

Climate change impacts present a range of challenges to New Jersey's watersheds. More frequent droughts can reduce groundwater recharge, lower levels in lakes and reservoirs, and reduce stream flow, resulting in a less predictable water supply. Increases in salinity due to flooding events or a more gradual intrusion of saltwater resulting from sea level rise may result in a degradation of water quality. More intense precipitation events will lead to more stormwater runoff and degraded water quality due to erosion and contaminants from overland flows. Storm and flooding events increase the risk of contamination of water resources due to infrastructure failure. Warming temperatures result in warmer water temperatures, loss of cold water habitat, and an increase in algal blooms. These impacts will exacerbate existing challenges to New Jersey's watersheds such as increasing water demand, land development, and habitat fragmentation.

Much of the current watershed work in New Jersey provides direct climate change resiliency benefits. Incorporating consideration of future climate projections, including changes in flooding, temperature and precipitation will strengthen ongoing efforts of watershed managers to prepare for a changing climate. Information on climate change impacts, as well as trends and projections for New Jersey, can be found via the New Jersey Climate Adaptation Alliance at: <http://climatechange.rutgers.edu/njadapt>.

What can watershed groups do to prepare for and adapt to climate change in New Jersey?

- 1. Disconnect impervious cover.** Excessive impervious coverage exacerbates flooding and impacts on water quality as result of increased stormwater drainage to local waterways. The primary cause of flooding and water quality issues is linked to excessive impervious surfaces that drain directly to local waterways. Once impervious surfaces have been identified, there are three steps to better manage these surfaces:
 - *Eliminate surfaces that are not necessary.*
 - *Reduce or convert impervious surfaces.*
 - *Disconnect impervious surfaces from flowing directly to local waterways.*Green infrastructure can be used to disconnect impervious surfaces. www.water.rutgers.edu
- 2. Preserve and restore wetlands and marshes.** Wetlands and marshes are effective barriers against flashfloods and sea level rise. These systems filter pollutants, slow flood flow, help to prevent erosion, and support biodiversity. Preserving and restoring wetlands and marshes next to streams and lakes are vital for strengthening watershed resilience. Comprehensive land preservation and restoration programs that are designed to protect and enhance critical watershed lands (including wetlands and marshes), are also critically important to enhancing the resilience of watershed systems.

- 3. Design green infrastructure tools such as rain gardens to capture and treat a higher capacity.** The Rutgers Cooperative Extension Program has compiled a set of fact sheets on green infrastructure which can be found at: http://www.water.rutgers.edu/Fact_Sheets/Default.htm. Stormwater management tools such as rain gardens, tree trenches, stormwater planters, pervious pavement and rain barrels capture and treat stormwater and allow it to infiltrate gradually into the ground. With more heavy-precipitation events and higher rainfall anticipated, it is critical to design green infrastructure projects with climate change projections in mind. Simple solutions such as increasing the depth of rain gardens can not only help treat localized flooding, but also increase a rain garden's capacity for higher rainfall intensities in a changing climate. <http://www.nj.gov/dep/gi/>
- 4. Restore streams and their floodplains.** Daylighting streams previously buried in pipes or culverts and restoring channelized streams to their natural flow patterns allows streams to access their natural floodplains, reducing downstream flooding. Stream restoration reduces runoff velocities, which in turn helps to reduce erosion.
<http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1043243>
- 5. Reestablish aquatic habitat connectivity by removing migration barriers.** Converting stream crossings from pipe culverts to bottomless arch culverts or bridges helps to reconnect fragmented aquatic habitats and increases the ability of fish populations to recover after storm events. Replacing narrow culverts with wider openings for water to flow through also increases carrying capacity during storm events, reducing upstream flooding.
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5166291.pdf
<http://thewatershed.org/science/current-projects/dam-removals/>
- 6. Maintain riparian buffers along waterways.** Riparian vegetation typically consists of a forested buffer strip along waterways that helps protect a stream from the impact of adjacent land uses. Riparian vegetation intercepts sediment, nutrients, pesticides, and other pollutants in surface runoff before it reaches the water body and reduces erosion by providing stream bank stabilization. Riparian vegetation serves as a habitat and wildlife corridor while providing shade, keeping the water cooler, and increasing biodiversity and habitat quality.
http://water.epa.gov/scitech/climatechange/upload/epa_2012_climate_water_strategy_full_report_final.pdf
- 7. Set up a monitoring program to measure the physical, biological, and chemical health of your watershed.** Identify key indicators and their critical levels pertaining to your watershed. Indicators may include water levels, fish stocks, wetland coverage, stream temperatures, nutrient loads, bacteria, or stream flow. Maintaining good data on existing conditions and trends allows watershed managers to be more sensitive to the impacts of climate change and to adapt management practices accordingly to protect vulnerable areas and species. It is critical to manage watersheds for change, given the uncertainties inherent in any future climate projections. Watershed professionals must periodically reevaluate not just their management practices but also their indicator targets in light of a changing climate.
<http://www.theresourceinnovationgroup.org/storage/watershed-guide/Watershed%20Guidebook%20final%20LR.pdf>

- 8. Partner with municipal governments to revise land use ordinances.** Work with local town councils and planning boards to assess land use, zoning, and other ordinances and to revise municipal regulations to encourage practices that enhance watershed protection, such as open space preservation and clustered development as well as practices that meet and exceed existing regulations promoting natural recharge and reductions in volume runoff. Ensure new development is, at minimum, complying with existing stormwater regulations. Encourage developers and municipalities to exceed existing stormwater regulations by incorporating consideration of future climate scenarios in their designs. Provide technical assistance and educate stakeholders about the connection between low impact development techniques and the enhanced resilience of local watersheds in the face of increased flooding, more intense precipitation, droughts, and water quality degradation. <http://www.anjec.org>
<http://njaes.rutgers.edu/pubs/fs1197/intro-to-green-infrastructure.asp>
http://www.njstormwater.org/bmp_manual2.htm
- 9. Educate the public on demand management and water supply protection strategies.** Conduct outreach to teach the public about strategies that can reduce personal water usage and protect groundwater quality, such as using high efficiency fixtures, using native plants for lawns that require minimal irrigation, pesticides, and fertilizers, redirecting downspouts to permeable surfaces, and having their septic system inspected every 2-3 years. Hold community workshops, prepare checklists of best practices for residents, and partner with local school systems. <http://www.njwatersavers.rutgers.edu/>
- 10. Plant tolerant native species and manage the spread of invasive species.** Native species are more adapted to our climate. Select plant species that can stand to be inundated for a few days in case of flooding and that can withstand warmer climates and more variable precipitation. Climate change continues to alter the “natural” borders of certain species as plants and animals requiring a cooler environment are shifting northward, while species previously more prevalent further south expand their range to New Jersey. With temperature and climate shifts, invasive species are becoming more abundant. Management programs that adapt to these changing realities can help to reduce the impact of invasive species on local native vegetation and establish native plants that are flexible enough to adapt to a changing climate. <http://www.npsnj.org/>

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