Catskills Active Restoration Effort (**CARE**)

Group 7:

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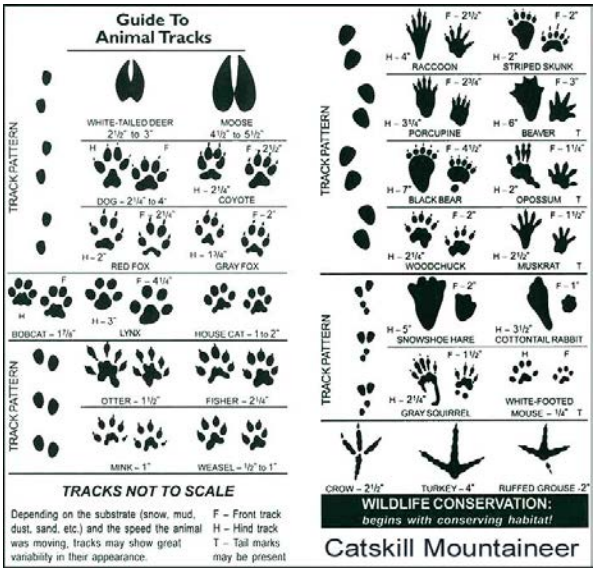
Mission Statement:

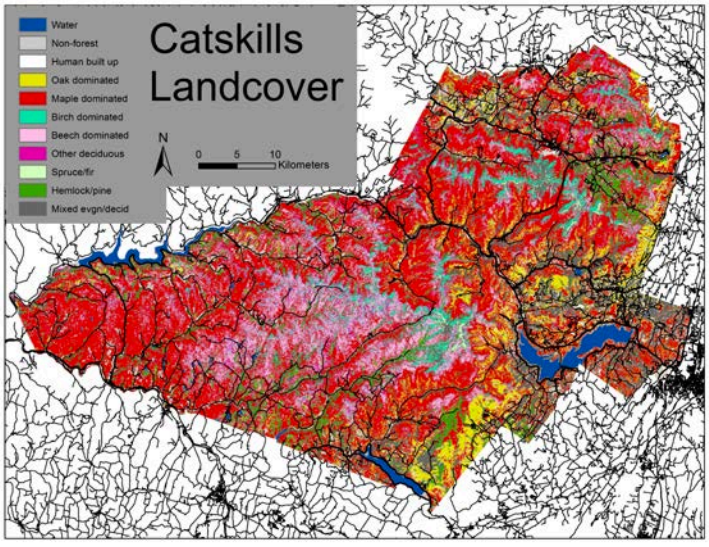
The mission of CARE is to analyze and reduce the human impacts on the Catskill watershed in order to preserve and improve the ecological health and water quality of the region. By focusing on issues such as flooding, phosphorus pollution, and sediment buildup, CARE aims to create a more sustainable and resilient watershed system. Specifically, CARE is committed to mitigating flood damages, decreasing pollutant levels—particularly phosphorus—by 40%, and reducing sedimentation by 30% by the year 2035. While these are not the only challenges facing the Catskill watershed, addressing them will significantly contribute to the long-term health of the watershed and its surrounding ecosystems, ensuring cleaner water and a more balanced environment for both wildlife and local communities.

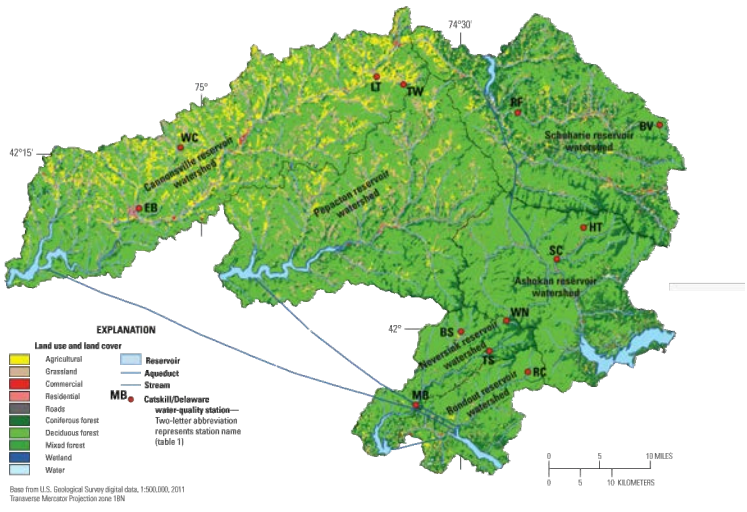
Background and History:



The Catskill watershed in southeastern New York encompasses approximately 1,597 square miles across five counties: Delaware, Greene, Schoharie, Sullivan, and Ulster. This region features the Catskill Mountains, characterized by rugged terrain and peaks exceeding 3,000 feet (6). The watershed includes six major reservoirs—Ashokan, Cannonsville, Neversink, Pepacton, Rondout, and Schoharie—that supply about 90% of New York City's daily water needs (7). The Catskill area is defined by its expansive forested areas boasting bright foliage of red maples and oaks. Aside from its beauty, the forests of the Catskills boast an abundance of wildlife, including black bears, coyotes, bobcats, porcupines, river otters, and rattlesnakes (11).

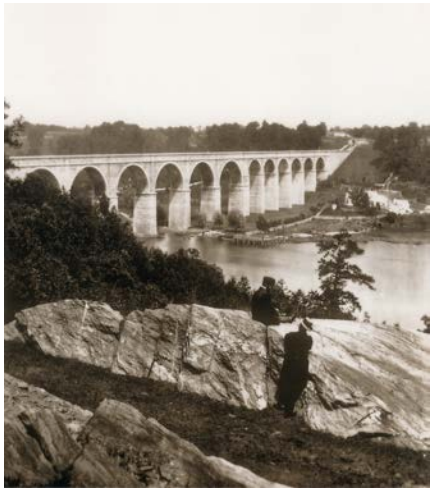
The land cover in the Catskills, as depicted in the two maps below, is a majority deciduous forest dominated by maple, beech, and oak trees. In the northwestern portion of the watershed, land is typically used for agricultural and residential purposes, while the eastern region of the watershed is mainly forested.





Prior to settlement in the Catskills and surrounding areas, the land was inhabited by multiple North American tribes (Haudenosaunee, Esopus Lenape, Munsee Lenape, Mohican) who served as stewards of the land. Following the arrival of settlers, the land became the home of Dutch settlements, leading to the creation of the Dutch-Native fur trading post (1606), which would later become modern-day New York City. By 1667, the first public well was dug, and in 1674, the Treaty of Westminster ceded the land to the British. The next century was met by the continuous British expansion westward that contributed to the decimation of native colonies and their land management practices.

Population growth in the Catskill watershed was not followed by the growth of sewage and garbage systems, and instead led to the contamination of public well systems in the early 1700s in the modern-day New York City area. In response, fresh groundwater from Brooklyn had to be transported into the city to support the rapid population growth that took place but this quickly diminished the availability of the water in Brooklyn. In the late 18th century, epidemics such as cholera broke loose as a result of water system mismanagement. In 1842, the Croton Aqueduct was constructed, which was capable of providing more than 90 million gallons of fresh water a day across the Harlem River to New York City (12).



Currently, as a result of climate change, flooding has become a growing issue in the Catskills, met with an increase in urban development and the threat of contaminants being transported through runoff. As a result, the CARE mission hopes to protect such a diverse and historical area.

Policies and Mandates:

- ➔ Public Health Act: Granted land and water rights to the city.
- ➔ Water Act: Granted permission to build aqueducts and reservoirs.
- ➔ Memorandum of agreement: set more stringent rules for organizations to follow to protect upstate New York economy and environment.
- ➔ FAD: able to avoid filtration process required by federal law as a result of New York City's clean drinking water, since meeting the requirements of the 1989 surface water treatment rule, and even meeting the requirements for the later enhanced surface water treatment rule. As a result, local agencies and governments have come together to implement watershed protection programs.
- ➔ Delaware River Basin Act: address conservation needs through a voluntary, incentive-driven, and collaborative approach. The DRB Act has since been reauthorized in 2023 to include the state of Maryland and increase federal cost share for small, rural, and disadvantaged communities to conserve biodiversity and sustain water quality throughout the whole Delaware River basin.
- ➔ NYDEC: Provides technical expertise and coordination with federal, state, and local governments. Responsible for regulating things such as residential septic systems, construction of impervious areas, and land clearing projects within proximity of wetlands, waterways, and rivers. Also (required to be guided under the Climate Leadership and Community Protection Act of 2019) (among the most ambitious environmental laws requiring NY to reduce greenhouse gas emissions by 40% by the year 2030 and 85% by the year 2050).
- ➔ Catskills Watershed Corporation: Locally-based nonprofit responsible for environmental protection, economic development, and educational programs within the watershed, helping keep a knowledgeable community.
- ➔ The Environmental Justice Siting Law (EJ Siting Law) is a nation-leading environmental justice law that requires the consideration of impacts and existing burdens in disadvantaged communities in certain environmental decision-making.

Problems Overview:

PROBLEM	DESCRIPTION	CAUSES
1. Repeated Flood Damage	Flood damage degrades water quality and causes a large quantity of pollutants and debris to enter the waterways. (2)	● Extreme precipitation in one period of time causes flash flooding and high water levels. ● Tidal flooding as a result of increased tides and tidal irregularities. (5)
2. Suspended Sediment Concentration	Sediment can transport pathogens that harm the water filtration and disinfection process (1). Increased soil erosion and runoff from agricultural and construction activities can degrade water quality and harm aquatic habitats.	● Land use changes from industries such as agriculture. ● Inorganic sediment runoff from farmland and industrial areas occurs during weather events. (3)
3. Excess Phosphorus	High phosphorus can cause algae blooms that negatively affect the odor, color, and taste of the water in the Catskills. Water with high phosphorus can lead to high plant growth and an increase in nitrogen development. (1) Nutrient pollution from agricultural runoff, septic systems, and stormwater. This can cause harmful algal blooms and disrupt ecosystems.	● Runoff from farmland (specifically dairy farms) raises the levels of phosphorus in waterways. ● Phosphorus fertilizer runoff (4)

Problem Analysis:

P1: Repeated Flood Damage

The Catskill watershed has experienced an increase in the frequency and severity of flood events. This flooding damages infrastructure, streambanks, and aquatic habitats while washing pollutants, nutrients, and debris into reservoirs and waterways. Climate change has intensified extreme precipitation events in the Northeast, and this is particularly evident in the Catskills, where storms are becoming more intense and less predictable. Additionally, increased urban development and the spread of impervious surfaces like roads and parking lots have reduced the watershed's ability to absorb rainfall, contributing to flash floods and stream overflow.

Floods not only threaten local property and infrastructure, but they also degrade water quality and increase treatment costs by mobilizing contaminants like bacteria, nutrients, and sediment. Streambank erosion, wetland loss, and the destruction of riparian buffers reduce the ecosystem's ability to regulate water flow, leading to more destructive downstream impacts.

➔ **Causes:**

- Extreme precipitation events due to climate change
- Tidal flooding and sea-level rise in coastal-connected areas
- Expansion of impervious surfaces from development
- Loss of natural flood-absorbing landscapes such as wetlands

Goal 1: Reduce Flood Impact and Improve Watershed Resilience

CARE aims to reduce the frequency and severity of flood-related damage by restoring riparian zones, preserving wetlands, and implementing green infrastructure (such as rain gardens and permeable surfaces) to absorb runoff and increase infiltration. This will reduce pollutant loading, improve water quality, and increase the resilience of the watershed to future flood events.

P2: Suspended Sediment Concentration

Suspended sediment in Catskill streams and reservoirs is increasing, primarily due to soil erosion from agricultural lands and construction activities. Sediment clouds the water, reducing light penetration and smothering aquatic habitats. It also acts as a carrier for pathogens, phosphorus, and other pollutants, which degrade water quality and complicate treatment efforts. High sediment levels also decrease reservoir storage capacity and increase dredging costs. Over time, this sediment alters stream morphology, which increases the risk of channel instability and habitat fragmentation. Natural erosion from steep slopes and glacial soils in the region exacerbates the problem when not mitigated by effective land-use practices.

➔ **Causes:**

- Soil erosion from farmland and development
- Increased stormwater runoff during heavy rains
- Disturbance of land from construction and deforestation
- Lack of riparian buffers to stabilize banks and filter runoff

Goal 2: Reduce Sediment Loads by 30% by 2035

CARE intends to reduce sedimentation through better land management practices. This includes planting riparian vegetation, improving erosion controls on farms and construction sites, and promoting conservation tillage and cover cropping. These strategies will limit runoff, stabilize soils, and protect aquatic habitats.

P3: Excess Phosphorus

Excess phosphorus in the watershed is largely attributed to agricultural runoff, particularly from dairy farms, as well as failing septic systems and fertilizer-laden stormwater. Elevated phosphorus levels cause algal blooms in streams and reservoirs, which degrade drinking water quality, produce unpleasant tastes and odors, and reduce dissolved oxygen in the water, a condition known as eutrophication.

Algal blooms threaten aquatic ecosystems by creating hypoxic zones that can lead to fish kills and loss of biodiversity. For New York City, which relies on Catskill reservoirs for unfiltered drinking water, increasing phosphorus levels jeopardize this system's ability to meet regulatory requirements under the Surface Water Treatment Rule.

➔ **Causes:**

- Runoff from manure and fertilizer in agricultural areas.
- Leaking or failing septic systems in residential zones.
- Stormwater runoff from urbanized land carries lawn fertilizers.
- Insufficient buffer zones between farms and waterways

Goal 3: Decrease Phosphorus Levels by 40% by 2035

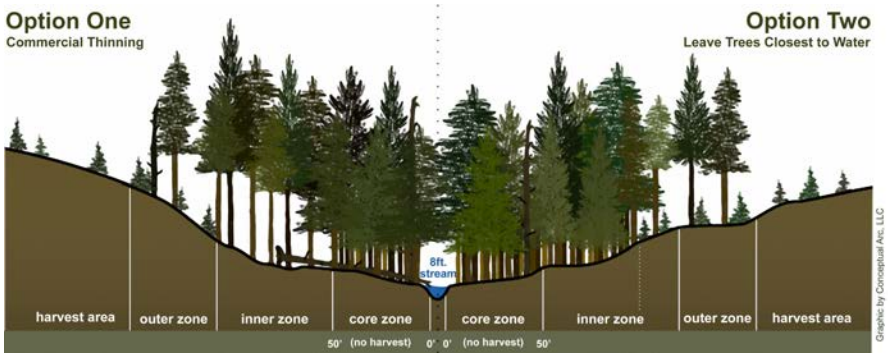
CARE aims to implement nutrient management strategies on farms (e.g., controlled fertilizer use, buffer strips), upgrade and monitor septic systems, and install green infrastructure to treat stormwater. These actions will limit phosphorus inputs and prevent harmful algal blooms, supporting both water quality and ecosystem health.

Recommendations

To address the three major issues, flood damage, sedimentation, and phosphorus pollution, CARE recommends a multi-faceted approach that balances ecological restoration, regulatory improvements, and community engagement. These strategies aim to improve water quality, protect ecosystem services, and ensure long-term watershed sustainability.

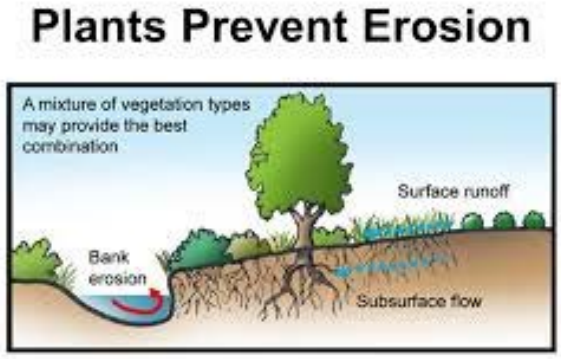
➔ **Flood Mitigation through Green Infrastructure and Land Protection**

- ◆ Expand riparian buffer zones by planting native trees, shrubs, and grasses along streams to absorb floodwaters and stabilize banks.
- ◆ Construct green infrastructure in urbanized areas, such as rain gardens and permeable pavements to reduce stormwater runoff.
- ◆ Promote wetland restoration and conservation, especially in areas prone to flooding, to increase natural water retention capacity.
- ◆ Collaborate with local governments to enforce zoning regulations that restrict development in floodplains.



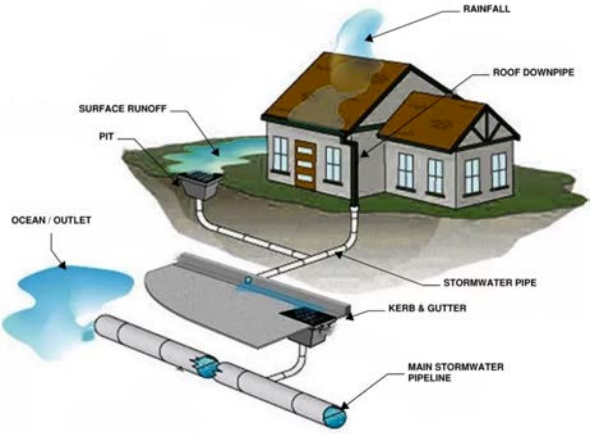
➔ **Sediment Control through Land Management and Erosion Prevention**

- ◆ Encourage conservation tillage, cover cropping, and contour farming to reduce soil loss on agricultural lands.
- ◆ Implement sediment and erosion control measures at construction sites, including silt fencing, check dams, and proper grading.
- ◆ Fund the installation of vegetated buffer strips between farms and waterways to trap sediment before it reaches streams.
- ◆ Launch educational campaigns for landowners about the impacts of erosion and how to reduce it through best management practices (BMPs).



➔ **Phosphorus Reduction through Targeted Agricultural and Wastewater Management**

- Partner with local farms to implement nutrient management plans, optimize fertilizer application, and install manure storage systems.
- Upgrade and monitor residential septic systems, especially in older or failing developments near waterways.
- Expand stormwater management programs to capture and treat nutrient-rich runoff from urban areas.
- Incentivize the use of phosphorus-free fertilizers for homeowners and landscapers through local ordinances and rebates.



➔ **Monitoring, Collaboration, and Policy Support**

- Increase funding for water quality monitoring stations to track phosphorus, turbidity, and bacteria levels in real time.
- Support interagency collaboration among groups like the Catskill Watershed Corporation, NYDEC, and local municipalities.
- Advocate for policy reforms and funding at the state and federal levels to support watershed restoration goals, particularly under the Climate Leadership and Community Protection Act and the Delaware River Basin Act.

Conclusion

The Catskill watershed is essential for clean drinking water and ecological health, but it's facing growing threats from flooding, sedimentation, and phosphorus pollution. These problems, made worse by climate change and land use, are already impacting water quality and habitat stability.

CARE provides a focused, realistic approach to reduce these threats through better land management, green infrastructure, and community collaboration. By meeting our goals, we can protect the watershed and ensure its long-term sustainability for both people and nature.

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