

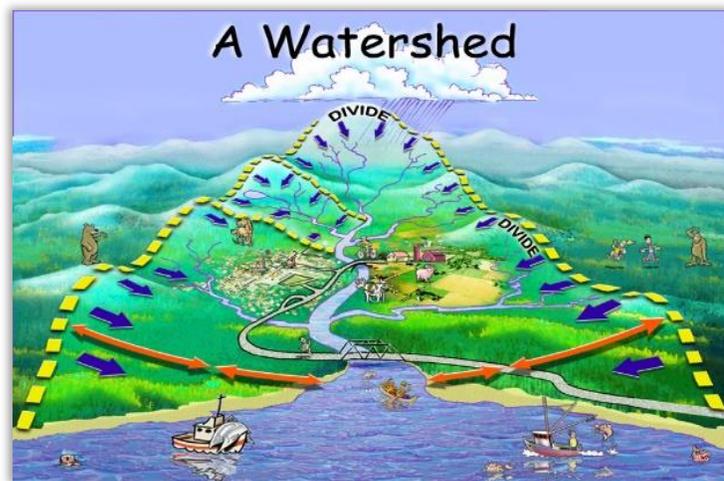
December, the Doorway to Winter: Where Does the Snow Go? Winter Watershed

The year's first major snowfall is always an exciting time and for a while afterward we are treated to a winter wonderland of sparkling piles of snow. But what happens when that snow starts to melt? Where does it go? How does snow factor into the water that you rely on and hope does not freeze in your pipes each winter? Most people would think it common knowledge that rain is an important source of drinking water, but what about snow? Even more importantly: how can we ensure that our snowmelt is safe?

All forms of precipitation that fall from the sky are a vital part of our water cycle, which is the basis of life on planet Earth! Whether it be a balmy summer rain or swirling frozen snowflakes, all water is connected in an endless cycle of melting, freezing, evaporating, and condensing, all while interacting with and supporting the plant and animal life included in the environment. Though the water cycle is fairly straight forward, the specific steps included are dependent on the local climate and season; if you would like to learn more about specifically the types of precipitation that occur during winter and in cold climates, check out [this awesome article on the Distance Learning Portal](#). No matter the climate and particular stages through which water goes, one thing is always constant: this process occurs in a **watershed**.



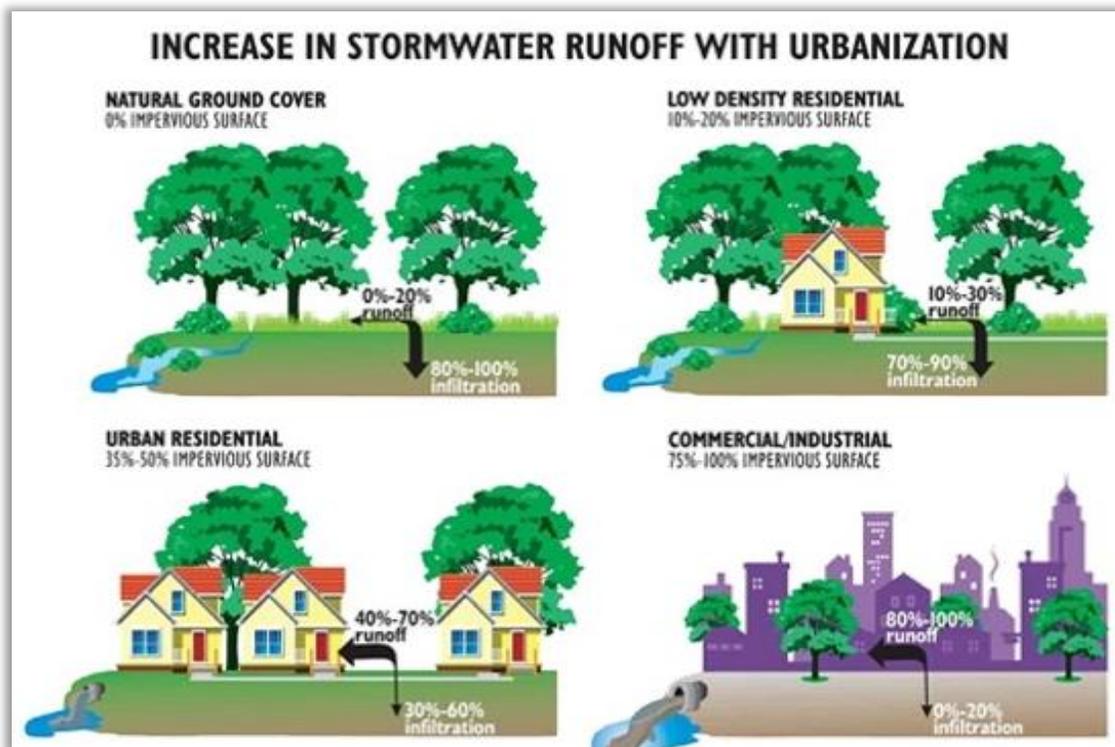
Whether you are standing atop a mountain in Japan, hiking through a deep ravine in the Grand Canyon, or sitting in a lawn chair in your backyard, you are in a watershed! Watersheds are areas of land that all contribute water to one major river, which will then contribute to the nearest ocean or sea. Water will always follow gravity downhill, no matter how shallow the decline, so any rain that falls will eventually flow and gather into a tiny stream, which will continue to flow and then meet with another tiny stream to form a small river, and so on until it all collects in one major river which will then empty into the ocean. Water does not just exist on the surface of the ground, it predominantly exists in groundwater sources below the soil, and the replenishment of this groundwater is vital to the precipitation cycle.



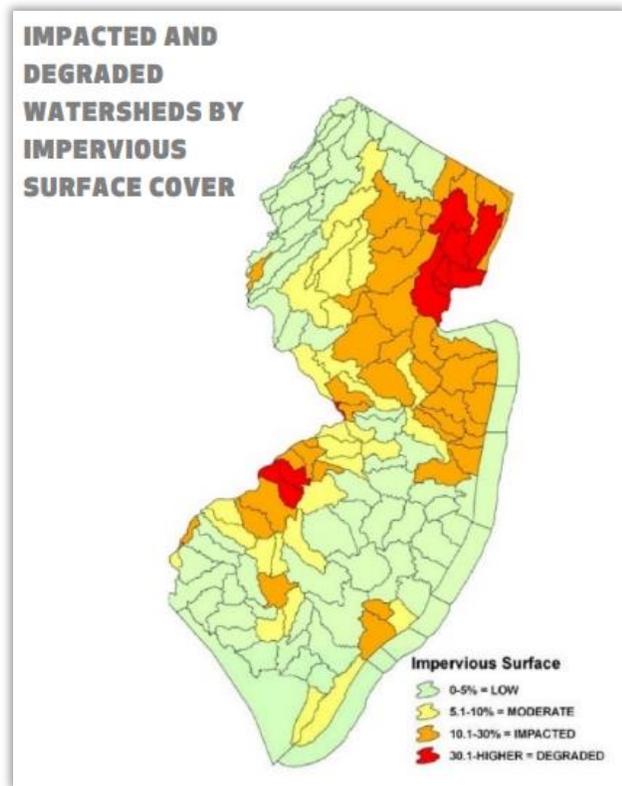
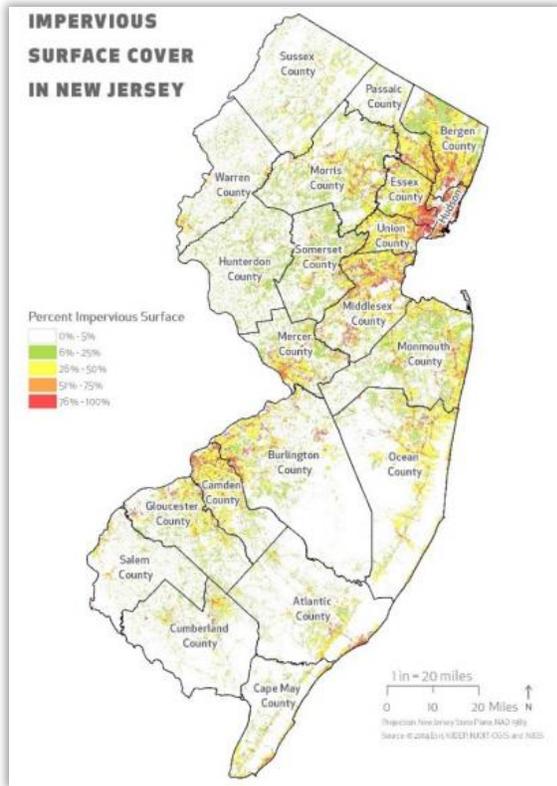
When it rains, the rain is supposed to fall onto the soil where it can be absorbed like a sponge and be filtered mechanically through all the layers of various sizes of soil particles, sand, stone, etc. This filtered water enters **aquifers** (sources of water stored below rocky layers of the earth) and the layer of water-saturated soil called the **water table**. This water inside the earth will eventually seep out into the waterways as we discussed earlier and contribute back to sustaining plant and animal life. The process is

the same when the precipitation falling from the sky is frozen but won't begin until the snow melts and soaks into the ground. What happens when humans start removing these **permeable surfaces** made of soil and instead replace them with **impervious surfaces** such as concrete, metal, and asphalt?

Duke Farms is in New Jersey, the most densely populated state in the country¹, and is located in the watershed that contributes all of its ground water to the Raritan River. The land that makes up the Raritan River Watershed is, according to the NJ Department of Environmental Protection, 10-30% covered in impervious surfaces such as sidewalks, roads, buildings, etc., and this has a severely negative impact on the health of the groundwater (and thus the drinking water!) of the region.¹ When it rains or snow begins to melt on a sidewalk, this water cannot soak through the concrete and into the soil beneath, but instead flows downhill and into a storm drain in the street, carrying with it whatever pollution it encounters! This litter, road salt, oil, dog poop, etc. flows into the storm drain and is dumped directly into whatever body of water is nearest; there is no treatment or cleaning of this **stormwater runoff** before it enters a natural waterway, where all the plants and wildlife are directly impacted by whatever pollution is in the water. Alongside the pollution, flooding becomes a major issue in urbanized watersheds because the sheer amount of storm water runoff is too much for these small waterways to handle naturally. When we interrupt the natural water cycle by reducing permeable surfaces, we endanger our own lives by contaminating our drinking water and we endanger the lives of all the plants and animals that are the structure of our global food web!



¹ Source: [2019 State of New Jersey Profile](#)



So, what can be done? The key is to interrupt the storm water before it flows into the storm drain! At Duke Farms, we demonstrate a few methods of water conservation, such as our use of [permeable pavement](#), the [collection and use of rainwater for indoor plumbing](#), and allowing rainwater to flow into natural filtration areas such as [bioswales](#) before entering the storm water system. It's also important to be careful when applying anything that can get swept away with rain or snowmelt, such as excessive amounts of rock salt during the winter! Remember, whatever you do on land impacts the water, no matter the season!

Lessons from the Enviroscope!

To learn more about watersheds and how the local ecosystem is impacted by what happens on the land, check out [this awesome video by New Jersey Watershed Ambassador Diana Maher](#) and watch as she demonstrates how a watershed functions using the Enviroscope. The Enviroscope model is a wonderful hands-on tool for learning about water conservation and how different human activities effect the health of local drinking water and habitats.





After you learn all about how a watershed works, during your next visit to Duke Farms you can use this map and the following guide to explore all the ways Duke Farms helps to protect the Raritan River Watershed with water conservation technology and restoration of our native vegetation!



1. An Eco-Friendly Place to Park

Parking lots are typically a main source of pollution of various kinds, but the Duke Farms lots are a functioning example of many ways that parking lots can become eco-friendly. You can read all about these innovative methods on the Distance learning Portal! There you will find articles about [bioswales](#), the electric car charging station, and much more!





2. Green Roof

Green roofs are a beautiful and efficient way to conserve energy and water, maintain ambient temperatures, and combat climate change. You can read all about the Green Roof at Duke Farms and others around the world in [this article](#).



3. Red Path Permeable Pavement

This path leads visitors from the Orientation Center to the main Core of the property...and it also helps filter rainwater! While permeable pavement can be made with many different materials, this red path is a mixture of gravel and recycled tires, which gives it a red hue. Though it is just as durable as regular pavement, the mixture allows water to filter through it and into the soil beneath it! Check out more about permeable pavement [in this article](#) on the Portal!

4. Constructed Wastewater Wetlands

Wetlands play a vital role in the ecosystem, and their incredible filtration abilities are being utilized for wastewater treatment at Duke Farms. Read all about it in [this article](#).





5. **Dukes Brook**

The only naturally occurring body of water on the property, Dukes Brook welcomes visitors as soon as they cross into the South Gate into the main core of the property. [In this Postcard From the Past](#), you can see a historic view of the waterfall as compared to the current, more natural state!



6. **Mermaid Pool**

A visitor favorite, this serene pool was once used for swimming, but now it is a hub of research and wildlife activity. It is host to some floating islands of vegetation that are used to naturally filter the water, and if you sit quietly you may be treated to the sight of fish, turtles, and even a resident heron or two! [Check out this Postcard From the Past](#) to see how it has changed from a place of recreation to one of restoration!





7. Riparian Restoration

Many efforts have been made to remove hardscaping such as fountains and concrete linings from the areas around the various lakes found on the property. This allows for better rainwater infiltration into the soil so that it can be naturally filtered. Riparian areas (the edges of waterways) are allowed to become full of native vegetation such as trees and shrubs in order to prevent erosion, provide habitat for native wildlife, and to help filter rainwater before it enters the streams and lakes. You can see the incredible restoration of various locations around the system of lakes in these articles on the Distance Learning Portal: [Postcards From the Past #13](#), [#14](#), and [#16](#).

Extensions Related to NJ Student Learning Standards

Teaching about watersheds is an important topic no matter the season and relates to an assortment of NJ Student Learning Standards in Science. Additionally, note how this article on the Winter Watersheds directly applies to the NJDOE Science Introduction and Vision posted on the NJDOE website.

2020 New Jersey Student Learning Standards

Science Introduction

Science Scientific and technological advances have proliferated and now permeate most aspects of life in the 21st century. It is increasingly important that all members of our society develop an understanding of scientific and engineering concepts and processes. Learning how to construct scientific explanations and how to design evidence-based solutions provides students with tools to think critically about personal and societal issues and needs. Students can then contribute meaningfully to decision-making processes, such as discussions about climate change, new approaches to health care, and innovative solutions to local and global problems.

Vision

Vision Prepare students to become scientifically literate individuals who can effectively:

- Apply scientific thinking, skills, and understanding to real-world phenomena and problems;
- Engage in systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned;
- Conduct investigations, solve problems, and engage in discussions;
- Discuss open-ended questions that focus on the strength of the evidence used to generate claims;
- Read and evaluate multiple sources, including science-related magazine and journal articles and web-based resources to gain knowledge about current and past science problems and solutions and develop well-reasoned claims; and
- Communicate ideas through journal articles, reports, posters, and media presentations that explain and argue.

For more information regarding interdisciplinary content connections please contact Kate Reilly, Manager of Education, Duke Farms. kreilly@dukefarms.org.