC Energy and Emissions Profile for Princeton Township, Mercer County, NJ, https://www.dvrpc.org/webmaps/municipalenergy/mcdDetail.aspx?mcdcode=3402160915

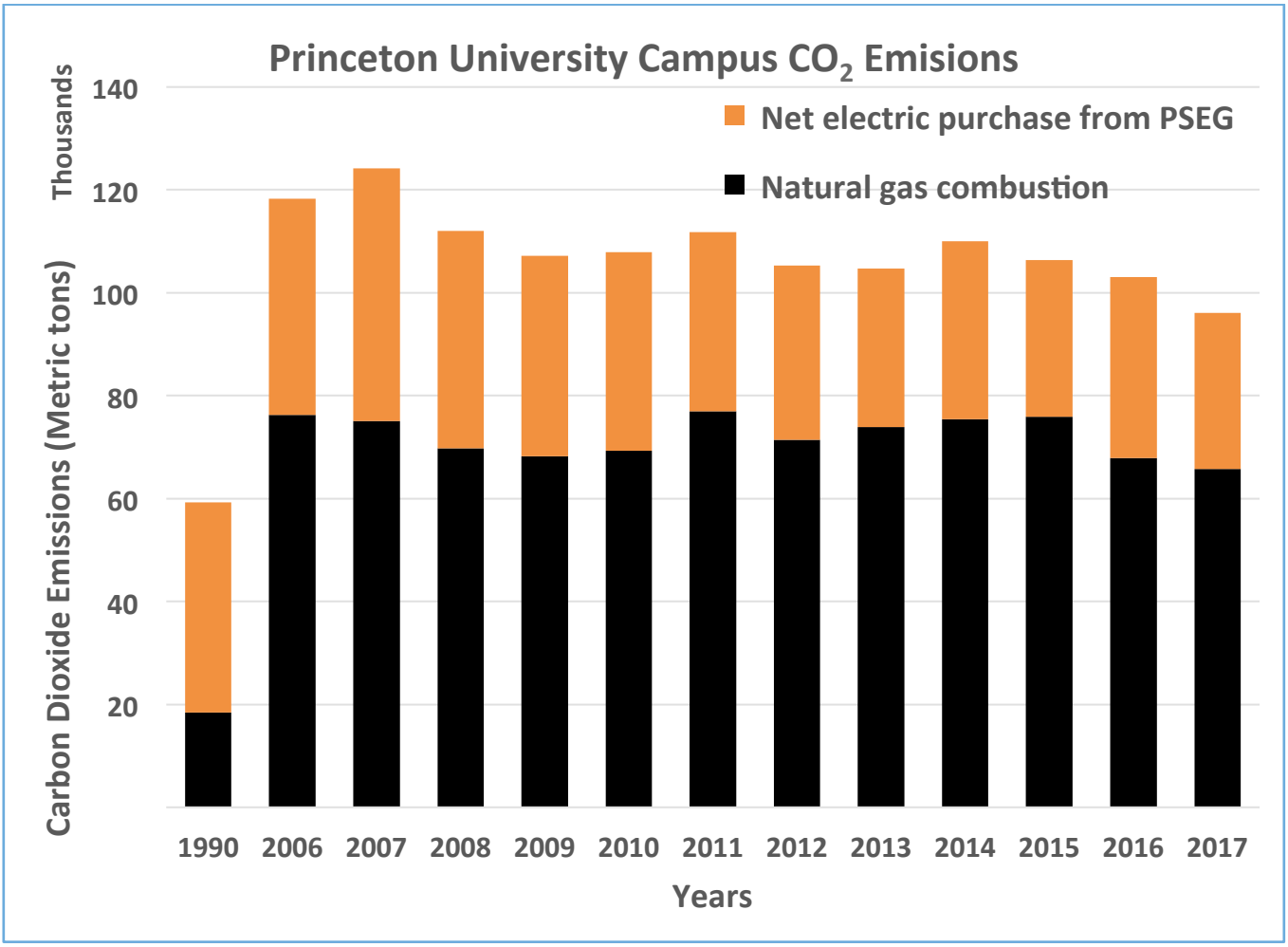


Figure 5.13 Princeton University's Green House Gas Emissions from Electricity and Natural Gas

Source: Edward Borer, Energy Plant Manager, Princeton University, etborer@princeton.edu 12/1/2017. Their Fiscal year is June-July. These numbers do not normalize for weather variations. The PSEG supply factor used in these calculations is .000365 short tons of CO2/kWh

Why do we care?

Carbon dioxide emissions from human activity, mostly the combustion of fossil fuels (coal, oil, natural gas) and large-scale deforestation, are the primary cause of the now famous global climate change. Experts say that no matter what we do, some warming and related negative effects will occur, however, the current consensus among experts is that it is not too late to stop "catastrophic warming" from occurring if we reduce our carbon emission to 1990 levels by the year 2020 and 80% below 2006 levels by the year 2050. Failure to do so will result in more flooding, blazing hot summers, tropical diseases, global famine, sea level rises, more intense storms, and ironically droughts in much of New Jersey.

How are we doing?

This indicator shows greenhouse gas emissions in metric tons of carbon dioxide equivalent ($MTCO_2e$) produced by various sectors in the Borough and Township. Because greenhouse gases vary in potency, gases such as methane, which are less prevalent than carbon dioxide, have been converted with eGrid emissions factors to the equivalent of $MTCO_2$. While such greenhouse gas emissions come from many sources, including vehicles, solid waste management, heating oil, electricity production, and natural gas use, reliable data is not readily available for all of these sources. This indicator tracks greenhouse gas emissions from electricity and natural gas only. When compared to New Jersey's overall carbon footprint, the emissions tracked in this indicator represent approximately 42% of the Princetons' overall greenhouse gas emissions.

In 2007, Princeton Township's energy-related greenhouse gas emissions were 329,571 $MTCO_2e$ - more than 10 times the size of the Borough's energy carbon footprint of 29,911 $MTCO_2e$. This calculation includes emissions attributed to electricity and natural gas consumption for buildings, street lights, and traffic signals. In order to reach the State's goal of reducing emissions by 80% from 2006 levels for 2050, Princeton Borough would have to reduce emissions by 23,929 $MTCO_2e$ to 5,982 $MTCO_2e$, and Princeton Township would have to decrease emissions by 263,657 $MTCO_2e$ to 65,914 $MTCO_2e$.

Figures 5.1a and 5.1b show emissions by sector for electricity (kWh) and natural gas (therm) consumption. The commercial sector is the largest contributor of CO_2 emissions in both the Borough and Township, contributing 68% and 71% of measured emissions respectively. The residential sector makes up the second largest percentage of these emissions at 28% for both the Borough and Township. This data shows that commercial natural gas-related emissions (51%) are the main source of greenhouse gases in the Township, while commercial electricity related emissions (48%) are responsible for the largest percentage of measured emissions in the Borough. In the Township, categories listed as "Other" include emissions from both Municipal Government and the Industrial

[19] International Energy Outlook 2008. http://www.eia.doe.gov/oiaf/ieo/emissions.html

[20] http://www.wnjpin.state.nj.us/OneStopCareerCenter/LaborMarketInformation/lmi02/index.html#mun

Sector and make up only 1% of the Township's total emissions related to electricity and natural gas. In the future, the Township should track energy use and emissions for municipal operations in order to segregate that data from industrial sources. In the Borough, these sectors are broken out, with Municipal Government representing 3% and Industrial 1% of the total Borough emissions. This data suggests that any effort to reduce greenhouse gas emissions will require participation from individuals and businesses in Princeton.

Because Princeton University is housed almost equally by both the Borough and the Township, Figure 5.1c shows Princeton University's carbon footprint separately. Housing a population of approximately 10,000 people (students, faculty, and staff) and state-ofthe-art academic facilities, Princeton University's carbon footprint is approximately six times greater than that of the Borough but still significantly less than the Township's footprint.

Another measure of CO_2 intensity is emissions per person. The final set of graphs, Figures 5.1d and 5.1e, shows greenhouse gas emissions related to electricity and natural gas use per capita for Princeton Borough and Princeton Township overall and then specifically for the residential sector. The data shows that Princeton Township residents have the largest carbon footprint, with 19.8 $MtCO_2e$ per year, followed by the average New Jersey resident who in 2005 produced 7.1 $MTCO_2e$ per year, and lastly by Princeton Borough residents, who are responsible for 2.4 $MTCO_2e$ per year. The average emissions per capita in only the residential sector where individual actions are likely to have the greatest impact are 5.24 $MTCO_2e$ per person per year in Princeton Township and 0.63 $MTCO_2e$ per person per year in Princeton Borough.

Studies show that city dwellers are greener than their country cousins as they live in smaller structures and more compact developments. Likewise, the Borough's high population density (7,500 people/sq mile) relative to that of the Township (1,000 people/sq mile) plays a significant role in the small carbon footprint of Borough residents. In the future, and as data becomes available, the Township and Borough's carbon footprint can include CO_2 emissions related to heating oil, solid waste production, and transportation.

5.2. Indicator: Clean and Renewable Energy

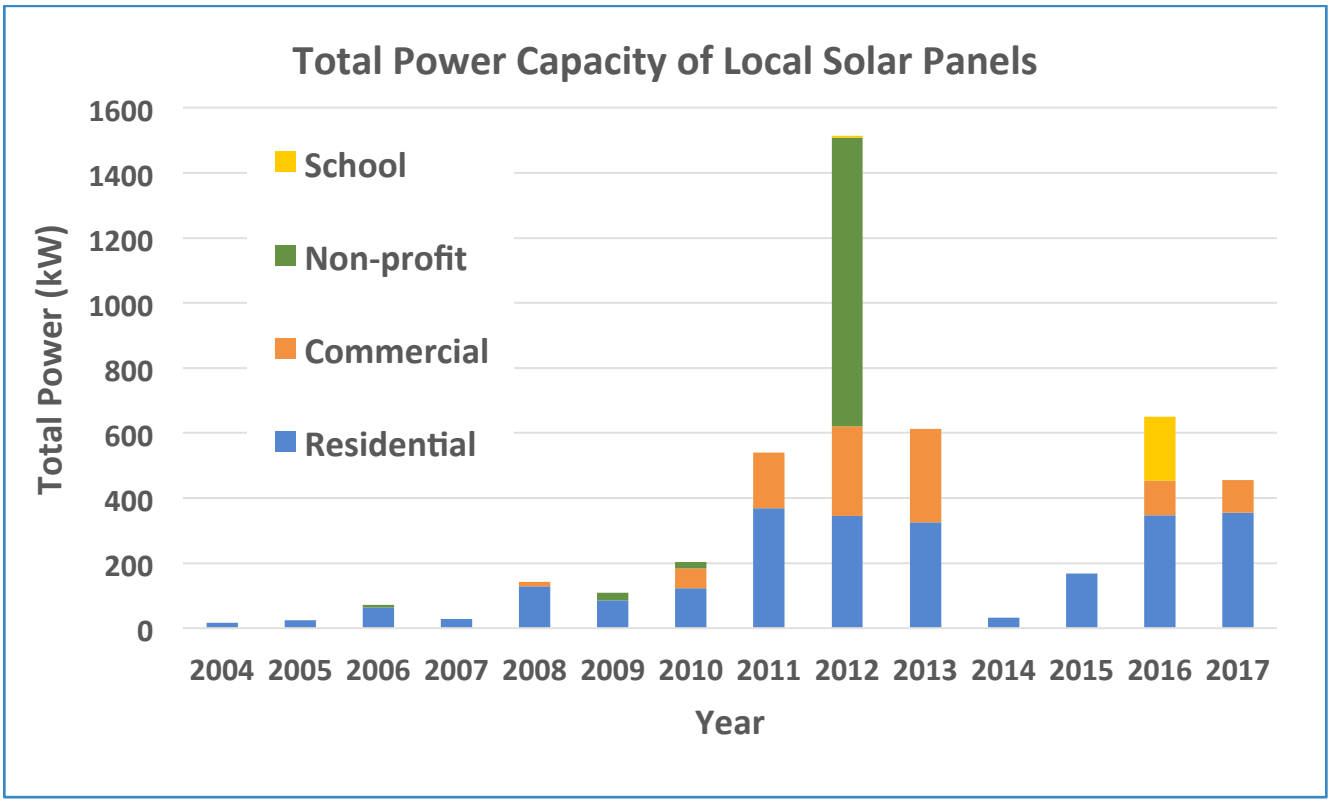


Figure 5.21 Total Power Capacity of Local Solar Panels

Source: NJ Clean Energy Program Consumer On-Site Renewable Energy http://njcleanenergy.com/renewable-energy/project-activity-reports/project-activity-reports. The data for the Princeton University (5404.656kW) was excluded from the graph.

Why do we care?

This indicator shows the annual cumulative electricity production capacity installed in Princeton Borough and Township using photovoltaic technology that produces energy

[21] Estimate of annual kWh generation of photovoltaic installations based on New Jersey Clean Energy Office calculations [total KW dc of installed photovoltaic multiplied by average yearly production or 1,000 kWh per year]

from the sun. Each dot on the graph represents a photovoltaic installation. Producing and consuming energy from fossil fuels has a tremendous negative impact on the environment. Global warming, acid rain, smog, oil spills, and strip mining are some of the many impacts that are a result of our need for cheap energy. But we have a choice. The State of New Jersey allows people to choose clean and renewable electricity that comes from sources such as solar and wind through the CleanPower Choice Program

(www.njcleanpower.com). There are also many incentives for people to install solar panels, fuel cells, and geothermal systems in their homes and businesses.

How are we doing?

This indicator shows that the Princeton community has increased its total solar electricity production capacity from zero in 2003 to close to 360,000 kWh in 2008 – enough energy to power more than 30 average homes for one year. During this time, Princeton residents have installed 30 Consumer On-Site Renewable Energy (CORE) installations or 216,219 kWh of solar production capacity. Princeton businesses and non-profit organizations have installed four CORE projects or enough photovoltaic capacity to produce 162,212 kWh of electricity.

Princeton University has also contributed to renewable energy sources. In 1996, the University installed a combined heat and power (CHP, also known as cogeneration) energy plant that supports all the chilled water and half of the electricity needs on the campus. Additionally, The Campus Club, a 12,600 square-foot building and former eating club that was acquired by Princeton University in 2006, is currently under renovation that will include a geothermal heating and cooling system.

New Jersey's current Renewables Portfolio Standard, which requires all energy providers to include renewable energy as a target percentage of their overall retail sales, calls for 16,000 Gigawatt hours (GWh) or 22.5% of electricity supply to come from renewable sources by 2021, including nearly 1,500 GWh (2.12%) from solar.[11] Princeton's current solar renewable energy portfolio represents only .01% of total electricity consumption in the Borough and Township, as noted from the chart above. Princeton can establish its own renewable energy goals and further the State's goals by encouraging individuals and businesses to take advantage of available federal tax credits and utility rebates, grants, and financing to install photovoltaic arrays. Individuals and businesses can benefit both from the production of electricity from photovoltaics and from the sale of Solar Renewable Energy Certificates (SRECs).[12]

[11] Database of State Incentives for Renewables and Efficiency (DSIRE). New Jersey Renewables Portfolio Standard. Available at www.dsierusa.org

[12] A Solar Renewable Energy Certificate represents the environmental attributes of power produced from solar energy and is sold separately from the electricity. SRECs are tradable commodities that represent the total value of clean energy benefits derived from solar-powered generation of electricity, such as the fact that it produces no greenhouse gas emissions.

6. Goal 6: Fostering an Educated, Engaged, Vibrant and Socially Responsible Community

What do we want to achieve?

Visions for the future

Our vision for Princeton is a place that provides equal access to housing, jobs, health services, education, and cultural and recreational resources for residents of all ages and backgrounds. It encourages individuals to embrace sustainability in their everyday lives and recognizes community members' efforts to achieve sustainability.

What do we see?

Current trends and new approaches

A society that can sustain itself is one with involved, healthy, content citizens. Princeton is committed to developing practices and actions promoting equity, access, and recognition so that people can experience the full array of community resources. To address housing equity, Princeton offers several affordable housing options. To keep youth engaged, Princeton offers a wide range of recreational activities to appeal to all ages and demographics. To help encourage residents to embrace sustainable lifestyles, the developing Sustainable Princeton web site will be a nexus of information. To recognize community members who demonstrate a commitment to sustainability, the Princeton Environmental Commission distributes annual Sustainable Princeton Leadership Awards. The commission also sponsors an annual Green Home and Garden Tour in the community to highlight residents, businesses, and organizations who have "greened" their homes and workplaces.. Princeton schools are educating students about the natural environment with outdoor edible garden classrooms and nature trails on school grounds. In addition, many Princeton schools are participating in Organizing Action Sustainability in Schools (OASIS) and Students Organizing Sustainability (SOS) programs that educate school officials and students about integrating sustainability into school operations and curricula.

How are we doing?

Indicators of success

- **6.1: Green Challenges**
- **6.2: Deaths from Heart Disease**
- **6.3: Educational Attainment**

What are we doing?

Actions to achieve this goal

- For Municipal Government (MG) actions, see page 130
- For School (S) actions, see page 151
- For Business & Non-profit (BN) actions, see page 175
- For Residential (R) actions, see page 195

6.1. Indicator: Green Challenges

Why do we care?

The Green Challenge Program identifies simple and meaningful ways for residents to reduce negative impacts on the environment, live healthier lifestyles, and create a more sustainable community. Each green challenge is tied to an action or lifestyle change that contributes to a more sustainable community. While the impact of each individual action may be small, the collective actions of all individuals in the community can have significant impacts. The Green Challenge Program will help track the efforts of Princeton residents as they take actions and make behavior changes that positively impact the health of Princeton's natural, economic, and social environment.

How are we doing?

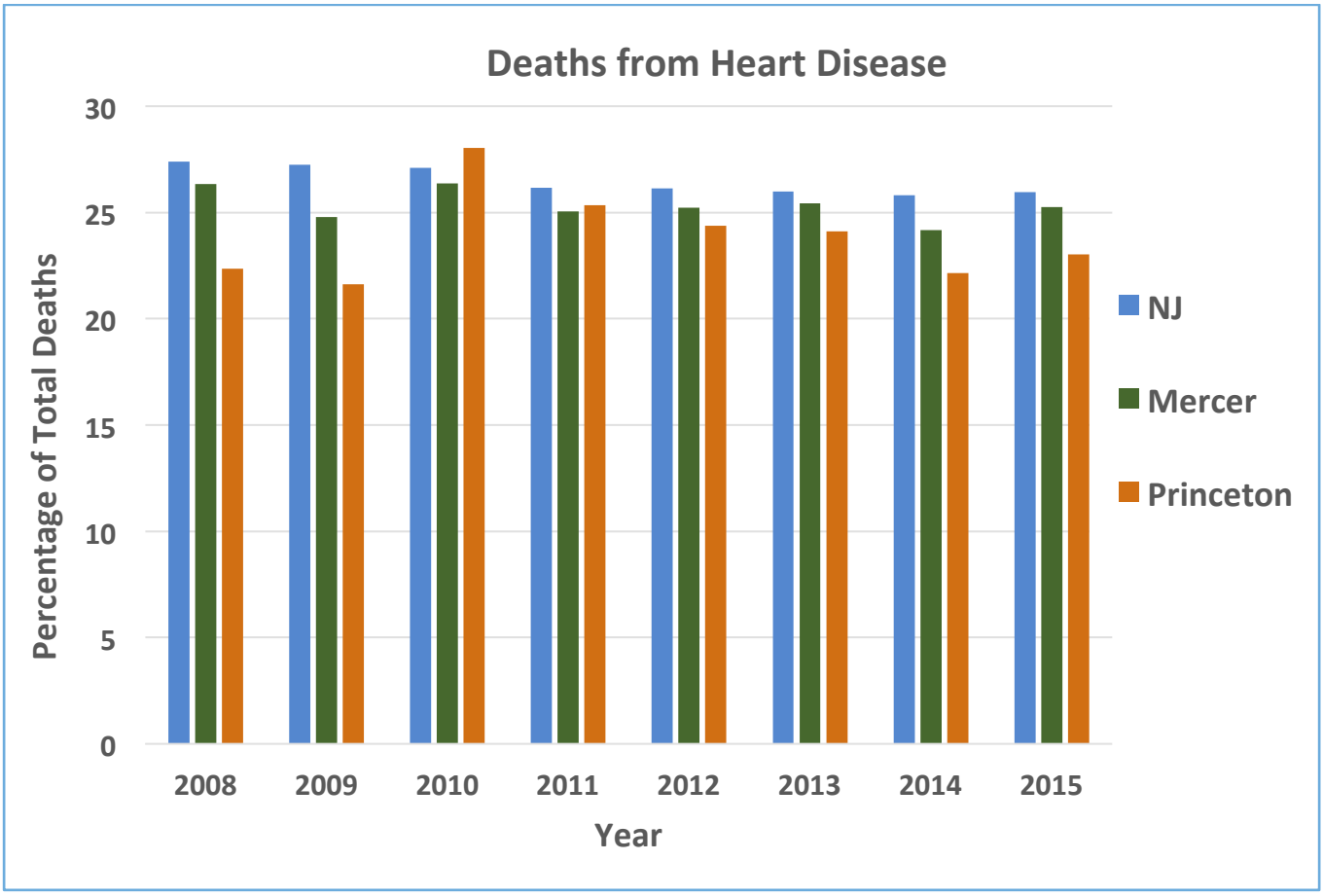
The Sustainable Princeton Green Challenge Program is only in the beginning stages with pledges collected from students at the Princeton Day School and from participants at the first Sustainable Princeton Public Workshop. The first three of a series of ongoing green challenges were launched in fall 2007. The first green challenge asked residents to start a backyard leaf compost pile. Currently 52 Princeton residents have signed onto this challenge. The second challenge asked residents to replace five incandescent light bulbs with more energy efficient compact fluorescent light bulbs (CFLs)*. Seventy-three people have taken the challenge- helping to prevent the release of 74,825 lbs of carbon dioxide from being released into the atmosphere.[24] The final challenge asked residents to leave their car at home for at least two in-town/local trips per week. Instead of using cars, residents are encouraged to walk, bike, and carpool or take public transportation. In the future, new actions can be added to the Green Challenge Program.

For more information and to sign up for the Sustainable Princeton Green Challenges, log onto www.sustainableprinceton.org

[24] Environmental Defense estimates that by replacing one 60-watt bulb with a CFL (which will last 6000 hours) that 205 lbs of CO2 will be avoided over the lifetime of the bulb. [205 lbs/CO2 X 5 CFLs X 73 people = 74,825 lbs CO2])

1.

6.2. Indicator: Deaths from Heart Disease



1..1.1.

Figure 6.21 Deaths from Heart Disease

1..1.2. Deaths from Heart Disease

Source: New Jersey State Health Assessment Data: https://www26.state.nj.us/doh-shad/query/result/mort/MortStateICD10/Count.html

Why do we care?

For many years, heart disease has ranked as the leading cause of death among all other types of death. Although many individuals are prone to heart disease through genetics, many others who are diagnosed with this disease developed it due to lifestyle choices (diet, activity, stress, etc.). With many of these factors controlled by an individual, death from heart disease is a strong sign of one's health in a given area. If the overall death rate from heart disease falls, we can infer that residents in the Borough and Township are taking steps to lead healthier, more sustainable lifestyles. Regular monitoring will allow the Borough and Township to determine how actions to increase community health have impacted residents. While historical data is only available at the municipal

level for Princeton during the years 2004 and 2005, this data will continue to be gathered and monitored by the NJ Department of Health and Senior Services.

How are we doing?

According to the New Jersey Department of Health and Senior Services, Princeton Township has a higher rate of mortality from heart disease than the Borough, Mercer County, or New Jersey. This fact should raise some flags as to the health status of residents in the Township, however Township residents' mortality rate from heart disease dropped by approximately 3 percent from 2004 to 2005, while there was no significant change in the rates for the Borough, Mercer County, or New Jersey. It is possible that these trends are in part due to the relative age structure and relative other types of deaths within the areas studied and not only to the general health of residents.

6.3. Indicator: Educational Attainment

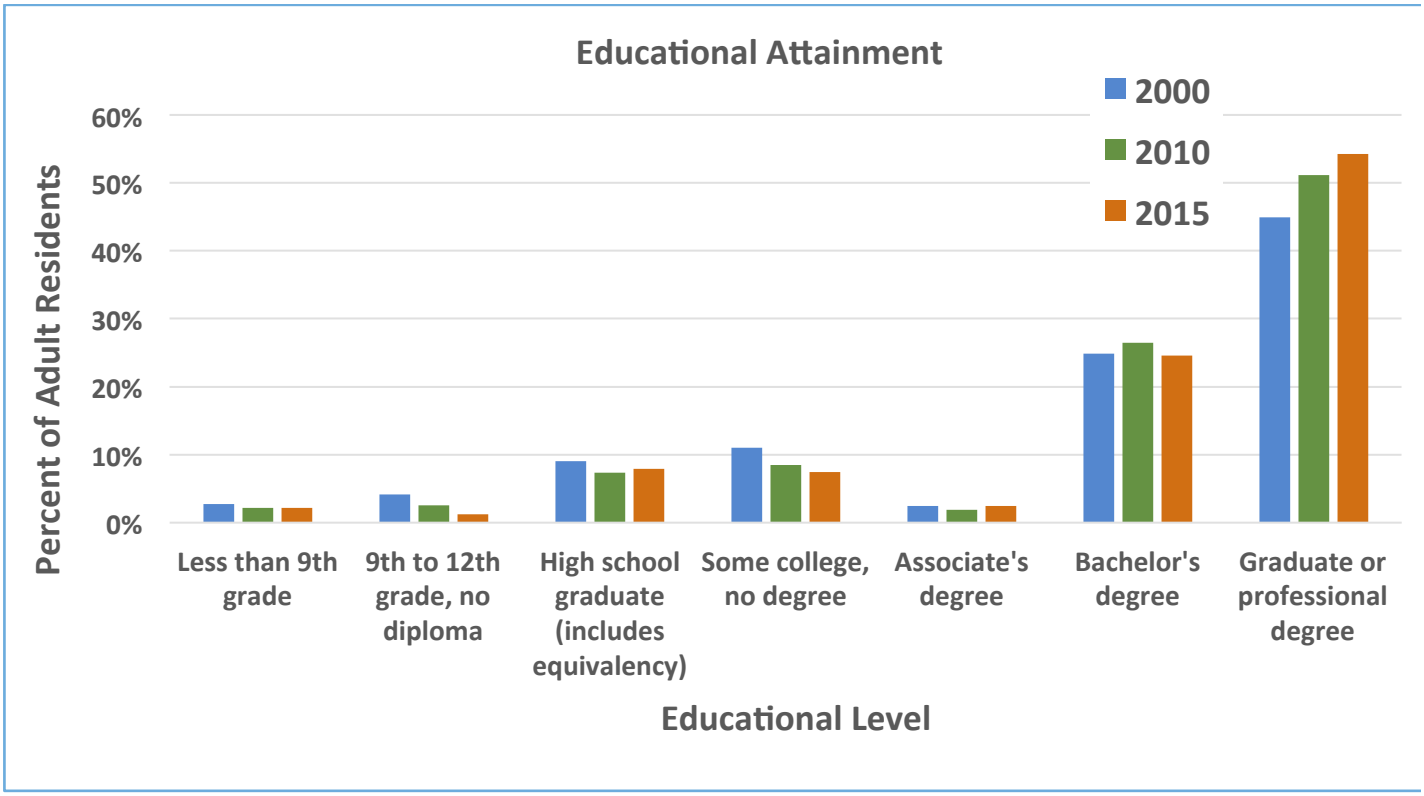


Figure 6.31 Education Attainment

Source: US Census Bureau data: ACS_15_5YR_S1501, ACS_10_5YR_S1501, DEC_00_SF3_P037

Why do we care?

This indicator shows the highest level of education attained by Borough and Township residents by percentage in 1990 and 2000. Level of educational attainment is a strong indicator of a resident's economic well being as well as potential for opportunities in life. Level of resident education also indicates the community's ability to attract successful, well-educated citizens who have many options of where to live. It is also important for a community to foster and support educational goals of residents.

How are we doing?

In Princeton Borough, there was a shift from the highest percentage of residents having some college but no degree in 1990 to the greatest percentage of residents holding graduate or professional degrees in 2000. In Princeton Township, the highest percentage of residents held a graduate or professional degree in both 1990 and 2000, and the second highest percentage of residents held a bachelor's degree for both years as well. Despite the high level of educational attainment as well as an increase in the number of residents holding higher degrees among Princeton Borough and Princeton

Township, more than 5% of residents in Princeton Borough and Princeton Township still did not possess a high school diploma in 2000. It is important to note that Princeton Borough is home to Princeton University with some of the University expanding into the Township as well. Therefore, it is likely that many alumni, faculty, staff, and students are residents of either the Borough or Township.