2020 *NATURAL RESOURCES INVENTORY*

TOWNSHIP OF MONTGOMERY
SOMERSET COUNTY, NEW JERSEY

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EXECUTIVE SUMMARY

Montgomery Township's updated *Natural Resource Inventory* is a comprehensive study of the natural resources within and surrounding the municipal and political borders, as well as a call to action for the protection of those important resources. As a leader in the industries of planning, conservation and sustainability, Montgomery Township continues its quest to be the example in Somerset County, the State of New Jersey and beyond.

The *Natural Resource Inventory* is divided into eleven chapters which examine the trends, statistics, current conditions, future planning strategies and health impacts of the following environmental resources and features:

- Agriculture
- Air quality
- Climate
- Geology
- Habitat & Wildlife
- Land Use / Land Cover
- Preserved Lands
- Soils
- Steep Slopes & Topography
- Surface Water, Subwatersheds & Flood Zones
- Wetlands

Each chapter is structured in the same fashion, addressing the following:

- Description of the natural resource and/or environmental phenomenon
- Regulations and programs pertaining to the resource
- Health benefits of the resource and detriments to health in the absence of the resource
- Initiatives being undertaken by Montgomery Township to protect the resource
- Recommendations to protect, restore and enhance the resource in Montgomery Township

Recommended projects and programming range in complexity and cost from small and low-cost to highly intense and expensive. The Township Committee and its advisory bodies will be able to sort through these potential opportunities, identify funding and staff, and implement the appropriate projects as feasible. They range in scope from policy & ordinance changes, community education & outreach, demonstration/pilot projects, and overall examination of the Township through Master Planning processes. The outcome of this implementation is a more sustainable, efficient and healthy community.

The Natural Resource Inventory also describes at length the importance of regional partnerships and relationships with Federal, State and County government, as well as non-profit entities, local land trusts and Friends groups and Sustainable Jersey.

The Appendices located at the end of the Natural Resource Inventory have been updated using the most readily available GIS data and reference the most recently updated planning documents. Where

appropriate, mapping has been integrated into each chapter.

This element of the Township's Master Plan is a true compendium of technical and natural resources, but also an overview of just a few of the great programs and policies implemented by Montgomery. It leans on the previous work completed by the Planning Board, Environmental Commission, Shade Tree Committee, Green Team, and many more groups of volunteers and Staff. The Township aspires to be an inspiration to surrounding communities that desire to conserve resources and move to the forefront of planning.

AGRICULTURE

"No Farmers – No Food" is a slogan typically found on a bumper sticker or plastered on a billboard sign but is probably one of the most accurate one-liners in relation to the importance of agriculture. This industry, which has strong roots in New Jersey, has an elevated importance due to its economic return and provision of basic needs for all life.
Communities with a strong agricultural industry and the support services needed to maintain it offer a greater sense of food security, numerous health benefits and unique recreational opportunities for visitors and residents.

Montgomery Township has a longtime, thriving agricultural industry, and has made its intention for supporting this industry known. Through municipal actions and ongoing commitment to best management practices, Montgomery has become a leader in the agricultural industry in Somerset County and all of New Jersey.

This chapter will address:

- Agricultural industry in and around Montgomery Township
- Regulations and programs related to agriculture
- Health impacts of agricultural availability and loss to humans, plants and animals
- Success stories from Montgomery Township
- Recommendations to sustain and enhance the agricultural industry in Montgomery Township

AGRICULTURAL INDUSTRY IN AND AROUND MONTGOMERY TOWNSHIP

Montgomery Township has a long history of studying and planning for the agricultural industry. The 2010 *Montgomery Township Comprehensive Farmland Preservation Plan* reviewed changes to the agricultural industry and farmland over time, and provided a framework for future preservation projects, needs for support services and recommendations for land use programs and partnerships with the potential to retain and enhance the industry.

The 2010 Plan provided a great deal of information related to the status of agriculture at the time of adoption. Some of the more important facts included:

- 5,594 acres were identified as Farmland Assessed
- 1,136 acres were preserved as farmland
- $14,202,837.50 was spent on farmland preservation projects across the Township
- 94% of soils in the Township were identified as "conducive to agriculture"
- 1,139 additional acres were prioritized as targeted farms for farmland preservation

The adoption of this Plan not only fulfilled the requirement for participation in the State Agriculture Development Committee's (SADC) Municipal Planning Incentive Grant Program (MuniPIG), but also provided an important framework for the Township's land use planning efforts.

Statistics about agriculture can also be gleaned from the United States Census of Agriculture, which is

performed every five years. Data can be viewed at the National, State and County level and serve as comparative data for a municipality and its surroundings. The most recent Census of Agriculture was completed in 2017 and was released to the public in May 2019. The report provided the following important insights for Somerset County:

- 452 farms were in operation in Somerset County, totaling 35,862 acres
- The average size of a farm in Somerset County is 79 acres
- $6,002,000 was reported in farm-related gross income

One of the major components studied in the 2017 Census of Agriculture is the division of agricultural products grown and raised in Somerset County. Figures A-1 and A-2 show the result of this data. Accompanying each figure is a table that demonstrates the changes from the previous (2012) and current (2017) Census of Agriculture.

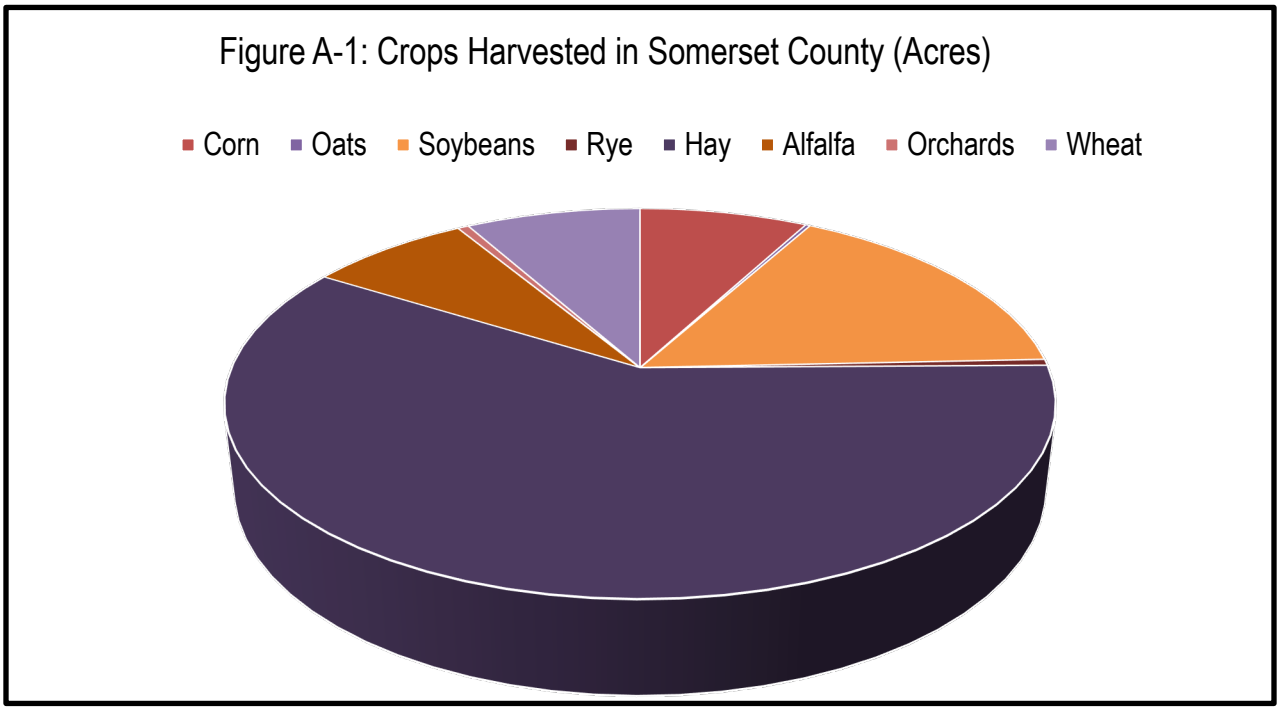


TABLE A-1: COMPARISON IN CROPS (ACREAGE) FROM 2012 AND 2017 CENSUS OF AGRICULTURE

CROP	ACRES HARVESTED (2017 CENSUS OF AGRICULTURE)	ACRES HARVESTED (2012 CENSUS OF AGRICULTURE)	PERCENT CHANGE
Alfalfa	1,067	1,121	-4.82%
Corn	1,112	2,657	-58.15%
Hay	8,393	9,758	-13.99%
Oats	30	255	-88.23%
Orchards	73	91	-19.78
Rye	72	143	-49.65%
Soybeans	2,310	2,354	-1.87%
Wheat	1,154	1,159	-0.43%

Figure A-2: Livestock Raised in Somerset County (Animal Units)

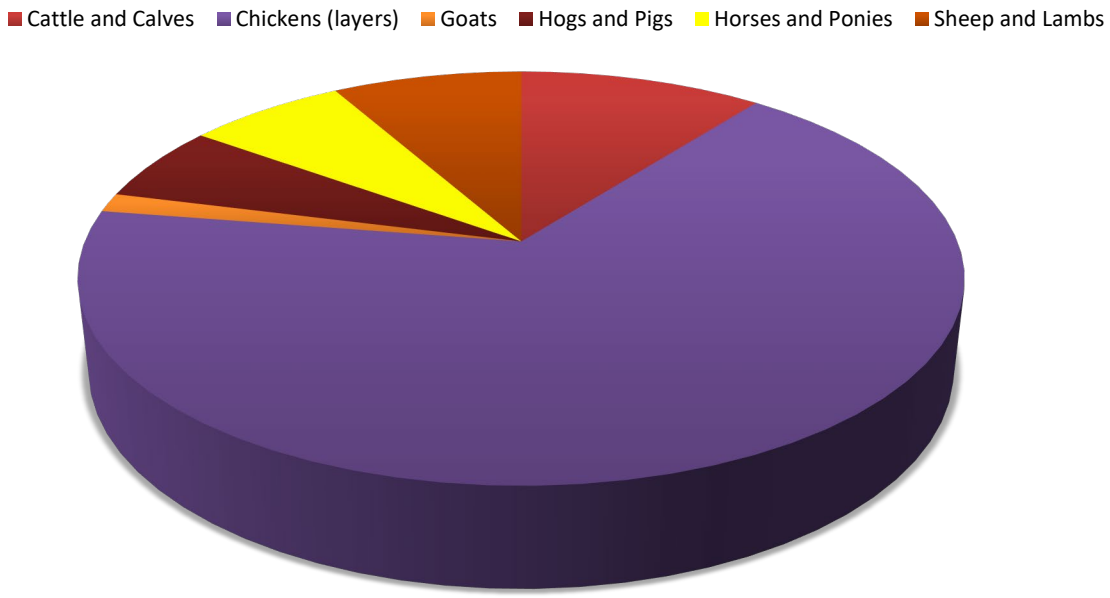


TABLE A-2: COMPARISON IN ANIMALS RAISED FROM 2012 AND 2017 CENSUS OF AGRICULTURE

ANIMAL	ANIMAL UNITS RAISED (2017 CENSUS OF AGRICULTURE)	ANIMAL UNITS RAISED (2012 CENSUS OF AGRICULTURE)	PERCENT CHANGE
Cattle and Calves	1,620	2,942	-44.93%
Chickens (layers)	10,296	7,758	+24.65%
Goats	226	226	0%
Hogs and Pigs	919	140	+556.43%
Horses and Ponies	1,055	1,507	-29.99%
Sheep and Lambs	1,263	926	+36.39%

To drill this information down to the municipal level, information from the Land Use Chapter of this *Natural Resource Inventory* can be studied and compared to data available from the *Montgomery Township Comprehensive Farmland Preservation Plan* and the Census of Agriculture. Table A-3 shows the changes in agricultural land over time, specific to Montgomery Township:

Table A-3: Change in Agricultural Land Use (1972 – 2018)

Land Use	Time Period	Delta – Acreage	Delta – Percentage
AGRICULTURE	1972 - 1986	-2,450.4	-23.8%
	1986 – 1995	-2,485.4	-31.8%
	1995 – 2002	-1,288.6	-24.1%
	2002 – 2007	-73.4	-1.8%
	2007 – 2018	-280.8	-7.1%

Every year, the Township submits an Annual Application for the MuniPIG program, which details changes in targeted farms (due to development or preservation of the parcel), additions to the preserved farmland inventory, properties currently under the process for farmland preservation, and changes to programs and policies. These applications effectively update the Comprehensive Farmland Preservation Plan and provides the Township with up $750,000.00 per year in funding for farmland preservation.

Map A-1 (Appendix) shows the farm assessed properties with zoning in Montgomery Township.

Map A-2 (Appendix) shows the defined Project Areas with preserved and targeted farms under Montgomery Township's Municipal Planning Incentive Grant Program

Map A-3 (Appendix) shows Montgomery's Project Areas and targeted farms as they relate to Somerset County's Agriculture Development Area.

Preservation Progress

Since the adoption of the 2010 Municipal Comprehensive Farmland Preservation Plan, nine (9) of the twenty-three (23) Targeted Farms, totaling 402 acres have been preserved through a combination of Municipal PIG,

County direct acquisition, non-profit easements, and use of Township Open Space Trust Fund dollars. One additional farm has been added to the list – the Halper Farm on County Route 601, which consists of approximately 103 acres. The Township continues outreach to the property owners and has one farm under contract and appraisals underway for another farm.

The iconic Matthews Farm, located on Route 206 and Rutland Road, preserved in 2019 (credit: Clem Fiori).

REGULATIONS AND PROGRAMS RELATED TO AGRICULTURE

The preservation of land for agriculture has proven to be one of the most effective methods for sustaining the industry in New Jersey. Following this program as equally important measures for agriculture are the Right-to-Farm Act and the On-Farm Direct Marketing Agriculture Management Practice. Numerous programs also exist to conserve resources and implement best management practices.

Agriculture Retention and Development Act

The Agriculture Retention and Development Act (ARDA), adopted in 1983, was, and still is, the initial and binding legislation that established the State Agriculture Development Committee (SADC), Agricultural Development Areas (ADA) and the process for farmland preservation. Technical standards for appraising preservation values were incorporated into the legislation, along with criteria for State, Municipal and later County programs. ARDA was most recently revised in 2018 to incorporate the Rural Microenterprise Rules, which allow for farms preserved before 2006 without exception areas to dedicate a portion of land for a nonagricultural commercial use.

For a full copy of the ARDA, please visit: https://www.nj.gov/agriculture/sadc/rules/ARDA.pdf

Garden State Preservation Trust Act

In 1999, New Jersey voters approved a constitutional dedication of $98 million dollars for open space, farmland and historic preservation. This dedication allowed a specific source to preserve lands for leisure, active and passive recreation, agricultural production and identified historic sites. The funds were administered and managed by the Garden State Preservation Trust by allocating funding to the New Jersey Department of Environmental Protection – Green Acres (open space), the State Agriculture Development Committee (SADC – farmland), and the State Historic Preservation Office (SHPO – historic preservation), with each office promulgating regulations for the disbursement of funding.

In 2007, an additional $200 million dollars was approved by referendum. This referendum came at a time of pure necessity, acting as a "stop-gap" where funding had been depleted. The funding followed the existing regulations for each department, however, would only last for short period of time.

On November 4, 2014, after a powerful grass roots campaign, New Jersey voters passed the "Preserve New Jersey" referendum that provided a stable source of funding. These funds are taken from the existing Corporate Business Tax and incorporated incremental increases over five years. This funding also allowed for new types of projects, specifically Blue-Acres (lands that suffer from repetitive flood loss and should be bought out for preservation and flood mitigation purposes).

Figure A-4 below shows the projected division of open space funding under the Corporate Business Tax. When all incremental increases are instituted in 2020 (July 1, 2015 – July 1, 2019 marks a 4% increase, followed by the increase to 6% on July 1, 2020 and beyond), 6% of the Corporate Business Tax will be dedicated to open space, farmland, historic and blue acres preservation.

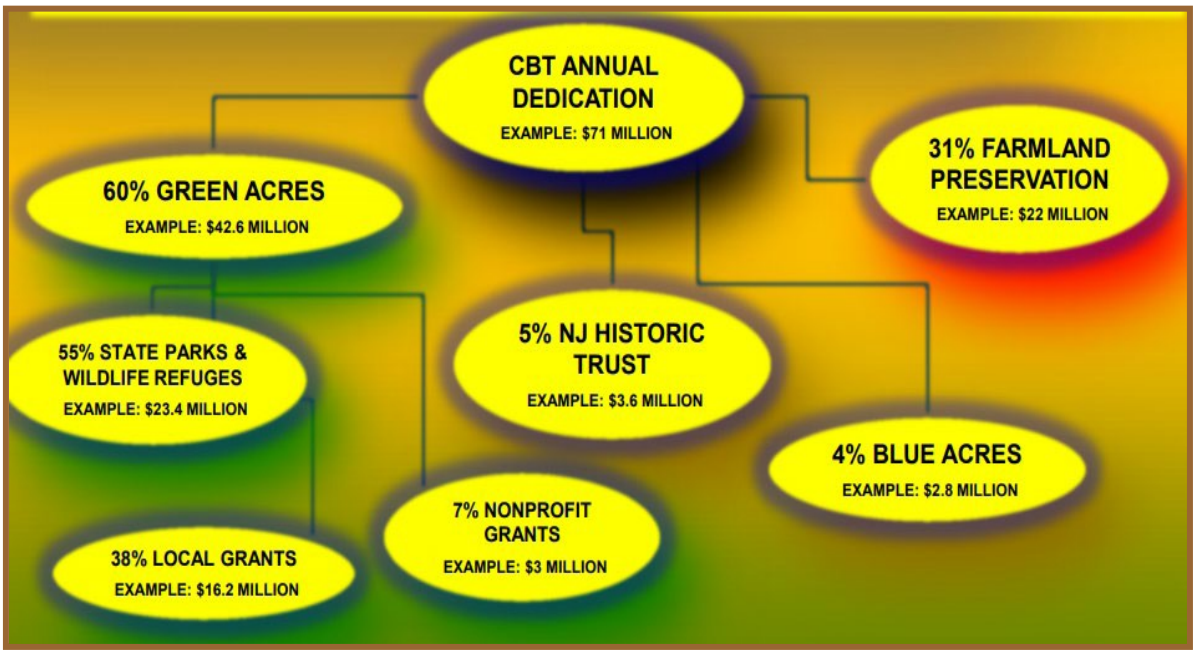


Figure A-4: Division of funding through the CBT
Source: https://www.state.nj.us/gspt/pdf/7IMAGEhandout.pdf

As of August 2018, the SADC reports that 232,806 acres were preserved as farmland. Of those preserved acres, 7,922 acres were in Somerset County. These acres represent an investment of over $630 million dollars from Federal, State, County and Municipal funding sources, with 57% of that total being invested by the County of Somerset. 1,240 acres have been preserved in Montgomery Township, representing an investment of over $16,161,737.62 in Federal, State, County and Municipal funding.

Farmland Assessment Act

The New Jersey Farmland Assessment Act, passed in 1964, taxes land devoted to agricultural production at its productivity rate, not its market value. This reduced tax rate is an incentive to farmers to continue farming the land. For basic eligibility, the following conditions apply:

- Applicant must own the land
- Land must be devoted to agriculture/horticulture for at least two (2) years prior to the filing for Farmland Assessment
- Applicant must apply for Farmland Assessment with the municipal Tax Assessor's Office by August 1st of each year
- Land must consist of at least five (5) contiguous acres devoted to agriculture/horticulture
- Gross sales from the land must consist of at least $1,000 on the first five (5) acres and $5 on each acre thereafter
- The owner must represent that the land will continue to be devoted to agriculture/horticulture after the Farmland Assessment is filed

The Farmland Assessment Act was amended in 2013 and 2018 for the purposes of ensuring that the lower tax rate was being properly applied and monitored. All Tax Assessors are now required to take a Certification Class every three (3) years. Those misrepresenting the allowance for farmland assessment are now subject to a $5,000 fine. The minimum income was raised from $500 for the first five (5) acres to $1,000. All of these changes are important to maintaining the allowances for agricultural use and the perception and acceptance of the general taxpayer.

Farmland Assessment is a particularly powerful tool in Somerset County, where taxes are among the highest in the nation. Providing appropriate tax relief to farmers provides a safeguard to our already diminishing agricultural lands.

New Jersey Right-to-Farm Act

The New Jersey Right-to-Farm Act (NJSA 4:1C-9) has been described as one of the most powerful pieces of legislation in the State. Established in 1983, the Right-to-Farm Act provided protections from unduly burdensome municipal regulations and private/public nuisance complaints for commercial farmers that allowed for the continued operation and success of their farm. It also provided a framework for conflict resolution between neighbors, farmers and municipal agencies.

The Right-to-Farm Act is divided into two types of requests:

1. Site-Specific Agriculture Management Practice (SSAMP) – request from a farmer to the CADB to procure allowances for specific practices, activities, or events in advance of implementation. This request allows for a partnership between the farmer, CADB and municipal agencies and opens a dialogue to achieve compromising solutions.
2. Determination/Hearing – a zoning violation or complaint forwarded about a practice, activity or event being performed on a farm. This request requires the CADB to issue a determination about whether the practice in question is protected by the Right-to-Farm Act, and therefore allowed to continue.

The Act has produced twelve Agricultural Management Practices (AMPs) to serve as guiding principles for County Agriculture Development Boards, who are charged with hearing cases under Right-to-Farm. These AMPs describe accepted agricultural practices that can be transferred to the operation in question. CADBs can hear cases that might normally be heard by a Planning or Zoning Board or court for a significantly reduced cost and timeframe.

The Right-to-Farm Act, while full of legal intricacies to balance the needs of farmers and the general community, is an important compliment to the Agriculture Retention and Development Act. It provides the allowance for the continuation of agriculture on the business side. The preservation of land provides for the necessary elements for agriculture, but it is the Right-to-Farm Act that allows the business of agriculture to run more smoothly and effectively.

Spotlight: On-Farm Direct Marketing Agriculture Management Practice (NJAC 2:76-2A.13)

In 2016, the SADC adopted the On-Farm Direct Marketing Agriculture Management Practice (OFDM-AMP). Farmers had been requesting specific protections for agritourism for many years, and the passage of the OFDM- AMP satisfied many of those needs. This AMP defines allowances for (including but not limited to):

- Facilities (new or existing)
- Activities
- Events
- Setbacks
- Buffering and Screening
- Signage
- Lighting
- Parking

This AMP allows for a separate but related source of income for farmers. Pick-Your-Own operations, Christmas tree cutting, corn/hay mazes, farm-to-table events, educational camps, and more were not previously offered protection from municipal regulations and complaints made this stream of income an impossibility. Additionally, it provided guidelines for CADBs when assessing a request for a Site-Specific Agriculture Management Practice (SSAMP), eliminating the strict "case-by-case" basis determination.

For a complete review of the OFDM-AMP, please visit:
https://www.nj.gov/agriculture/sadc/rtfprogram/amps/adoptedamps/onfarmdirectmarketing.html

HEALTH IMPACTS OF AGRICULTURAL AVAILABILITY AND LOSS TO HUMANS, PLANTS AND ANIMALS

Impacts to human health, economics and social interactions in correlation to the availability and loss of agriculture have been studied at length at the local, State and Federal levels. While the prime concern is often preserving farmland, special concern needs to be directed to the collateral damage that results from a loss of farmland, farmers and proximity to a variety of agriculture.
The most glaring impact for humans is the basic needs for food fulfilled by agriculture. In addition to this need, agriculture provides a unique social and recreational opportunity, and serves as a major contributor to the economics in New Jersey and across the United States.

Food and Fiber

As referenced in the United States Census of Agriculture, farming is the epicenter for providing fruits, vegetables, meat, dairy, herbs, and spices used in foods across the world. Agriculture is also the main source for fibers used for clothing, fabrics and a plethora of textiles.

Environmental Benefits

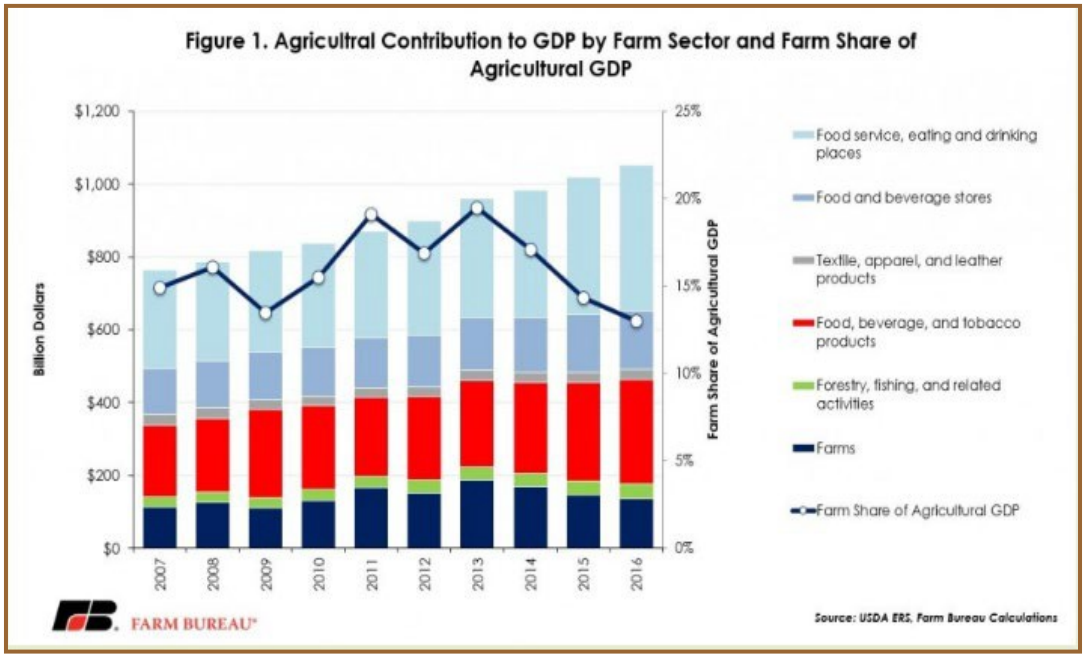
Agriculture can be a source of negative environmental impacts if not properly managed, such as nutrification of streams through livestock grazing, over-fertilization of land or fertilization of lands not conforming with best management practices, or mismanagement of soil, leading to erosion or

contamination. When properly managed, agriculture can provide numerous positive environmental benefits such as:

- Biodiversity – crops bring in bees and butterflies for pollination; farms serve as a site for growing unique and/or rare plants; cover crops using native grasses can serve as areas for soil health and bird nesting
- Reduction of sprawl – preserved farmland leads to farmbelts, advancing the industry and creating green spaces that could otherwise be developed for housing or commercial uses
- Close care of the land - Local farms tend to care for the land in a way that large scale, industrial farms do not. These practices are not only healthier for the land, but improve the land when managed correctly
- Less fuel – because local farms typically use support services and sell within 100 miles of their farm, they use much less fuel in transporting their goods. This fuel conservation provides fresher food to the consumer and reduces air toxics emissions.

Economic Benefits

In 2016, agriculture contributed 18.6 trillion dollars to the gross domestic product, representing 5.7% of the total economy. In 2017, over one billion cash receipts were generated in New Jersey. Gross farm- related income accounts for over three million dollars annually in Somerset County alone, with agritourism bringing in almost one million dollars annually (excluding income).



Even with a decrease from 2013 through 2016 due to loss of farmland and the aging of the American farmer without one-to-one replacement, agricultural contributions to the GDP are still plentiful and important.

While preserved farmland pays a lesser tax, as stated in the above section, farms do not require the usual services required by residential and commercial land uses, such as sewer and road infrastructure. The landowner also realizes the benefit of preservation as they still retain ownership of the land after the site is preserved. Once paid for the development rights, the landowner still has full use of the land for agricultural production or can sell the land for a profit to another agricultural user.

Agriculture gives residents across the State unique opportunities for purchasing food and fiber and provides leisure and recreational opportunities at a lower cost with the wholesome, family quality. Farmers can test

their products with instant feedback when sold at Farmers Markets. These Markets also allow for Farmers to sell their products without having to invest in costly infrastructure or storefronts. Farmers Markets have been proven to create robust communities and enhance relationships, thereby creating what economists refer to as a 'multiplier effect", meaning that the money spent at Farmers Market is recycled in many ways throughout the community.

Social Benefits

Agriculture provides opportunities for agritourism, which can bring families together for fun and cost-effective quality time. Christmas tree cutting, pick-your-own fruits, berries and vegetables, fall festivals, wine tastings and more are activities and events unique to farming that give visitors an outdoor, non-digital experience. Farmers Markets create a pleasing experience where consumers interact directly with their producers and neighbors.

HOW IS MONTGOMERY TOWNSHIP WORKING TO SUSTAIN AND ENHANCE AGRICULTURE?

Montgomery Township has taken important steps to ensure the retention and advancement of agriculture. These actions can be viewed in the Township Code, preservation programs and partnerships, and local practices. The following are the major policies and programs implemented in Montgomery Township.

Montgomery Township Code

Chapter 8-5 of the Montgomery Township Code is the Right-to-Farm ordinance. The Township utilized the New Jersey Right-to-Farm act but tailored it to the needs of Montgomery's farmers and farming industry. One example is the amending of the Township's Land Development Ordinance (Chapter 16) in 2017 to redact a section of Township Code that prohibited swine anywhere within municipal borders, and instead formulated an allowable number of swine per acre. The Township arrived at this this revision after engaging farmers, residents, State agencies and other experts. This amendment proved Montgomery's commitment to farmers in the community who wanted the right to raise swine, as we as their intent to balance that need with those of the community.

The Township's Zoning Code also provides for relief for farmers in the following ways, including but not limited to:

- Barns and silos are exempt from maximum height restrictions (Chapter 16-6.2)
- Permitting roadside farmstands (Chapter 16-4.2)
- Permitting sale of Christmas trees in the Village Neighborhood (VN), Neighborhood Commercial (NC), and Highway Commercial (HC) districts (Chapter 16-6.2)
- Farm equipment is exempt from noise ordinances requirements (Chapter 3-3)
- Construction of barns, silos and sheds for agricultural purposes do not require site plan approval (Chapter 16-8.2)

Comprehensive Municipal Farmland Preservation Plan

The Montgomery Township Municipal Farmland Preservation Plan was approved by the SADC in 2010. This Plan fulfilled the requirements that allowed the State to allocate funding for farmland preservation to the municipality. Priority areas for farmland preservation were identified (see Map A-2) and prioritized, with specific property meeting soil quality and tillable acreage criteria being identified as target farms. This Plan outlines criteria used to approve potential farmland preservation projects, how appraisals are to be obtained, and survey and closing requirements. Today, the Plan still serves as the foundational document for all decisions related to farmland preservation.

Agricultural Advisory Committee

According to the Township's website (https://twp.montgomery.nj.us/elected-officials/township-committee/#ag), "the Agricultural Advisory Committee shall make recommendations as to which farms should be preserved and shall report those recommendations to the Planning Board. The creation of an Agricultural Advisory Committee enables the Township to obtain farmland preservation planning incentive grants for the purpose of preserving significant areas of reasonably contiguous farmland that will promote long term economic viability of agriculture as an industry in Montgomery Township". The Committee is comprised of five members and two advisors who meet several times each year.

Montgomery Friends of Open Space – Farmers Market

Montgomery Township has a close working relationship with the local Friends group, the very active and established Montgomery Friends of Open Space (MFOS). The Friends host a lively Farmers Market from the beginning of June through the end of October at the Village Shopper Market on Route 206. Produce, meats, dairy, honey and more are sold at this well-attended Market, which has become a staple for the community. Last year, MFOS started a holiday market in December to expand the consumer experience for a different season.

Agricultural Leases of Township-owned Lands

The Township currently leases 14 properties totaling over 375 acres. These properties were in active agriculture at the time acquisition and the Township wanted to continue to have these properties farmed in order to preserve the Township's agricultural heritage and to provide scenic, open viewsheds. In 2012, the properties were offered for a five-year lease term at an auction style bid, and each property was subsequently leased. The leases require the farmer to implement best management practices to prevent erosion, nutrient management, runoff and to manage herbicide/pesticide application. The farmer provides a valuable service to the Township by managing the lands for agriculture, which in turn manages invasive species, and the farmer maintains pathways around the field edges by mowing/tilling, thus lightening the burden of maintenance on the Township's Department of Public Works. The Township plans to continue with the terms of these leases, and re-bid four (4) properties where the farmer chose not to continue the lease.

Pathway around the edge of agricultural fields on Township property on Montgomery Road, June 2019.

RECOMMENDATIONS AND POTENTIAL PROJECTS

- Update the Municipal Farmland Preservation Plan – at the time of this update of the NRI, the Comprehensive Municipal Farm Plan is nine years old. Updating the Plan to reflect the new OFDM-AMP, Rural Microenterprise Rules, Deer Fencing Program and other advances at the State and Federal level would be beneficial to the township. This would also provide the opportunity to review the Project Areas in coordination with the County's updated Plan, anticipated for completion in late 2019.

- Pilot a low/no-till requirement on Township-owned farmland or open space as a demonstration project

- Work with the New Jersey Sustainable Business Registry – currently there are few farms on the Registry. Adding sustainable farms to the Registry brings notoriety to farmers and promotes the industry of agriculture in the municipality

CITATIONS

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AIR QUALITY

Air quality is a critical issue for any municipality in the State and across the world. Humans and animals need air to breathe, and plants need clean air to grow and store food which is tantamount to a sustainable food system and agricultural economy. While air is invisible and intangible, it is imperative to maintain its quality and composition is imperative to respiratory function, plant growth, and the movement of sound and smell. The quest to clean our air is a daily task that must be undertaken at the individual, commercial, institutional, governmental and global level.

Typically, air quality is not focused on at the forefront of a Natural Resource Inventory. Through this document, the Township of Montgomery chooses to address this valuable and vital resource so that air quality is protected for current and future generations.

This chapter will address:

- Characteristics of air
- Clean Air Act and the 1990 Amendments to the Clean Air Act
- Monitoring program requirements
- Statistics in New Jersey and the region enveloping Montgomery Township
- Health impacts of air pollution to humans, plants and animals
- Recommendations to improve air quality at the local level
- Success stories from Montgomery Township

CHARACTERISTICS OF AIR

Air is comprised mostly of nitrogen and oxygen, with smaller portions of carbon dioxide and helium. This critical resource has been often been neglected in the name of advancing industry and manufacturing, despite its absolute necessity in our lives. Air – specifically healthful, good quality air – is essential to plant, animal and human life. Humans and animals need air to breathe, plants use air to create and store food, and air in general provides a protection around the Earth.

Air pollution is an extremely important issue as pollutants move through the air at a fast pace and a far distance. Winds move this pollution around even further, thereby increasing health impacts, reducing crop production and causing harm to cultural resources. Most damage to air quality is caused by humans through manufacturing and industrial processes, emissions from transportation and the usage of products containing harmful chemicals.

REGULATIONS PERTAINING TO AIR QUALITY

The Clean Air Act

In 1970, the United States Environmental Protection Agency (USEPA) was in its infancy. As one if its first charges, the USEPA passed the Clean Air Act with the intentions of reducing air pollution, improving air quality and create regulations for industry. The CAA delegated responsibilities of enforcement to individual states through the development of State Improvement Plans. Each state must meet the minimum standards set by the USEPA and has the option to impose stricter regulations as they see fit.

CRITERIA POLLUTANT	CHARACTERISTICS	LIMITATION	PRIMARY AND/OR SECONDARY DESIGNATION
Carbon Monoxide (CO)	Colorless, odorless gas Released through combustion Higher concentrations typically found indoors Can cause dizziness, confusion, fatigue, organ damage and death when inhaled in high concentrations	35 ppm (over 1- hour averaging time) Threshold cannot be exceeded more than once per year	Primary and Secondary
Lead (Pb)	Heavy metal Soft and malleable Released into the air through ore and metals processing, aviation, utilities and waste incinerators Accumulates in human bones Can cause kidney disease and neurological deficiencies	0.15 micrograms per cubic meter (over 3-month rolling averaging time) Threshold cannot be exceeded.	Primary and Secondary
Nitrogen Dioxide (NO2)	Highly reactive gas (part of NOx) Released through burning of fuel Higher concentrations contribute to acid rain and reduced visibility Higher concentrations irritate the human respiratory system	100 ppb (over 1- hour averaging time) 98th percentile of 1-hour daily maximum concentrations, averaged for 3 years	Primary and Secondary
Ozone (O3)	Occurs in the Earth's upper atmosphere and at ground level "Good Ozone" – occurs naturally in the Earth's upper atmosphere and protects from ultraviolet radiation (often referred to as "the ozone layer" "Bad Ozone" – created by chemical reactions of NOx and VOCs (often referred to as "smog")	0.070 ppm Annual 4th-highest daily maximum over 8-hour concentration, averaged for 3 years	Primary and Secondary

Particle Pollution (PM)	Mixture of solid particles and liquid droplets in the air Can be emitted from direct sources (construction sites, unpaved roads) Can be emitted from complex chemical reactions (power plants, automobiles) Separated into: ○ PM10 (10 micrometers or smaller) ○ PM2.5 (2.5 micrometers or smaller) Fine particles settle deep in the respiratory causing breathing issues	<u>PM 10</u> 150 micrograms per cubic meter (not to be exceeded more than once every 3 years) <u>PM 2.5</u> 35 micrograms per cubic meter (98th percentile, averaged over 3 years)	Primary and Secondary
Sulfur Dioxide (SO2)	Colorless, pungent gas Released through burning of fossil fuels and industrial processes Causes respiratory distress and skin irritation	75 ppb (95th percentile of 1-hour daily maximum, averaged over 3 years)	Primary

In 1990, Congress amended the Clean Air Act to provide broader authority to the USEPA for the reduction of emissions and the implementation of cost-effective practices to improve air quality. The amendments brought new power to the CAA, specifically in the following areas:

- ∂ created specific thresholds for six criteria pollutants known to be particularly harmful to public health and welfare
- ∂ encouraged the use of performance-based standards
- ∂ set standards for alternative fuel projects
- ∂ promotes clean coal and natural gas
- ∂ reduces energy wastes and increases use of energy efficiency

Monitoring Program

To uphold the principles of the Clean Air Act, monitoring the air quality is crucial. States are required to monitor air quality and report the findings to the USEPA. Pollutants are analyzed based on public health and welfare standards. Data obtained through monitoring has documented a 70% decrease in aggregate emissions of the six criteria pollutants. Other progress to be noted includes:

∂ Between 1990 and 2015, concentrations of carbon monoxide have decreased 84% and fine particle matter has decreased 37%

Stationary sources emit 1.5 trillion tons less emissions than they did in 1990

∂ Wet deposition of sulfur decreased by 55% on average across the eastern United States (reduction of acid-rain forming pollution)

∂ Typically, new coal-fired plants install technology that captures 98% of sulfur dioxide and 90% of

nitrogen dioxide (previously uncontrolled emissions)
The composition of sulfur in gasoline has reduced by 90%
Compared to vehicles in 1970, cars and trucks are 90% cleaner for common pollutants
The reduction of air pollution has caused a 5.5-billion-dollar benefit to the agricultural and timber industries across the United States

The 1990 Clean Air Act Amendments created the National Ambient Air Quality Standards (NAAQS) for six principal pollutants, known as criteria pollutants. Every region in the country is required to establish a monitoring program in accordance with the NAAQS, and classified as an Attainment Zone, meaning that the NAAQS standards are met, or a Non-Attainment Zone, meaning that the NAAQS standards have been exceeded. In addition, each criteria pollutant is given a designation of primary (provides public health protection) and/or secondary (provides public welfare protection). Table AQ-1 shows the criteria pollutants and their limitations.

The Air Quality Index (AQI) is a national rating system built upon the NAAQS. The results of monitoring stations are used to calculate an index that projects any potential health impacts that could occur within a few hours or days of exposure to high concentrations of air pollutants. The AQI is a scale that runs from 0 – 500. Compliance with the NAAQS is 100 on the AQI scale, meaning that ratings of 100 or below are within the designated parameters of the NAAQS. Exceedances of these standards are seen at level of 100 or above.

For ease of use, the AQI is also color-rated, based on health impacts and air quality conditions:

TABLE AQ-1: CRITERIA POLLUTANTS

Source: *https://www.epa.gov/criteria-air-pollutants/naaqs-table*

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*..air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

Source: https://airnow.gov/index.cfm?action=aqibasics.aqi

New Jersey's Program and Statistics

New Jersey began its work to improve air quality five years before the federal government signed the initial Clean Air Act. In 1965, the New Jersey Department of Environmental Protection (NJDEP) began monitoring air quality to provide data on the condition of this natural resource, and to construct remediation techniques when necessary.

Historically and currently, New Jersey is a Non-Attainment Zone, meaning that the standards set for criteria pollutants by the USEPA are not met. The northern part of the State is classified as moderate and the southern portion classified as marginal.

In 2016, New Jersey operated 35 ambient air monitoring stations for criteria pollutants. Once an hour, the results of many of these monitoring stations are posted on www.aimow.gov . Using this website, residents can learn about any dangers related to air quality and take necessary measures to protect health, especially in sensitive populations.

Source: http://njaqinow.net/App_Files/2016/2016%20Air%20Quality%20Report.pdf

Below is a summation of results found in the 2016 Air Quality Report, published by the NJDEP's Division of Air Quality. For more detailed results, please see: http://njaqinow.net/App_Files/2016/2016%20Air%20Quality%20Report.pdf.

Nitrogen Dioxide

In addition to public health impacts, nitrogen dioxide has a profound impact on the environment. This criteria pollutant causes decreased visibility, eutrophication of water bodies and acid rain. **In 2016, no exceedances of the standard for Nitrogen Dioxide were reported at any of the 11 monitoring stations in the State**.

Sulfur Dioxide

In addition to the public health impacts, SO2 can cause acid rain and decreases visibility. **Of the 9 monitoring stations in New Jersey, 2 reported exceedances to the standards** (both occurring in the City of Camden).

Carbon Monoxide

While carbon monoxide is typically more dangerous when found in high concentrations indoors, the impacts of carbon monoxide in the atmosphere should not be ignored. **Of the 7 monitoring stations in the State, no reported exceedances of the standard for CO were reported.**

Lead

Lead is a naturally occurring element and is frequently released through manufacturing and industrial processes. **In 2016, there were no reported exceedances of the standard for Pb**.

Particulate Matter

19 sites collect PM 10 data, while 5 sites collect PM 2.5 data. This pollutant, often referred to as Fine Particulate Matter or Fine Particles, is especially irritating and dangerous to the human respirator system. To monitor for particulate matter, stations pull in a predetermined volume of air and separate the particles into filters. These filters are weighed before and after the test, thereby determining the amount of particulate matter in the air. **In 2016, there were no reported exceedances of particulate matter at any of the 24 monitoring stations in New Jersey**. Since the beginning of monitoring for this criteria pollutant in 1999, a significant decrease has been documented.

Volatile Organic Compounds

4 sites collect data on Volatile Organic Compounds (VOCs), commonly referred to as air toxics. While there are no established standards for these pollutants, exposures to high concentrations have been shown to cause numerous types of cancer. The closest stations to Montgomery Township monitoring these data are located in Flemington (Hunterdon County) and Rutgers University – New Brunswick campus (Middlesex County). Every 3 years, the USEPA produces the National Emissions Inventory which estimates the public's daily exposure to air toxics**. In 2016, 26 days were classified as "Unhealthy for Sensitive Groups" due to the AQI reaching above 100**. (2 separate days were classified as "Unhealthy" because the AQI exceeded 150, however this was later attributed to a wildfire in Canada).

Ozone

16 sites collect data for ozone across the State. Increased levels of ozone at ground level is poses threats to human health, while the depletion of the ozone in the stratosphere causes different, but still significant, threats. **In 2016, all 16 monitoring stations reported exceedances to the standards for ozone.**

Montgomery Township's Statistics

As mentioned above, New Jersey is a Non-Attainment Zone with the northern part of the State (of which Montgomery Township is located) is classified as "moderate". Review of Attainment versus Non-Attainment drilled down to Somerset County provides the following results:

- The entirety of Somerset County and New Jersey has been classified as "Non-Attainment: Severe" for Ozone (1-hour) and "Non-Attainment: Moderate" (8-hour) since 1992.
- A portion of Somerset County was classified as "Non-Attainment: Moderate" for Carbon Monoxide in 1992 – 1995. Since that point, Somerset County has been designated as "Attainment" for Carbon Monoxide.

- A portion of Somerset County was classified as "Non-Attainment" for Particulate Matter 2.5 from 2005 – 2012.
- Since that point, Somerset County has been designated "Attainment" for Particulate Matter 2.5.

A full report of the entire State, divided by County, can be found at:
https://www3.epa.gov/airquality/greenbook/anayo_nj.html

As part of this update, Kenyon Planning, LLC generated and analyzed reports for the New Brunswick monitoring stations (located at Rutgers University), which represents the closest monitoring stations to Montgomery Township. The following parameters were used to generate the reports from the NJDEP's Station Reports database:

- Data from Rutgers University monitoring stations were segregated
- Data was then reviewed for the entire month of July 2016, July 2017 and July 2018
- Criteria contaminants monitored (Ozone, Nitrogen Dioxide and Particulate Matter 2.5)were then compared against the designated criteria pollutants standards (Appendix AQ-2)

From this 3-year review, it is clear that these monitoring stations, located within 2 miles of Montgomery Township, did not document any exceedances to the standards.

HEALTH IMPACTS OF AIR POLLUTION TO HUMANS, PLANTS AND ANIMALS

Air pollution causes imminent and dangerous threats to our planet and population. These issues can be mitigated and/or prevented through a series of public education and standards, discussed in more detail below, but the current conditions pose concern. In some cases, sensitive groups, determined by the presence of a pre-existing medical condition, age or other demographic indicator, certain pollutants can be more dangerous, even in lower concentrations.

Montgomery Township is fortunate to be in a region where the air quality is healthy much of the time. On the other end of the spectrum is over 7.7 million people who live in a city where they are exposed daily to unhealthful levels of ozone, short-term particulate matter and long-term particulate matter. This exposure can cause serious health problems such as bronchitis, asthma, cardiovascular dysfunction, lung cancer and reproductive deformities.

The following section outlines some of the major health impacts caused by higher concentrations of the six criteria pollutants and air toxics.

Nitrogen Dioxide

Nitrogen dioxide is a reactive gas emitted from motor vehicles, combustion of coal and natural gas, and industrial processes. Short-term exposure to this criteria pollutant can cause throat and eye irritation, fatigue and shortness of breath, while long-term exposure has been proven to have the potential to cause permanent lung damage.

Sulfur Dioxide

Sulfur dioxide is a pungent gas formed when gasoline is extracted from oil or when fuels are burned. Sulfur dioxide poses serious health impacts to sensitive populations, specifically children, the elderly and those with heart conditions. This criteria contaminant is associated with skin irritation, respiratory irritation, decreased visibility, and erosion of stone and marble.

Carbon Monoxide

Carbon Monoxide is a colorless, odorless gas formed through combustion. 50% of CO is attributed to motor vehicles in New Jersey. Short-term exposure to CO has been attributed to chest pain, fatigue and shortness of breath, while long- term exposure reduces carrying-capacity of oxygen through the bloodstream.

Lead

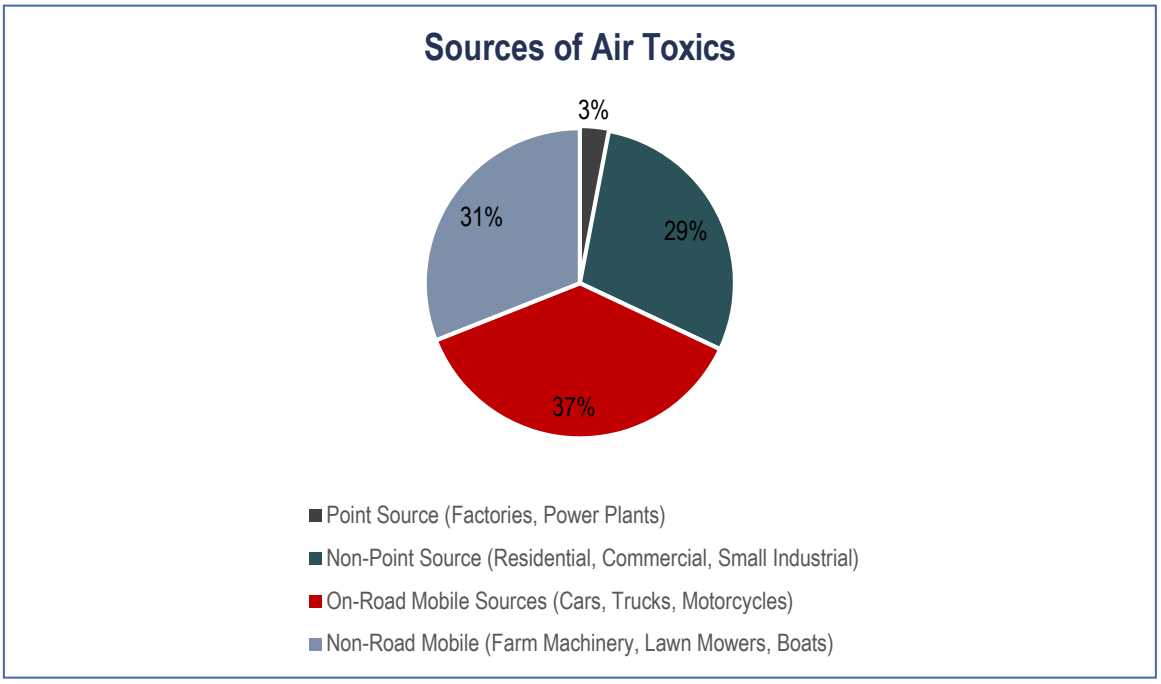
Lead is a heavy metal that is often released through manufacturing processes and is also a naturally occurring element on Earth. High concentrations of lead have been associated with hypertension and kidney damage in adults. Children are more susceptible to the effects of lead pollution, including permanent neurological and nervous system damage.

Particulate Matter

Particulate Matter poses a threat to human health, with that threat becoming more dangerous as the size of the particles decreases. Fine particles can settle deep into the lungs and respiratory tract causing shortness of breath, asthma, emphysema and Chronic Obstructive Pulmonary Disease (COPD).

Air Toxics

Air Toxics describe a group of non-criteria pollutants that can be categorized as dangerous to human health and/or carcinogenic. A standard has not been set federally for air toxics, however the source for this group is found in most human activities or products generated thereof:



Source: ***https://www.nj.gov/dep/airtoxics/sourceso11.htm***

Ozone

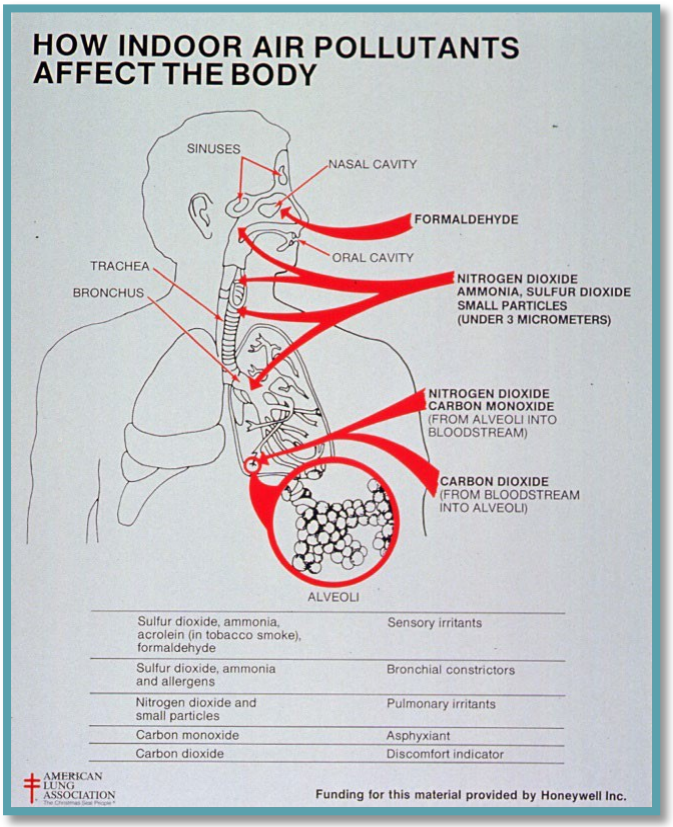
Ozone in high concentrations has been associated with dizziness, fatigue, shortness of breath, and respiratory tract irritation. This pollutant is exceptionally dangerous to children, who breathe in more oxygen per pound of body weight in comparison to adults.

The lack of ozone in the stratosphere can be associated with skin cancer and eye dysfunction. As the

ozone layer depletes, dangerous ultraviolet waves are trapped in the troposphere causing mutation of skin cells and burning of eye membranes.

Ground level ozone is responsible for 500 million dollars in reduced crop production, due to its interference with a plants ability to make and store food. This is significant as its domino affect includes a reduction of the food supply, creating food security and sustainability issues.

Ozone is also associated with decreased visibility (commonly referred to as haze). This condition does not pose direct impact to human or plant health, however, can cause dangerous transportation conditions, which lead to higher instances of vehicular collisions.



Source: US National Library of Medicine (https://www.nlm.nih.gov/exhibition/visualculture/environmental08.html)

HOW IS MONTGOMERY TOWNSHIP WORKING TO IMPROVE AIR QUALITY?

As in many cases of natural resource conservation, Montgomery Township has made strategic and targeted efforts to improve air quality for its residents and the surrounding area. Every individual needs to make efforts to improve air quality for these initiatives to be totally successful. Strong municipal leadership can provide a foundation for these individual efforts, inspire other municipalities to follow suit and engage the business and industrial sectors to participate in a meaningful and impactful way.

Actions of the Montgomery Township Council and Planning Board

In 2008, the Township entered into a partnership with Stockton University to identify greenhouse gas emissions Township-wide (Carbon Inventory – 2008). This partnership found that greenhouse gas emissions in Montgomery Township coincide very closely with those of the State of New Jersey. It was also

determined that transportation was the most significant contributor of greenhouse gases in Montgomery. This report recommended that the Township develop a less-intensive motor vehicle transportation system.

In 2009, Energy Audits performed were performed the on Municipal Complex and Otto Kaufman Community Center through assistance from the Somerset County Energy Council. These Audits revealed the need to replace inefficient equipment, specifically three boilers. The Township also used these Audits as the platform to install solar-powered trash receptacles and upgraded thermostats to reduce internal temperature and reduce emissions.

In 2010, the Township adopted an ordinance banning smoking on Township property (10-1374). Metal placard signs were installed at Township facilities to make the general public aware, and to remind employees, that the facilities and grounds are smoke-free. The Township's Health Department has routinely offered smoking cessation seminars, and now offers a chronic disease management seminar for all New Jersey residents.

This initiative was submitted to Sustainable Jersey and received 10 points towards Certification.

"No Smoking Sign" at Van Horne Park Playground

In 2012, Township Council passed a Complete Streets Policy, which calls for sidewalk improvements and connections and designing roadways to provide access for bikes, pedestrians and cars. Streets that offer a variety of uses offer more transportation choices, inherently reducing emissions from the largest contributor of air pollution (motor vehicles). While this initiative seems to be transportation-oriented on the surface, its successful implementation has and will continue to have a major impact on improving air quality.

This initiative was submitted to Sustainable Jersey and received 10 points towards Certification.

Also, in 2012, the Township Council passed Ordinances 14-3 and 15-56, which establish limitations for tree clearing, and set standards for tree mitigation. Trees clean the air and provide shade, making these ordinances very important to improving air quality.

Actions of the Montgomery Township Board of Health

Montgomery Township's Board of Health Code - Chapter 5 prohibits air pollution in the Township, and

specifically:

- ∂ Prohibits burning garbage
- ∂ Prohibits smoke from combustion of fuel
- ∂ Establishes standards for emissions of particles
- ∂ Establishes standards for construction of chimneys and stacks
- ∂ Establishes regulations for installation and operation of incinerators
- ∂ Appoints the Director of the Board of Health as the Director of Air Pollution Control
- ∂ Establishes provisions for emergency inspections

Montgomery Township's Shade Tree Committee

Montgomery Township's Shade Tree Committee, formed in 1986, developed a planting plan for street trees and the native plantings at the Montgomery Township Arboretum. The planting plan began in 1988 and has resulted in the planting of over 1,600 trees to date.

Each year, the Shade Tree Committee prioritizes several street tree locations for planting and typically bids out the project for fall and spring plantings. They also continue to add to the Montgomery Arboretum of Native Flora, established in 1996, and install plantings at Township parks and facilities.

Source: Infographic: Improving Air Quality (created by Kenyon Planning, LLC)

This initiative was submitted to Sustainable Jersey and received 10 points towards Certification.

RECOMMENDATIONS AND POTENTIAL PROJECTS

∂ Request that NJDEP install an Air Monitoring Station in Montgomery Township to gauge data in a closer proximity

∂ Implement a large-scale, Township-wide electric vehicle program, including education, public electric vehicle charging stations, and replacing Township vehicles and machinery with energy-efficient models

∂ Add a movie about air pollution, such as *Under the Dome*, to the Environmental Movie Series

∂ Provide educational materials about the health impacts of air pollution

∂ Provide education about the importance of maintaining vehicles

∂ Work with local gas stations, service stations and mechanics to provide incentives for regular maintenance of vehicles

∂ Launch a Township-wide anti-idling campaign

CITATIONS

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Montgomery Township Greenhouse Gas Emissions Inventory and Suggested Policy. Richard Stockton College of New Jersey.
https://twp.montgomery.nj.us/twpcommittee/CarbonInventory.pdf

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New Jersey Air Quality Report (2016). New Jersey Department of Environmental Protection – Bureau of Air Monitoring.
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The Plain English to the Clean Air Act. United States Environmental Protection Agency.
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CLIMATE

Climate is a determinant for many of our daily choices, both short and long term. Knowledge of the climate may be a key factor when choosing a permanent place of residence, as well as a type of housing structure. Climate also influences daily choices such as attire, activities to participate in and what we eat. Over the past 100 years, climatologists have documented incremental shifts in temperatures and precipitation across the planet. These shifts mark serious threats to human health, pollutant loading and various habitat. The studying of climate and weather is not only valuable at the global level but is a necessity at the municipal level.

This chapter will address:

- Characteristics of climate in and around Montgomery Township
- How climate affects and is affected in the environment
- Health impacts of climate change to humans, plants and animals
- Success stories from Montgomery Township
- Recommendations to adapt to and stabilize climate change in Montgomery Township

CHARACTERISTICS OF CLIMATE

What is climate?

Climate can be simply defined as the prevailing weather conditions in an area over a long period of time. Climate is ultimately a measure of typical weather over a period of at least thirty years. Often, climate is mistaken for weather, which can change within minutes and only looks at short periods of time.

New Jersey's location near the Atlantic Ocean makes it highly susceptible to weather variations. Most areas in New Jersey experience between 43" and 47" of precipitation annually. The State typically realizes 25-30 thunderstorms per year, with approximately five weak tornadoes recorded across the State annually. Temperatures, especially in the winter months, are very different in the northern part of New Jersey when compared with the southern area.

Land area is divided into climate regions, which are influenced by geology, distance from the ocean and atmospheric flow patterns. New Jersey is divided into five climate regions:

Northern – this region covers approximately 25% of the entire State and is characterized by a colder temperature regime than the rest of the State. Because of the elevations in this region, cold air is often forced over the through mountains and passages, creating clouds and precipitation. The Northern Region has the shortest growing season at 155 days, which makes agriculture a more challenging industry in this area.

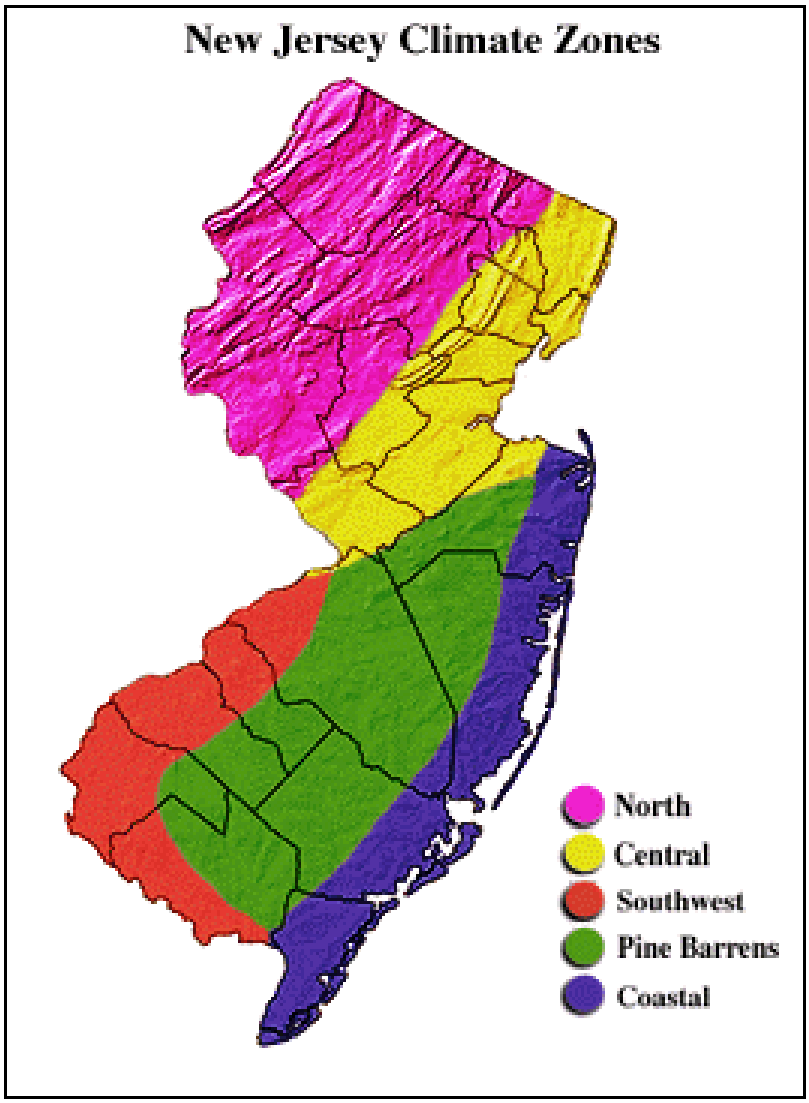
Central – this region is characterized by urbanized areas and impervious coverage. Because of the way that these surfaces retain heat, the Heat Island Effect is a factor affecting climate. Within the region itself, boundaries exhibit some temperature fluctuations: the northern edge of the Central Region is typically the defining line between freezing and non-freezing temperatures in the winter, and comfortable versus uncomfortable nighttime sleeping conditions in the summer months. **The Township of Montgomery is**

located in the Central Region.

Pine Barrens – as referenced by its name, this region is abundant with vegetation and trees. Interestingly enough, the Pine Barrens climate region is influenced heavily by the presence of sandy soils. Because these soils absorb water quickly, drier conditions are typical, allowing for a range of temperatures. In addition, solar radiation is reflected back to the atmosphere more quickly which makes overnight low temperatures cooler than the surrounding areas.

Southwest – farmers in the Southwest Region are likely to be the most satisfied in their industry due to this region being home to the longest growing season. Its location near the Delaware Bay brings warmer temperatures in the summer along with cooling breezes. This region is characterized by the highest temperatures for any region without sandy soils, as well as the least amount of precipitation.

Coastal – the Coastal Region is highly influenced by its proximity to the Atlantic Ocean. In late autumn, the water temperature tends to be higher than the land temperature, making land temperatures warmer overall. This area tends to experience the most frequent extreme weather events, specifically nor-easters from April through October.



Source: Office of the NJ State Climatologist

New Jersey is also divided into four zones, called Hardiness Zones, which detail the types of plants, crops and growing seasons in that area. These regions are based on the annual average extreme minimum temperatures
during a 30-year period. Farmers and gardeners alike can utilize this tool, developed by the United States Department of Agriculture to enhance their harvest and maximize profits.

Montgomery is located in Hardiness Zone 6b, categorized by a medium length growing season, a last frost date of May 1st and a first frost date of November 1st. This information is especially helpful in determining the plant and landscaping materials that can be grown but can also assist in determining what, if any, soil additives or other accommodations need to be implemented to ensure success. Some of the plants that thrive in Hardiness Zone 6b are detailed below in Chart CC-1.

Source: USDA

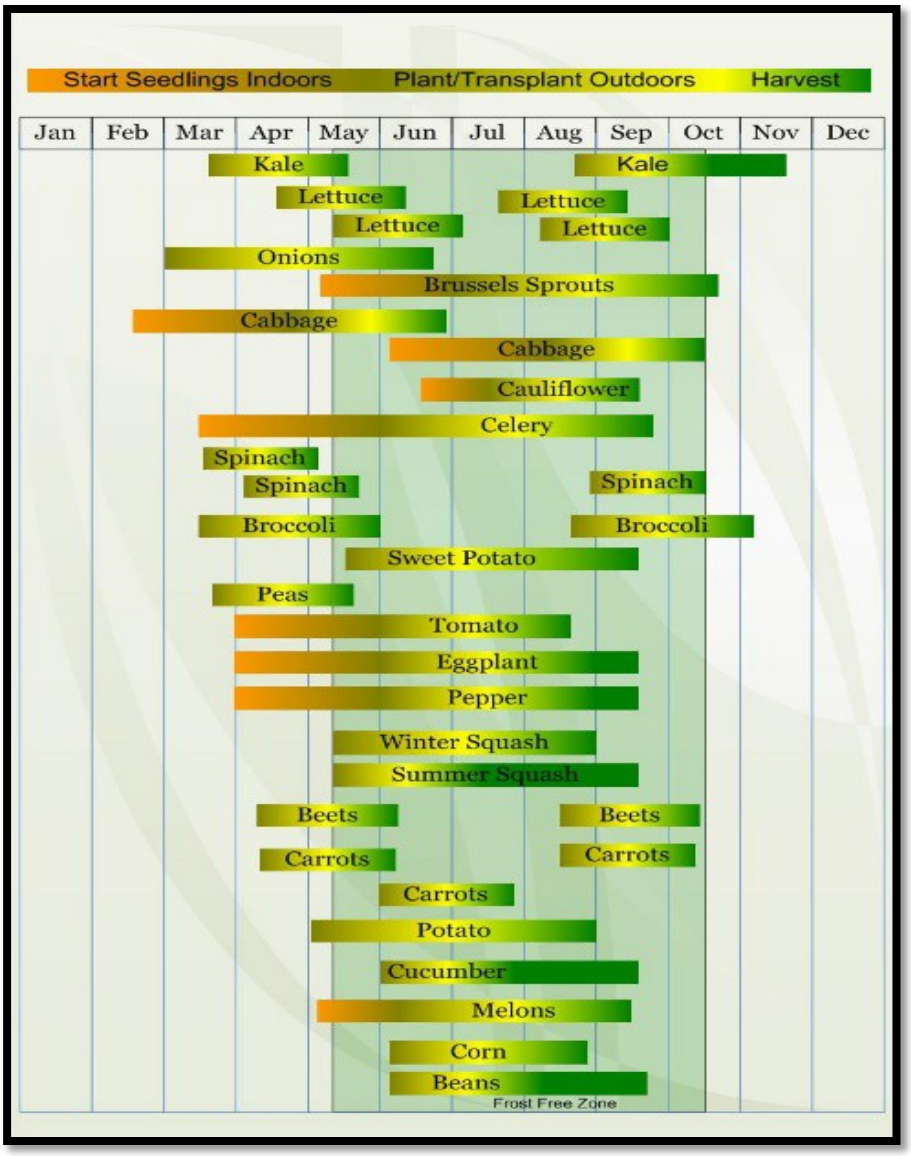


Chart CC-1:
Source: VeggieHarvest.com

HOW CLIMATE AFFECTS AND IS AFFECTED BY THE ENVIRONMENT

Climate change affects the natural environment, which in turn continues to alter the climate. The cycle causes a rise in temperature, increase in precipitation, higher frequency of extreme weather events, concentration of pollutants and poses threats to plant and animal species. These changes are not easily rectified and leave behind permanent negative effects.

Rise in Temperature

The average temperature around the globe has risen an average of 1.5 degrees Fahrenheit over the last century, with continued rise of at least 1-degree Fahrenheit being projected. This increase in temperature is causing a rise in the temperature of water bodies, large and small, altering the conditions and production of all aquatic life, and affecting wind patterns. The effects on aquatic life is of particular worry due to the economic and health impacts caused by reduction of fish production.

Increase in Precipitation

Climate change has caused a rise in precipitation across the globe, due to intensification of the natural water cycle, which causes more evapotranspiration, directly increasing precipitation. This increase has been the cause of more extreme weather events, especially flooding. It has been estimated that by the year 2030 flooding like that documented during Superstorm Sandy will be more prevalent.

Concentration of Pollutants

Warmer temperatures create warmer air which creates more water vapor. Water vapor, defined as a greenhouse gas, traps heat in the atmosphere. Increased temperatures are also responsible for more ozone, a powerful and harmful pollutant often referred to as "lungs sunburn".

Threats to Plants and Animals Species

Aquatic life has very little tolerance for changes in water quality and temperature. Because of this sensitivity, fish species will migrate further north for cooler waters to breed and live in. Plants that cannot survive higher water levels or soils that are non-porous will not be able to function adequately. Animals that are not properly equipped for a rise in temperature and precipitation will have to relocate to nest, find food and satisfy their basic needs.

Amphibians are considered an indicator species for climate change because of their ability to live in two distinct environments (land and water) and because of the ability to breathe through their skin. This type of skin brings about the uptake of toxins, radioactivity and disease. In areas with few amphibians, it can be deduced that the ecosystem is not healthy for plants and animals.

As temperatures and precipitation levels change, plants and animals that are native to other parts of the State or region may move into new habitat areas. The changing climate could also increase the susceptibility of habitats to colonization by invasive species. New species, whether native elsewhere in the United States, or native to foreign countries may outcompete the native plant and animal species, which will completely change the native ecosystem.

Just as climate affects life on Earth, climate is affected and changed by the population and environment. Most actions related to climate change are caused by human activity. Increased concentration of CO_2 due to industrialization is a main culprit for the greenhouse effect, along with the use of certain agricultural processes (methane gas production, use of fertilizers), and the overdevelopment of land. The dependence on the automobile is also a main concern, as cars have become the highest priority use for transportation, specifically in New Jersey. Lastly, the ever-increasing use of mobile devices (laptops, cell phones, tablets) increase demand for electricity during all times of the day and across all land uses. This demand creates more pollution and is a key contributor to climate change. As we continue to employ unsustainable and detrimental practices in the name of commercial and industrial advancement, the changes to climate will continue and be exacerbated over time.

SPOTLIGHT: NEW JERSEY

In 2018, the Associated Press conducted a comprehensive study regarding climate change in New Jersey. The study was performed by analyzing data from the National Oceanic and Atmospheric Administration (NOAA) to establish temperature changes between 1988 and 2017, and then compared these changes to documented temperatures of 1901 – 1960. The report provided information about climate change in New Jersey, including the following:

 In New Jersey, temperatures rose by 2.19 degrees Fahrenheit during the period of 1988 – 2017. The national average during that same time period was only 1.6 degrees Fahrenheit.

- NOAA divides New Jersey into three regions: North, Central and Southern – all three regions are among the fastest heating regions in the United States (**the Township of Montgomery is located in the Northern Region**).
- The state of New Jersey is the third fastest warming state in the country, only behind Alaska and Vermont.

For some time, New Jersey has been striving to stabilize climate change. A goal of reducing emissions by 80% of the 2006 baseline by the year 2050 was established by *Executive Order 54*. The state is ahead of schedule in achieving this goal, as well as the attainment of a greenhouse gas reduction goal to 1990 levels by the year 2020. The State continues to address climate change through initiatives underway the New Jersey Department of Environmental Protection, the New Jersey Board of Public Utilities, the New Jersey Office of Clean Energy, Sustainable Jersey and many local and grassroots organizations.

HEALTH IMPACTS OF CLIMATE CHANGE TO HUMANS, PLANTS AND ANIMALS

As referenced throughout this chapter, climate change has a major impact on the health of plants, animals and the environment. The threats to human health are of paramount concern due to its lasting effects on the current and future population.

Increased temperatures and precipitation will lead to periods of drought and flooding. These weather-induced events will be more severe over time, forcing humans to relocate their homes and places of business. At the extreme end of the spectrum, NASA has predicted that sea level will rise 1-4' by the year 2100, and hurricanes will strengthen in force and frequency.

The trapping of pollutants and UV rays due to the greenhouse effect will be a catalyst for serious health issues. Those at high risk (children, the elderly and those with reduced immune systems) will have to be especially careful as these contaminants can exacerbate asthma, emphysema, and other respiratory ailments. In addition, the trapping of UV rays has been linked to skin cancer and melanoma.

In 2018, the World Wildlife Foundation published *Wildlife in a Warming World* to study and report on the effect of climate change on over 80,000 plant and animal species. The findings of this report, which focused on Priority Places (those with biodiversity richness and threats) included:

- Even an increase of climate by 2 degrees Celsius could cause a 25% elimination of sensitive animal species, specifically in Priority Places such as the Amazon Rainforest.
- The continued temperature rise could cause the elimination of nearly 50% of sensitive plant species, limiting biodiversity and constraining food sources and habitat for other animal species.
- Conservation Planning must begin to address climate change in every aspect in order to adequately protect species.
- Reduction of greenhouse gases is imperative to halt climate change.

Humans do not typically think of animal and plant species when addressing climate change, however their existence and their extinction have equally opposite effects on our population. Many plant species are used in medicines for treatment of human disease, provide food sources and habitat to keep our own food chain functioning, and provide important land management techniques (pollination, soil movement and infiltration and more).

HOW IS MONTGOMERY TOWNSHIP WORKING TO ADAPT TO AND STABILIZE CLIMATE CHANGE?

Montgomery Township Greenhouse Gas Inventory and Suggested Policy Options

Students from the Richard Stockton College of New Jersey collected and analyzed 2008 data to prepare a municipal greenhouse gas inventory for the community. Overall greenhouse gas emissions were categorized as:

- Residential
- Commercial
- Transportation
- Waste and Sewage

The findings of this study found that emissions in greenhouse gas reported for the Township coincided closely with those documented at the State level. Emissions were projected to increase by 16% by the year 2020. It was also concluded that transportation, as across the State of New Jersey, was the major contributor to greenhouse gases. In addition, municipal facilities and operations were specifically analyzed to determine emission levels and provide recommendations for future stabilization and reduction.

The full report can be viewed at: https://twp.montgomery.nj.us/twpcommittee/CarbonInventory.pdf

Township Ordinance 12-1418: Wind, Solar and Photovoltaic Energy Systems Ordinance

On May 17, 2012, the Council of Montgomery amended portions of its Land Development Ordinance to allow for energy generation via wind, solar and photovoltaic means. The ordinance provided for allowances for the construction and installation of sustainable energy, thereby reducing greenhouse gas emissions and the trapping of other pollutants.

The full ordinance can be viewed at: http://sj-site-legacy-migrate.s3.amazonaws.com/m18134!40.pdf

Township Ordinance 14-3: Clearing and Removal of Trees

This tree protection ordinance controls the indiscrete removal of trees and requires mitigation of tree removal by requiring tree planting. This ordinance is especially important in that it protects a resource that cleans the air, thereby reducing greenhouse gas emissions.

The full ordinance can be viewed at: http://sj-site-legacy-migrate.s3.amazonaws.com/m181311!70.pdf Tree

Canopy Goal

The Montgomery Township Environmental Commission and Shade Tree Commission established a goal of 50% Tree Canopy by the year 2020. This goal has been memorialized as an Action under the Township's Sustainable Jersey Certification Report.

For more information, please visit: http://sj-site-legacy-migrate.s3.amazonaws.com/m181311!91.doc

Resolution 09-8-258: Sustainable Land Use Pledge

On August 6, 2009, the Township Committee created a Sustainable Land Use Pledge which included goals such as:

- Facilities Siting – walkability, bikeability and other alternative transportation factors will be considered when locating new municipal facilities

- Housing Variety – options for all incomes, ages and demographics will be planned for within Montgomery Open Space Preservation – the Township made open space and farmland preservation a priority
- Water Quality Protection – the community made a proactive choice to protect water quality in the Township, reduce nonpoint source pollutants, enhance stream buffers, and more
- Transportation Choices – all modes of transportation are to be considered when reviewing site plans and subdivision plans
- Mix of Uses – a pledge was made to actively review redevelopment infill, encourage smart growth principles and address needs of the specific community
- Green Design – the Township placed an emphasis on low-impact development, LEED standards, use of renewable materials and water-friendly landscape design
- Regional Cooperation – Montgomery agreed to coordinate with neighboring municipalities to encourage environmentally-friendly practices that do not end at the municipal border
- Parking Regulations – parking areas will be reviewed to effectively manage stormwater, reduce the heat island effect and decrease impervious coverage.

The full resolution can be viewed at: http://sj-site-legacy-migrate.s3.amazonaws.com/m18137010.pdf and is listed in the Appendix as C-1.

RECOMMENDATIONS AND POTENTIAL PROJECTS

- Improve local public transportation options
- Implement a bike-sharing program
- Promote composting and food waste recycling at municipal facilities, school facilities, businesses and residential households
- Minimize mowing at Township facilities and open space as a method to sequester carbon
- Review "Assessing Health Vulnerability to Climate Change – A Guide for Health Departments"; implement appropriate programs and policies
- Host a Climate Preparedness Workshop – educate the public about extreme weather events and how to properly prepare for them
- Perform the "Getting to Resilience" program, an online assessment tool for New Jersey municipalities to study readiness and vulnerability; this activity also qualifies for Sustainable Jersey points
- Continuation of land preservation, particularly forested land that serves as a source for carbon sequestration
- Host educational campaigns and events that encourage walking and biking, reduce energy usage, and reduces automobile idling
- Provide temperature and/or rain gauges to Township residents through an educational program.

After Photo at Black Horse Run

CITATIONS

"Amphibians and Climate Change". Climate Change Resource Center. https://www.fs.usda.gov/ccrc/topics/amphibians-and-climate-change

"Climate Change". New Jersey Department of Environmental Protection – Office of Air, Energy and Sustainability. https://www.nj.gov/dep/aqes/climate/

"The Climate of New Jersey". The Office of the New Jersey State Climatologist. https://climate.rutgers.edu/stateclim_v1/njclimoverview.html

Hossay, Dr. Patrick and Students. *Montgomery Township Greenhouse Gas Inventory and Suggested Policy Options*. Richard Stockton University. 2008.

Executive Order #54. State of New Jersey (signed by Governor Jon Corzine). February 13, 2007. "Global Climate Change". NASA. https://climate.nasa.gov/causes/

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"Hardiness Zone Maps". United States Department of Agriculture. https://planthardiness.ars.usda.gov/PHZMWeb/

Ludlum, David. The New Jersey Weather Book. Rutgers University Press. 1983.

"Meet the Challenges of a Changing Climate". U.S. Climate Resiliency Toolkit. https://toolkit.climate.gov/

"New Jersey is one of the fastest warming states in the US – here's what that means" https://www.nj.com/news/index.ssf/2018/06/nj_is_one_of_the_fastest_warming_states_in_the_us.html

"NOAA's Annual Greenhouse Gas Index". NOAA – Earth Monitoring Laboratory. https://www.esrl.noaa.gov/gmd/aggi/

Wildlife in a Warming World. World Wildlife Federation. March 2018.

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https://www.nj.com/news/index.ssf/2018/05/climate_change_is_forcing_fish_farther_north_rutge.html

GEOLOGY

The underlying composition of our Earth has an impact on our daily lives that is often forgotten or ignored. The rocks and minerals beneath the ground we walk have input into the availability and quality of groundwater, the quality of the soil, and the suitability of development. Events millions of years ago shaped this precious resource, with the outcomes of those events still shaping our use of the Earth today. Through this document, the Township of Montgomery chooses to address this valuable and vital resource so that the importance of geology is relayed to current and future generations.

This chapter will address:

- Characteristics of geology in and around Montgomery Township
- Formation of geological characteristics, over time, in and around Montgomery Township
- Health impacts of air pollution to humans, plants and animals
- Recommendations to preserve important geology in Montgomery Township
- Success stories from Montgomery Township

WHAT IS GEOLOGY?

Geology is defined as the study of Earth, the materials of which it is made, the structure of those materials, and the processes acting upon them. Time is a critical component of studying geology, in that events over time altar the geologic makeup of a region, which creates a domino effect of change to organisms and structures.

Three types of rocks assist in identifying the characteristics of geology in a region or area. These three types consist of:

Igneous
These are the most common types of rocks in the Earth's crust and are formed from molten material.

Sedimentary
These rocks are formed from other rocks or remains of plants or animals. Fossils are typically petrified in sedimentary rocks.

Metamorphic
As the name suggest, metamorphic rocks are created through a transformation of igneous or sedimentary rocks through pressure, heat or intrusion of fluids.

THE PIEDMONT PROVINCE AND THE NEWARK BASIN

Geologic provinces are regions with common geographic attributes. These attributes may include landforms, topography and types of rocks. A significant change in these attributes signal a change in geographic province. Montgomery Township is located in the Piedmont Province, characterized by an abundance of sedimentary and igneous rocks resulting from the Triassic and Jurassic periods (190-200 million years ago).

“Piedmont” translates to “foot of the mountain” in Greek, likely due to the rising and falling mountains and valleys of the region.

The supercontinent of Pangea began to break apart in the Mesozoic Area, with the complete dissolution ending in the Triassic-Jurassic periods. Figure G-1 depicts Pangea as it once was, specifically the location of New Jersey as central.

Figure G-1: Pangea

During this process, the Newark Basin was formed. This rift stretches from northern New Jersey on a Northeast to Southwest axis and makes up more than 95% of the Piedmont Province in New Jersey. Most rocks are characterized as igneous and sedimentary rocks, forming the topographic highs of the Watchung and Sourland Mountains. Examples of these rocks can be easily seen along the road cuts on Interstates 287 and 78, as well as the various mountain ranges that lie within this physiographic province. Figure G-2 depicts a cross-section of the Newark Basin.

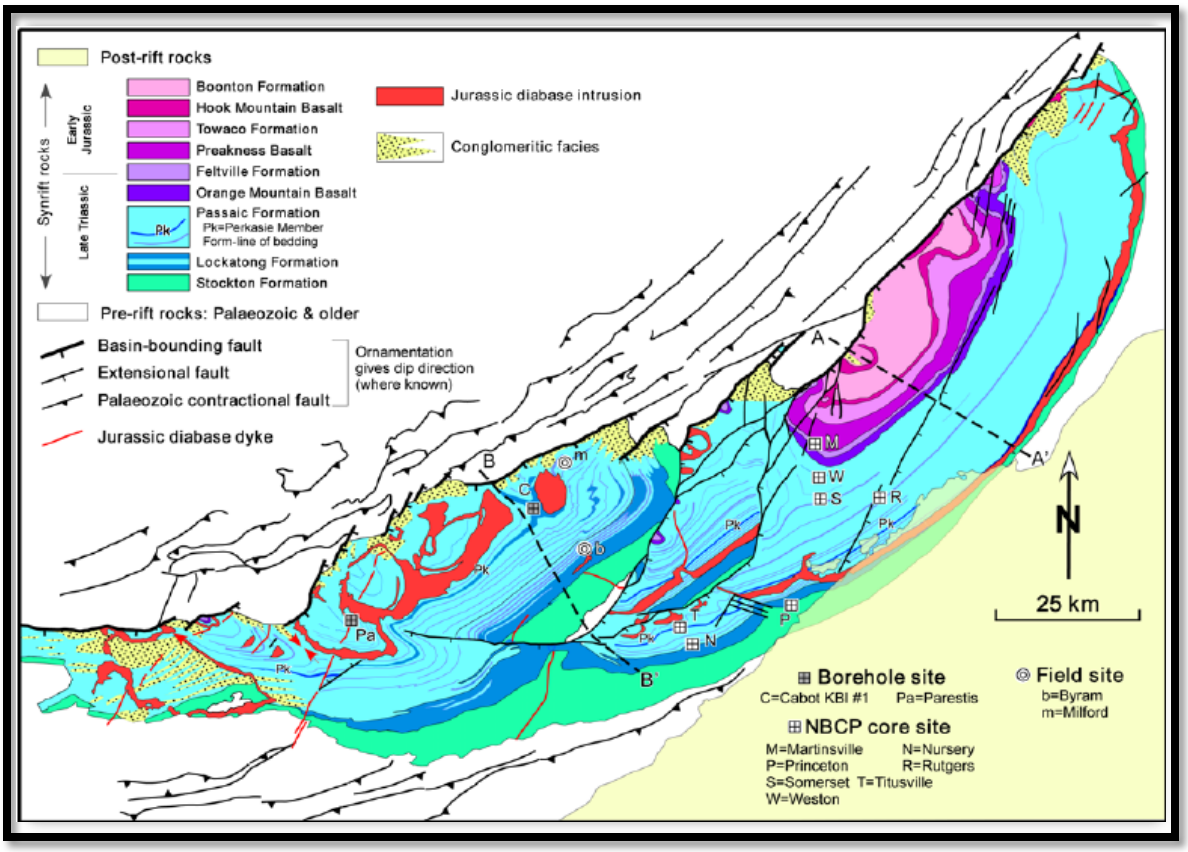


Figure G-2: Newark Basin (cross-section)

In addition to the massive volume of igneous and sedimentary rock deposited in the Newark Basin, the southeastern tip of Montgomery Township is home to an intrusion of Jurassic Diabase. Diabase is an igneous rock that was originally introduced into the Basin as lava flow, is commonly used for the construction of roads, buildings, railroads and levees. There is also high demand for diabase as ornamental stone, especially in New Jersey.

GEOLOGY OF MONTGOMERY TOWNSHIP

81% of Montgomery Township is underlain by the Passaic and Passaic Gray bed formations. This formation is characterized by shale, siltstone and sandstone.

Shales tend be appear red or as darker sheds and break apart easily. Shale today is used in the formation of clay, brick, terracotta pots. Unfortunately, shale is not very stable for land development, and is the rock type most often associated with landslides.

Shale

Siltstone

Siltstone are created when water or ice deposits silt, which then conglomerate. It usually appears gray, brown or red, and is much rarer than shale or sandstone. Unfortunately, there are not many uses for siltstone due to its instability as a building material, and its weakness to weathering and erosion.

Sandstone is composed of sand-sized grains that cement together to form rock. This sedimentary rock is frequently used in man-made aquifers and as a raw manufacturing and construction material. Sandstone is one of the most common types of rock, found in abundance in the Newark Basin and across the world.

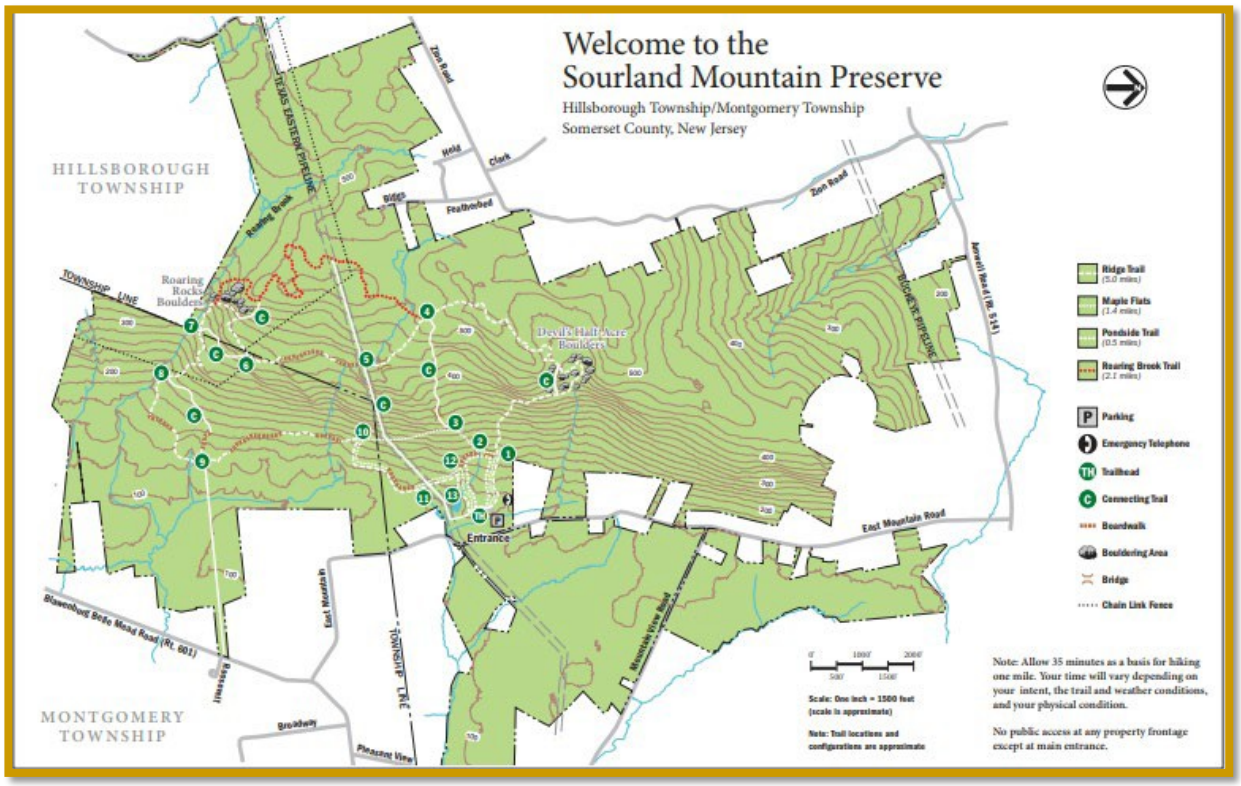
Sandstone

Spotlight: Sourland Mountain

The 90-square mile Sourland Mountain Region stretches from Hillsborough Township, through Montgomery, into the Amwells and Hopewell Township. The highest elevation is 568 feet, offering beautiful views to its visitors. This region is rich in resources, particularly geologic outcroppings, surface waters, soil and more. 4,000 acres are preserved through the Somerset County Parks Commission, with more parcels targeted for preservation due its high-quality natural resources, aesthetic qualities and development pressure. The Township has specifically targeted properties along Rock Brook in the Sourland Mountain to create a continuous greenway and pathway, all centered around the natural geology of the area.

> ***"The Sourlands breathtaking boulder fields are emblematic of the area's unique geology; its mountain springs feed the headwaters of many streams and rivers. Still, water is a fleeting resource here, as the rocky land severely limits the recharge of groundwater, upon which thousands of people depend on for daily use."*** - **The Sourlands Conservancy**

The majority of the Sourland Mountain Region is comprised of diabase rock (volcanic rock) and the Lockatong Formation (sedimentary rocks). Interestingly enough, these rocks and the Formation was created by volcanic eruptions and glacial interactions, even though there was never a volcano or glacier near the site.



Map of the Sourland Mountain Preserve in Somerset County

Rocky conditions make the availability and recharge of groundwater limited, which is direct opposition to the desire for livability. Because of these amazing resources and scenic vistas, people tend to attempt to develop in the region, even though the septic suitability is not optimal. This forced development leads to water contamination and the widening of fractures in groundwater. Because of this effect, geology of the Sourlands is very important to the health of those who live there and nearby. This Region must be treated as a sensitive resource, especially because of its geology.

Of special interest is the Roaring Brook, located in Hillsborough Township, just north of Montgomery Township. During the Ice Age, extreme cold caused the soil to move downslope, exposing bare rock and breaking it into boulders. The stream that was present was effectively moved beneath these boulders, making it virtually invisible to humans. During heavy rains, the roar of the stream moving beneath the ground can still be heard, giving it the name “Roaring Brook”. This example is maybe one of the most interesting and apparent explanations of how changes in time and temperature affect geology, which ultimately influences the future landscape, habitat and natural resources.

WATER AVAILABILITY AND ITS IMPACTS

As mentioned above, geology determines soil quality and water availability. Across the Newark Basin, shallow wells (wells with a depth of 75 feet or less) are a common complaint. When people want to live in an area where a deep well cannot be accommodated, a common practice is to dig into the fractures between bedrock. While this does allow for better access to groundwater, it can also lead to an unintended point of contamination due to the interactions of groundwater with effluent from septic systems.

The Sourland Mountain is an example of where these issues frequently arise. The Sourland Mountain, specifically in Montgomery Township, is a desirable place to live because of its scenic vistas, rolling landscape and inherent privacy. Unfortunately, the underlying and harsh geology significantly reduces groundwater recharge, thereby limiting water availability. Most of the Sourland Mountain has an estimated water yield of 5-7 gallons per minute.

HEALTH IMPACTS OF GEOLOGY ON HUMANS, PLANTS AND ANIMALS

Geology and geologic foundations do not have a very direct influence and clear path to human, plant and animal health. The use or misuse of underlying geology spur changes and practices that can impact human, plant or animal health in some very serious ways.

Fractured bedrock is often used as an opportunity to develop in areas that are not properly suited for development (see above). Septic systems are sometimes installed in areas that are forced and unsuitable, thereby causing water contamination because of the interface of groundwater and effluent. Geology controls the flow of water and effluent once it enters the soil, which can lead to pollution and health impacts.

Plants and animals using areas specific areas for their habitat are also affected by these matters. Contamination of soil and water through the fractures and network of geology are perpetuated through transpiration and upward mobility through the food web. This contamination can cause disease, suppression of growth and potential fatalities in species.

HOW CAN GEOLOGY BE PROTECTED?

Geology is a resource that can be difficult to protect or preserve due to its innate competition with development and other intrusive uses. Over time, the Federal Government has recognized the importance of geology to the environment and has put in place some regulations for its protection. While this is a foundation, more work is needed to preserve this precious resource.

The National Parks Omnibus Management Act gives the National Park Service (NPS) the authority to "withhold information from the public in response to a FOIA request concerning the nature and specific location of threatened, endangered, rare, or commercially valuable objects, or objects of cultural patrimony located in units of the National Park System, unless the Secretary determines that the release of such information would not harm the objects". While this may seem broad, this Act includes surface and subsurface data, as well as geologic features.

The NPS has also enacted the Archaeological Resources Protection Act of 1974 and the Paleontological Resources Protection Act of 2009 to further the protection of geological features, minerals, caves and fossils.

HOW IS MONTGOMERY TOWNSHIP WORKING TO PRESERVE GEOLOGY?

As in many cases of natural resource conservation, Montgomery Township has made strategic and targeted efforts to improve preserve geologic formations for its residents and the surrounding area. Every individual needs to make efforts to be aware of the geology surrounding their residence and business for these initiatives to be totally successful. Strong municipal leadership can provide a foundation for these individual efforts, inspire other municipalities to follow suit and engage the business and industrial sectors to participate in a meaningful and impactful way.

Actions of the Montgomery Township Council and Planning Board

Under the Township's Land Development Ordinance (Chapter 16, Section 8-4), provisions for an Environmental Assessment are described. This section specifically allows for a review of major subdivisions and site plans and for use variances (D-Variances) before the Zoning Board. During this review, impacts to groundwater, stormwater, habitat, tree removal, soil and more can be assessed by a member of the Environmental Commission. This review is imperative in ensuring the health and sustainability of the area with any proposed new development of change in allowed use.

Specifically relating to geology, this ordinance is very important because it recognizes the importance of protecting and preserving natural resources, including geologic features.

Chapter 14-1 entitled, "Soil and Sediment Control" reiterates the requirements in place by the Natural Resource Conservation Service and enforced by the Somerset-Union Soil Conservation District. This section also states the requirements for soil excavation and cuts made into the Earth. By incorporating this section into Township Code, it demonstrates the importance geology plays in development and preservation, as well as the Township's commitment to conserving and protecting natural resources.

Actions of the Montgomery Township Environmental Commission

The Montgomery Township Environmental Commission has taken its authority under Chapter 16:8-14 very seriously. A liaison is appointed from the Environmental Commission to the Planning Board to provide the review of all major site plans and subdivisions and use variances. Beyond reviewing these proposed plans for potential threats to natural resources, the Environmental Commission will also utilize the Natural Resource Inventory.

Rock Brook, south of Dutchtown-Zion Road

RECOMMENDATIONS AND POTENTIAL PROJECTS

- Hold a Geology Education Event – volcanic eruptions, plates colliding, earthquakes, oceanic circulation
- Partner with the Sourlands Conservancy to discuss the relation of geology and climate change (example: field observation day/hike)
- Create a Green Land Development Checklist that includes review of geologic features (where appropriate
- Research paleontological, mineral or archaeological assets that may be within the Township

CITATIONS

Bedrock and Surficial Maps of New Jersey – New Jersey Geologic Service https://www.nj.gov/dep/njgs/

Certification Report for the Township of Montgomery – Township of Montgomery and Sustainable Jersey

"Dear College Students: This Is Why You Should Take Geology" – Erik Klemetti – *Wired Magazine* https://www.wired.com/2016/08/dear-college-students-take-geology/

Digital Geodata Series: Physiographic Provinces of New Jersey – New Jersey Geological and Water Survey https://www.state.nj.us/dep/njgs/geodata/dgs02-7.htm

Geology of the Newark Rift Basin – Roy Schlische – Department of Geological Sciences – Rutgers University
http://www.rci.rutgers.edu/~schlisch/103web/Newarkbasin/NB_frame.html

Geology of Somerset County in Brief – New Jersey Geological Service
https://www.state.nj.us/dep/njgs/enviroed/county-series/Somerset_County.pdf

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http://sourland.org/about-spc/geology/

Laws, Regulations and Policies – National Park Service
https://www.nps.gov/subjects/fossils/fossil-protection.htm

Montgomery Township Natural Resources Inventory – Township of Montgomery and Banisch Associates Pages 19-23

New Jersey Geology: Global and Regional Context – Roy Schlische – Department of Geological Sciences – Rutgers University
http://www.rci.rutgers.edu/~schlisch/103web/NJcontext/njcontext_frame.html

Northeast Region of New Jersey – United States Geologic Service
https://www.usgs.gov/science/regions/northeast/new-jersey?qt-states_l2_landing_page_tabs=0#qt-states_l2_landing_page_tabs

Roadside Geology of New Jersey – David P. Harper – Mountain Press Publishing Company - 2013

Rocks – National Geographic.
https://www.nationalgeographic.com/science/earth/inside-the-earth/rocks/

Somerset County Natural and Cultural Resource Inventory Map – Somerset County Planning Division
https://www.co.somerset.nj.us/home/showdocument?id=2052

Sourland Mountain Preserve in Winter – New Jersey Hiking
https://www.njhiking.com/sourland-mountain-preserve-in-winter/

Sourlands Preserve Map – Somerset County Parks Commission
http://www.somersetcountyparks.org/maps/SourlandsMap.pdf

HABITAT AND WILDLIFE MANAGEMENT

Habitat is one of the most critical resources affected by human interaction and land development patterns. Continued development of the built environment has led to the fragmenting of habitat for many different animal and plant species. Introduction and proliferation of invasive species, both plant and animal, have also led to habitat loss for native species. Through this breakdown, food sources, movement and shelter opportunities have become increasingly stressed and led to many species becoming threatened, endangered or even extinct.

Protecting, restoring and enhancing habitat, along with proper wildlife management, is a major issue in New Jersey that needs to be addressed through a variety of planning and conservation approaches. By beginning to assess and address the issue at the local level, connectivity can begin to be restored and those species that are in danger can be managed and enhanced.

This chapter will address:

- Habitat needs, patches, and connectivity
- Threats to habitat
- Regulations and programs related to Habitat Connectivity and Wildlife Management
- Species of special concern, threatened and endangered species in and around Montgomery Township Health impacts of habitat loss and disconnection to humans, plants and animals
- Recommendations to protect, restore and enhance habitat and wildlife species at the local level
- Success stories from Montgomery Township

HABITAT NEEDS, PATCHES AND CONNECTIVITY

Habitat can be simply defined as “the area in which a species lives”. For a species to survive and thrive, there are five basic requirements for that habitat:

1. Sufficient space
2. Food
3. Water
4. Shelter
5. Provision to reproduce

In addition to that space being sufficient, it also must be connected to a larger community. This allows for the sharing of resources, expansion of the species, exchange of genetic biodiversity, and protection from predators. While protecting, restoring and enhancing individual patches of critical habitat is a first step, looking at a larger network where these patches are connected and allow for multi-modal movement is the only way to ensure maintenance of the wildlife that lives there.

Lack of suitable habitat and incompatible land uses can lead to a species being added to the New Jersey Threatened and Endangered Species List. This list, managed by the Division of Fish and Wildlife, details hundreds of plants and animals' species in need of protection and restoration and provides action recommendations to realize these goals.

As a matter of definition, the NJDEP defines Threatened Species as "those that may become endangered if conditions begin or continue to deteriorate". Endangered Species are defined as those whose prospects for survival in New Jersey are in immediate danger because of loss of habitat, predation, competition, disease, disturbance or contamination. Further defined are Species of Special Concern – those that require special attention due to evidence of decline, vulnerability or habitat modification.

THREATS TO HABITAT

The largest threat to habitat is continued development of the built environment, which is discussed more fully in the Land Use/Land Cover chapter that follows later in this report. The other most serious threats to habitat are overpopulation of white-tailed deer and invasive species.

White-Tailed Deer

The estimated population of white-tailed deer in Montgomery Township is between 90-100 deer per square mile. Dr. Jay F. Kelly's research at Raritan Valley Community College concludes that a sustainable population level of deer is considered to be under 20 deer per square mile to allow for forest regeneration. This overpopulation is due to a number of factors including absence of natural predators, and an overall decrease in hunting. Hunting has decreased State-wide and nation-wide, mainly due to less interest from the younger generations. As of December 1, 2016, there were 124,280 hunting licenses issued in New Jersey, compared to 241,522 licenses issued in 1975, representing a 40% decrease. Furthermore, due to residential development, there is less available land to hunt.

The deer density present in Montgomery has a severe impact on forest health. Deer browse any new seedlings, and rub the bark on young trees, causing damage that typically results in death of the tree. This means that forests are not regenerating, and as older trees die, there are no new trees to take their place. This has a chain reaction for birds, insects and other animals that use the trees for foraging, habitat, breeding and other essential functions. The overpopulation of deer also causes health impacts due to deer-car collisions, as well as the proliferation of tick-borne diseases such as Lyme Disease, Babesiosis, and Tularemia.

Invasive Species

According to the New Jersey Invasive Species Council, there are 2,100 native plant species in New Jersey. About 4,000 species of plants have been introduced to the United States, and 400 of those are now considered invasive. Many of these invasive species outcompete the native plants for space within the ecosystem. The invasive plants proliferate quickly because native animal species do not utilize them as a food source. Some species of invasive plants can change the soil chemistry, which prevents growth of the native plants. When native plants are not able to regenerate, this causes impacts to the larger ecosystem because the food sources for native animals become scarce. Invasives cause further negative impacts to nutrient cycling, and pollination & dispersal.

Invasive plants are not the only issue; invasive animal species such as the Asian long horned beetle, emerald ash borer and spotted lanternfly are causing severe harm to our forested environment. According to a 2009 study from the NJ Invasive Species Council, invasive pests and pathogens are causing over $290 million in losses in the State's agricultural industry.

REGULATIONS AND PROGRAMS RELATED TO HABITAT AND WILDLIFE MANAGEMENT

Wildlife management and the protection of threatened and endangered species cannot be worked on by just one individual entity. The task must be accomplished through partnerships formed through regulations, grassroots organizations, research and funding.

Federal Endangered Species Act

Protection of endangered species can be traced back all the way to 1900, when Congress passed the Lacey Act which prohibited the interstate sale of animals killed illegally and required the restoration of many species. Later in 1964, the Department of the Interior published the Redbook, which detailed a list of species in immediate danger of extinction. Two years later, the first piece of comprehensive legislation - Endangered Species Protection Act - was passed. In 1973, the Endangered Species Act was enacted and signed by President Richard Nixon, with the lead agencies being the United States Fish and Wildlife Service and the National Oceanic and Atmospheric Association's Fisheries Service. The law prohibits the importing, exporting or inter-stating of endangered species, as well as the "taking" of any existing habitat for endangered species. The Act also requires that Federal agencies ensure that any actions they undertake, or fund do not result in the jeopardizing of endangered wildlife and critical habitat. This is the strongest law across the globe for the protection of endangered species as well as critical habitat. It's estimated that since its inception in 1973, the Act has prevented the extinction of 99% of the species listed under its protection.

The first federally listed species, often referred to as the "Class of 1967", were the forefathers of the Threatened and Endangered Species List. 75 species were added on March 12, 1967, notably including:

- Bald Eagle
- Grizzly Bear
- American Alligator
- Red Wolf Whooping Crane
- Mexican Duck
- Canada Goose

The USFW Service also has the authority to designate critical habitat, requiring Federal agencies to ensure that actions they take on or fund at the designated site do not negatively impact the listed species. The pairing of these listings protects and prevent the continued decline of federally recognized species.

NJDEP's Endangered and Nongame Species Program has designated a State-level list of threatened and endangered species. This list also aims to protect, restore and enhance species and determine actions to ensure the continued survival of these plants and animals. The complete list of threatened and endangered species in New Jersey is listed as Appendix 1 of this Chapter.

Endangered and Nongame Species Program

The Endangered and Nongame Species Program, housed under the NJDEP's Division of Fish and Wildlife, is responsible for the protection and management of nearly 500 wildlife species in New Jersey, 83 of which are threatened and endangered. This important program is funded almost entirely by donations through Income Tax refunds, personalized license plate fees and the Conserve Wildlife Foundation. More information on this program can be found at: https://www.state.nj.us/dep/fgw/ensphome.htm.

Inception of the Landscape Project

In 1993, the New Jersey Department of Environmental Protection's (NJDEP) Endangered and Nongame Species Program moved to a landscape approach, strengthening even further the model of habitat connectivity. In order to create this comprehensive approach, NJDEP partnered with the Rutgers Center for Remote Sensing and Spatial Analysis to digitally map over 20 land cover types. Once this layer was completed, habitat suitability was determined through a series of methodologies. The last step was to overlay these data with the existing Natural Heritage Program's Biological Conservation Database, which is continuously updated making it the most digitally comprehensive database for threatened and endangered species. The result, titled *The Landscape Project*, is used often by planners, natural resource managers, and researchers in strategic planning tasks such as:

- Preparation of Environmental Impact Statements
- Supplementation of field surveys
- Identifying highest quality areas for natural diversity
- Minimizing conflicts of land uses
- Prioritizing lands for preservation/protection
- Avoiding unnecessary remediation costs

Rating System

As aforementioned, the Biological Conservation Database is the most comprehensive clearinghouse for data on threatened and endangered species in New Jersey. This system is home to more than 11,000 records of locations of are plant and animal ecosystems. In order to keep this system current, the Natural Heritage Program partners with local affiliates and agencies to update the data and offers a method for any person who encounters a sighting of such a species to report it directly. The compilation of data has led to the development of five rankings, as shown below:

RANK	INDICATION
1	Suitable habitat; no special concern, threatened or endangered species sighted
2	Habitat patch with species of special concern present
3	Habitat patch with State threatened species present
4	Habitat patch with State endangered species present
5	Habitat patch with Federal threatened or endangered species present

Table H-1: Habitat Rankings

The most recent version of The Landscape Project Report (Version 3.3) was drafted in 2017, and can be viewed at: https://www.state.nj.us/dep/fgw/ensp/landscape/lp_report_3_3.pdf

State Wildlife Action Plans

State Wildlife Action Plans are plans adopted by almost every state in the United States and address the following:

- Status and health of each state's habitat and wildlife species
- Current issues related to threatened or endangered species and their habitat
- Recommendations to protect, restore and enhance threatened and endangered species in the State

Funding is available through the State Wildlife Grants program to prevent at-risk species from moving to the Endangered Species List. In order to receive State Wildlife Grants, each State must have a State Wildlife Action Plan in place. Funding is to be used for approved preventative actions and is matched by the receiving State agency.

The original New Jersey State Wildlife Action Plan, adopted in 2005, and was recently revised and re-adopted in July 2018. This Plan describes 107 focal species and serves as an outline for the conservation and protection of wildlife and wildlife habitat. The entire Plan can be viewed at: www.njfishandwildlife.com/ensp/wap/pdf/wap_plan18.pdf.

Connecting Habitat Across New Jersey

The Connecting Habitat Across New Jersey Program (CHANJ) is a statewide initiative launched in 2012 and overseen by a working group of over 100 professionals and stakeholders. The vision of this organization is to "make landscapes and roadways more permeable to wildlife movement and to create a blueprint for strategic habitat conservation". It is the belief of this group that the connectivity of habitat is paramount to the protection of wildlife across the State.

In January 2018, CHANJ launched their innovative Gene Flow Analysis. Over 60 volunteers were trained to perform ear clippings from small mammal roadkill all over New Jersey. These samples are sent to the National Genomics Center for Wildlife and Fish Conservation in Montana, which will assist in identifying the most serious barriers to wildlife movement and additional threats to already threatened species. By September 2018, over 680 samples were collected from 22 different species. The study will continue through 2022.

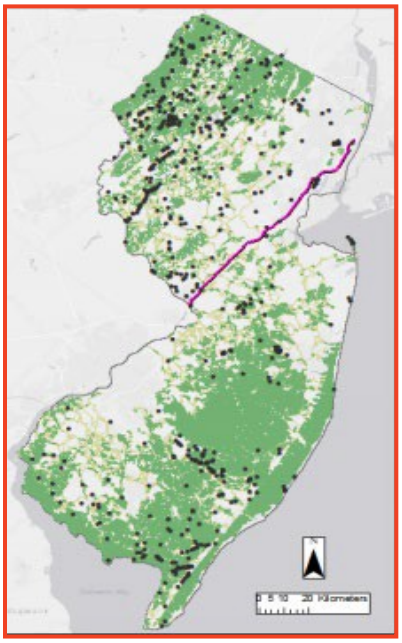


Figure H-2: Sites of Gene Flow Analysis Sampling

In April 2019, CHANJ released an interactive mapping tool that allows users to identify areas of connecting habitat, along with areas that pose a threat to existing and potential connections. The mapping is available via an online viewer (mobile application) that allows users to visualize their specific area within the connectivity cores and corridors. In addition to the mapping capabilities, CHANJ released a companion guidance document that helps to put the data into perspective for strategic decision-making. In addition to providing background on the CHANJ initiative and findings from the study, the appendices include the Roadkill Survey and Photo Classification Protocols. The guidance document, entitled, "CHANJ Guidance Document – Version 1" can be accessed at https://www.njfishandwildlife.com/ensp/chanj_guidance.pdf?utm_medium=email&utm_source=govdelivery .

To access the mapping tool, please visit: https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=53339ff12f27488d8462e5e2c4c21b5c

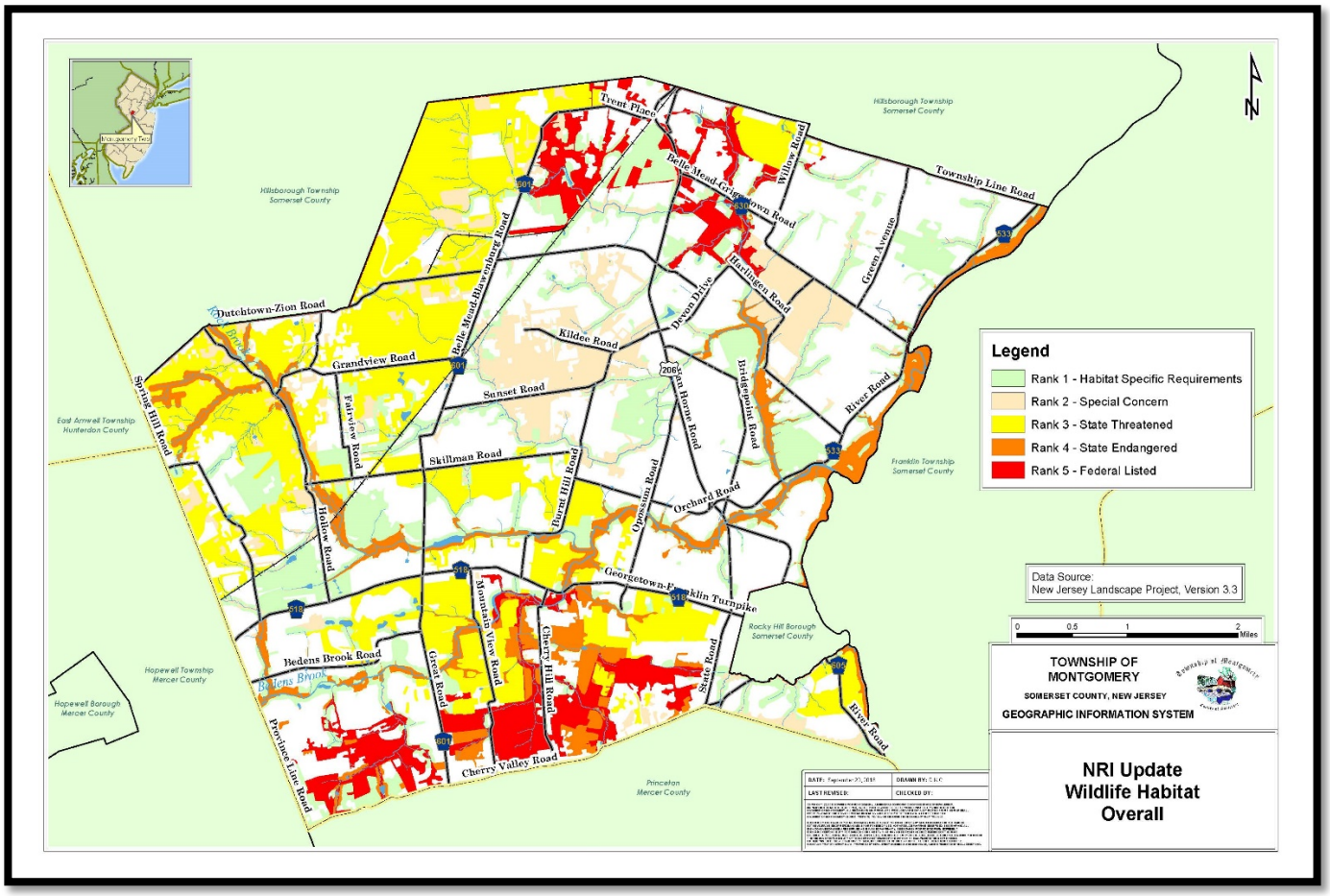
SPECIES OF SPECIAL CONCERN, THREATENED AND ENDANGERED SPECIES IN AND AROUND MONTGOMERY TOWNSHIP

Critical Habitat and Wildlife in Montgomery Township

At the hyperlocal level, municipalities serve as the frontline for species protection. Montgomery Township is home to federal and state-listed threatened and endangered species across the municipality, in a variety of landscapes and land uses. Appendix 2 of this Chapter shows the ranked habitat taking all landscapes and land uses into account. As demonstrated in this map, federal-listed species are most prevalent in the north-central and south- central portions of the Township. State-endangered species are found in the highest concentrations along the Royce Brook and Bedens Brook flowing through the center of the municipality

from west to east. 30% of Montgomery Township is home State-threatened species, especially in the Northwest and Southern sections.

For purposes of this update to the Natural Resource Inventory, the exercise of overlaying threatened and endangered species data with land use data within the municipal boundaries was performed and analyzed.



Eight maps, located in the appendices of this document, show the results of this exercise, and how habitat is intertwined with a variety of land uses.

HEALTH IMPACTS OF HABITAT LOSS AND DISCONNECTION TO HUMANS, PLANTS AND ANIMALS

Impacts to human health, economics and social equity has been studied at length by national and even global agencies. Biodiversity has become an issue that is equally as important as climate change, in that both are environmental phenomenon that are dangerous and constantly accelerating. While the prime concern tends to be protecting, restoring and enhancing threatened and endangered species, special concern needs to be directed to the collateral damage that results from a decline in biodiversity.

The most glaring impact for humans is the basic needs for food fulfilled by animal and plant species. Furthermore, thousands of plants are used as a source of food, bees and butterflies (many species threatened or endangered) are needed to pollinate plants for further production of food. Habitat for these plants and animals is imperative for the continuance and furtherance of these species so they can continue to complete their tasks.

Medicinal Benefits of Biodiversity and Protection of Habitat

According to the National Wildlife Federation, in the United States, 56% of the 150 most prescribed prescription drugs are derived from natural compounds. These drugs are instrumental in treating serious and fatal diseases affecting humanity. The plants sourced for medicinal purchases are nearly threatened, if not already threatened or endangered species. Without these advances to modern medicine, survival rates for many of the most common diseases would be much lower, as would the average life expectancy. Below are just a few examples:

Purple Foxglove Plant – this plant species, native in Europe, is the source of Digitalis, a medication prescribed to over three million Americans suffering from heart disease.

Pacific Yew Tree – found predominantly in the Northwest Region of the United States, this nearly threatened tree was originally thought to be the equivalent of a weed until it was discovered that substance in the bark can be used to treat breast, ovarian and lung cancers. This substance is the main ingredient in Taxol, a chemotherapy offered to millions of patients each year.

Rosy Periwinkle is not listed as endangered but was almost extinct due to habitat loss in its native Madagascar, until it was discovered that it had medicinal properties used specifically to treat blood cancers. The medicines derived from Rosy Periwinkle are proven to increase survival rates in childhood leukemia by nearly 60%.

Environmental Benefits of Biodiversity and Protection of Habitat

Suitable habitat properly maintained by its species also provides a variety of environmental benefits. In addition to providing source materials for food, pharmaceutical products, housing, cosmetics and much more, critical habitat allows for nutrient upcycling, plant pollination, and pest control. These benefits, referred to as Ecosystem Benefits, are necessary to prevent food insecurity, vulnerability to natural disasters and to promote recreation, tourism and scientific research.

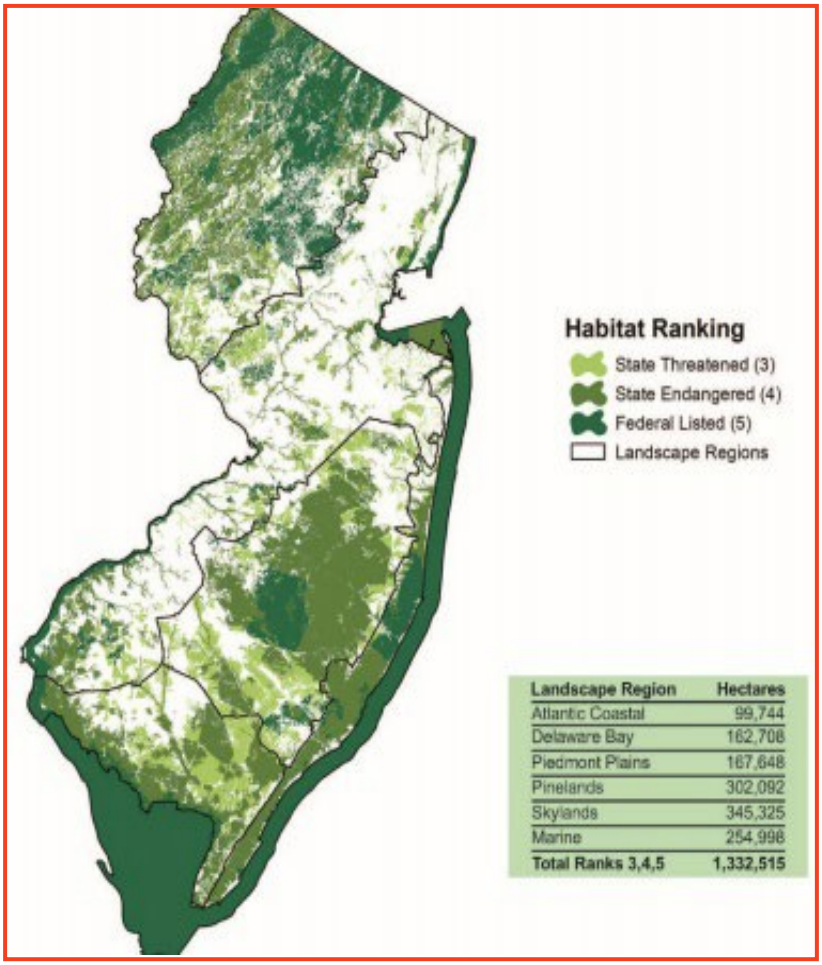
Economic Benefits of Biodiversity and Protection of Habitat

A report published in 2018 by the United Nations- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services studies the economics of biodiversity. Results showed that biodiversity accounts for 24 trillion dollars a year worldwide in its roles of climate regulation, pollution filtration, food production, flood prevention and more. The presence of biodiversity with their critical habitat also provide tourism and recreation opportunities in the form of birdwatching, hiking, and photography. These activities, participated in by 60% of Americans, provide revenue for local, State, regional and national budgets.

Social Benefits of Biodiversity and Protection of Habitat

Rare species of birds and insects are a key function of ecotourism and recreation in the United States. Many people will visit a particular place for birdwatching and photography opportunities.

HOW IS MONTGOMERY TOWNSHIP WORKING TO PROTECT, RESTORE AND ENHANCE HABITAT AND BIODIVERSITY?



Landscape Region	Hectares
Atlantic Coastal	99,744
Delaware Bay	162,708
Piedmont Plains	167,648
Pinelands	302,092
Skylands	345,325
Marine	254,998
Total Ranks 3,4,5	**1,332,515**

Montgomery Township has taken important steps to ensure the health of critical habitat and threatened and endangered species. These actions can be viewed in the Township Code, preservation programs and partnerships, and local practices. The following are the major policies and programs implemented in Montgomery Township.

Montgomery Township Code

Chapter 16-8.4 of the Township's Land Development Ordinance outlines standards for the submission of site plans and subdivisions. All Use Variance requests, major subdivision plans over ten lots and all applications for Preliminary Major Subdivision or Site Plans require the completion of an Environmental Impact Assessment. A main component of an EIA is identifying the presence of threatened or endangered species. An added protection is that the ordinance allows the Planning or Zoning Board to require an EIA at its discretion. This Assessment, performed early in the process of land development, provides important information for developers as to where development is appropriate on a site, and where critical habitat and threatened or endangered species are already located.

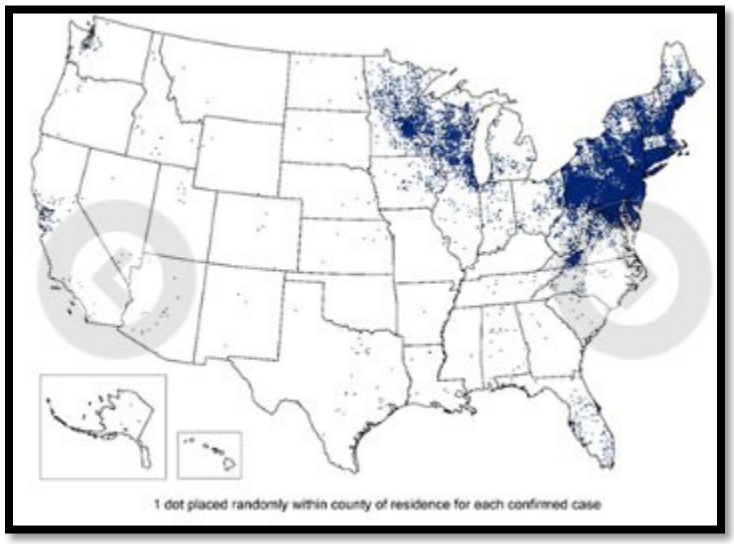
Township Code Section 16-5.6d requires tree planting of fourteen trees per acre on residential and nonresidential lots. Native plants species are required.

Township Code Section 16-5.6e requires conservation easement or conservation deed restrictions on all critical areas (i.e., steep slopes, stream corridor, wetlands.

Township Code Section 16-6.4 prohibits tree clearing in the stream corridor, limits uses permitted in the stream corridor, floodway, flood hazard area, special flood hazard areas and combinations thereof.

Township Code 14-3 limits tree planting to 20,000 square-feet for lots that can be further subdivided, and 40,000 square-feet or 50% of the lot (whichever is less) for other lots, both residential and nonresidential.

Montgomery Township Wildlife Management Committee and White-Tailed Deer Hunting Program



The deer population in New Jersey is estimated at 100,000. While this represents a decrease in population since 1995, it still represents almost 50% above what is considered ecologically stable. Deer cause hazards to drivers, with a fatality occurring in neighboring Franklin Township in 2017.
Deer-Motor Vehicle Collisions (DMVC) account for approximately 26,000 documented accidents, particularly during mating season (mid-October through mid-December). Deer are also responsible for most of the transmission of Lyme Disease, a potentially debilitating illness transmitted through a bite from an infected black-legged tick (often referred to as "deer ticks"). The Center for Disease Control (CDC) estimates that approximately 300,000 may be diagnosed annually.

Montgomery Township began its study of the deer population within the Township as early as 2001. During this time, an Ad-Hoc Wildlife Management Committee was formed to establish a Deer Management Program, with the primary mechanism being hunting. As a first step, a Deer Survey was performed, showing that there were approximately 89 deer per square mile with the municipal borders alone. The Wildlife Management Committee worked closely with residents to formulate a program that has been successful for over 15 years. Montgomery's Program follows the rules developed by the New Jersey Department of Environmental Protection's Deer Management Program for hunting seasons, times and boundaries/buffers.
To date, the program includes twenty-one municipally owned properties, encompassing over 1,200 acres. The number of permits varies by property according to site constraints such as tree cover, topography, proximity to neighboring land uses and other factors.
The Township encourages hunters to take additional deer by providing a refrigerated trailer at the Municipal Building where hunters may drop off deer that are not wanted for personal use. The Township then pays for butchering of the deer and donates the meat to a food pantry in Union County. Recently, the Wildlife Management Committee has begun to explore possible additional incentives to hunters such as waiving the permit fees for the following hunting season if a hunter culled a certain amount of deer.

The recent deer cull history is as follows:

- 2018 – 2019: 214
- 2017 – 2018: 174
- 2016 – 2017: 164
- 2015 – 2016: 163
- 2014 – 2015: 192

- 2013 – 2014: 191
- 2012 – 2013: 214
- 2011 – 2012: data unavailable
- 2010 – 2013: 203

This action was submitted as part of the most recent Sustainable Jersey Certification round and was awarded 10 points.

Reforestation Project and Creation of Vernal Ponds – Cherry Brook Preserve

In 2006, the Township received a grant from the United States Fish and Wildlife Service (USFWS) to restore a twenty-five-acre, former agricultural field in the Township-owned Cherry Brook Preserve, which consists of over 400 acres of preserved forested land. USFWS provided over 1,000 tree seedlings which were planted by volunteers over two days. A main goal was to fill in the forest canopy and remove the existing edge habitat around the agricultural field. Edge habitat provides a ripe opportunity for invasive species, both plant and animal, and for predation. This area of the Township was particularly important for habitat enhancement because it serves as a breeding and migratory stopover grounds for more than sixty species of neotropical birds migrating between the Yucatan Peninsula in Mexico to Canada. As another facet of the project, staff from USFWS created three vernal ponds on the property, near the existing forest edge, to provide critical breeding habitat for salamanders and other amphibians.

Now, over ten years removed from the project, the Township has observed an 80% survival rate for the plantings and observed salamander egg sacs and other wildlife utilizing the vernal ponds. Additional adjoining lands have been purchased and protected to increase the size of the Preserve.

An August 2006 aerial (left) shows the property as a 25-acre active agricultural field, while the aerial on the right from July 2018 shows the progress of the reforestation project over 10 years later.

Reforestation Projects

The Township's Open Space Committee has identified additional project areas on several open space properties for potential reforestation. A particular target is the Rock Brook stream corridor, and the Open Space Committee has been working in cooperation with the Somerset County Park Commission on a reforestation project along Rock Brook in Skillman Park. Since 2014, the Committee has hosted volunteer workdays planting trees along the stream, with over 700 trees and understory plants planted as of the date of this plan.

Volunteers planting trees and understory shrubs along Rock Brook, Skillman Park, April 2019.

Meadow Management

The Township manages several properties as meadow, including Hobler Park and the fields around the Stonebridge community on Montgomery Road (formerly "Ingersoll Rand"). These meadow areas are maintained as such, not only to provide an aesthetically pleasing viewshed, but more so to provide a variable habitat.

Hobler Park is mowed in sections on a rotating basis to keep out the pioneer species and manage invasive plants such as mugwort (Artemisia vulgaris), Callery pear (Pyrus calleryana) and spotted knapweed (Centaurea stoebe L.subsp. Micanthros, Centaurea maculosa). The fields around Stonebridge are mowed annually in the late Fall or winter, as weather permits. Both properties are terrific opportunities for birding for hawks, observing butterflies and other wildlife. An annual butterfly survey conducted at Hobler Park in 2017b by the North American Butterfly Association noted thirty different species of butterfly including Eastern Tiger Swallowtail, Silver Spotted Skipper, Wild Indigo Duskywing and Little Glassywing.

Montgomery Arboretum of Native Flora

In 1997, the Township of Montgomery and the Shade Tree Committee opened the Montgomery Arboretum of Native Flora, located within Montgomery Veterans Park. The Arboretum is home to native trees and shrubs, many rare, threatened or endangered. Examples of its rare inventory include:

- Kentucky Coffee Tree
- Round Lobed Sweetgum Tree
- American Beech Tree
- Male Osage Orange Tree
- Pond Cypress

Along with educating the public about native species and providing the opportunity to see rare tree and shrub pieces firsthand, the Arboretum is also a haven for wildlife. This scenic and peaceful place has become a popular birding site for rare birds, including but not limited to:

- Bobolink
- Grasshopper Sparrow
- Vesper Sparrow
- Upland Sandpiper

Preservation of the Sourland Mountain

Most land preservation initiatives and projects will produce a positive impact for wildlife habitat; however, the preservation of the Sourland Mountain has provided undisputed benefits for biodiversity in and around Montgomery Township. The critical forest habitat of the Sourland Mountain supporting state endangered species stretches from the northern boundary of the Township with Hillsborough southwest along the mountain into East Amwell and Hopewell Townships. The foot of the Sourland Mountain has important grasslands, uniquely suited to reproducing populations of neo-tropical migrating birds.

The Township continues its quest in the preservation of the Sourlands Mountain, as well as agricultural and open space lands that inherently provide critical habitat for rare, threatened and endangered species.

Spotlight: Bees – Pollinators and Producers

Bees serve as the main pollinator for the Earth's plants and crops. Their task of pollinating plants is directly tied to our food security, balance of ecosystems and sustenance of species. Farmers often plan crops integrated with pollinator-friendly flowers and crops (lavender, alfalfa) as bees are a main component for successful agriculture. Residential landowners are realizing the necessity of bees and are changing their behaviors accordingly. In short, humans are finally understanding our reliance on bees.

Colony Collapse Disorder (CCD) is a phenomenon where most workers bees leave the hive and the Queen, leading to the collapse of the colony, ultimately leading to a dangerous reduction in the bee population. Changes in food and foraging for the bees have been largely blamed for this issue. In 2007, the United States Department of Agriculture formed the Colony Collapse Disorder Committee, which was charged with studying the phenomenon through data collection and hypothesis-driven research. The Committee continues to find mitigative procedures and restorative projects to bring the bee population back to a healthy rate.

RECOMMENDATIONS AND POTENTIAL PROJECTS

- Create educational materials on native plants, such as a recommended planting list.
- Perform a bird and butterflies' study with New Jersey Audubon Society, Natural Resources Conservation Service, or similar entity to inventory the populations of rare birds and butterflies in the Township, and identify ways to encourage nesting and mating within the municipal borders
- Plan for and create a Native Grasslands Preserve that can serve as a "birding hotspot" and additional recreation area.
- Train staff and volunteers to perform Stream Culvert Assessments, using protocol designed by CHANJ
- Research potential for safe wildlife crossing design (underground tunnel, wildlife crossing bridge) to allow for safe passage to connected habitat patches

Underground Tunnel - Bedminster Township

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LAND USE/ LAND COVER

Evaluating the existing land uses versus the planning land uses in a community is one of the most valuable exercises a municipality undertake to achieve its vision and future goals. Development patterns highlight the desires of the residents, and hopefully relay the concept crafted by the local governing body. Deviation from this vision lead to a fragmented land cover pattern, ultimately influencing the future economics, conservation and desirability of the community. In this chapter, the Township of Montgomery will complete this basic land use planning exercise, document the results, and update its vision for the future of the municipality.

This chapter will address:

- Current land uses in Montgomery Township
- Changes in land use and land cover in Montgomery Township since the April 2004 NRI
- Health impacts of land use planning decisions on people, plants and animals
- Recommendations for future land use planning in Montgomery Township
- Success stories from Montgomery Township

LAND USE PLANNING IN MONTGOMERY TOWNSHIP

Montgomery Township has a rich agricultural history and is home to expansive forests and open space areas and impressive natural features. Conversely, the Township is also home to a variety of housing and robust commerce. Because of these competing uses, the proper planning for land development is of the utmost importance to maintain the balance needed for an optimal community.

Planning and Zoning Department

Montgomery Township has an experienced Planning and Zoning Department, whose mission is "to plan, guide and coordinate future growth and development of Montgomery Township in a manner that strengthens the local economy, improves and protects the quality of the environment and enhances the quality of life and the well-being of current and future generations." The Planning and Zoning Department oversees open space, farmland and historic preservation, site plan and subdivision review, sustainability, affordable housing and business expansion.

Planning and Zoning Department also reviews the current zoning of the Township and makes recommendations for future zoning, review projects with requests for relief from certain zoning conditions and enforce zoning throughout the Township. Projects and questions usually fielded by the Zoning Officer include permits for signage, changes in use for a specific structure or property, and many more.

The Township's "Development Projects" page has a list of current large-scale development projects underway in the Township. This page is a resource for developers, residents and commercial investors. https://twp.montgomery.nj.us/departments/planning/development-projects/

Montgomery Township Master Plan

The original Master Plan for Montgomery Township was adopted in 1971. Since that time, Montgomery has experienced a boom in population growth, with a population density of 723.9 people per square mile according to the 2016 US Census. The Township has been active in updating the original Master Plan to proactively guide development and respond to the changing population and land cover. Re-examinations have been adopted in 1993, 1998, 2001, 2008 and 2017. In addition, the Township has adopted multiple elements to enhance the Master Plan, including the Traffic Circulation Plan, Stormwater Management Plan, Farmland Preservation Plan, Housing Plan and Recreation Plan. Many reports have been made available to the public at:
https://twp.montgomery.nj.us/departments/planning/planning-reports-studies/

"A man who does not think and plan ahead, will find trouble right at his door"
- Confucius

Montgomery Township Zoning Ordinance and Map

There are twenty-four zoning districts in the Township as well as five optional Development Alternative Districts and a Redevelopment Area. Most of the districts allow for single-family residential, with many areas being reserved for parks and recreation. The western portion of the Township has swaths of land designated as Mountain Residential, specifically referencing and managing land in the Sourland Mountain. The Development Alternative Districts allow for innovative development including clustering and Planned Unit Development. Map LU-1 shows the adopted Zoning Map, and the current Zoning Code can be in Chapter 16 of the Municipal Code.

CURRENT LAND USE/LAND COVER SINCE PREVIOUS NRI (APRIL 2004)

As aforementioned, Montgomery Township has and allows a variety of uses, and has done an excellent job in creating a desirable balance. Over time, the population in this 33-square mile community has exploded, however the rural character has been preserved. To ensure continued success, Montgomery Township has inventoried its existing uses as a first step. Table L-1 below shows the current land uses in the Township:

Harlingen Road - 20th Century View

Harlingen Road - Current View

Table L-1: Existing Land Cover
Source: Township of Montgomery – GIS Department (2018)

Land Cover (type)	Land Cover (acreage)	Land Cover (percentage)
Agricultural	3,698.50	17.79%
Agricultural Wetlands	354.31	1.70%
Athletic Fields	73.01	0.35%
Barren Land	51.50	0.25%
Brush Covered Fields	110.55	0.53%
Commercial	497.55	2.39%
Coniferous Forest	563.93	2.71%
Coniferous Wooded Wetlands	30.34	0.15%
Deciduous Forest	3277.93	15.77%
Deciduous Wooded Wetlands	1,719.53	8.27%
Disturbed Wetlands	17.30	0.08%
Herbaceous Wetlands	132.12	0.64%
High Density Residential	352.37	1.70%
Industrial	34.15	0.16%
Low Density Residential	784.15	3.77%
Managed Wetlands	59.51	0.29%
Medium Density Residential	308.23	1.48%
Mixed Forest	1,181.29	5.68%
Mixed Wooded Wetlands	166.56	0.80%
Other Urban	661.22	3.18%
Plantation	8.47	0.04%
Recreation Land	807.46	3.88%
Rural Residential	5,290.77	25.45%
Stormwater Basin	274.96	1.32%
Transportation and Utilities	149.82	0.72%
Water	182.23	0.88%
TOTAL	**20,787.73**	**100.00%**

As shown in the Charts L-2 and L-3 (below), the current land uses are very different in some cases when compared to those reported in the *April 2004 Montgomery Township Natural Resources Inventory*.

Chart L-2
(source: Montgomery Township Natural Resource Inventory – 2004)

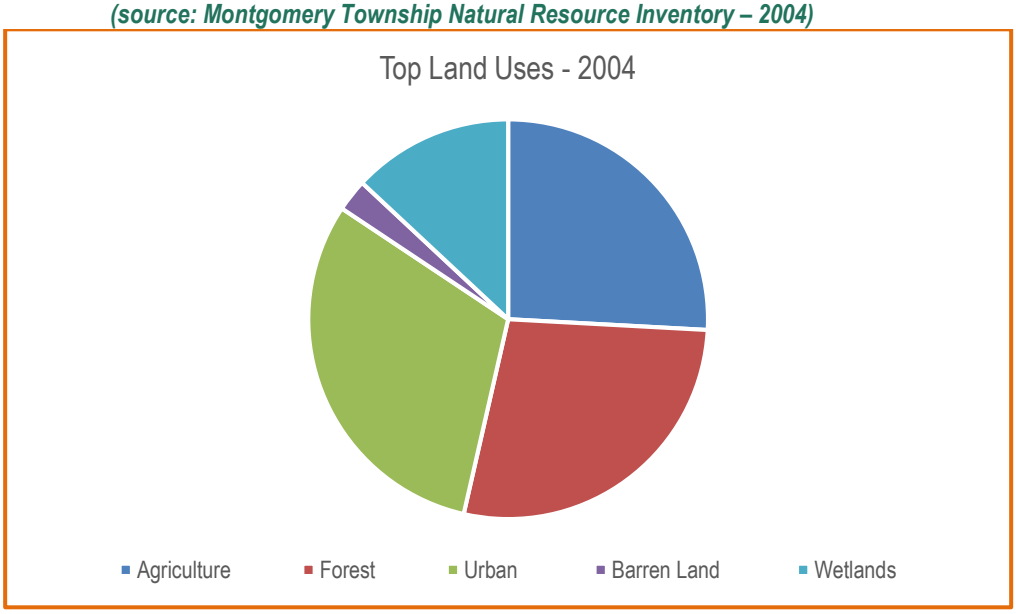
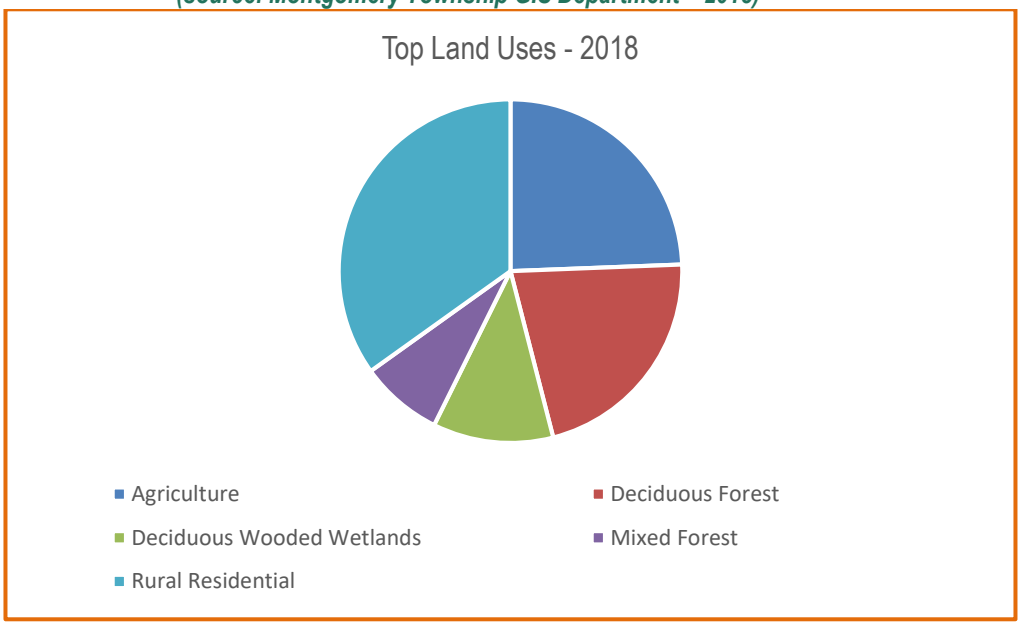


Chart L-3
(source: Montgomery Township GIS Department – 2018)



Tables L-8 and Chart L-9 below shows the changeover in each of these previously documented uses:

Table L-3: Change in AGRICULTURE Over Time

Land Use	Time Period	Delta – Acreage	Delta – Percentage
AGRICULTURE	1972 - 1986	-2,450.4	-23.8%
	1986 – 1995	-2,485.4	-31.8%
	1995 – 2002	-1,288.6	-24.1%
	2002 – 2007	-73.4	-1.8%
	2007 – 2018	-280.8	-7.1%

Table L-4: Change in BARREN LAND Over Time

Land Use	Time Period	Delta – Acreage	Delta – Percentage
BARREN LAND	1972 - 1986	+361.4	+2,986.8%
	1986 – 1995	+164.8	+44.1%
	1995 – 2002	-187.8	-34.9%
	2002 – 2007	-276.7	-78.9%
	2007 – 2018	-22.3	-30.3%

Table L-5: Change in FOREST Over Time

Land Use	Time Period	Delta – Acreage	Delta – Percentage
FOREST	1972 - 1986	-1,141.3	-17.2%
	1986 – 1995	+234.2	+4.3%
	1995 – 2002	-264.6	-4.6%
	2002 – 2007	-136.5	-2.5%
	2007 – 2018	-181.2	-3.4%

Table L-6: Change in URBAN Over Time

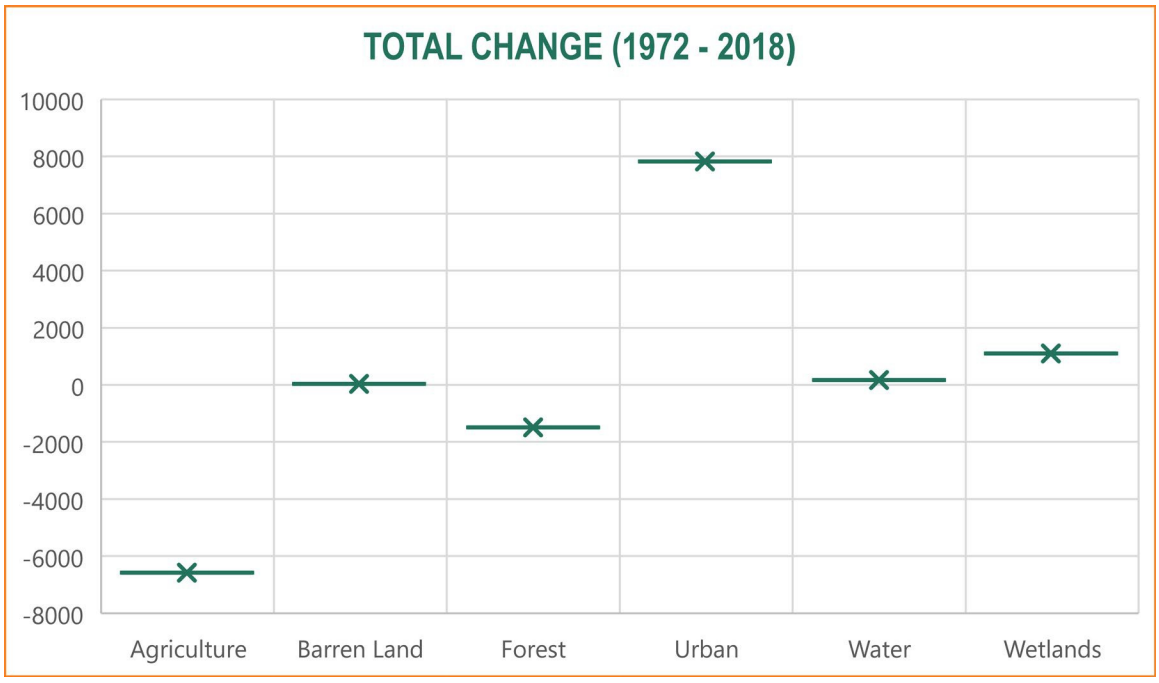
Land Use	Time Period	Delta – Acreage	Delta – Percentage
URBAN	1972 - 1986	+3,337.1	+236.6%
	1986 – 1995	+1,609.8	+33.9%
	1995 – 2002	+1,856.7	+29.2%
	2002 – 2007	+526.7	+6.4%
	2007 – 2018	+492.9	+5.6%

Table L-7: Change in WATER Over Time

Land Use	Time Period	Delta – Acreage	Delta – Percentage
WATER	1972 - 1986	+113.6	+1,438.0
	1986 – 1995	+10.9	+9.0%
	1995 – 2002	+30.7	+23.2%
	2002 – 2007	+13.4	+8.2%
	2007 – 2018	+5.8	+3.3%

Table L-8: Change in WETLANDS Over Time

Land Use	Time Period	Delta – Acreage	Delta – Percentage
WETLANDS	1972 - 1986	+851.6	+61.9%
	1986 – 1995	+465.6	+20.9%
	1995 – 2002	-148.6	-5.5%
	2002 – 2007	-51.3	-2.0%
	2007 – 2018	-14.2	-0.6%



FACTORS CONTRIBUTING TO LAND USE/LAND COVER CHANGE

When analyzing these changes, it becomes apparent that there must be some policy, regulation, movement or other factors serving as the catalyst. The following are just a few of the main issues that shaped development in New Jersey which has trickled down to the municipal level, including Montgomery Township:

- Extension of transportation infrastructure
- Suburban sprawl
- Economic downtown and subsequent rebound
- Rise of Millennials and Generation Z
- Creation of Farmland, Open Space and Historic Preservation Program
- Requirement for municipality to provide its “fair share” of affordable housing

In order to complete the sound planning practice of reviewing development patterns and inventorying natural resources, Montgomery Township has taken the step to not only look at the data but to try to understand why the data presents the way it does. Having this knowledge helps to shape future development and the future vision for the Township.

Wastewater Management Planning has been a factor in limiting growth in the Township. For areas outside the sewer service area, in order to safeguard against contamination of the underground potable water supply, the capacity of the soils throughout the Township to absorb and adequately filter septic effluent has been the basic consideration in establishing residential densities and minimum lot sizes for housing. For areas within the sewer service area, growth is limited by the capabilities of the wastewater treatment plants and the capacity of the receiving waterbody to handle the effluent from the respective plants.

Extension of Transportation Infrastructure

The New Jersey Turnpike was completed in 1952, and the Garden State Parkway was completed in 1957. The construction of these two major travel routes led to the creation of an industrial movement across the State. By the 1970s, New Jersey became the leader in the pharmaceutical industry and topped the nation in chemical production. Through the 1980s and 1990s, people sought the refuge of the suburbs with its open spaces and large lots and began fleeing compact city life. The 2000s have been marked as a return to a more integrated life, where work, home and play intersect constantly.

These same trends can be drilled down to the municipal level for Montgomery Township. New Jersey Route 206 runs north to south directly through the Township and has opened the Township to a variety of residential and commercial uses. However, the Township has resisted large-scale transportation corridor projects such as widening of Route 206, the Route 92 east-west corridor, and the Route 95 north-south project, in order to keep the rural character of the Township intact.

Suburban Sprawl

As the transportation network grew and with-it opportunities for commerce, residential uses began to sprawl. People began moving to more rural area, like Montgomery Township, because they now had an opportunity to earn income and live on a larger lot in a quieter community. The effect of suburban sprawl began to fragment the landscape as larger agricultural and open lots became sites for single-family homes.

The housing stock and proximity to open spaces and farms makes Montgomery an ideal place to live for many people, however the adjacency of incompatible land uses can cause serious issues. The New Jersey Right-to-Farm Act (NJSA 4:1C) provides protections for farmers where zoning is burdensome or where neighboring complaints cause a negative impact to their business.

Suburban sprawl has also placed a burden on the transportation network, which ironically is part of the reason sprawl was even a possibility. Because people were now living further away from downtowns, places of employment and other human accommodations and necessities, Montgomery Township became automobile- centric. This led to increased traffic, and the furtherance of breaking up land to provide services and commercial options.

Economic Downturn and Subsequent Rebound

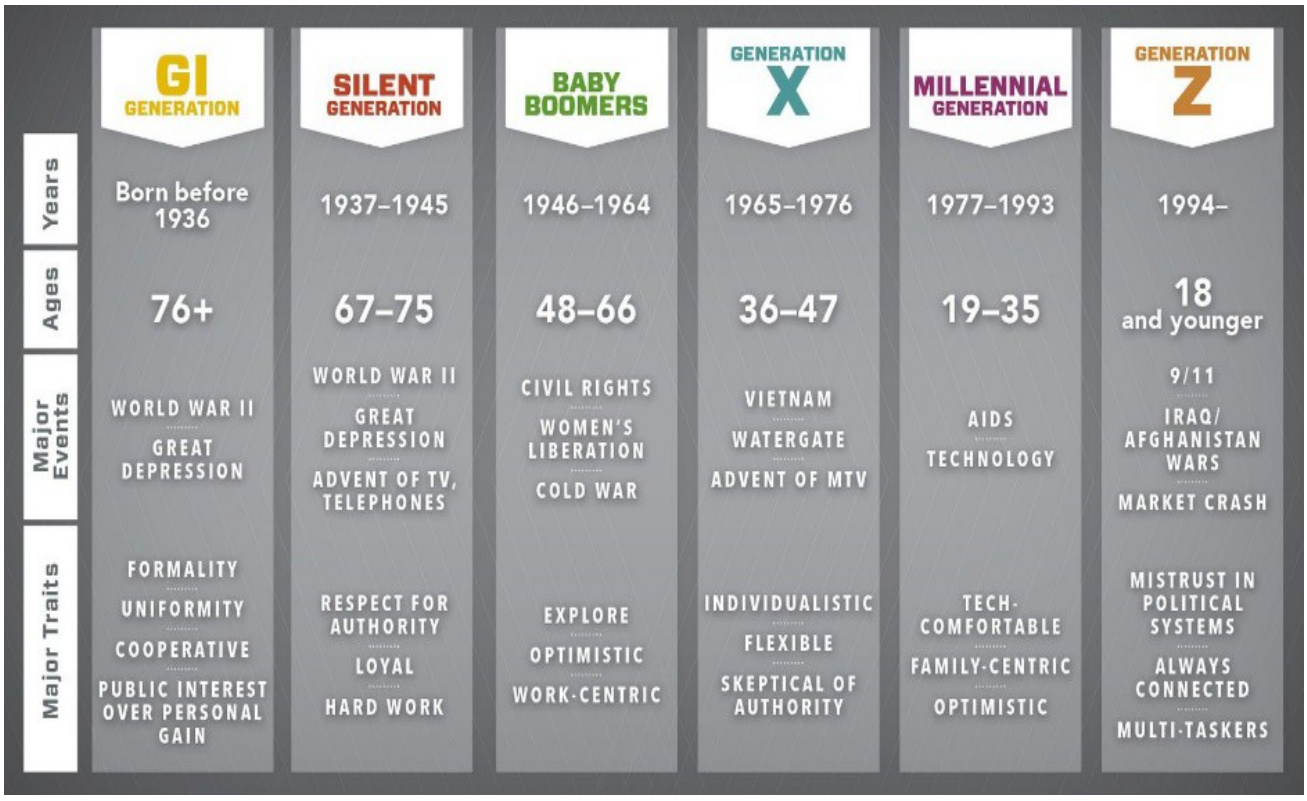
The recessions and upswings of the economy in New Jersey had a profound effect on many communities, including New Jersey. Of note is the most recent recession period of 2007 – 2009. New Jersey bounced back slower than the rest of the nation (employment lost was not recaptured until 2016), however progress has been made in many suburban communities. A great deal of development in Somerset County came to a halt during this period, however projects have now begun to materialize again. This “go-go to slow-go”, as coined by Professor James Hughes, Dean of the Edward J. Bloustein School of Planning and Public Policy, is the cause of stop gaps in development. During this Great Recession, many development projects came to a complete stop, leading to housing prices escalating, existing homes going into foreclosure and small businesses closing unexpectedly. The new boom time is seeing the restructuring and construction of these projects, with more opportunities for commerce being installed along County Route 518 and State Route 206.

Rise of the Millennials and Generation Z

Millennials are quite arguably the most interesting demographic group to be studied. People born between 1981 and 1996 have changed the way developers develop land, and how municipalities view the needs of housing, employment, travel and entertainment. Millennials were the first group in a long time that wanted to go back to compact living, and favored alternative modes of travel (biking, walking and public transit).

Local governments began to redefine zoning allowances and land use planning to accommodate this large sector of the population. This led to land uses being more integrated so that employment, housing and entertainment could be better integrated. It also sparked the need for better roadway design that included Complete Streets policies and safer methods for those that wished to travel this way. The construction of large-scale office complexes and sprawling commercial campuses were redesigned to fit the needs of this demographic who prefer remote access employment and condensed working hours.

The next demographic sector being studied has been dubbed Generation Z. This group, born between 1995 and 2010 have learned from the mistakes made by their parents in the Great Recession, and are therefore motivated more by security. They tend to appreciate independence more than their millennial friends, marked by the desire to live on their own earlier (millennials were famous for the boomerang effect) and to start a small business. The most interesting difference is that Gen Z prefers face-to-face contact instead of the digital meetings of millennials. This demographic group may spawn a different view of land development for local governments moving forward. Office space will be desired again, however compact design and the use of green infrastructure will be key. For a township like Montgomery, the use of major roadways (with access for all), the appropriate retrofitting of office spaces and the integration of services with housing will be instrumental in the growth of the community.



Credit: Alejandra M.A. Vergara

Creation of Farmland, Open Space and Historic Trust Fund

In 1998, New Jersey voters approved a constitutional dedication of $98 million dollars for open space, farmland and historic preservation. In 2007, an additional $200 million dollars was approved by referendum. In 2015, a stable source of funding taken from the Corporate Business Tax was instituted, with incremental increases planned over five years.

Montgomery Township has impressively leveraged funding available from the State and its municipal open space trust fund. To date, the Township has targeted and preserved nearly 8,000 acres of open space, representing 37% of the Township's land area. The preservation of these greenbelts and farmbelts precludes development in perpetuity, basically crystallizing the existing development pattern.

RECOMMENDATIONS AND POTENTIAL PROJECTS

- Collaborative review of development with Planning Board, and Environmental Commission to identify preferred areas of growth versus preservation
- Institute concepts of adopted Complete Streets Policy
- Perform a study of potential green infrastructure improvements and/or retrofits at municipal facilities
- Perform a build-out analysis
- Update a Bicycle and Pedestrian Travel Plan that considers the needs and desires of Millennials, Gen Z and an active aging population
- Partner with Somerset County Business Partnership to procure data about current employment statistics, office design spaces and demographic trends; use this data to brainstorm methods to retain existing employers and attract new ones, and to implement sustainable and innovative land use and employment practices

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Van Harlingen Historical Society
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PRESERVED LANDS

Land preservation is a powerful planning tool that provides for open spaces and recreational opportunities for a municipality's residents, while also enhancing quality of life and protecting natural resources. Having an inventory of preserved acres is not enough to glean the full benefits of land preservation – stewardship is a main ingredient to success. This chapter will look at the current state of preserved lands in Montgomery Township, the future of preservation and the stewardship programs and efforts that will continue to advance this initiative in and outside of the municipal borders.

This chapter will address:

- Current inventory and trends of land preservation in Montgomery Township
- Regulations and programs related to land preservation
- Health benefits of preserved lands
- Recommendations to protect, restore and enhance preserved lands in the Township

CURRENT INVENTORY AND TRENDS OF LAND PRESERVATION IN MONTGOMERY TOWNSHIP

Approximately 1/3 of the land area of Montgomery Township is preserved as open space, farmland, trails, pathways or in golf courses. This translates to approximately 7,700 acres of preserved land within Montgomery Township alone.

Most of the preserved open space is located in the north-northwestern portion of the Township, while the bulk of preserved farmland is located in the central – south central area. In addition to the larger parks with dedicated pathways and infrastructure, there are also a series of smaller parks and trails that add to the inventory. The following are descriptions of a few of the main parks and pathways in Montgomery Township.

Montgomery Veterans Park

The oldest park in Montgomery Township with over 2.25 miles of pathway also serves as the Township's namesake. Located on Harlingen Road, Montgomery Veterans Park is over 100 acres in size, and nearby to the historic three-arch Mill Pond Bridge. Montgomery's Arboretum of Native Flora, established in 1997 by the Shade Tree Committee and Township through Green Acres funding, is also located in Montgomery Veterans Park. This park offers sand volleyball, basketball, soccer and softball, along with benches and shade. The Township's Veterans Memorial and 9/11 Memorial are located here, and the park is used for Memorial Day, Veterans Day and 9/11 Remembrance ceremonies.

Hobler Park

Hobler Park

Dedicated in 1990 by the Cherry Valley County

Club developers, Hobler Park consists of 50 acres and is located on Great Road. The park offers active recreation for adults and children with a playground, multi-purpose play field and pathways. A Little Library and gazebo are onsite to provide areas for reading, shade and supervising children. Hobler Park is managed as meadow and has been described as a birding hotspot.

Stonebridge

Located on Montgomery Road, the 149-acre Stonebridge property was preserved in 1997 by a partnership of the Township, the Borough of Rocky Hill, D&R Greenway Land Trust and the State of New Jersey's Green Acres Program. This open space is adjacent to an adult-living community, providing easily accessible recreational opportunities for senior citizens. The property boasts 2.5 miles of pathways, with some portions consisting of paved pathways so that they are accessible for strollers, wheelchairs and other pedestrian-assistant devices.

A field of blue bells (Mertensia sp.) in bloom along the pathway around Stonebridge, April 2019.

Van Horne Park

Van Horne Park is a great example of partnerships between the County and municipalities to preserve land for the entire population in a creative way. The site consists of 93 acres, with 1.25 miles of trails (mostly paved). Park entrances are located off Route 206 at Benjamin Boulevard and on Princeton Avenue in Rocky Hill Borough, and easily accessible by adjacent residential and commercial uses. The park, which is home to a myriad of active uses including bocce ball, lacrosse, softball and basketball, is owned by the County but maintained jointly by Montgomery Township and the Borough of Rocky Hill.

Cherry Brook Preserve

Cherry Brook Preserve

Cherry Brook Preserve is one of the largest, uninterrupted woodlands preserve in the Township and Somerset County. This unique site provides habitat to many sensitive plant and animal species, including several species of neo-tropical birds that require large areas of contiguous forest for breeding and stopover grounds during migration. Parcels that were previously farmed are being reforested or are planned for reforestation. Visitors flock to the Preserve in search of passive recreation, including walking, hiking, birding, and cross-country skiing. In November 2017, 36.5 additional acres of woodland were added to the existing 400-acre Cherry Brook Preserve.

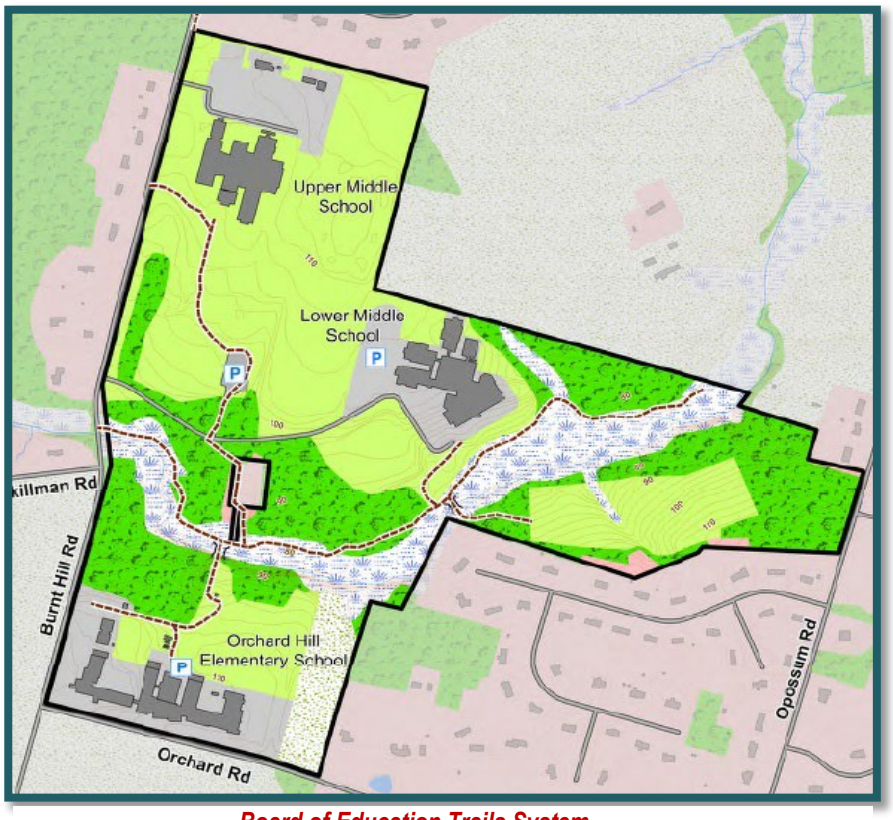
Skillman Park

Of all the properties in Montgomery's open space inventory, this property has the most interesting and somewhat divisive history. The property was initially known as the New Jersey Village for Epileptics, a place specifically dedicated to the treatment of epilepsy in a completely autonomous village, established in 1898. Originally, the Village was deemed an advanced facility in the medical community, until budget cuts during World War II led to understaffing and overcrowding. In the 1950s, the Village for Epileptics was converted into the New Jersey Neuro-Psychiatric Institute and charged with the treatment of patients with drug addiction, cerebral palsy and children with emotional issues. When the facility closed in the mid-1990s, it had been renamed as the North Princeton Development Center (NPDC). In 2007, Montgomery Township purchased the property, demolished the buildings onsite, and later sold the property to Somerset County, which ultimately converted the site into a park.

Located off County Route 601 and Burnt Hill Road, this 247-acre park is the newest addition to the Somerset County Parks System. A 2.25-mile paved loop trail system with access from multiple parking areas allows visitors the opportunity for active and passive recreation.
Skillman Park provides chess tables, benches and a leash-free dog park. Beginning in 2014, the Township coordinated volunteer planting events hours to reforest portions of the property along the Rock Brook.

Board of Education Trails System

The Board of Education has acquired lands that allow trails to link Orchard Hill Elementary School, Kid Connection, Lower Middle School and Upper Middle School. Not only are these trails an amazing addition to the Township's open space inventory, they allow for a means of safe transportation for students and parents on their way to school. This action has a domino effect, as the increase of trail usage leads to a decrease in motorized vehicle traffic, along with reductions in CO_2 emissions and fuel consumption.



Board of Education Trails System

Smaller Tracts of Lands and Pathways
In addition to the larger and more formally defined parks in the Township, there are many smaller sites and pathways to enjoy. Swan Tract, Sunset Park and Rock Mill Preserve add additional miles of pathways, scenic vistas, passive recreation opportunities and correlation with historic sites.

For information on all parks and pathways in the Township, please visit:
https://recreation.montgomery.nj.us/parks/

Appendix PL-1 is a map of all preserved lands in Montgomery Township.

Appendix PL-2 includes individual trail and property maps of parks and pathways described in this chapter.

Appendix PL-3 is a map showing all trail heads in Montgomery Township.

Preserved Farmland

Preserved farmland is not public land but is a public investment into private agriculture that allows for the permanent use of the land for agriculture only. The landowner retains all the rights of ownership, however the development potential is retired via a recorded Deed of Easement and filed in the County Clerk's Office. The Deed of Easement runs with the land and not the property owner, meaning that once a farm property is preserved, it can never be developed for residential, commercial or industrial use. The Deed of Easement does not dictate the type of agriculture that can be conducted, nor does it restrict it to the type of agriculture at the time of preservation. The Agricultural Retention and Development Act is the law that created farmland preservation, with oversight being remanded to the State Agriculture Development Committee.

Farmland preservation is not only a necessary component of food production and the sustenance of agriculture as an industry in New Jersey, but it also offers affordable tourism opportunities. Visitors from all over New Jersey and the surrounding states visit farms, preserved and unpreserved, for pumpkin-picking, Christmas-tree cutting, pick- your-own apples and peaches, hayrides, horseback riding, goat yoga, and much more.

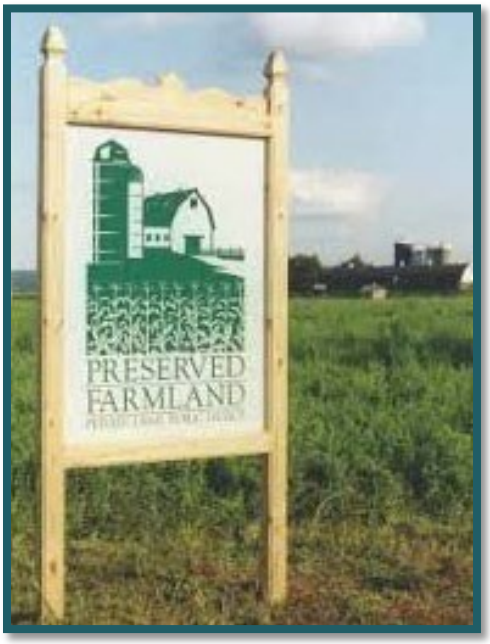
Farming requires onsite labor, which creates jobs. Preserved farmland will always be farmland by its sheer definition, meaning that agricultural labor will be needed. These jobs include farm managers, horse grooms, trainers, day laborers, educators, accountants, attorneys, and many more.

Crops also draw in pollinators in the form of birds, bees and butterflies. These pollinators serve their function on the farm, and then pollinate surrounding areas.

As of August 2018, the SADC reports that 232,806 acres were preserved as farmland. Of those preserved acres, 7,922 acres were in Somerset County. These acres represent an investment of over $630 million dollars from Federal, State, County and Municipal funding sources, with 57% of that total being invested in Somerset County. 1,240 acres have been preserved under the SADC program in Montgomery Township, representing an investment of over $16,161,737.62 in Federal, State, County and Municipal funding under this program alone. Montgomery has worked with non-profit entities and municipal dollars to preserve additional lands under similar program.

According to the 2010 Municipal Farmland Preservation Plan, 1,136 acres in Montgomery were preserved as farmland. This represents an investment of over 14 million dollars across the Township and with the assistance of the State Agriculture Development Committee, Somerset County and many non-profit entities. 1,139 additional acres have been prioritized as targeted farms for future preservation.

Montgomery Township is home to over 5,500 acres of farmland assessed land, lending it to become a hub of agriculture and tourism. Through all the acres of farmland, preserved or unpreserved, the Township has the privilege of housing several economically, environmentally, ecologically and socially beneficial farm operations including:



- Elite horse boarding and training facilities
- Niche crop growers
- Farm to Table operations Livestock
- Organic production
- Community Supported Agriculture

The *Agriculture* chapter of the NRI provides a much more detailed understanding of farmland preservation and the agricultural industry in Montgomery Township.

Appendix PL-4 shows Montgomery's Project Areas and targeted farms as they relate to Somerset County's Agriculture Development Area.

In 1999, New Jersey voters approved a constitutional dedication of $98 million dollars for open space, farmland and historic preservation known as the Garden State Preservation Trust Act. This dedication allowed a specific source to preserve lands for leisure, active and passive recreation, agricultural production and identified historic sites. The funds were administered and managed by the Garden State Preservation Trust by allocating funding to the New Jersey Department of Environmental Protection – Green Acres (open space), the State Agriculture Development Committee (SADC – farmland), and the State Historic Preservation Office (SHPO – historic preservation), with each office promulgating regulations for the disbursement of funding.

In 2007, an additional $200 million dollars was approved by referendum. This referendum came at a time of pure necessity, acting as a "stop-gap" where funding had been depleted. The funding followed the existing regulations for each department, however, would only last for short period of time.

On November 4, 2014, after a powerful grass roots campaign, New Jersey voters passed the "Preserve New Jersey" referendum that provided a stable source of funding. These funds are taken from the existing Corporate Business Tax and incorporated incremental increases over five years. This funding also allowed for new types of projects, specifically Blue-Acres (lands that suffer from repetitive flood loss and should be bought out for preservation and flood mitigation purposes).

Figure A-4 below shows the projected division of open space funding under the Corporate Business Tax. When all incremental increases are instituted in 2020 (4% increments begin July 1 2015 through July 1, 2019, with the increment increasing to 6% beginning on July 1, 2020), 6% of the Corporate Business Tax will be dedicated to open space, farmland, historic and blue acres preservation.

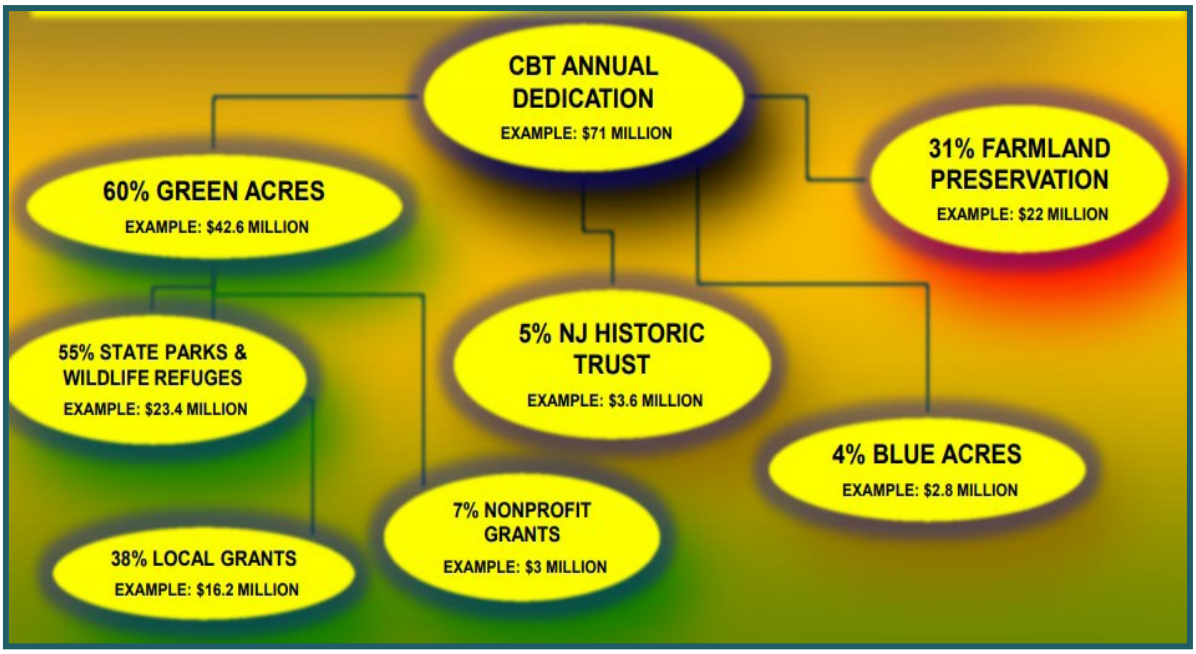


Figure PL-5: Division of funding through the CBT
Source: https://www.state.nj.us/gspt/pdf/7IMAGEhandout.pdf

Agriculture Retention and Development Act

The Agriculture Retention and Development Act (ARDA), adopted in 1983, was, and still is, the initial and

binding legislation that established the State Agriculture Development Committee (SADC), Agricultural Development Areas (ADA) and the process for farmland preservation. Technical standards for appraising preservation values were incorporated into the legislation, along with criteria for State, Municipal and later County programs. ARDA was most recently revised in 2018 to incorporate the Rural Microenterprise Rules, which allow for farms preserved before 2006 without exception areas to dedicate a portion of land for a nonagricultural commercial use.

For a full copy of the ARDA, please visit: https://www.nj.gov/agriculture/sadc/rules/ARDA.pdf

New Jersey Right-to-Farm Act

The New Jersey Right-to-Farm Act (NJSA 4:1C-9) has been described as one of the most powerful prices of legislation in the State. Established in 1983, the Right-to-Farm Act provided protections from unduly burdensome municipal regulations and private/public nuisance complaints for commercial farmers that allowed for the continued operation and success of their farm. It also provided a framework for conflict resolution between neighbors, farmers and municipal agencies.

The Right-to-Farm Act is divided into two types of requests:

1. **Site-Specific Agriculture Management Practice (SSAMP)** – request from a farmer to the CADB to procure allowances for specific practices, activities, or events in advance of implementation. This request allows for a partnership between the farmer, CADB and municipal agencies and opens a dialogue to achieve compromising solutions.
2. **Determination/Hearing** – a zoning violation or complaint forwarded about a practice, activity or event being performed on a farm. This request requires the CADB to issue a determination about whether the practice in question is protected by the Right-to-Farm Act, and therefore allowed to continue.

The Act has produced twelve Agricultural Management Practices (AMPs) to serve as guiding principles for County Agriculture Development Boards, who are charged with hearing cases under Right-to-Farm. These AMPs describe accepted agricultural practices that can be transferred to the operation in question. CADBs can hear cases that might normally be heard by a Planning or Zoning Board or court for a significantly reduced cost and timeframe.

The Right-to-Farm Act, while full of legal intricacies to balance the needs of farmers and the general community, is an important compliment to the Agriculture Retention and Development Act. It provides the allowance for the continuation of agriculture on the business side. The preservation of land provides for the necessary elements for agriculture, but it is the Right-to-Farm Act that allows the business of agriculture to run more smoothly and effectively.

HEALTH, ECONOMIC, ECOLOGICAL AND SOCIAL BENEFITS OF LAND PRESERVATION

Land preservation is beneficial to people, plants, animals and the planet. The physical preservation of land means a reduction in residential, commercial and industrial development in these strategically identified areas. Development, especially in a sprawling fashion, creates the need for municipal services and schools. Having a percentage of land preserved balances these uses and prevents the overextending of municipal staff and resources.

Preserved lands serve as a natural filter and cleaner for the environment. A prime example would be that of the Cherry Brook Preserve. This heavily forested area reduces temperatures, filters and stores water which prevents flooding and cleans the air by uptaking contaminants. In a 2007 study entitled, *The Economic*

Benefits of Land Preservation, conducted by The Trust for Public Land, determined this service alone has been estimated to be worth $1,190.54 per acre of tree canopy. Additionally, the return on investment has been calculated at $10.00 for every $1.00 per acre.

The current trend is to view preserved lands as an amenity when choosing a place to live and work, with similar valuation to entertainment amenities, cultural venues and tourism. In today's environment, people are more in tune with how the natural and built environment affects their health. Preserved lands are innate to improved health through its inherent abilities to clean water and air, provide access for exercise of all ranges, and calming qualities.
Preserved lands provide these amenities, along with passive and active recreation.

Sensitive plant and animal species require specialized and niche habitat, most of which are found in environmentally sensitive lands. Because of this, these areas should be preserved to protect the habitat for the future. If these lands were to be developed or even significantly disturbed, the loss or disconnection of habitat could lead to the decline and ultimate extinction of a species. Land preservation is a powerful tool to protect biodiversity and its habitat.

Ribbon Cutting at Skillman Park

Preserved lands provide areas for social interaction and immersion with the natural world. These lands often serve as sites for in-person meetings, field trips, studying, photography, fitness events, farmers markets, emotional therapy and more. Agriculture provides opportunities for agritourism, which can bring families together for fun and cost-effective quality time. These activities and events unique to preserved lands give visitors an outdoor, non- digital experience in an affordable and wholesome manner.

HOW IS MONTGOMERY TOWNSHIP WORKING TO PROTECT, RESTORE AND ENHANCE PRESERVED LANDS?

Employment of Full-time Open Space Coordinator

The Township had the foresight to employ a full-time Open Space Coordinator, with duties including:

- Planning for and managing open space acquisitions
- Preparing and administering grant applications for open space acquisitions and stewardship
- Works with Township Committee, Planning Department, Open Space Committee and Township Committee
- Reviews develop pathways, manage preserved lands and establish recreational uses and development applications as it relates to open space planning
- Supervises Eagle Scout projects taking place on preserved lands

Because of this position, land preservation is always at the forefront of the municipality's strategic planning and goals. Having such a position also allows for coordination between land purchases and development and provides a direct contact for recreation and preservation-related issues to the public.

The *Montgomery Township Municipal Farmland Preservation Plan* was approved by the SADC in 2010. This Plan fulfilled the requirements that allowed the State to allocate funding for farmland preservation to the municipality. Priority areas for farmland preservation were identified (see Map A-2) and prioritized, with specific property meeting soil quality and tillable acreage criteria being identified as target farms. This Plan outlines criteria used to approve potential farmland preservation projects, how appraisals are to be obtained, and survey and closing requirements. Today, the Plan still serves as the foundational document for all decisions related to farmland preservation.

Open Space Committee

Appointed by the Township Committee, the Open Space Committee is charged with:

- Making recommendations to the Township Committee about land preservation properties, stream corridor dedications, and farmland preservation
- Seeking opportunities for open space and farmland preservation, as well as pathway development and recreation opportunities
- Coordinating with other Boards and Committees relating to open space and farmland preservation, and pathways development
- Assisting in the drafting and adopting of open space, farmland and pathways plans
- Performing other duties as assigned by the Township Committee

Township Code 16-6.5 – Clustering Ordinance

The Township adopted a residential clustering ordinance as part of its municipal code, with Section D clearly stating the open space requirements. The ordinance requires 40% of the tract to be set aside for open space, when the clustering option is enacted by a developer. The open space must be accessible by multiple lots and dedicated to the Township or acceptable land trust by deed. This option has benefits for developers by allowing a denser development and provides for preserved land, recreational opportunities, resource conservation and protected habitat. Several residential subdivisions were built using this design alternative.

The Township also adopted a provision for "Single-Family Conservation Design Subdivision" (Code Section 16-6.5g). This option is available in the R-5 and MR zoning districts, which require five-acre and ten-acre minimum lot sizes, respectively. This development alternative allows for a developer to develop smaller lots in order to protect wetlands, stream corridors, forested areas and other critical areas. A minimum of 65% of the property in the R-5 zoning district and 80% of the land in the MR zoning district must be dedicated as open space.

Agricultural Advisory Committee

According to the Township's website (https://twp.montgomery.nj.us/elected-officials/township-committee/#ag), "the Agricultural Advisory Committee shall make recommendations as to which farms should be preserved and shall report those recommendations to the Planning Board. The creation of an Agricultural Advisory Committee enables the Township to obtain farmland preservation planning incentive grants for the purpose of preserving significant areas of reasonably contiguous farmland that will promote long term economic viability of agriculture as an industry in Montgomery Township". The Committee is comprised of five members and two advisors who meet several times each year.

Partnerships are essential for leveraging funding and completing priority projects. The Township has

worked with Somerset County, the State Agriculture Development Committee, NJDEP's Green Acres Program, New Jersey Conservation Foundation, D&R Greenway Land Trust and Montgomery Friends of Open Space. In some projects, the Township takes the lead, while on other situations the Township serves as a cost-share partner only. The partnership changes from project to project, however the partnerships allow the Township to stretch our preservation dollar even farther.

RECOMMENDATIONS AND POTENTIAL PROJECTS

- Update the Township's Open Space Plan to include recently preserved lands.
- Update the Township Farmland Preservation Plan to include recently preserved farmland
- Perform a Farmland Affordability Study within the Township to understand the current trends of farmland purchases, before and after preservation
- Incorporate data and applicable policies from the County's Preservation Plan (anticipated completion by the end of 2019) – this Plan looks at Open Space, Farmland and Historic Preservation within Somerset County as individual programs and at how they can coordinate. The Plan will identify key techniques for leveraging funding, applying for grants, preserving a property at its best or dual use, and more.
- Overlay the data mined by the Connecting Habitat Across New Jersey (CHANJ) project with targeted open space and farmland properties to determine where preservation should be prioritized based on habitat sensitivity (see Habitat Chapter for more detail)

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"Why Preserve Land?". Hunterdon Land Trust. https://hunterdonlandtrust.org/protecting-land/why-preserve-land/

SOILS

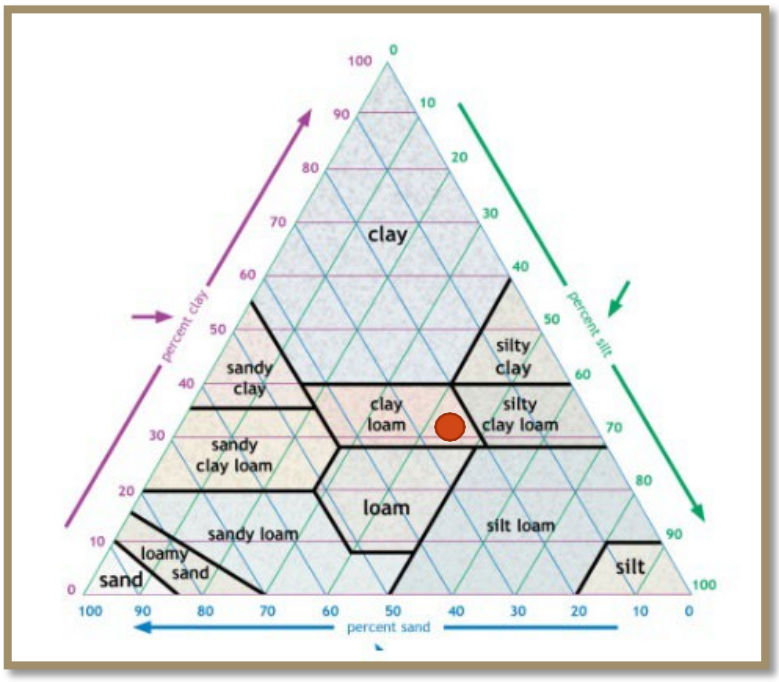
Soil is the essential building block for many parts of the ecosystem. It is the womb for agricultural and horticultural production. It is a habitat for some of earth's most fascinating creatures. It is a filter for contaminants, and storage system for water. Without soil, food, plants, specific insect and animal species and flood control would be severely limited or even eliminated altogether. This chapter will describe the functions of soil, the threats facing its stability and ways in which this resource can be protected now and for future generations.

This chapter will address:

- Types and functions of soil in and around Montgomery Township
- Regulations regulating soil quality control and stability
- The importance of soil to humans, plants and animals
- Threats to soil quality and stability in and around Montgomery Township
- Societal and economic benefits of soils to the environment and ecosystem

THE BASICS OF SOIL

According to the *Soil Science Glossary*, published by the Soil Science Society of America, soil is defined as, "the unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants".



S-1: Soil Texture Triangle, showing Silt Loam

What are the components of soil?

Soil is composed of three main soil separates – sand, silt and clay. Sand is a fast-draining, nutrient deficient medium containing particle sizes of 0.063mm – 2.000mm in size. Silt is a dust-like sediment, usually less than 0.005mm in size. Clay is the smallest particle (0.002mm or less in size) and forms a concrete-like substance when dry and sticky mixture when wet. These three main separates are situated on the Soil Texture Triangle, used for determining the specific makeup of soil at a specific site. By following the percentage of soil in a sample, one can determine what type of soil is available, thereby gaining a better understanding of what functions are most appropriate. As shown in Figure S-1, a soil consisting

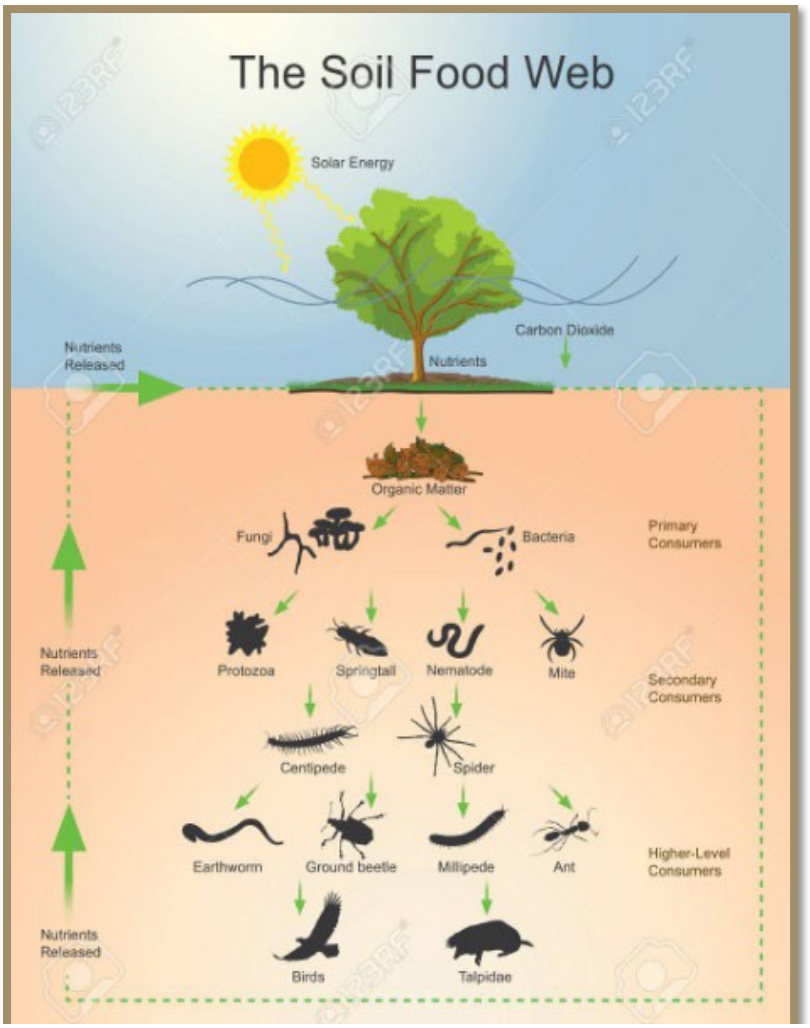
of 20% clay, 20% sand and 60% silt is designated as a Silt Loam.
Loams which contain silt and sand, with a smaller amount of clay are soils that are the best medium for growing crops and plants of all varieties. Because loams are a mix of the three main soil separates, they are not designated on the Soil Texture Triangle but can be found by its use.

Properties of Soil

The properties, or characteristics, of soils demonstrate what the soil feels like, looks like and functions like based on their components (sand, silt or clay). Soil properties help identify the type of soil, but more importantly they provide knowledge to farmers, gardeners and homeowners about the functioning of the soil onsite. When looking for soil properties, we are specifically looking at:

- Texture – how does the soil feel and drain? Is it grainy, rocky, or smooth?
- Moisture – does the soil retain water and feel moist, or does it form a sticky substance and or crumble due to dryness?
- Fertility – does the soil produce grasses, crops, plants, etc., or is there a barren spot?
- pH Level – is the soil alkaline or acidic?

In addition to these qualities, soil can be assessed by studying microorganism and earthworm activity. The presence of these organisms, including earthworms, spiders, and ants, serve as a crucial indicator as to the soil health. To depict this complex ecosystem, the Soil Food Web was created. This diagram (shown below as Figure S-2) demonstrates the organisms that live with and in the soil, as well as how they interact with the surrounding environment. Not only is the soil home to insects, fungi and bacteria, it also serves as a food source for birds and other animals, which contributes to the release of nutrients back into the soil. As you move down from the topsoil, organisms decrease in physical size, but increase in population. Knowing the properties of the soil onsite can help in determining the types of plants and crops to plant, assist in making informed decisions about water usage, and to choose the types of amendments needed, if any, to improve the soil quality.



S-2: The Soil Food Web (The Smiling Gardener)

The Importance of pH

pH in the soil is extremely sensitive and one of the most important properties for the health and functioning of the soil. pH is measured on a scale of 0 – 14, and affects all aspects of soil, including crop yield, nutrient availability and uptake and microorganism activity. The optimum pH in soil for plant growth is between 5.5 and 7.0 – below 7.0 is acidic and above 7.0 is alkaline.

ACIDIC VERSUS ALKALINE SOILS

	ACIDIC (pH below 7.0)	ALKALINE (pH above 7.0)
Nutrient Access	Limited; Increased solubility of aluminum	Limited; Increased presence of calcium, sodium and magnesium
Commonly Referred to As…	*Sour Soil*	*Sweet Soil*
Common Problems	Reduction in bacteria and fungi populations, growth retardation	Restricted root access, growth retardation
Crops that Thrive	Blueberries, Broccoli, Parsley	Alfalfa, Cabbage, Beets
Flowers/Shrubs/Trees That Thrive	Azaleas, Rhododendrons, Hydrangeas	Zinnias, Boxwood, Lavender
Soil Amendments	Ammonium-N, Compost, Lime	Sulfur, Wood Chips, Peat Moss

S-3: Acidic Versus Alkaline Soils

pH is affected by land management and land use, especially in a nearly built-out state like New Jersey. Development of lands that were previously forested leads to a significant loss in organic matter and causes pH to drop. This change creates nutrient deficiencies, limited crop yield, root toxicity and sometimes plant death. Lands with higher clay content or organic matter have a higher buffering capacity – the ability to resist changes in pH.

Agriculture can also cause soil deficiencies if not properly conducted. Tilling the land aerates the soil and allows for seeding, however continuous tilling can destroy soil structure and lead to erosion. The use of sometimes necessary fertilizers and/or soil amendments for agricultural purposes can change the composition of soil, thereby limiting the growth of “good” bacteria and increasing the growth of “bad” bacteria. Planting cover crops, rotating field, limiting grazing to appropriate quantities and incorporating a low or no-till practice can significantly improve soil quality.

Downer Soil Profile
Surface layer: dark grayish brown loamy sand
Subsurface layer: grayish brown sandy loam
Subsoil - upper: yellowish brown gravelly sandy loam
Subsoil - lower: yellowish brown sand and coarse sand

SOILS ACROSS NEW JERSEY AND IN MONTGOMERY TOWNSHIP

New Jersey

Downer soil, established in 1960 in Gloucester County, is designated as the official state soil in New Jersey. It is recognizable as a sandy loam with that ranges in color from grayish brown at the top horizon to a yellowish-brown at the bottom horizon.
40% of the Downer in New Jersey is used for crop production, specifically vegetable production. Downer soil tends to be found in wooded areas, and is prominent in the Piedmont Geographic Region, where Montgomery is located.

The Garden State is fortunate in having access to many technologically advanced resources for determining locations, characteristics and limitations of soils. These tools are of the utmost assistance to farmers, gardeners, and landowners. The National Cooperative Soil Survey produced, and the NRCS operates, the Web Soil Survey (WSS). This online, interactive tool is the official soil survey and is considered the sole source for soil information. The database and corresponding mapping platform provide access to 95% of the world's soils. This information is invaluable for agricultural planning, land preservation, choosing plant materials, and designing soil erosion control plans.

Between 1996 and 2001, 248 soil samples were taken across the State to determine soil health. Aluminum, calcium, potassium, iron, sodium and magnesium were found in abundance across the State, with some levels topping several thousand milligrams per kilogram. Other elements, such as chromium, barium and zinc were found in exceedances of standards, with nickel, copper and lead being found in lesser amounts. Many of these elements pose threats to human health; for example, chromium is a carcinogen, lead can cause lead poisoning and aluminum can lead to root restrictions in plants thereby limiting food production.

Montgomery Township

There are five soil associations in Montgomery Township, each of which are categorized by the parent material from which they were formed.

1. Soils formed mainly in glacial till or material weathered from granitic gneiss, diabase or basalt – these soils are characterized by a depth to bedrock of four or more feet, level to very steep, are typically gravelly or stony and are usually associated with wooded areas or ridges. Soils in this category include:
    a. Neshaminy-Mount Lucas-Amwell Association –found in the Sourland Mountain and along the southern boundary of the Township.

2. Soils formed in material weathered mainly from shale, siltstone or sandstone but partly from conglomerate and argillite – these soils are nearly level to very steep and have a surface layer of silt loam. They are typically found in the agricultural areas of Somerset County, and include:
    a. Penn-Klinesville-Reaville Association - found throughout the central portion of Montgomery Township.
    b. Royce-Penn-Klinesville Association – found along the base of the Sourland Mountain and along the northern border of Montgomery Township
    c. Chalfont-Lehigh-Croton Association – found atop the Lockatong and Stockton formations of the

Sourland Mountain and along the western border of Montgomery Township

3. Soils formed in recent alluvium and old alluvium – these soils are nearly level to strongly sloping and were formed predominantly in stream sediment and glacial outwash. They are typically found in farmed land, specifically pastures, and include:
   a. Rowland-Birdsboro-Raritan Association - found along the banks of the Millstone River.

Septic Capabilities

Knowing septic capabilities of soils onsite is imperative to reviewing development and zoning for the area. Septic systems can only function properly if the soil in the leach field is permeable enough to treat the effluent. Before a site can be developed, a permeability test (commonly referred to as "perc test") must be performed. This test will determine if the soil permeability is adequate to support an onsite septic system. This is one of the major determinations of site development.

Most soils in the Township are characterized as having "severe limitations" in relation to septic capability. Such limitations are preventative to large-scale development. As shown in S-4 (*Soils – Septic Limitations*; Appendix), there are sporadic patches of soils with "moderate limitations", and just a few with "slight limitations". S-5 below documents the results of a more detailed review of septic capability data.

S-5: Change in Septic Capabilities Characteristics in Soils

Classification	Acreage (2004 NRI)	Current Acreage	% Change
Slight Limitations	465.65	465.08	-0.12%
Moderate Limitations	2687.21	2634.79	-1.95%
Severe Limitations	17529.39	17557.73	+0.16%
Variable	51.68	51.68	+0.00%
Water	54.03	78.38	+45.07%

Soil Erodibility

Measuring soil erodibility is a measure of the stability of soil in the face of weather elements and other forces. Erodible soil is not optimal for development and farming, as the ground itself is not stable and is easily separated. The largest contiguous swath of land with soils classified as "highly erodible" is located along the northwestern and western boundaries of the Township (adjacent to Hillsborough Township – Somerset County and Hopewell Township - Mercer County). A contiguous swath of land with soils classified as "not highly erodible" is located just opposite along the northeastern and eastern boundaries of the Township (adjacent to Franklin Township – Somerset County and Rocky Hill Borough – Somerset County). The remainder of Montgomery is classified as "potentially highly erodible", as shown in S-6: *Erodibility – Soils Map* (Appendix). The breakdown is detailed in S-7 below.

S-7: Change in Erodible Soil Classifications (Source: Montgomery Township GIS Department)

Classification	Acreage (2004 NRI)	Current Acreage	% Change
Highly Erodible	2818.70	2841.47	0.82%
Potentially Highly Erodible	15587.85	15572.33	-0.10%
Not Highly Erodible	2381.39	2373.47	-0.33%

Highly erodible lands must be protected, especially during farming practices. Techniques such as crop rotation, contour farming, low or no-till farming and planting of appropriate cover crops must be employed to reduce soil erosion, which has a permanent effect on the soil quantity and quality. These soils are not appropriate for development or other high intensity uses.

Depth to Bedrock

In the Township, approximately 17% of soils, located mainly in the central portion of the Township, have a depth to bedrock of less than 20 inches. 33% of soils in the Township have a depth to bedrock of 20-40 inches, classifying them as "moderately deep". Of the remaining soil types, 33% can be classified as "deep depth to bedrock" based on their depth of 40 - 60 inches. The depth to bedrock is a key component in determining septic capability as the depth has a direct relationship to the processing of effluent before groundwater is contaminated. Depth to bedrock is also integral in determining road construction, drainage and landscaping on residential and commercial properties alike.

Depth to Seasonal Water Table

Depth to the seasonal high-water table is a measure of the highest level below the surface that groundwater reaches in most years, typically between October and June. Soils with a depth to seasonal water table of 4 feet or less exhibit two water table types:

- Apparent – water standing in a freshly dug hole; usually found in stream beds and wetlands
- Perched – water standing above an unsaturated zone in the soil horizon, often obstructed by impermeable or hydraulically restrictive layers; mostly found atop and at the base of the Sourland Mountain

In Montgomery Township, 21% of soils have an Apparent Water Table, while 22% have a Perched Water Table.

42% of soils have a shallow depth to seasonal water table, with 3% of that sector having a depth of 1 foot or less. Only 2% of soils in the Township can be classified as moderate depth to seasonal water table, representing a depth of 4 feet. Fortunately, the majority of soils in the Township have a deep depth to seasonal water table at approximately 6 feet. Most of these soils coincide with Prime Soils for agricultural production and are least susceptible to development related problems.

When reviewing depth to seasonal water table, restrictions can be identified in development. In residential cases, basements are not optimal in areas where there is a shallow depth to seasonal water table as flooding can occur during moderate to high precipitation events. Additionally, septic systems cannot be approved if the seasonal high-water table is less than twenty-four inches (24"), and foundations can become weakened in such an area. Conversely, wildlife and plant communities are supported in soils with a shallow depth to seasonal water table and may be a good source to protection of such wildlife and rare plant life.

Soils of Agricultural Importance

As shown in *S-8: Soils – Prime Farmland*, the Township of Montgomery is comprised of mostly Prime Soils and Soils of Statewide Importance. This classification is important because these soils are the most productive agriculturally for a variety of crops and horticultural production. Also, according to eligibility criteria established by the State Agriculture Development Committee for farmland preservation using funding from the Municipal Planning Incentive Grant, properties under 25 acres must be comprised of 75% quality soils (Prime and Statewide) and soils above 25 acres must be comprised of 50% quality soils (Prime and Statewide).

Prime Soils have a dependable water supply, optimal pH and are optimal for growing high-yield and economically sustainable food, feed, fiber and forage.

Soils of Statewide Importance Soils are not technically classified as Prime Soils, however under the correct conditions, can produce high-yield crops.
Soils of Local Importance are not classified as Prime Soils or Statewide Soils, however, can produce high-yielding crops under correct conditions and proper management. In Somerset County, locally important soils are Rowland Silt Loam (Ro) and Klinesville (Shaly Loam, 2-12% slopes - Klc). Chart S-9 below details the current presence of agriculturally important soils, as well as the change since the last Natural Resource Inventory of 2004.

S-9: Change in Agricultural Soil Classifications (Source: Montgomery Township GIS Department)

Classification	Acreage (2004 NRI)	Current Acreage	% Change
Prime Soils	7486.49	7512.30	0.34%
Soils of Statewide Importance	6834.97	6902.44	0.99%
Soils of Local Importance	5152.93	5143.91	-0.17%
Not Prime Soil	1259.53	1150.64	-8.65%
Water	54.03	78.38	45.05%

REGULATING SOIL PROPERTIES AND MOVEMENT

Regulations have been implemented to protect soil as a precious resource and medium for a variety of life. Many regulations are triggered when construction takes place, however importation or deportation of soil is also regulated in some instances. The following section describes some of the most important regulations in New Jersey and specifically Montgomery Township.

New Jersey Soil Erosion and Sediment Control Act (NJSA 4:24-39)

Implemented by the New Jersey Department of Agriculture and overseen and enforced by the County Soil Conservation Districts, this Act regulates construction activities that disturb 5,000 square feet or more soil. In order to comply, all activities exceeding 5,000 square feet must develop the property within the scope of a Soil Erosion and Sediment Control Plan. These Plans must contain measures for the prevention of erosion and runoff during and after the completion of the construction. Plans are approved by the local County Soil Conservation District and forwarded to the municipal Planning Board and New Jersey Department of Agriculture.

The Act contains 32 standards that describe in detail the proper design for the prevention of soil erosion and sedimentation. The first ten standards focus on vegetation as the preferred standard for soil stabilization, while the remaining twenty-two standards address temporary or permanent engineering designs. The Soil Erosion and Sediment Control Act is important because it puts checks and balances into place for large construction projects that could have a significant impact on erosion and sedimentation. It also provides extensive guidance for the development of Soil Erosion and Sediment Control Plans and requirements for permitting and violations.

New Jersey Soil Restoration Act (P.L. 2010, Chapter 113)

This Act, while short in text, is impactful because it focuses on soil compaction during construction activities. Soil compaction is a serious issue as it precludes water infiltration, thereby forever impacting soil quality, groundwater recharge, crop yield and nutrient uptake.

Some activities require compaction, even temporarily, and are therefore excluded. Some of these activities are landscape capping, Industrial uses and golf courses.

New Jersey Fertilizer and Soil Conditioner Law (NJSA 4:9-15.1 – 15.42)

The regulation of commercial fertilizers and soil conditioners is covered under these regulations. This document requires that all manufacturers and distributors of commercial fertilizers or soil conditioners have a license, establishes mandates for the labeling of these chemicals, and establishes fines for violations to the law.

This law is vital because it provides parameters for the manufacturing and distributing of fertilizers and soil conditioners, which alter the soil permanently and ultimately infiltrate to the groundwater.

Montgomery Township Code, Chapter 14:1-3

The Township has established requirements for soil erosion, sedimentation and loss of soil due to tree removal.

Chapter 14:1 follows the regulations implemented in the New Jersey Soil Erosion and Sedimentation Control Act. Authority for review is given to the Somerset-Union Soil Conservation District, with feedback provided by the Municipal Planning Board.

Chapter 14:3 serves as a preventative measure for soil erosion and sedimentation through the regulation of tree removal. Tree roots anchor soil in place and serve the entire soil ecosystem and Soil Food Web in a myriad of way. Under this section of the Township Code, removal of any public tree requires a permit, unless:

- The tree in question is subject to an approved Woodlands Management Plan The tree in question is dead or dying
- The tree in question poses an immediate threat to public safety
- The tree in question is located in an Air Safety Zone

Chapter 16-5.6c regulates soil hauling by establishing that no more than 20 cubic yards of soil may be removed or imported from a site without Planning Board approval.

The Township also considers critical soils as a critical area to be preserved under Chapter 16-5.6e. This section requires conservation easements and/or restrictions for critical resources, including Prime agricultural soils and hydric soils.

WHAT IS MONTGOMERY TOWNSHIP DOING TO PROTECT SOIL QUALITY AND IMPROVE SOIL HEALTH?

Montgomery Township has once again been a leader in implementing prevention and conservation measures for soil erosion and sedimentation. While many of these measures are designed to be implemented while achieving a larger goal, they are nonetheless effective and important. The following actions represent the Township's continued dedication to natural resource protection.

Montgomery Township's Comprehensive Farmland Preservation Plan

The Township has a very active farmland preservation program and created a Comprehensive Farmland Preservation Plan that meets the requirements of the State Agriculture Development Committee. As one of the baseline criterion and major focus of the Plan, a description and in-depth mapping of soils is required. The Township inventoried and mapped all soils and then further identified those soils that are productive for agricultural purposes. This Plan is imperative for the planning and preservation of farmland in the Township

and provides crucial protection for soils. This action achieved ten points towards Sustainable Jersey Certification.

Habitat Conservation Ordinance

The Township has adopted a Habitat Conservation Ordinance, which focuses on the conservation of biodiversity and its habitat. Because soil is such a large home for microorganisms and plants, this biodiversity is an important part of this protection. This action achieved ten points towards Sustainable Jersey Certification.

Tree Protection, Planting and Forestry Cover

The Township has undertaken a series of initiatives to protect existing trees, plant new trees and maintain a forest cover for soil health, air quality, erosion prevention, and more. The Tree Protection Ordinance requires preserving trees onsite during construction and replacing those trees when they are removed under the auspice of a permit. The Tree Planting Program started in 1986 and has resulted in the planting of over 1,600 trees across the Township, while also engaging and educating the public. The Community Forest Cover Plan identifies goals maintaining tree cover and preserving forested areas, specifically upland forests. The Township adopted an aggressive goal of achieving 50% tree canopy cover by 2020.

All these activities are crucial to protecting soil from a series of potentially dangerous threats. The implementation of all these programs earned the Township forty points towards Sustainable Jersey Certification.

THE IMPACTS OF SOIL HEALTH ON HUMAN, PLANT AND ANIMAL HEALTH

In 2012, the National Institute of Health released its five-year "Human Microbiome Project", which views the human body as a superorganism, and has been often compared to the soil ecosystem. Both systems are complex and delicate at the same time.

In an interesting article published by *The Atlantic* on June 11, 2013, soil bacteria were compared to the human stomach and microorganisms were likened to the human immune system. The article went on further to describe the destruction and degradation that has occurred in our soil and how that degradation has a direct impact on humans. Most of our food sources are contingent on the health and fertility of the soil. Reduced soil quality leads to reduced crop production, lower quality vegetables, and contamination. Decline in microorganism populations are a direct result of poor soil quality, which furthers the degradation and leads to a new segment of endangered species.

Because soil basically is ground zero for the human food chain, its impacts on human health are direct and serious. As plants and animals' intake contaminants in the soil, microorganism populations decline and cease cleaning the soil, and overall quality reduces the amount of food produced, human health will suffer. While this health concern is real, it is often neglected because this resource is underfoot and often going unrecognized.

> **"We know more about the movement of celestial bodies than about the soil underfoot"** - Leonardo Da Vinci

RECOMMENDATIONS

- Provide soil testing information and kits for residents for use in their garden or with landscaping needs with the assistance of Somerset-Union Soil Conservation District and/or Rutgers Cooperative Extension
- Promote Federal and State programs that provide technical assistance and/or funding for farmers to:
- Plant appropriate cover crops
- Manage irrigation
- Review low or no-till practices on all or a portion of the land
- Better understand the use of soil additives and fertilizers
- Require a Conservation Plan for each preserved farm or farm that obtains a Site-Specific Agricultural Management Practice under Right-to-Farm. Farms preserved using SADC funding are already required to have a Conservation Plan, however farms preserved under other vehicles are not. These plans can be completed for free by NRCS or can be completed by an approved Technical Service Provider for a nominal cost.
- Add an Afforestation Program to the Tree Planting Program (encourage planting in the undergrowth to protect that area specifically
- Require crop rotation and pH testing on all municipally leased farmland Follow stocking rates for animals on farms to prevent overgrazing
- Make enforcement of illegal soil removal, soil importation and tree removal a priority

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STEEP SLOPES AND TOPOGRAPHY

Topography is simply defined as the arrangement of physical and artificial features on the land. Elevation, or slope, has a significant bearing on the topography of a place by defining peaks and valleys, dictating appropriate development and serving as critical habitat for plants and animals. When studying topography, it is imperative to determine not only what features are present, but how those features were formed, what purpose they serve and how they can be protected.

This chapter will address:

- Characteristics of topology and steep slopes in and around Montgomery Township
- How topography affects and is affected in the environment
- Health and environmental impacts of damage or elimination of steep slopes to humans, plants and animals
- Spotlight: Ridgelines
- Recommendations to preserve important topography and steep slopes in Montgomery Township
- Success stories from Montgomery Township

CHARACTERISTICS OF TOPOGRAPHY AND STEEP SLOPES

What is topography?

Topography can be mapped to show the natural and artificial features of the landscape. On a map, contour lines depict the changes in elevation – the closer the contour lines, the higher the elevation. Topography was being determined since the beginning of time, with significant changes being caused by development, human settlement, erosion and agriculture. Today, topography can be reviewed via spatial and satellite data, and analyzed in connection with local zoning and development patterns. Even more importantly, the study of topography and steep slopes is crucial to determining appropriate development that works to protect environmental features and habit.

In the most basic terms, slope is defined as rise over run. Steep slopes are a crucial subset of topography, defined as those with elevations of 20% over 10 feet. The Township exceeds this general definition by defining steep slopes as those over 15% or greater (Township Code Chapter 16-3.3, Chapter 16-5.6d 12 and Chapter 16-6.4a).

Characteristics of Topography and Steep Slopes in Montgomery Township

Montgomery Township is characterized by two general landforms: flat to gently rolling expanses in lower elevations, and the higher elevation of the Sourland Mountain. The Sourland Mountain and Pheasant Hill, in the western portion of the Township, have its highest elevation at 465' and represent the most prominent topographic features in the Township. The Rock Brook stream corridor forms a ravine at Hollow Road. The remainder of the Township is relatively flat and rolling, apart from some minor hills in southern Montgomery.

Steep slopes represent areas of transition from high elevation to lower terrain, as well as transition into stream corridors. According to Township Code Sections 16-3.3, 16-5.6d.12 and 16-6.4a, steep slopes are defined as 15% or greater, demonstrating the Township's high standards of environmental protection. In Montgomery Township, the most extensive areas of steep slopes (measured at 15% or greater) are found along the eastern side of the Sourland Mountain in two distinct areas:

- Vicinity of Rock Brook near Hollow Road from Hillside Terrace to the Township's western border
- Vicinity of Black Brook and Township's northern border with Hillsborough Township

Rock Brook

HOW TOPOGRAPHY AFFECTS AND IS AFFECTED BY THE ENVIRONMENT

Topography and steep slopes influence the environment and affect the quality of the environment in a variety of ways. In particular, the elevation and change in elevation of a specific place has a very real effect on the water and soil quality near it. The following describes the types of issues that affect topography and can lead to additional environmental degradation.

Development

Development on critical topography, specifically steep slopes, is the cause of serious environmental degradation as well as safety issues related to those that reside or work on, or adjacent to the developed property. Unfortunately, areas of important topography, specifically steep slopes, tend to be prime real estate for development due to the beautiful scenic vistas and privacy offered by its location. Ironically, it is exactly this development that inhibits these beautiful viewsheds and reduces the environmental and economic capabilities of these properties.

Municipalities have discretion to determine at what level development should be prohibited and how zoning and regulations can be used as a vehicle to achieve these goals. The following planning principles can be employed:

- Create a zoning overlay district – an overlay district allows for uniform regulations to be followed regardless of the zoning districts regulations. This type of overlay can be valuable for municipalities in that the protection of steep slopes can be employed regardless of the zoning allowances in a district.
- Pass a municipal ordinance that prohibits development or requiring additional study on defined steep slopes – depending on the topographic features, municipalities may choose to follow slopes established under soil classifications or to pass more restrictive criteria. Tiers can be drafted so that a first level of steep slopes are prohibited for development (example: 25% or greater), while development on lower elevations (example: 10% or less) require additional soil studies, slope mapping and onsite sewage disposal system percolation tests.
- Employ performance-based standards – The Lehigh Valley Planning Commission in Pennsylvania has documented success with creating permitted, prohibited and conditional uses for steep slopes. These standards allow for municipal planners to assess the projected performance of a site based on site-specific review, rather than previously approved use regulations.

Agriculture

Agriculture is one of the most necessary industries across the globe, with its main input being the land itself. Farmers with animal-based operations employ pasturing and free-range practices where animals will mobilize around the entire property, especially in search of water. While this seems to be very natural, animals can cause damage to important topography and steep slopes. These issues can be mitigated in the following ways:

- Providing alternative means to water – Animals will walk to the closest available water source. If farmers provide intermittent watering stations, animals will take that water rather than walk to an environmentally sensitive feature or stream to satisfy this need. This easy practice can reduce trampling of steep slopes, leading to erosion and slippage, and minimize fecal nutrient loads into streams directly and via runoff from steep slopes.
- Fencing off areas where steep slopes are present – Fencing off areas or moving pastureland away from important topography can protect this resource simply by disallowing activity on it.
- Contour farming – this sustainable farming practice, dating back to the early Phoenicians in the eastern Mediterranean, involves planting crops across or perpendicular to the contours of the fields. This allows for man-made water breaks, increasing water infiltration and storage and reducing the need for irrigation. In addition, this practice reduces soil erosion and increase soil fertility, thereby reducing non-point source pollutants and sedimentation. This is a way where farmers can benefit from the features of their land, while still protecting them.

Erosion

Erosion on steep slopes is the cause of what many homeowners refer to as “hill slip”. This phenomenon, moving soil via water and wind, reduces the elevations of important topography and steep slopes, literally removing the steepness of the slope. While erosion is always an issue for land management, erosion on steep slopes is of the utmost importance for protection. To minimize erosion, the following practices can be employed:

- Planting of appropriate vegetation – hearty vegetation planted along and at the bottom of the slope can root soil and reduce erosion by serving as a wind and water break
- Soil additives – shredded mulch and leaf compost, when applied properly, can knit soil together thereby making it more resistant to erosion
- Constructing terraces – these features can be made of impervious materials or natural materials and look like steps. These terraces slow down the flow of water and the speed of wind, effectively reducing erosion.

HEALTH AND ENVIRONMENTAL IMPACTS OF DAMAGE OR ELIMINATION OF STEEP SLOPES TO HUMANS, PLANTS AND ANIMALS

On the surface, the erosion or elimination of steep slopes and important topography would not seem to have an impact on human, plant and animal health. These features in their natural state do not have a major impact, however their degradation does. The loss of steep slopes increases non-point source pollution and sedimentation to our streams and other surface waters. This pollution has a direct effect on human health, and the sustenance of plant and animal species. The loss of important topological features also has an impact on our leisure and recreation opportunities, as well as the aesthetics of our place on the planet. These features provide us with many of the beautiful scenic vistas where we love to walk, hike, birdwatch and relax. They also provide areas of exercise and social interaction, having an impact on mental and emotional well-being.

SPOTLIGHT: RIDGELINES

Montgomery Township's Environmental Commission has developed an interest in the study and protection of ridgelines within the municipality, specifically because of the resource availability and opportunities provided by the Sourland Mountain. Map RL-1 (Appendix) shows the ridgelines with a height greater than 1000'. As seen, ridgelines are concentrated in the Sourland Mountain Region but are dispersed throughout the Township. Because of this unique topography, there is an opportunity for Montgomery to position itself as a user and protector of ridgelines, which are so frequently taken for granted.

Ridgelines are home to unique habitat, and provide distinct recreational activities including hiking, walking, and wildlife watching. They can also serve as an important planning tool to guide development to appropriate locations.

Case Study: Washington Township, Morris County, New Jersey

Washington Township felt the need to protect its ridgelines and steep slopes. The vehicle chosen to do this was the adoption of the Special Development Regulations into the Washington Township Zoning Code. Development proposed in a mapped ridgeline protection area requires review of the Township Engineer. If it was determined that the proposed development was in the ridgeline protection area, construction could not commence until a Certificate of Compliance with the ordinance is issued by the Planning Board. One example of compliance would be for the developer to satisfy the increased setbacks of development from ridgelines, thereby protecting the scenic vista. This review and permitting process achieves the goals of Washington Township to preserve the scenic vistas created by ridgelines within its community.

A complete copy of this ordinance can be viewed at: https://ecode360.com/11404380?highlight=ridgeline,ridgelines#11404380.

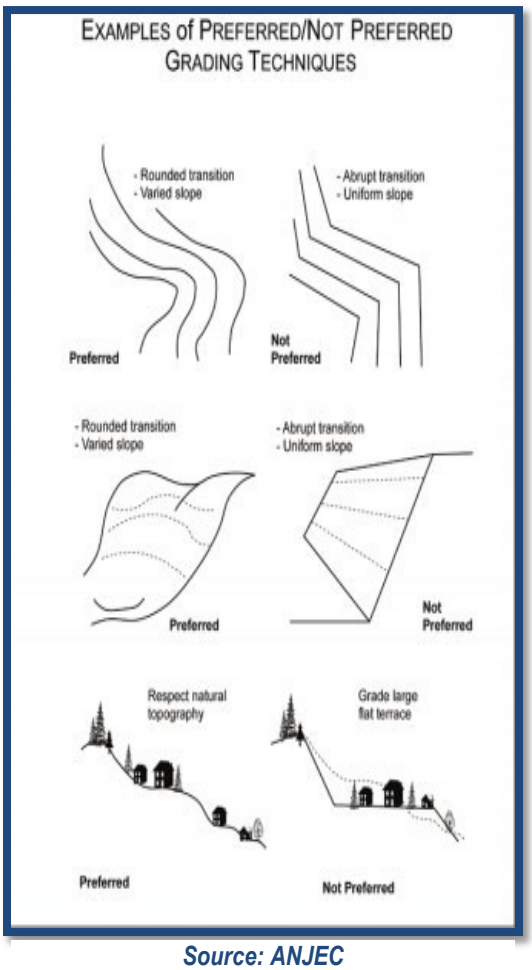
HOW IS MONTGOMERY TOWNSHIP WORKING TO PROTECT TOPOGRAPHY AND STEEP SLOPES?

Critical Areas Ordinance

The initial restriction for steep slopes was added to the Township Code in 2001 by ordinance 01-1039, with further additions by ordinances 03-1119 and 07-1260. In 2016, the Montgomery Township Council adopted ordinance 16-1534, known as the Critical Areas Ordinance. This ordinance called for the protection of critical areas in the Township including steep slopes of 15% or greater. The purpose of the ordinance is to protect environmentally fragile lands, prevent erosion and pollution, maintain species of plants and animals and more.

The Critical Areas Ordinance includes slopes of 15% or greater, when stream corridor development or disturbance is being proposed. In addition, adequate drainage ways are required for structures constructed on steep slopes. Finally, the ordinance calls for additional engineering and environmental studies where critical areas are defined.

Ordinance 16-1534 is attached as Appendix TSS-1.



Source: ANJEC

Preservation of the Sourland Mountain

Montgomery Township has been a leader in land preservation, especially in the critical lands of the Sourland Mountain. Since the 1980s, the Township (along with numerous partners) has successfully preserved over 4,880 acres within the Sourland Mountain, representing most steep slopes within the municipal boundaries. As recently as June 2018, an additional 63 acres along Spring Hill Road was preserved through a partnership of the Township and the New Jersey Conservation Foundation.

This preservation not only protects the scenic vistas and recreational opportunities offered by this prominent landform but is also instrumental in reducing erosion and non-point source pollution sources.

Mapping of the Sourland Region's preserved open space is attached as Appendix TSS-2.

Mapping of the contours of the Sourland Mountain Region is attached as Appendix TSS-3.

RECOMMENDATIONS AND POTENTIAL PROJECTS

- Adopt a performance-based review for development of steep slopes – this will allow the Township to define what slopes should be protected and where appropriate development should be directed
- Create a Ridgeline Protection Area and Ordinance using GIS analysis

- Review agricultural management practices related to Contour Farming – provide education to the agricultural community about the benefits of this sustainable practice
- Perform a study related to pollutant loading and sedimentation deposited as a direct result of steep slope disturbance
- Research the ability to “preserve” ridgelines using a mechanism like farmland preservation (purchase of development rights)

CITATIONS

"Ground Covers for Steep Slopes". Backyard Conservation Tip Sheet.
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=nrcs143_023569

"History of the Sourlands Region". The Sourlands Conservancy.
https://sourland.org/about-spc/history/

"Open Space Mapping of the Sourlands Region". The Sourlands Conservancy.
https://sourland.org/wp-content/uploads/2014/09/SC_Final_Report_8_14_HM.pdf

"Ridgeline Protection Ordinance". Washington Township, Morris County.
https://ecode360.com/11404380?highlight=ridgeline,ridgelines#11404380

"Steep Slope Model Ordinance". New Jersey Department of Environmental Protection
(https://www.nj.gov/dep/wqmp/docs/steep_slope_model_ordinance20080624.pdf)

"Steep Slope Ordinance". Pennsylvania Land Trust.
https://conservationtools.org/guides/59-steep-slope-ordinance

"What is Contour Farming?". World Atlas.
https://www.worldatlas.com/articles/what-is-contour-farming.html

"What is Done to Reduce Soil Erosion on Steep Slopes?". San Francisco Gate.
https://homeguides.sfgate.com/done-reduce-soil-erosion-steep-slopes-103909.html

"Protecting the Heights". *The San Diego-Union Tribune*. 2004.
https://www.sandiegouniontribune.com/sdut-protecting-the-heights-several-cities-have-2004dec12-story.html

SURFACE WATERS, SUBWATERSHEDS AND FLOOD ZONES

The presence of surface waters along with the location and environmental features of watersheds and subwatersheds dictate many of the land development activities in a municipality. Surface waters not only provide humans, plants and animals with one of the most basic survival necessities, but also provide important habitat, create scenic vistas and recreational opportunities and bring the meandering landscape that is enjoyed by so many. Geography within a watershed, and at a smaller scale the subwatershed, play a large role in water availability, flooding and recharge capabilities. The protection and restoration of these vital natural resources is imperative to the furtherance of a healthy ecosystem and planet.

This chapter will address:

- Presence and classification of surface waters in Montgomery Township
- Regulation of surface waters and flood zones
- Health impacts of surface water and flood zone availability and quality to humans, plants and animals
- Location and characteristics of the Millstone and Raritan Watersheds and its subwatersheds
- Recommendations to protect and restore surface waters and flood zones in Montgomery Township
- Success stories from Montgomery Township

WHAT ARE SURFACE WATERS?

Surface waters are defined by the United States Geologic Service (USGS) as "waters that collect on the surface in the nation's rivers, streams, creeks, lakes and reservoirs". Nearly 80% of the water used in the United States comes from surface water features, with uses including public drinking water, recreational sporting and fishing, hydroelectricity, agricultural and industrial. It is due to these intensive and inclusive uses that surface waters must be protected and restored (where applicable).

PRESENCE AND CLASSIFICATION OF SURFACE WATERS IN MONTGOMERY TOWNSHIP

The Millstone River is the principal surface water body in Montgomery, ultimately receiving drainage from the entire Township via a network of tributaries comprising 116-miles of surface waters. Other noteworthy statistics are:

- 42% of Montgomery surface waters are designated as headwaters (First Order), most flowing off the Sourland Mountain
- 73% of Montgomery surface waters are designated as tributaries, with the majority flowing from west to east.
- The Pike Brook flows north to south, while the Cherry Brook flows south to north

- 35% of Montgomery surface waters are classified as streams
- 8% of Montgomery surface waters are classified as rivers

REGULATION OF SURFACE WATER

In 1948, the Federal Clean Water Act was enacted, becoming the first legislation at the national level to regulate pollutant discharge to surface water. This powerful legislation recognized the importance of protecting surface water quality and provided standards for the continued maintenance and restoration of surface waters in the United States. All discharges to surface water are prohibited without a permit obtained through the National Pollutant Discharge Elimination System (NAPDES) or the state- level equivalent (in New Jersey, this program is called the New Jersey Pollutant Discharge Elimination System). The stipulations of the Clean Water Act are enforced through cooperation of State partners via the Clean Water Act Compliance Monitoring Program. This Program protects human health and water quality through site inspections performed by professionals and reporting requirements.

USEPA cites nutrients (specifically nitrogen and phosphorus) as one of the leading causes of water quality impairment - 31% of all freshwaters were not supporting of aquatic life due to exceedances of phosphorus

The United States Geologic Survey (USGS) produces an annual report based on the water year (October 1st – September 20th). This *Stream Flow Report – Water Year 2017* details the stream flow across the United States as it relates to the reference period of 1930-2017. Of interest, New Jersey was classified as one of only five states as "Below Normal", meaning that stream flow in water year 2017 was between 10%-24% below the context period.

In New Jersey, surface waters are regulated via the Surface Water Quality Standards (NJAC 7:9B). This Act establishes designated uses and stream classification and sets antidegradation categories using water quality criteria. This legislation provides for the maintenance and restoration of polluted surface waters to ensure the continued safe use of these natural features in three tiers:

- Designated uses – surface waters are given uses which are the primary use for that body of water. Each designated use has a set of criteria for water quality protection, and restoration back to the original designated use is required. Designated uses are:
  - Public Potable Water Supply (after conventional treatment)
  - Recreation
  - Fish Consumption
  - Shellfish Harvesting
  - Maintenance, migration and propagation of fish production
  - Agricultural and Industrial Water Supplies
  - Any other reasonable uses

- Classification of uses – surface waters are first classified based on their composition (freshwater versus saline waters). Following that classification, freshwaters are categorized by discharges to that body of water and based on the capabilities for trout production and maintenance. Freshwater classifications are:
  - FW1 – not subject to any man-made wastewater discharge; non-degradation waters are set aside in posterity for their ecological significance
  - FW2 – all other freshwaters except those in the Pinelands. These waters are further classified on their ability to maintain trout:
    - Trout production (FW2-TP)

- Trout maintenance (FW2-TM)
- Non-trout (FW2-NT); **all surface waters in Montgomery Township are FW2-NT**

Saline waters are classified as:

- Saline estuary – further classified on their abilities to support recreation, shellfish harvesting and warm water fish (SE-1, SE-2 and SE-3)
- Saline coastal

Antidegradation policies – all surface waters are subject to antidegradation standards based upon the designated uses and classifications. This policy states that all surface waters must be protected for and maintained to the designated use for that water body. Where surface waters are impaired, restoration must be completed to the standards of the antidegradation policies. Three tiers exist:

- Outstanding National Resource Waters - most protective and apply to FW1 and Pinelands (PL1) waters
- Category One (C1) – protected from any measurable change to existing water quality based on their exceptional ecological, recreational, water supply and fisheries resources
- Category Two (C2) – some lowering of existing water quality is permitted based on social or economic justification; **all surface waters in Montgomery Township are C2**

At the time of this report, the New Jersey Department of Environmental Protection had drafted an amendment to the Surface Water Quality Standards which would upgrade the classification of 749 river miles to Category 1 across the State. Due to exceptional ecological and environmental significance, a portion of the proposal includes the reclassification of the Rock Brook from the municipal border of Hillsborough Township to Camp Meeting Avenue in Montgomery Township. The first draft of the rule proposal was published in the March 4, 2019 New Jersey Register and can be found at: https://www.nj.gov/dep/rules/proposals/20190304a.pdf

Beyond these regulatory classifications, surface waters can also be categorized by type:

- Headwaters (also known as First Order)
- Tributaries – freshwater streams that feed into a larger waterbody and do not flow into the ocean
  Streams – surface water that flows in between the bed and banks of the channel
- Rivers – natural flowing watercourses that lead to other rivers, seas or the ocean

The United States Environmental Protection Agency (USEPA) requires the New Jersey Department of Environmental Protection (NJDEP) to monitor and determine if surface waters in the State meet the criteria set forth in the Clean Water Act. Where these standards are not met, NJDEP must provide a restoration plan for these impaired waters. In addition to this reporting, the USEPA requires the distribution of an agency-prepared Consumer Confidence Report by all water purveyors to consumers. This report includes information pertaining to each surface water source, contamination with corresponding levels, potential health risks and activities planned to restore surface waters (where impaired).

Ambient Biomonitoring Network

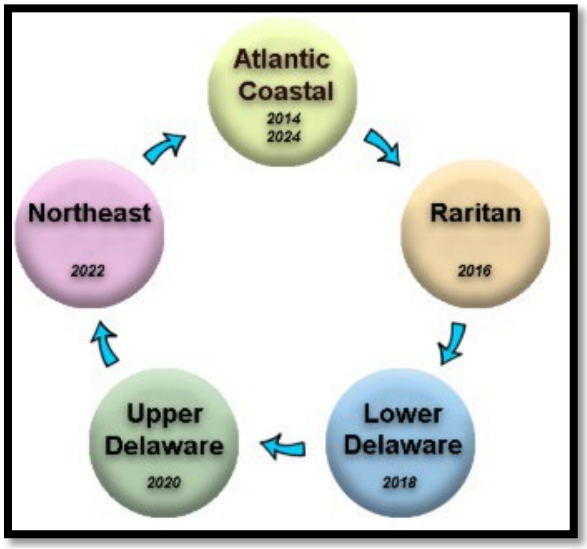
The Ambient Biomonitoring Network (AMNET) is the surface water quality mechanism in New Jersey. The system is comprised of 165 monitoring sites, with six being located in Montgomery Township. Benthic communities in freshwaters are observed and analyzed to determine if contamination is present, and if so, at what level. Macroinvertebrates are specifically analyzed due to their adaption to water quality, making them a living time analysis for surface water quality measurements.

The process begins with visual and stream habitat assessments at the chosen segment of the water body. The visual assessment is very literal – a trained professional or volunteer observes the water body, its banks and channel, and presence of aquatic life. The stream habitat assessment is then performed, which involves using a net to capture samples of the benthic community present. These samples are tested using the EPA's Rapid Bioassessment Protocol, with results being reported to the USEPA on a five-year cycle. This data is used to draft the biennial *Integrated Water Quality Monitoring and Assessment Report*.

SITE NUMBER	WATER BODY	LOCATION	IMPAIRMENT STATUS (ROUND 4)	CHANGE IMPAIRMENT STATUS FROM ROUND 3
AN0399	Rock Brook	Long Hill Road	Good	NO CHANGE
AN0400	Rock Brook	Burnt Hill Road	Fair	NEGATIVE
AN0401	Bedens Brook	Route 206	Good	NO CHANGE
AN0403	Cruser Brook	Route 206	Fair	NEGATIVE
AN0404	Back Brook	Route 206	Fair	NO CHANGE
AN0405	Pike Run	Route 533	Fair	NO CHANGE

NJDEP's Integrated Water Quality Monitoring and Assessment Report

Under Sections 303(d) and 305(b) of the Federal Clean Water Act, each state is required to assess, monitor, review and report on water quality, including changes in impairment status, every two years. Known as "The Integrated Report", this document serves as a vehicle to relay attainment or non-attainment of the requirements of the Act, as well as strategies for improving water quality and promoting a balance ecosystem of fish and wildlife. The data and findings are used by the USEPA and Congress to prioritize water quality projects and to budget funding opportunities and needs.



Source: NJDEP Bureau of Environmental Analysis, Restoration and Standards

In order to efficiently monitor the State in a comprehensive fashion, NJDEP has employed a rotating regional approach. This approach involves conducting a streamlined assessment of one of the five water regions every two years. The first tier of the rotating regional approach was conducted in 2014. The Integrated Report for the Raritan was scheduled for 2016, however is under development.
Data collected between July 2014 and September 2015 has been compiled, and outreach performed with assistance from the Sustainable Raritan River Initiative, and the finalized report is expected in the near future.

What is a flood zone and a floodplain?

A flood zone is defined by the Federal Emergency Management Agency (FEMA) as, "a geographic area, depicted on a community's Flood Insurance Rate Map (FIRM), with various levels of flood risk".

A floodplain is defined by FEMA as, "any land area that is susceptible to be inundated by flood waters". These areas consist of two main sections:

- *Floodway* – main channel of the river itself (may be seasonal)
- *Flood Fringe* – extends from the outer banks of the floodway to the bluff lines of the river valley

Floodplains are formed through two natural processes:

- Erosion – earth being worn away by the movement of a floodway
- Aggradation/Alluviation – earthen materials increase as floodways deposit sediment

Flood Hazard Areas are defined by FEMA as, "land areas that will be inundated by a flood event having a 1% chance of being equaled or exceeded in any given year." This 1% chance is often referred to as "base flood" or "100-year flood".

These areas have been designed by nature to absorb overflow of waterbodies for the purposes of infiltration and groundwater recharge. For humans, this means a solution to flooding and access to quality drinking water. Unfortunately, due to the ever- increasing sprawl pattern, these areas have become prime development sites due to their scenic vistas and recreational opportunities. With this development comes the fragmentation followed by the complete elimination of these natural areas which have served as areas of environmental defense, habitat and economic opportunities.

Map FP-1 (Appendix) shows the designated flood zones in Montgomery Township. All floodplains in Montgomery Township are in zones A and AE, with the majority being found along the Bedens Brook and Rock Brook.

The following tables created by FEMA demonstrate the flood hazard designation along with its description and flood risk:

Moderate to Low Risk Areas

In communities that participate in the NFIP, flood insurance is available to all property owner s and renters in these zones.:

Zone	Description
B (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100- year and 500-year floods. Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-yearflood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C and X (unshaded)	Area of minimal flood hazard usually depicted on FIRM as above the 500-year flood level. Zone C may have ponding and drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100- year flood.

High Risk Areas

In communities that participate in the NFIP, mandatory flood insurance purchases are required in the following zones:

ZONE:	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a *16%* chance offloading over the life of a.30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRM s instead of Al-A30 Zones.
A1-3D	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding. usually in the form of a pond, with an average depth ranging from 1 to 3 feet.These areas have a 16% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirement s will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

High Risk - Coastal Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones.

ZONE	DESCRIPTION
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
VE, V1 - 30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

Undetermined Risk Areas

ZONE	DESCRIPTION
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

Development in floodplains, specifically residential development, require flood insurance due to the risk of damage and repetitive loss. This insurance is designed to repair these damages, replace where appropriate and buy out, when necessary, repetitive loss structures (those that incur flood-related damages two times in a ten-year period where damage equaled or exceeded 25% of the structure's value at the time of the second claim). Because of the structure's undesirable location and the cost associated with reported damages, this insurance is very expensive and, in many cases, prohibitive to potential homebuyers. In response to these issues, Congress created the National Flood Insurance Program (NFIP) in 1968. This program offers affordable insurance to landowners in communities that engage in floodplain management area regulations and programs, including but not limited to:

- Site Plan and Subdivision ordinances that require review of flood zones and floodplains
- Changes to building code requirements in flood zones and floodplains
- Green infrastructure requirements or incentives

What About Agriculture?

In the United States, over three billion dollars are spent annually on flood insurance premiums, with an additional four billion dollars being spent on crop insurance payments. Because of the fertile soils and biodiversity naturally found in floodplains, farmers have historically sought out these lands for agricultural productivity. While these soils may have amazing features for farming, the delicate nature of the land along with the risk for weather-related obliteration of the crops and income associated with them is exceptionally high. In an effort to balance this industry's needs with the inherent nature of floodplains, FEMA drafted a policy entitled, "Floodplain Management Requirements of Agricultural Structures and Accessory Structures" (comment period closed January 21, 2019). This policy recognizes the unique needs of agriculture and provides recommendations for the placement of these structures within an existing floodplain. A complete copy of this policy can be viewed at:

https://www.fema.gov/media-library-data/1542663224257-96019ef5bc1bb0589ab29c4f7d96d534/UPDATED_DRAFT_FEMAFPMAgandAccessoryStructuresPolicy.pdf

HOW ARE FLOOD ZONES AND FLOODPLAINS REGULATED?

The Flood Hazard Control Act Rules (NJAC 7:13), adopted on November 5, 2007, regulate certain development and disturbance within flood hazard areas and riparian areas. The rules were amended and re-adopted on December 18, 2017 to include additions to the permit categories, changes to riparian buffer requirements and merging of Special Water Resource Protection Areas (SWRPA).

The FHA Rules require permits for certain types of construction within the designated flood hazard area and riparian buffer. The most recent version recognizes four types of permits:

- *Permits-By-Rule* – these projects are automatically issued a permit by NJDEP, and include fences, pools, sheds and minor home additions. The 2007 Rules included 47 permits-by-rule, with the most recent iteration including 63 types
- *General* – these activities, including stream cleaning, agricultural activities and home reconstruction require a simple permit and application fee for approval by NJDEP.
- *Individual* – larger projects that disturb a greater area of the flood hazard zone, where an application, fee and site visit is required by NJDEP
- *Permit-By-Certification*- these projects are between the categories of permits-by-rule and general permits.

This new category allows the applicant to log in to the NJDEP system to answer a series of question, which determine eligibility. This permit can be downloaded instantly for fifteen different project types.

Within these same rules are regulations for riparian zones (vegetative buffer around streams and rivers). Depending on the classification of the waterway, a riparian buffer may have a 50', 150' or 300' protection. These riparian areas provide critical habitat, stabilize stream banks, and protect the waterway from sun exposure. Without these important areas, ambient water temperatures would rise, fish populations would change, and biodiversity would be lost.

An interesting coupling was proposed in the 2017 FHA Rules with the Stormwater Management Rules. Special Water Resource Protection Areas are defined within the Stormwater Management Rules. These areas are created by placing a 300' buffer around Category One waters, where development is strictly reviewed and permitted. Because riparian zones are present regardless of the size of the proposed development, NJDEP determined that combining both sets of regulations would reduce confusion, eliminate overlapping regulatory review and provide the necessary protections.

WHAT IS A SUBWATERSHED?

According to The Watershed Institute, a watershed is defined as "an area of land that drains into a particular body of water, such as a stream, river or pond." Watershed boundaries do not align with municipal boundaries but are shaped by topography and land uses. Watersheds are identified as Hydrological Unit Code 11 (HUC-11). In Montgomery Township, the prevalent watershed management area is the Millstone WMA (designated as WMA 10). WMA 10 is comprised of 265 miles and 25 towns, with the Stony Brook feedings into the Raritan River as a major tributary.

Subwatersheds are smaller areas created by the division of watersheds. These areas, identified as HUC-14, are more manageable for the monitoring of surface waters and implementation of projects. There are nine subwatersheds in Millstone Watershed within Montgomery Township.

Because of the situating of watersheds, it is imperative to municipalities work together to perform watershed-based planning rather than traditional land use planning and management based on political lines. Planning for surface water protection, stormwater management and cross-municipal water conservation, restoration and maintenance projects is the most effective method for protecting surface water quality and providing environmental and ecological balance.

HOW ARE SUBWATERSHEDS ASSESSED AND MONITORED?

Throughout New Jersey, there are many governmental and non-governmental organizations that specialize in the maintenance, monitoring and restoration of subwatersheds and surface waters. These entities are responsible for numerous projects that assess fish populations, review and address changes in wildlife and plant biota, collect and compile data related to pollution of surface waters, educate the public about best management practices to protect surface water and reduce nonpoint source pollution within the subwatershed, and much more. The following are just a few of the important agencies working within Montgomery Township to protect and preserve the Millstone Watershed:

The Watershed Institute

Formerly known as the Stony Brook-Millstone Watershed Association, the Watershed Institute's project area and focus is on the Millstone Watershed Management Area (WMA 10). This entity has provided a great deal of guidance and advocacy within Montgomery Township and across the additional 24 municipalities within the Millstone Watershed. The Watershed Institute educates adults and children through its programming and interactive activities, collects and compiles water quality data and administers the popular and successful River-Friendly Program.

The Sustainable Raritan River Institute

This collaborative effort began in 2009 as an effort to identify projects and programs that meet the requirements of and advance the intent of the Clean Water Act, specifically as it relates to the Raritan River. Over the last ten years, SRRI has been responsible for the advocacy and outreach of the 2016 Raritan Integrated Report, held numerous topical workshops for professionals and volunteers, and has provided invaluable technical assistance to municipalities and other non-profits.

Sustainable Jersey

Sustainable Jersey is "a non-profit organization that provides tools, training and financial incentives to support communities as they pursue sustainability programs". This organization has developed one of the largest and most successful municipal certification programs in the United States, with Montgomery Township being one of the municipalities honored multiple times. Sustainable Jersey offers certification points for many water conservation programs and projects, stormwater management and green infrastructure. These actions ultimately improve overall quality of the Millstone Watershed Management Area and the surface waters located within it.

HEALTH IMPACTS OF SURFACE WATER, FLOOD ZONES/FLOODPLAINS AND SUBWATERSHED DEGRADATION TO HUMANS, PLANTS AND ANIMALS

Surface waters provide much of our drinking water and other potable water uses, including irrigation, thermoelectric power and mining. Water pollution is responsible for a variety of illnesses in over one billion

people every year. Pathogens from human and animal viruses and waste, along with contaminated runoff from stormwater and other nonpoint sources of pollution. Surface water degradation is also responsible for reduction of drinking water supply, habitat disconnection and threats to plant, animal and fish species.

Illness

Surface water contamination has been linked multiple illnesses, ranging from skin rashes and eye irritation to respiratory infections and mercury poisoning. Surface water is contaminated through many vehicles, including but not limited to:

- Pasturing and watering of animals near surface water bodies – this agricultural practice brings animals towards the surface water, leading to the depositing of animal waste carrying pathogens and viruses directly into the water supply
- Deposition of chemicals and pollutants from stormwater runoff – chemical contaminants from automobiles (gasoline, motor oil, antifreeze) travel from runoff to surface water bodies, leading to the contamination of the entire system. Other contaminants subject to runoff are fertilizers, insect repellants and litter.
- Direct pollution – many surface waters are also the source of recreational opportunities and vacationing areas. In the most unfortunate instances, pollution is directly imparted into the surface water through illegal dumping, malfunctioning infrastructure, or combined sewer overflow systems.
- Increase in ambient temperatures – an increase in temperatures can lead to a buildup of algae. A buildup of blue-green algae causes a Harmful Algal Bloom, which contains toxins to animals and humans. Exposure to such algae can lead to nausea, rashes, and seizures.

Reduction of Water Supply

As aforementioned, most of the surface water is used for drinking water. The contamination of the water supply inevitably leads to a reduction in water supply, ultimately a reduction to the most basic human, plant and animal need. Water supply is finite, so contamination and degradation of the supply is very difficult to remediate and cannot be resupplied.

Habitat Disconnection and Threats to Species

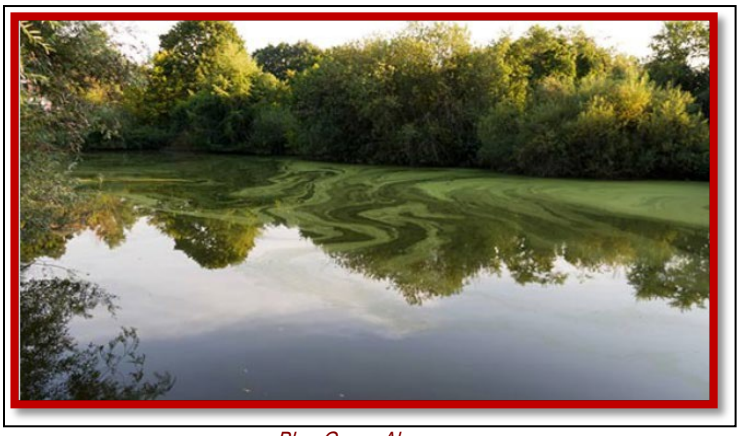
Surface water is home to thousands of fish and plant species. It also serves as a life source and connector for an all species. Contamination, reduction or elimination of water supply not only affects the species living within the surface water body, but ultimately affects all species surrounding the surface water body. This disconnection of habitat can affect species miles away, thereby influencing the entire ecosystem.

Loss of Recreational Opportunities

Recreational opportunities such as boating, fishing, camping and wildlife watching are bound to healthy surface waters and floodplains. These opportunities not only represent an industry of billions of dollars, but also contribute to human health and wellness, along with quality of life issues.

THREATS TO SURFACE WATER, FLOOD ZONES/FLOODPLAINS AND SUBWATERSHEDS

Because of the increasing development pressure in New Jersey, surface waters and the health of the subwatersheds are under attack. These threats along with constraints imposed by contamination have a major effect on water quality, health and habitat. Specific threats include:



Blue Green Algae

- Antiquated agriculture practices (excessive use of fertilizers and chemicals)
- Overstocking of agricultural animals, especially near surface water bodies
- Overdevelopment within the subwatershed
- Development on environmentally sensitive features, such as steep slopes Combined Sewer Overflow systems

Many industries are striving to improve their impact on surface water quality and the overall health of the watershed. Municipalities must work closely with businesses and individuals to understand the importance of surface water quality and the impacts on the environment and ecosystem.

HOW IS MONTGOMERY TOWNSHIP PROTECTING SURFACE WATERS AND SUBWATERSHEDS?

Montgomery Township considers the protection of surface water and subwatersheds to be a priority. This concept is included in many of the Township's projects and polices, as well as at the forefront of conversation at the Environmental Commission.

Stormwater Management Plan

In 2007, Montgomery Township adopted the revised Stormwater Management Plan as an element to the Township's Master Plan. This document included a build-out analysis, design and performance standards and a mitigation plan. As part of this updated Plan, the Township's Stormwater Management Ordinance was also re-evaluated and redrafted. This Plan meets the standards set forth by the State of New Jersey and establishes design and capacity standards for development regarding stormwater detention, retention, treatment and mitigation.

A full copy of the Stormwater Management Plan can be viewed at:
https://www.montgomery.nj.us/depts/landuse/StormwaterMgtPlan/Text/StormwaterPlan07.13.07.pdf

Site Plan Green Design Standards

In September 2008, Montgomery Township adopted an enhanced checklist for site plans, subdivisions and variances. Of the environmental requirements added, stormwater management including drainage calculations and a LEED checklist were incorporated. These additional requirements protect surface water in a variety of methods, along with the comprehensive health of the watershed. The enhanced checklist

was awarded points towards certification under the Sustainable Jersey Program.

Police Regulations: Chapter 3-1.10 – Litter in Fountains and Streams

"No person shall throw or deposit litter in any fountain, pond, stream, ditch or drainage easement or any other body of water within the Township." (Ordinance #254)

Chapter 11: Streets, Recycling, Storm Sewers and Sidewalks

"No person shall make any excavation or place any form of construction in, over, within or upon any street, or otherwise endanger or obstruct the normal flow of traffic or normal flow of surface water by the placing of any barricade, structure, material or equipment not normally designed to be operated, placed, or used on a street, nor make any connection to any storm drain, inlet or utility within the street without first obtaining a written permit, approved by the Township Engineer for such fees as provided in this section." (Ordinance #193)

Chapter 12-4.15: Sewer and Water

Water test must be performed on pipes to document leakage. Where a water test is not possible, a maximum leakage has been set at 20 gallons per day per inch of pipe diameter per mile of pipe. (Ordinance #89-643).

The Township recently upgraded two of its sewerage treatment plants (Pike Brook and North Princeton Development Center). In addition, the Township decommissioned two of its older plants (Oxbridge and Riverside) because the upgrades needed to satisfy NJDEP requirements would have been substantial. Wastewater is now pumped to the two newer plants, which are better equipped and available to perform the necessary treatment.

Chapter BH13: Onsite Wastewater Disposal Systems Management

This chapter, under the code of the Board of Health, requires that onsite wastewater disposal systems be properly managed and maintained to prevent leakage into surface water and infiltration to ground water. These systems, while necessary in many areas of the Township, can be a source of serous pollution if not properly installed and maintained. This section provides requirements for tanks, pumps, pipes and hoses, specifically to ensure water-tight conditions.

The Township exceeds State regulations by requiring property owners, and receive approval for, from the Board of Health for a primary and reserve septic system for new construction. In addition, the Township requires that residents conduct maintenance of their septic system every three years for conventional systems. Alternative technology systems are required to have a maintenance contract with the installer, which typically calls for a bi-annual inspection. Alternative technology systems also required annual re-licensure with the Montgomery Township Board of Health. For more information, please visit: https://health.montgomery.nj.us/servies/environmental-health/septics/

Chapter 16: Land Development Ordinance

The Township has enacted ordinances to control nonpoint source pollutants for all subdivision or site plan approvals, "d" variances pursuant to NJSA 40:55D-70d, and "c" variances for lot coverage. Stream corridors are required to be created 100 feet from the 100-year floodplain or top of bank, whichever is greater, of all streams, intermittent streams, and/or state open waters.

Monitoring Compliance

The Township experienced an issue with stormwater runoff from the quarry operated by the Minnesota Mining and Manufacturing Company (3M) in the early 2000s. The quarrying operation occurs in

Hillsborough Township, but the main site access and office buildings are located in Montgomery. The nature of 3M's operation created very small particulates, called "fines", which had no other applications. The fines were amassed in a "pile" and would run off into nearby streams during rain events, creating issues of sedimentation and turbidity – giving the stream a milky appearance. The current owner of the quarry, now *Constructural Dynamics*, has stabilized the fines pile with vegetation. They are modifying the onsite stormwater management basins to better treat any stormwater runoff from the site. The Township continues to monitor the project and compliance.

Public Outreach and Education

The Township offers a wide variety of information stormwater management and pollution on the website, and in printed materials available to the public at the Municipal Building. Plastic labels ("No Dumping") have been installed on all existing inlets, and any road rehabilitation or reconstruction projects require mold stamped grates with "Dump No Waste, Drains to Waterways".

The Environmental Commission furthers this mission by providing practical information at the annual Earth Day Fair on stormwater management for residents such as proper handling of pet waste, washing your car and lawn fertilizer. For several years, the EC has co-hosted an annual stream cleanup with The Watershed Institute. Details of the past few cleanups are below.

STREAM CLEANUP YEAR	QUANTITY	LOCATION
2016	608.5 lbs.	Montgomery Park
2017	135 lbs.	Mill Pond Park
2018	357 lbs.	Mill Pond Park
2019	709 lbs.	Montgomery Veterans Park

Table 1: Details of annual stream clean up by year and location.

Montgomery Environmental Commission members at annual 2019 Stream Cleanup at Montgomery Veterans Park

River-Friendly Program

In June 2016, the Township announced a partnership with The Watershed Institute to promote and educate residents and business owners about the River-Friendly Program. The Township posted a survey for landowners to take to show actions they have already implemented to become River-Friendly. By providing assistance to those within the Township, Montgomery is effectively ensuring the longtime health of the watershed.

What does "River-Friendly" mean to us?

The River-Friendly Programs revolve around four main components with specific goals

Source: https://www.njriverfriendly.org/

RECOMMENDATIONS

- Impervious Coverage Assessment – the last NRI called for an examination of impervious coverage in the Township. This examination should be performed to review changes in impervious coverage over time, as well as increase in volume and velocity of stormwater runoff. This examination could lead to changes in allowance of impervious coverage across land uses in Montgomery.

- Currently, the Association of New Jersey Environmental Commissions (ANJEC) is working on an Impervious Coverage Assessment that will specifically cover Montgomery Township. This data can be easily used by the Township and/or adopted into elements of the Master Plan.

- Water Infrastructure Assessment – New Jersey is highly affected by aging infrastructure, as are many of the original states in the America. An assessment of the age, condition and potential expansions and replacements of the infrastructure system would be beneficial for the Township in that it would provide the full picture of the system in place. This Assessment would also provide a framework and action plan for addressing infiltration, pollutions sources and other areas of concern to surface water and the watershed.

- Incentivization of River-Friendly and Comparable Surface Water Protection Programs – the Montgomery Township Environmental Commission should work with the Montgomery Business Association and Economic Development Department to incentivize participation in the River-Friendly and other comparable environmental programs.

- Participation in EPA's WaterSense Program – this voluntary program makes finding water efficient products and programs (defined as those that reduce water use by 20% or more) simple for everyday consumers. Montgomery can participate in this program for free by utilizing free labeling and promotional materials, while educating the general public.

- Pass a Water Conservation Ordinance – the City of Camden recently passed a comprehensive Water Conservation Ordinance, which has been praised by Sustainable Jersey. The Township should use this as a template to pass a similar but comprehensive ordinance to conserve and protect surface waters.

- Drafting of a Township-specific Stormwater Control/Management Ordinance – there is no "one-size fits all" approach to stormwater management and control at the municipal level. The Township may want to consider drafting an updating ordinance that will address water quality and conservation through proper stormwater control and management.

- Review existing Floodplain Development Ordinances/Regulations – review the existing allowances for floodplain development and amend as necessary to provide added protections

- Review and ensure compliance with the NJDEP's Total Maximum Daily Load (TMDL) – NJDEP's Bureau of Environmental Analysis, Restoration and Standards (BEARS) is responsible for establishing TMDLs for each region in New Jersey. TMDLs are implemented when a surface water does not meet the criteria for Surface Water Quality Standards. An online tool is available to look up applicable TMDLs. Montgomery Township should assess this tool and ensure compliance with the standards.

  The TMDL can be found at: https://www.nj.gov/dep/dwq/msrp-tmdl-rh.htm

- Explore opportunities to retrofit existing stormwater basins (designed and constructed prior to the 2005

stormwater regulations contained in N.J.A.C. 7:8) into bio-basins and/or naturalized basins utilizing the New Jersey Stormwater Best Management Practices Manual.

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"WMA 10: Millstone". The Watershed Institute.
https://thewatershedinstitute.org/wma-10-millstone/

WETLANDS

Swamps, marshes and bogs – these are the common names that refer to one of most valuable natural resources. Wetlands provide a unique habitat for many species of plants, insects and animals, and are essential for groundwater recharge and flood retention. Wetlands also provide economic and societal direct and indirect that are often misunderstood or taken for granted. This chapter will describe the form and function of wetlands and will explain how these features are a vital cog in the wheel of environmental protection and sustainability.

This chapter will address:

- Form and function of wetlands in and around Montgomery Township
- Regulations regulating wetlands and regulated waters
- Health impacts of wetlands loss to humans, plants and animals
- Recommendations to protect and preserve wetlands in Montgomery
- Township Success stories from Montgomery Township

WHAT ARE WETLANDS?

Wetlands are defined by the United States Environmental Protection Agency (USEPA) as "the land area that is saturated or inundated with surface or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation". These environmental features are sometimes referred to as the kidneys of the landscape due to their filtering and cleansing capabilities. Due to the rich nutrients and water storage capacity, many wetlands have been lost to accommodate agriculture.

Prior to European settlement, the United States was home to approximately 220 million acres of wetlands; today, about half of that remains.

Wetlands can be identified by the following indicators:

- Hydric Soils – soils permanently or seasonally saturated, leading to anaerobic conditions
- Hydrophytic Vegetation – plants that have adapted to growing in low oxygen conditions due to constant wet conditions (aerial flowers, floating leaves, reduced root system)
- Hydrology – movement of water in and out of the wetland ecosystem

W-1: Cattail Plants (Photo Courtesy of The Nature Conservancy)

Because wetlands may not always be totally saturated, the identification of these features may prove to be difficult. In the field, observers and scientists may look for softer soils underfoot, water marks on trees or

banks, pooling or ponding in certain areas, and the abundance of green plants and dark soils. In New Jersey, *The Federal Manual for Identifying Jurisdictional Wetlands* is used, with the above indicators serving as the main source for the method.

PRESENCE OF WETLANDS IN MONTGOMERY TOWNSHIP

In 2004, as part of the Montgomery Township Natural Resource Inventory, 2,914.57 acres were identified across thirteen types of wetlands. Deciduous Wooded Wetlands (wetlands with vegetation that seasonally sheds its leaves), Agricultural Wetlands (wetlands that have been modified/drained for the purpose of agricultural production), Deciduous Scrub/Shrub (wetlands dominated by grasses and small shrubs), and Herbaceous Wetlands (wetlands dominated by plants having little or no woody tissue and a reduced root zone) were the four largest sections of identified wetlands as part of the previous analysis.

In 2018, as part of the update to the Montgomery Township Natural Resource Inventory, 2,660.90 acres of wetlands were identified across twenty types. The same four sectors dominated the wetlands types in Montgomery Township. Additionally, the following types of wetlands were identified and calculated using the 2012 Wetlands Data developed by the New Jersey Department of Environmental Protection:

- Coniferous Scrub/Shrub = 24.05 acres
- Former Agricultural Wetlands, Becoming Shrubby, Not Built Up = 4.22 acres
- Managed Wetlands in Built-Up, Maintained Recreation Area = 38.42 acres*
- Managed Wetlands in Maintained Lawn Greenspace = 21.10 acres*
- Mixed Scrub/Shrub (predominantly Coniferous) = 40.57 acres
- Phragmites Dominate Interior Wetlands = 2.74 acres
- Unvegetated Flats = 0.23 acres
- Wetlands Right-of-Way = 5.73 acres

* *denotes types that were combined in 2004 Natural Resource Inventory*

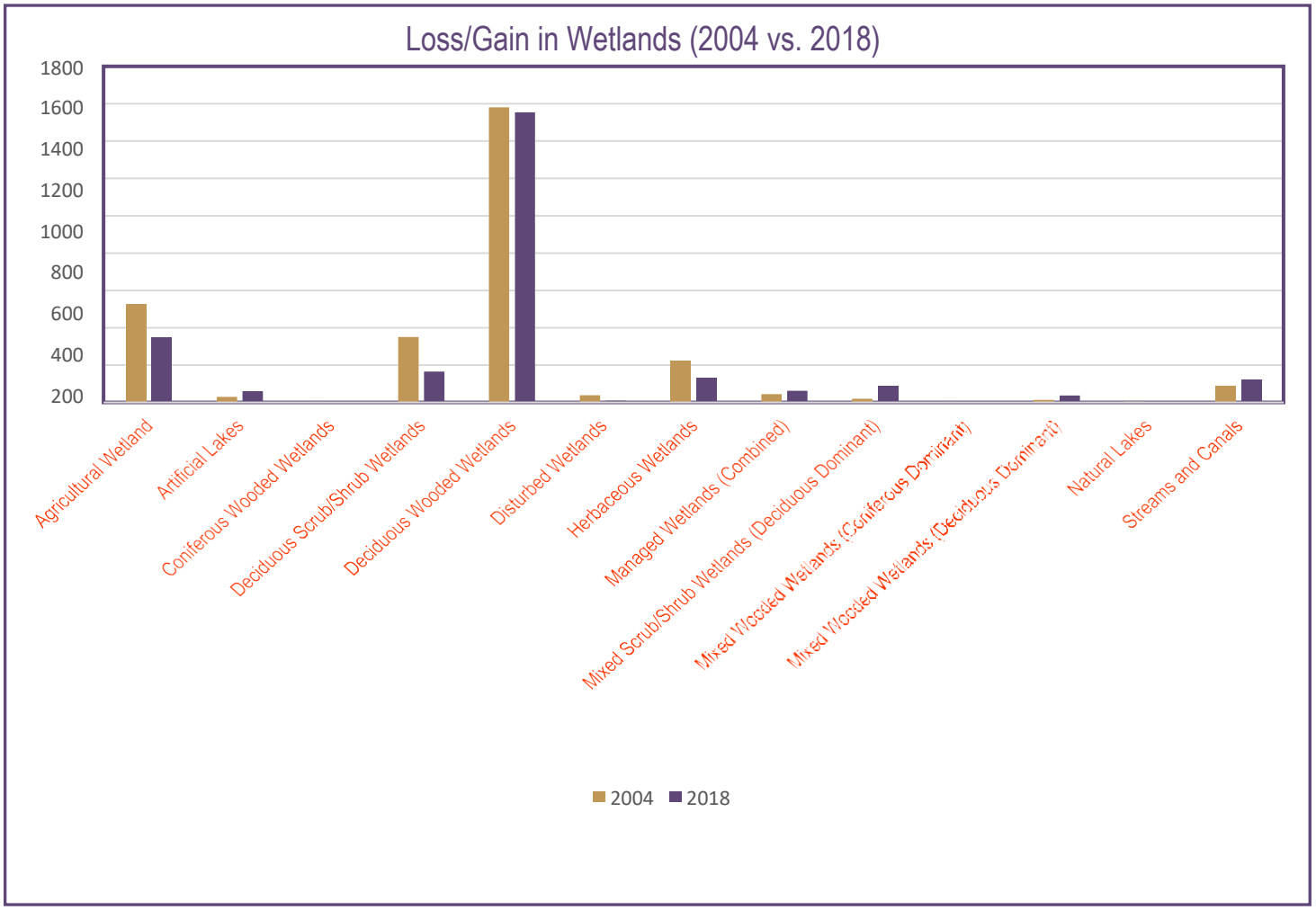
The following wetlands types realized an **INCREASE** in acres between 2004 and 2018 (using 2012 Wetlands Data):

- Streams and canals [+31.45 acres]
- Mixed wooded wetlands (predominantly deciduous) [+23.42 acres]
- Mixed scrub/shrub (predominantly deciduous) [+70.18 acres]
- Managed wetlands [+16.48 acres – recreational use and landscape use combined]
- Coniferous wooded wetlands [+4.46 acres]
- Artificial lakes [+29.86 acres]

The following wetlands types realized a **DECREASE** in acres between 2004 and 2018 (using 2012 Wetlands Data):

- Natural lakes [-1.54 acres]
- Herbaceous wetlands [-88.88 acres]
- Disturbed wetlands [-29.04 acres]
- Deciduous wooded wetlands [-25.63 acres]
- Deciduous scrub/shrub wetlands [-183.84 acres]
- Agricultural wetlands [-176.91 acres]
- Mixed wooded wetlands (predominantly coniferous) remained neutral at 0.94 acres.

Comparison of wetlands data from 2004 through 2018 (using Wetlands 2012 Data) shows a **net loss of 253.67 acres** across the various types of wetlands in Montgomery Township.



W-2: Loss and Gain of Wetlands

HOW ARE WETLANDS REGULATED?

New Jersey has long recognized the importance of wetlands, and the value of protecting them. The first Wetlands Act was adopted by the New Jersey Legislature in 1970. The intent of the 1970 Act was to protect coastal wetlands from undesirable or unnecessary disturbance. While this was the first major step to protecting this natural resource, the legislation did not provide adequate protection for all wetlands, especially in the wake of sprawl and large-scale commercial development.

In 1987, the New Jersey Freshwater Wetlands Act was passed, superseding all other wetlands regulations except in the Meadowlands and Pinelands. This legislation put powerful regulations in place for the development of wetlands, extended the boundaries of protection for wetlands, and created a comprehensive permitting process.

Under these rules, wetlands are categorized in three distinct levels:

- Exceptional Wetlands – wetlands that are home to, or a potential home to, threatened or endangered species. Wetlands in this category are also associated with FW-1 and FW-2 trout production waters, and have a 150' regulated transition area (upland area adjacent to freshwater wetlands)
- Intermediate Wetlands – those wetlands not classified as Exceptional or Ordinary. The regulated transition area is 50'.
- Ordinary Wetlands – these wetlands are typically isolated, smaller in size (less than 5,000SF), and sometimes include manmade drainage facilities. For ordinary wetlands, no transition area is regulated.

Any activities occurring in a wetland, state open water or regulated transition area are regulated by the New Jersey Freshwater Wetlands Act, thereby requiring permitting. Twenty-seven possible General Permits are available, allowing the landowner to apply online for a specific regulated activity provided that the activities proposed are minor in nature. Activities requiring more substantial infrastructure or loss of wetlands are required to obtain an Individual Permit, requiring the applicant to provide proof of desirability from a health or safety standpoint, no feasible alternative and methods of mitigation for loss of wetlands. A few activities in wetlands and transition areas are exempt from permitting and regulation, including:

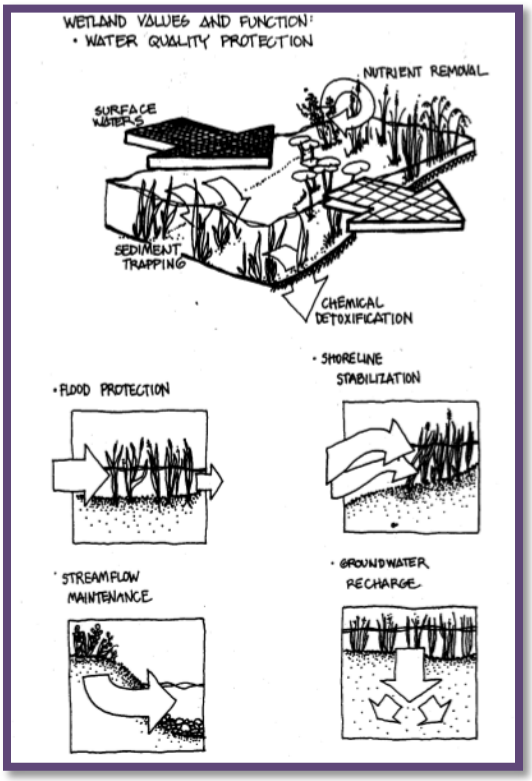
- Surveying
- Temporary structures less than 32SF (wetlands) and 150SF (transition area)
- Guy anchors for utility poles
- Hand trimming vegetation
- Normal maintenance
- Creation of new gardens less than ¼ acre

REGULATED ACTIVITIES UNDER THE NEW JERSEY FRESHWATER WETLANDS ACT	
WETLANDS	*TRANSITION AREA*
Any excavation	Any excavation
Drainage or disturbance of the water table	Drainage or disturbance of water table
Discharge of any fill	Erection of any structures
Driving of pilings	Placement of any pavements
Placement of permanent obstruction	Destruction of plant life that altars the characteristics
Destruction of plant life that altars the characteristics	

W-3: Chart of Regulated Activities

Wetlands mitigation is a major component of the permitting process. Projects causing permanent wetlands loss must be mitigated at a ratio of 2:1. The process and accounting of wetlands mitigation is contained within the Wetlands Mitigation Bank, which is overseen by the Wetlands Mitigation Council (in, but separate of, NJDEP).

In 2017, amendments were adopted to align the Freshwater Wetlands Act, the Flood Hazard Control Act and the Coastal Zone Management Act. The purpose of these amendments was to streamline the permitting process, specifically by aligning the requirements for all three sections, incorporating an in-lieu of fee for wetlands mitigation, developing an online permit application platform and incorporating new allowances for agricultural use in wetlands.



W-4: Wetlands Values and Functions (ANJEC)

HEALTH IMPACTS OF WETLANDS LOSS TO HUMANS, PLANTS AND ANIMALS

Wetlands purify water by filtering out contaminants and sediments, performing groundwater recharge, providing flood storage, building habitat for unique species, and creating recreational opportunities. These widespread benefits make this resource well worth its protection, preservation and enhancement.

Filtration

Because of its vegetation and soil quality, wetlands have a unique ability to filter out sediment and absorb pollutants. Not only does this process improve water quality, but it also removes sediments that could potentially obstruct waterways.

Groundwater Recharge

Wetlands are an excellent source for groundwater recharge due to their storage and slow release of water. This is extremely important in the Sourland Mountain, where groundwater recharge rates are extremely low.

Flood Storage

Wetlands slow down the flow of water from heavy weather events, specifically precipitation. This process stores water, reducing flooding and gradually releasing it, eliminating soil erosion and destruction from natural disasters.

A recent study published in Scientific Reports entitled, *The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA*, described wetlands as "the first line of defense during major weather events". Research of the most recent damaging weather event in New Jersey, Superstorm Sandy in October 2012, showed that the presence and upkeep of wetlands prevented approximately $425 million dollars in property damage in New Jersey alone. Additionally, the presence of wetlands in front of a property can reduce annual flood loss by a minimum of 16%.

Habitat

Wetlands create a special environment for many species, especially those that are threatened or endangered. These species may be water dependent, rely on the unique food source provided by wetlands, or need the soils found in these areas. The Wood Turtle (threatened), Timber Rattlesnake (endangered), Blue-Spotted Salamander (endangered), and Eastern Pond Mussel (threatened) are just a few of the reptile, amphibians and invertebrate species found in the Township of Montgomery and dependent of wetlands for their survival. Plant species include Nuttalls Mugwort, New Jersey Rush, and Slender Wheat Grass.

W-5: Wood Turtle

Recreational Opportunities

Wetlands can provide a multitude of recreational opportunities that cannot be found in any other feature. These areas are hotspots for birding, provide a beautiful backdrop for photography, provide access for water sports, and offer opportunities for walking, hiking and biking.

THREATS TO WETLANDS

Because of the ever-increasing development pressure in New Jersey, wetlands are under attack. Developable areas are more limited as we approach build-out in the Garden State. In many instances, wetlands are made to fit into a development scenario that is not appropriate in order to take advantage of scenic vistas and proximate open space.

The agricultural industry has modified wetlands across the State for the purpose of advancing the industry through increased crop production. Wetlands are the source of many stored nutrients, creating highly favorable conditions for growing food. Agriculturally modified wetlands are drained so that they can be farmed, and while they can return to wetlands when left untouched, it does take a great deal of time and effort.

Wetlands mitigation can also pose a threat when executed incorrectly. When wetlands are lost, and mitigation is required, the form and function of the original wetlands must be replaced to truly mitigate the issue. A properly calculated water budget must be conducted to analyze the water coming in (precipitation, surface and groundwater inflow) and out of (evapotranspiration, surface and groundwater outflow) the wetlands to accurately design mitigation that provides the same functions as the original wetlands. All mitigation projects must be designed by a hydrologic engineer and should include the guidance of the Township to precisely account for the wetlands loss and replace it with equal function.

The most rapidly disappearing type of wetland in New Jersey is the vernal pool, a seasonal wetlands that provides breeding habitat for frogs and other amphibians. In spring and summer, frogs, toads and salamanders may be heard using their species' distinct call to find a mate at a time of year and a time of day or night unique to their species. Vernal pools often occur in floodplains, but they may also be found as small isolated wetlands. Unfortunately, amphibians are declining worldwide, and need breeding habitats.

Many species of amphibians live and hibernate in forested places, by utilizing trees, fallen logs and leaf litter for cover. Vernal pools interior to forests or abutting the forest edge are most useful to amphibians because there is less risk for predation as they move between their natural habitat and their breeding

habitat of the vernal pools.

Preservation of vernal pools in Montgomery should be a priority. Even when an existing vernal pool is filled for development, landowners could be constructed to construct a new one as mitigation for a variance or provide for creation of a vernal pool on open space. Vernal pools in open areas should be improved with tree and understory plantings to provide enhanced habitat and reduce predation, as explained above. As part of a United States Fish and Wildlife Service (USFWS) grant, three vernal pools were created on Township-owned open space at the Cherry Brook Preserve, at the edge of the existing forest as part of a reforestation project in an area nearby exceptional resource value wetlands.

HOW IS MONTGOMERY TOWNSHIP PROTECTING WETLANDS?

Montgomery Township considers the protection of wetlands to be a priority. This concept is included in many of the Township's projects and polices, as well as at the forefront of conversation at the Environmental Commission.

Skillman Park Wetlands Enhancement

Skillman Park, consisting of 247 acres on County Route 601, is home to beautiful vistas, trails, and a dog park. In 2011, the Somerset County Board of Chosen Freeholders assisted the Township in preserving this newest piece of open space, which was formerly a psychiatric treatment center known as the "North Princeton Developmental Center".

W-6: Map of Skillman Park (Source: Somerset County Parks Commission)

On June 3, 2014, the New Jersey Wetlands Mitigation Council approved a grant in the amount of $56,500.00 to implement the Skillman Park Wetlands Enhancement Project for the wetlands near the Rock Brook. Wildlife habitat and natural buffers were set aside by the County to protect wetlands and its habitat.

The Township secured a grant from the USFWS to reforest a former agricultural field that is surrounded by

a mature forest. In spring 2017, over 1,000 trees were planted by volunteers and USFWS installed three vernal pools along the field edge. Salamanders have been identified each spring using the ponds in the years since.

US Fish and Wildlife Service creating vernal ponds at Cherry Brook Preserve, February 2007

Vernal pond at Cherry Brook Preserve, June 2014

Environmental Assessment Ordinance

Montgomery Township successfully drafted an Environmental Assessment Ordinance, which requires review of land development applications for the protection and conservation of significant environmental features.

RECOMMENDATIONS

- Identify Sites for Wetlands Restoration – currently, 8.61 acres of wetlands the Township are classified as "Disturbed". This may serve as a starting point for wetlands restorations projects. Funding can be sought through the Natural Conservation Resources Service and through the Department of Agriculture through programs such as Wetlands Reserve Program.
- Organize Wetlands Health Volunteering Opportunities – volunteer groups such as the Girl Scouts and Boy Scouts, can help maintain the delicate balance of the wetlands through cleanup and public education.
- Install Signage – describe the Township's good work through signage that clearly describes wetlands work that has been completed or is underway, species that live in wetlands, and more.

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REGIONAL RELATIONSHIPS AND PARTNERSHIPS

In order to leverage resources and maximize existing planning efforts, regional relationships and partnerships must be formed and fostered. Somerset County and the State of New Jersey have implemented numerous planning and sustainability initiatives over the past few years, which can be used as a catapult for new municipal projects. Services can be shared to advance existing projects or revitalize projects that have come to a standstill. The following describes just a few of the innovative projects completed or being undertaken by Montgomery's regional neighbors.

SOMERSET COUNTY'S PRIORITY INVESTMENT AND PRESERVATION FRAMEWORK

Adopted in 2014, the County Investment Framework "supports opportunities for local and regional smart growth, preservation, economic revitalization, and resiliency planning initiatives through tactical alignment of land use, infrastructure and preservation plans, resources, programs, policies and investment decisions, and conveys a clear investment message regarding local and regional land use priorities to both public and private sectors. "This project, the first and most comprehensive of its kind in New Jersey, is not only a valuable planning tool rooted in smart growth and strategic planning principles but is also accompanied by a useful mapping document and coincides with findings of the Somerset County Comprehensive Economic Development Strategy. A full report about the findings of the project is listed on the website.

For more information, please visit: https://www.co.somerset.nj.us/government/public-works/planning/master-plan/thriving- communities

SOMERSET COUNTY'S WASTEWATER MANAGEMENT PLAN

Montgomery Township and the Montgomery Township Sewer Utility has long been at the forefront of wastewater management planning. At the time that the State tasked counties with wastewater management planning responsibilities, Montgomery Township was one of only thirteen (13) municipalities in the State with a valid wastewater management plan.

The New Jersey Water Quality Planning Act requires Wastewater Management Plans (WWMPs) to be adopted and updated every five years. The County Planning Board and the Township work closely to ensure a balance between wastewater capacity and current and projected development. The WWMP effort utilizes extensive GIS analysis to identify where sewer capacity is available, where sewer service areas are located, and how projected development intersects. The Wastewater Management Plan a powerful local plan, as it identifies where wastewater capacity is available, thereby dictating where future development can occur.

The Montgomery component of the Somerset County WWMP is expected to be adopted shortly, despite changing regulations at NJDEP. The Township and the County worked hand in hand, along with the Planning Board, Environmental Commission, local citizens, and the Montgomery Township Sewer Utility to complete the WWMP. An enormous amount of data has been compiled as part of this effort.

To learn more about the Somerset County Wastewater Management Plan, please visit: https://www.co.somerset.nj.us/government/public-works/planning/wastewater-plan

SOMERSET COUNTY'S PRESERVATION PLAN

In 2017, Somerset County began a comprehensive and collaborative update to its existing Open Space, Farmland and Historic Preservation Plans. Anticipated to be complete and published in 2019, this Plan will update each area of preservation on its own merits, while looking at how each preservation mechanism

intersects and affects the other. An extensive amount of mapping will be provided to show existing and targeted open space parcels, existing and targeted farmland preserved parcels, and existing and targeted historic preservation sites. Mapping will also be provided to show where these areas overlap to allow for a strategic approach to preservation, and potential leveraging of funding between these programs. Other areas of focus will include economic costs and benefits of preservation, societal impacts of preservation of a types and tourism across all three types.

For information on the County's Preservation Plan, please visit:
https://www.co.somerset.nj.us/government/public-works/planning/current-projects

SOMERSET COUNTY'S COMPREHENSIVE FARMLAND PRESERVATION PLAN

In 2008, the Somerset County Agriculture Development Board and Somerset County Planning Board adopted the *Comprehensive Farmland Preservation Plan*. The Plan specifically coordinates with the State Agriculture Development Committee's rules for County Planning Incentive Grants (released in 2007). In addition to identifying properties eligible for farmland preservation, it also discussed the industry of agriculture as it relates to the local and State economy and tourism, as well as Right-to-Farm and projected future projects.

Every year, the County and all participating municipalities are required to submit an Annual Application to the SADC for funding. This Application identifies targeted properties preserved and developed since the last Annual Application. The Application is also an opportunity to request amendments to the Project Areas and/or Agricultural Development Areas.
To read the full Plan, please visit: https://www.co.somerset.nj.us/home/showdocument?id=28695

SOMERSET COUNTY'S WALK-BIKE-HIKE PLAN

The *Walk-Bike-Hike Plan* will strategically plan and identify an integrated network of multi-use trails, bicycle lanes and paths that will serve as transportation, recreation and tourism. This network will allow for energy conservation, economic development, recreational opportunities and educational points of interest. The Plan will be implemented through a series of infrastructure improvements, including:

Pathway connections
Bicycle facilities
New and enhanced crossings and linkages
Improved pedestrian safety

For more information on the County's *Walk-Bike-Hike Plan*, please visit:
https://www.co.somerset.nj.us/government/public-works/planning/walk-bike-hike-plan

SOMERSET COUNTY'S COMPREHENSIVE ECONOMIC DEVELOPMENT STRATEGY (CEDS)

In May 2013, the Somerset County Business Partnership, with assistance from the Somerset County Planning Division, adopted the Somerset County CEDS. The United States Economic Development Agency provided a grant to the County for the purposes of developing "an economic roadmap to diversity, strengthen and sustain regional economies". In addition to fulfilling this goal, the County embarked on a massive community engagement process with representatives from a variety of industries.

Through prioritization of projects and programs, other important issues such as quality of life, hazard mitigation and tourism were discussed and reviewed as ancillary and complimentary activities related to economic development.
To read the full report, please visit: https://www.co.somerset.nj.us/home/showdocument?id=7987

SUSTAINABLE JERSEY

In 2006, the College of New Jersey was awarded a grant to create a Sustainable Communities Leadership Network to support municipal progress towards sustainable development through the implementation of best management practices, facilitating peer-to-peer collaboration, establishing metrics and providing technical resources. Through a series of partnerships with the New Jersey Department of Environmental Protection, the New Jersey Board of Public Utilities and the New Jersey League of Municipalities, Sustainable Jersey was formed, and has since become a model across the nation for implementing sustainability at the municipal level.

Montgomery Township was one of the initial municipalities to become registered (March 5, 2009) and certified (November 2009) with Sustainable Jersey. The Township has successfully obtained grant funding from this organization and has used that funding to further its goals and objectives as they relate to sustainability. One example is a $10,000 grant that was awarded for a Bicycle Safety Pilot Program.

As of July 2019, 405 municipalities were participating (registered) with the Sustainable Jersey Program, with 203 of those communities certified. Montgomery Township has been consistently certified over the 10 years of the program, with the most recent Certification obtained at the Bronze level on October 10, 2018.

For a link to the Township's full Certification Report, please visit: http://www.sustainablejersey.com/actions-certification/participating-communities/

Montgomery Environmental Commission Chair Mary Reece accepting the Township's 2018 Sustainable Jersey certification from Randall Solomon, Executive Director of Sustainable Jersey (L) and Richard Dover, Chairperson, Board of Trustees, Sustainable Jersey (R).

NEW JERSEY STATEWIDE COMPREHENSIVE OUTDOOR RECREATION PLAN

The New Jersey Department of Environmental Protection's Green Acres Program prepares the *State's Comprehensive Outdoor Recreation Plan* every five years. This document serves as the main framework for open space preservation in New Jersey and assists in the allocation of funding. The Plan consists of six sections:

1. Policy Plan
2. Supply and Demand
3. Issues and Policies
4. Project Priorities Selection Process
5. Action Plan
6. New Jersey's Wetlands Plan

To view the full 2018-2022 Report, please visit:
https://www.nj.gov/dep/greenacres/pdf/2018_draft_SCORP.pdf

NJDEP'S 2016 ENVIRONMENTAL TRENDS REPORT

New Jersey Department of Environmental Protection's Division of Science and Research updates its State

of the Environment Report since 1998. The trends studied in this Report can be viewed individually or compiled to create an entire outlook for our environment. The Report serves as a comprehensive review of environmental factors over the last twenty years. Some of the trends studied include:

- Air
- Climate
- Open Space and Land Use
- Pollution Prevention
- Water
- Plants and Wildlife

To learn more, please visit: https://www.nj.gov/dep/dsr/trends/

NJDEP'S NEW JERSEY TRAILS PLAN

In 2009, the Green Acres Program updated the Trails Master Plan. This updated Plan builds upon existing State plans and was drafted through collaboration of the New Jersey Trails Council, the Trails Plan Advisory Committee, NJDEP and the New Jersey Department of Transportation. The purpose of the Plan is to look at the needs and desires of trail users and providers.
Municipalities can use this Plan as a foundation when creating or updating their own Trails Plan.

Of particular note is the extensive outreach that was undertaken for the update of this Plan. After meetings and discussion with trail users, trail providers, municipal staff and officials, transportation professionals, planners and more, a summary of recommendations (organized into seven different topic areas) was developed. Some of these projects include:

- Incorporation of trails planning into Farmland Preservation projects
- Conduct a Statewide Trails Needs Assessment
- Encourage the use of trails in the Safe Routes to School Program
- Expand volunteer programs to assist with necessary trails maintenance
- Provide funding incentives for multi-jurisdictional trails
- Incorporate the requirement for trails in the land development process

To view the entirety of the Plan, please visit: https://www.nj.gov/dep/greenacres/trails/plan.html

NEW JERSEY ENERGY MASTER PLAN

New Jersey drafted its first Energy Master Plan in 2008, which was subsequently updated in 2011 and 2015. On March 23, 2018, Governor Murphy signed Executive Order 28, which directed Staff to update the existing Energy Master Plan in 2019. One of the many lofty goals to be established in the updated Plan is a goal to convert to 100% clean energy by the year 2050. Executive Order 28 also called for the growing of the clean energy economy, including community solar facilities, battery storage, offshore wind power.

Each update of the State's Energy Master Plan called for a specific set of overarching goals. In 2011 and 2015, the main goals were:

1. Drive down the cost of electricity for all customers
2. Promote a diverse portfolio of clean energy
3. Reward electricity efficiency and conservation, and reduce peak demand
4. Capitalize on emerging technologies for energy production
5. Maintain renewable energy portfolio standard at 22.5% by 2021

The next generation of the Energy Master Plan will designate new goals, specifically:

1. Put New Jersey on a path to achieve 100% clean energy by the year 2050
2. Grow New Jersey's clean energy economy
3. Ensure reliability and affordability for all residents
4. Reduce the State's carbon footprint
5. Advance new technologies for all residents

The Energy Master Plan is overseen by the Board of Public Utilities, with five working groups mainly composed of State agency staff. The Plan is scheduled to be presented to the Governor in June 2019.

To learn more about the *2019 Energy Master Plan*, and to read the previous versions of the Energy Master Plan, please visit: https://www.nj.gov/emp/index.shtml

STATE AGRICULTURE DEVELOPMENT COMMITTEE (SADC)

The SADC is housed under the New Jersey Department of Agriculture and is the leader in preserving farmland and providing innovative techniques for retaining and advancing agriculture in the State. The SADC consists of eleven members (six are appointed by the Governor and five represent ex-officio membership). In addition to preserving farmland, the SADC administers the Right-to-Farm program, which reviews nuisance complaints against farmers against existing municipal zoning and provides the opportunity for farmers to obtain Site-Specific Agricultural Management Practices on their farms. The SADC also drafts legislation related to issues affecting agriculture in New Jersey.

The Township has consistently participated in the SADC's farmland preservation program, which typically provides a 60% cost-share to municipalities preserving eligible farms. Criteria related to soil type and tillability are mandated by the SADC, with the allowance for additional criteria being established by the county or municipality.

For more information about the State Agriculture Development Committee, please visit: https://www.nj.gov/agriculture/sadc/

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION AGENCY'S GREEN ACRES PROGRAM

The mission of Green Acres is to "achieve, in partnership with others, a system of interconnected open spaces, whose protection will preserve and enhance New Jersey's natural environment and its historic, scenic, and recreational resources for public use and enjoyment". Since its creation in 1961, the Green Acres Program has protected over 650,000 acres of open space and contributed to hundreds of recreational activities across New Jersey. The program is also responsible for administering the Blue Acres Program, which allows for the "buy-out" of properties suffering repetitive, documented loss due to flooding.

Montgomery Township has worked with the New Jersey Green Acres Program, housed under the New

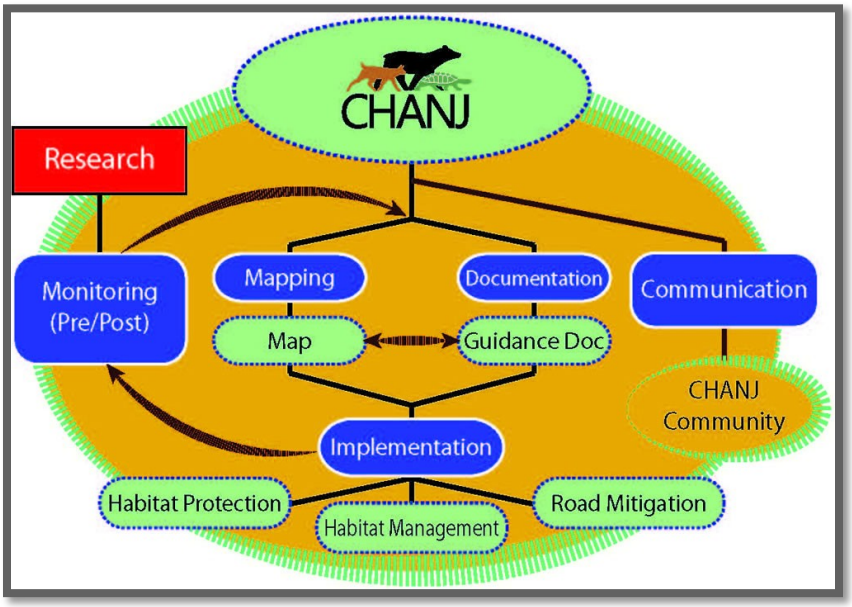
Jersey Department of Environmental Protection, to preserve lands as open space and acquire lands for recreation throughout the Township. Montgomery was one of the first communities to have an approved "Planning Incentive" project with Green Acres and has been awarded over $6.8 million in matching grant funds as of the date of this plan. The municipal Recreation and Open Space Inventory, dated June 27, 2019, can be found at: https://www.nj.gov/cgi-bin/dep/greenacres/facproc.pl

For more information on the Green Acres Program, please visit: https://www.nj.gov/dep/greenacres/

CONNECTING HABITAT ACROSS NEW JERSEY (CHANJ)

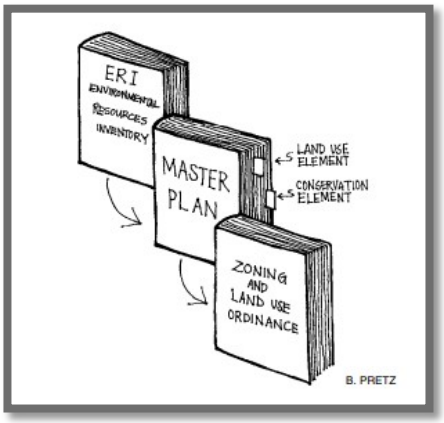
Launched in 2012 and housed under the New Jersey Department of Protection's Division of Fish and Wildlife, CHANJ seeks to make roadways safer and more permeable for wildlife. Their approach has two important steps:

Identification of cores and corridors (areas of important wildlife habitat and the means they use for movement and passage)
Creating opportunities for reconnecting and restoring habitats within key areas



CHANJ is overseen by a working group comprised of researchers, natural resource managers, planners and more. Through their work, they have developed a mapping tool and guidance document (expected to be released in 2019) and have trained local volunteers to document animal fatalities (primarily deer) related to motor vehicle accidents.

For more information, please visit: https://www.nj.gov/dep/fgw/ensp/chanj.htm



ANJEC'S RESOURCE PAPER ON ENVIRONMENTAL INVENTORIES

ANJEC has created a guidance document for the drafting and updating of Environmental Resource Inventories (also known as Natural Resource Inventories). The website provides examples of noteworthy plans as well as guidance for the preparation of such Plans.

ANJEC also created a resource paper, entitled "The Environmental Resource Inventory: ERI". This resource paper describes in detail the sections that should be in any good ERI, as well as mapping requirements and the public input process. This document has been used by many municipalities across New Jersey, still serving as a prime framework for the creation and updating of these documents.

To read the entire paper, please visit: http://www.anjec.org/pdfs/ERI2013.pdf.pdf

To provide useable resources for local environmental commissions, ANJEC has created the following:

- Library of model ordinances (http://anjec.org/category/ordinances/)
- Overviews (white papers) on environmental issues, including hazardous waste disposal, recycling, groundwater, and more (http://anjec.org/library/)
- Publications for sale, including The Environmental Commissioners Handbook (http://anjec.org/publications/)
- Hosting of events and conferences focused on environmental issues (http://anjec.org/conferences-workshops/#)

COLLABORATION WITH LOCAL AND REGIONAL NON-PROFIT ENTITIES

Land preservation and natural resource conservation are very rarely achieved without forming relationships and leveraging funding and opportunities. Montgomery Township has formed long-lasting and mutually beneficial partnerships to achieve its sustainability, land preservation, and natural resource conservation goals, some of which are detailed below:

- *Sourlands Alliance* – formed in 2009 to bring together partners with land in the Sourland Region (http://sourlandalliance.com/)
- *Millstone Valley Preservation Coalition* – focuses on the preservation of the Millstone Scenic Byway, a National and State designated Scenic Byway (http://www.millstonevalley.org/home.html)
- *Central Jersey Transportation Forum* – since its initial meeting in 1999, the Forum is focused on addressing transportation issues in the highly traveled areas of Central New Jersey (https://www.dvrpc.org/Committees/CJTF/)
- *Greater Mercer TMA* – comprised of employers, governments, and State agencies committed to providing good transportation choices to those who live and work in Mercer and Ocean counties (https://gmtma.org/)
- *Montgomery Friends of Open Space* – a non-profit, all volunteer organization formed in 2002, dedicated to preserving remaining open space in Montgomery Township and acting as stewards of land already preserved (https://montgomeryfriends.org/)
- *New Jersey Conservation Foundation* – focusing on the protection of strategic lands, promoting strong land use policy and forming partnerships to achieve conservation goals (https://www.njconservation.org/)
- *D&R Greenway Land Trust* – a mission to conserve and acquire land, while inspiring a strong conservation ethic (https://drgreenway.org/)

SHARED SERVICE AGREEMENTS

The Township shares services with neighboring municipalities and Somerset County to provide for cost-savings for residents and the provision of better overall services. By combining efforts, each partner can provide more services than would be provided if a municipality was to provide that service on its own. Not only are there significant cost-savings to the taxpayer, the quality of services and the quality of life overall are improved. Some of the shared services and the collaborations in which Montgomery Township participates are:

- *Health Services*: Pennington Borough, Rocky Hill Borough and Hopewell Borough

- *Health Education*: Pennington Borough, Rocky Hill Borough, Hopewell Borough, Branchburg Township and Princeton
- *Public Health Nursing*: Pennington Borough, Rocky Hill Borough, Hopewell Borough, and Branchburg Township
- *Municipal Court*: Township of Hillsborough
- *Accounting/Payroll Services/Chief Financial Officer/Purchasing Agent/Treasurer*: Manville Borough

SPOTLIGHT: COLLABORATION WITH PRINCETON, NEW JERSEY

Montgomery Township and Princeton have collaborated to reconstruct sections of Cherry Valley Road over the past several years. Cherry Valley Road forms the border between the two municipalities and is a busy commuter thoroughfare. By partnering on the project, the municipalities have been able to secure grant money and better coordinate road closures and detours. The latest segment is an improvement of Cherry Valley Road from 300' west of Cherry Hill Road to the Mercer County Bridge at Jefferson's Curve. This inter-municipal partnership, commencing in November 2018, will result in the following improvements:

- 30' wide roadway which will accommodate bike lanes
- Storm sewer drainage system
- 6' wide sidewalk on the southern side of the roadway connecting to the existing walkway
- Belgian block curbing

Trees will be planted on open space properties in Princeton Township to mitigate for trees removed to implement this project.

RECOMMENDATIONS

- Review these relevant documents when updating municipal Planning documents – these existing State and regional plans can provide much of the background and foundational information for municipal Plans. These documents can also serve as a database for potential projects and programs that can be implemented in the municipality.

- Look for gaps that can be filled – when overlapping these planning principles, areas of need may be identified. These are areas where municipal projects may be useful for the advancement of natural resource conservation, habitat connectivity, energy efficiency and more.

- Fold in the review of relevant State and Regional Plans into updates for all municipal plans and zoning – this exercise will potentially save staff time and resources by looking at data and projects already available that can be used by Montgomery Township.

APPENDICES

Map A-1: Farm Assessed Properties with Zoning

Map A-2: Project Areas with Targeted and Preserved Farms

Map A-3: Relation of the Township's Project Areas and Targeted Farms in Relation to Somerset County's Agriculture Development Area

AQ-1: Analyzation of Recent Air Monitoring Stations (New Brunswick, New Jersey)

C-1: Resolution of Sustainable Land Use Pledge (Resolution 09-8-258)

Map FP-1: Flood Zones

Map SW-1: Surface Waters and Subwatersheds, with AMNET Monitoring Sites

WH-1: List of Threatened and Endangered Species in New Jersey

WH-2: Ranked Habitat

HABITAT OVER LAND USES

Map WH-3: Critical Habitat Located in Agricultural Land Uses

Map WH-4: Critical Habitat Located in Barren Land

Map WH-5: Critical Habitat Located in Forest

Map WH-6: Critical Habitat Located in Urban Land

Map WH-7: Critical Habitat Located in/near Water

Map WH-8: Critical Habitat Located in Wetlands

Map LU-1: Zoning Map

Map LU-2: Land Use/Land Cover

Map PL-1: All Preserved Lands in Montgomery Township

Map Compendium PL-2: Trail and Parks Maps

Map PL-3: Trail Heads

Map PL-4: Farmland Projects Areas in Relation to Somerset County's Agriculture Development Areas

TSS-1: Critical Areas Ordinance (#16-1534)

Map TSS-2: Preserved Open Space in the Sourland Mountain Region

Map TSS-3: Contours of the Sourland Mountain Region

Map TSS-4: Steep Slopes and Ridgelines

Map S-1: Soil Erodibility

Map W-1: Wetlands