Climate change and Garden State agriculture

By **Marjorie B. Kaplan, Dr.P.H.**, Co-Director, New Jersey Climate Change Resource Center and Senior Associate Director, Rutgers Climate and Energy Institute, Rutgers;
Mark Robson, Ph.D., Dean of the School of Graduate Studies and Distinguished Professor, Rutgers; and
James Shope, Ph.D., Assistant Extension Specialist, Department of Environmental Sciences and New Jersey Agricultural Experiment Station, Rutgers

Climate change due to greenhouse gas emissions from fossil fuel combustion and land use change is happening now and impacting New Jersey. Since the early 1900's, long-term changes in NJ's climate include approximately:

- 4°F increase in annual average temperature;
- a 7 percent increase in total annual rainfall; and
- 18.2 inches of sea level rise along the coast.

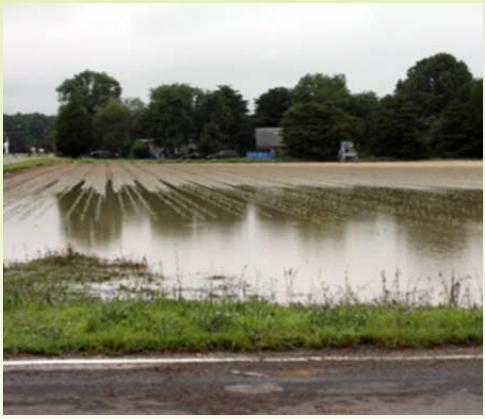
Precipitation is coming in more intense rainfall events and, despite increasing rainfall, higher temperatures increase water demand and evaporation, which can result in drier soil conditions. These trends are projected to increase over the next century, with the amount dependent on greenhouse gas emission levels.

What does this mean for Garden State agriculture? New Jersey's average seasonal temperatures have been warming at higher rates in all seasons, but the rate of warming has been highest in the winter. Blueberry and cranberry plants have chilling requirements during late fall to early spring and, while these crops can still meet these requirements now, scientists at Rutgers are actively monitoring these seasonal changes. Summer precipitation is not projected to change substantially; however, with higher temperatures and evaporation rates, the duration of future summer dry spells is expected to increase.

Challenges to agriculture

Farmers have always adapted to challenges that changes in the weather bring; however, longer-term climate shifts that are now in play exacerbate these challenges with impacts to soil, crops, livestock, farm workers and market access.

Heavy precipitation can result in topsoil erosion, nutrient loss, delayed preparation and planting, and increased soil compaction. New Jersey farmers are experiencing more intense rainfall leading to flooding in their fields and on farm access roads for extended periods and in new locations. This flooding results in crops rotting, plants being knocked over, and creating conditions conducive to disease from soil pathogens that thrive in wetter conditions. More intense storms bring winds that damage infrastructure like high tunnels. Flooding and storms affect electricity and road infrastructure that impede farm egress and ingress and impact storage and transport of perishable products. Power outages can



August flooding in fall vegetable field in Vineland Photo by Richard VanVranken

shut down on-farm cooling and washwater for produce, delaying the transporting of goods to market.

Rising sea level raises the baseline for coastal flooding. Storms along tidal waterways erode adjacent agricultural land and contaminate soil, crops, farm ponds and wells with saltwater overwash and tidal flooding.

Warmer temperatures are leading to increased pest and disease pressure in our region with northward expansion of weeds and pests and an earlier bloom time for some crops. For example, peaches have been several weeks ahead of schedule during warmer springs, coincident with diseases such as peach rusty spot and peach blossom blight showing up earlier and persisting longer. When warm winters push berries and fruit trees to bloom too early, they are also at greater risk from frost damage. Warmer winters also allow established pests to survive and thrive earlier in the season.

Periods of high heat in the summer result in reduced crop yields, diminished crop quality, and the risk of heat stress for farm crews. Higher temperatures stress livestock and reduce milk, egg and meat production.

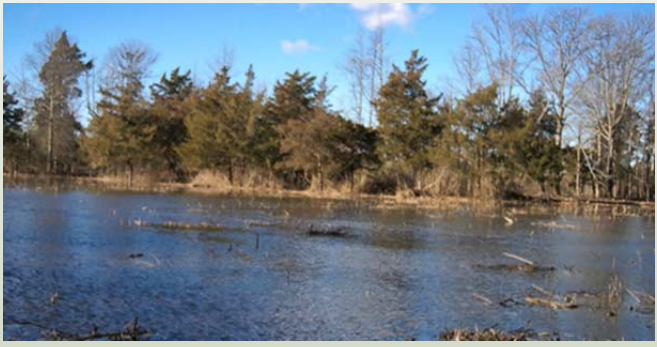
There will be winners and losers: later onsets of first frosts in the fall and an earlier start to the growing season may extend the growing season for warmer season crops while cooler season crops may have a shorter season.

Adapting to climate change

Farmers in our region are adapting to the changing climate in many ways, including approaches that also reduce their carbon footprint, such as:

- improving soil health through cover crops, crop rotation and low till agriculture, practices that increase soil organic matter, improve water infiltration and moisture retention and sequester carbon;
- diversifying crops to manage risk;
- installing renewable energy on site;
- using high tunnels and greenhouses to address weather variability;
- monitoring soil moisture and employing micro-irrigation; and
- adding drainage systems.

Other adaptation strategies include installing hedgerows and planting native pollinator meadows to increase biodiversity, protect against storms and increase soil carbon. Growers are integrating trees into their farm practices,



Former cornfield along the Cohansey River in Fairfield flooded from a 2024 winter storm. The field has been rendered unusable over the past two decades due to increasing soil salinity and tidal storm flooding. Photo by John Zander

Cover crops planted into small grains
Photo by USDA, NJ Natural Resources Conservation Service

providing additional income sources, shade, carbon sequestration, runoff and wind speed reduction and biodiversity. Farmers are supporting farm workers' health by adjusting schedules, utilizing mobile shading structures and increasing hydration for employees.

Farmers in tidal areas are raising dikes to protect crops from tidal over wash and erosion and exploring alternatives like farming tidal grasses for use in tidal wetland restoration and enhancement.

Researching solutions

What agricultural research is underway in the Garden State? Rutgers plant breeders are currently developing new varieties of crops to be more resilient to higher temperatures, drought and disease, such as basil, oregano, blueberries, hazelnuts and others. University scientists have confirmed that the invasive blueberry

Plant hardiness zone map has shifted

In November, the US Department of Agriculture (USDA) released a new version of its Plant Hardiness Zone Map (PHZM), updating this valuable tool for gardeners and researchers for the first time since 2012. The updated map, which is more accurate and contains greater detail than prior versions, guides gardeners and growers regarding which plants are most likely to thrive at a particular location.

When compared to the 2012 map, the 2023 version reveals that about half of the country has shifted to the next warmer half zone, meaning those areas warmed somewhere in the range of 0 to 5 degrees Fahrenheit. The other half of the country remained in the same half zone, although they may have experienced some warming in the range of 0 to 5 degrees.

The 80 million Americans who are frequent users of the PHZM are not the only ones requiring this information. The USDA Risk Management Agency also refers to hardiness zone designations to set certain crop insurance standards. Scientists also incorporate the plant hardiness zones as a data layer in many research models, such as those modeling the spread of exotic weeds and insects.

The new map is available online at *https://planthardiness.ars.usda.gov/.*

Spotted-wing drosophila, an invasive blueberry pest, has been active earlier in the year as winters have warmed.
Photo by Elvira de Lange

pest, the spotted-wind drosophila, has been active earlier in the year. Anticipating increases in overwintering adults and spring populations, faculty are modeling how such drosophila activity is projected to change in the future to inform integrated pest management strategies.

At Duke Farms, Rutgers faculty are evaluating carbon sequestration of all land use types, including agricultural land, to ascertain the onsite potential for mitigating climate change.

The Rutgers Agrivoltaics Program has combined agriculture and solar arrays at three research farms to evaluate how these systems can increase farmer income while reducing operational risks to family farms. Depending on their design, agrivoltaic systems can keep crops cooler and use less water during the summer heat.

Additional resources regarding Climate Change and agriculture in the Garden State can be found through the NJ Agricultural Experiment Station (*https://njaes.rutgers.edu/*) and the NJ Climate Change Resource Center (*https://njclimate resourcecenter.rutgers.edu/*).

Rutgers Agrivoltaics Program has combined agriculture and solar arrays at three research farms to evaluate how these systems can increase farmer income while reducing operational risks to family farms. **Photo by Advanced Solar Products**