Advancing Leadership on Climate Change Through the New Jersey Agricultural Experiment Station (NJAES)

New Jersey's Agricultural Vulnerability to Sea-Level Rise

Marjorie B. Kaplan, Associate Director
Rutgers Climate Institute

Issues

- Agriculture is NJ's third largest industry; cash receipts of $1billion annually.
- New Jersey and Northeast experiencing climate change (e.g., increasing temperatures; intense precipitation; sea-level rise).

Issues

- NJAES carries forth Rutgers land grant mission to **support research, education, and extension** to serve NJ citizens and communities. Traditionally grounded in improving practices and technologies in agriculture, its mission expanded to meet changing landscape of NJ.

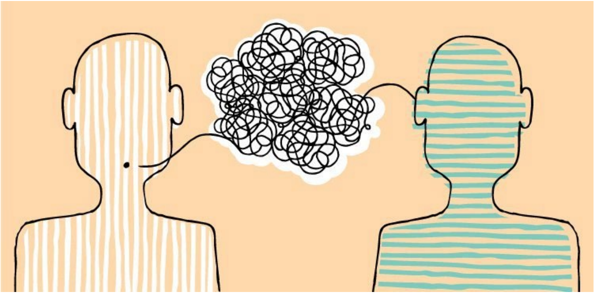
- Studies of NE farmers find concern about climate impacts, but concerns about other business pressures drive decisions; e.g., labor availability, regulation,market concerns (Lane et al. 2018). Independently, NJ extension personnel affirm.

- Land grants trusted information source on complex issues; yet extension personnel in NE found **barriers to addressing climate change include funding, time**, **locally relevant information and challenges with target audiences** (Tobin et al. 2017).

How might NJAES strategically address climate impacts to agriculture in New Jersey?

Narrowed focus on sea-level rise as a pilot to explore addressing other impacts.

- Survey data for NJ identified concern (Kaplan et al. 2014)
- NJAES Agent expressed salt water intrusion concern (estimated perhaps 1,000 acres at risk in one county).



- Constituent (farmer) concern about potential for contaminated wells and erosion from sea-level rise.
- Sea-level rise may be something experienced by some farmers today as related to climate change; i.e., it may not be perceived as just "weather."

Methods

- Literature Review
- Expert Consultations
  - Rutgers NJAES
  - US Department of Agriculture
  - NJ Department of Agriculture
  - U.S. Geological Survey
  - New Jersey Geological Survey
  - Maryland Department of Planning
  - U Maryland Center for Environmental Science
  - Harry R. Hughes Center for Agro-Ecology, U of MD
- Preliminary Analysis of Ag Land Vulnerable to Sea-Level Rise

Mechanisms of Impact

- Sea-level rise, which also raises the baseline for coastal flooding from storms, has the potential to:

  - Erode adjacent agricultural land along tidal waterways and compromise integrity of near-shore freshwater wells.

  - Contaminate soil, farm ponds, crops, and groundwater from saltwater overwash and tidal flooding.

  - Result in excessive salt that can pull water out of plant roots, result in root & plant death; chloride in saltwater taken up by plants results in edge & tip burn; increase soil pH interferes with plant nutrient uptake. Leaves & branches covered by salt water at risk of dying; salt spray can deposit salt on above-ground portions of plants.

  - Elevate the water table in low-lying coastal areas, potentially reducing freshwater recharge and/or resulting in standing water causing localized flooding.

  - Over time create new wetlands, expand others, change surface drainage and inundate land.

Mechanisms of Impact (continued)

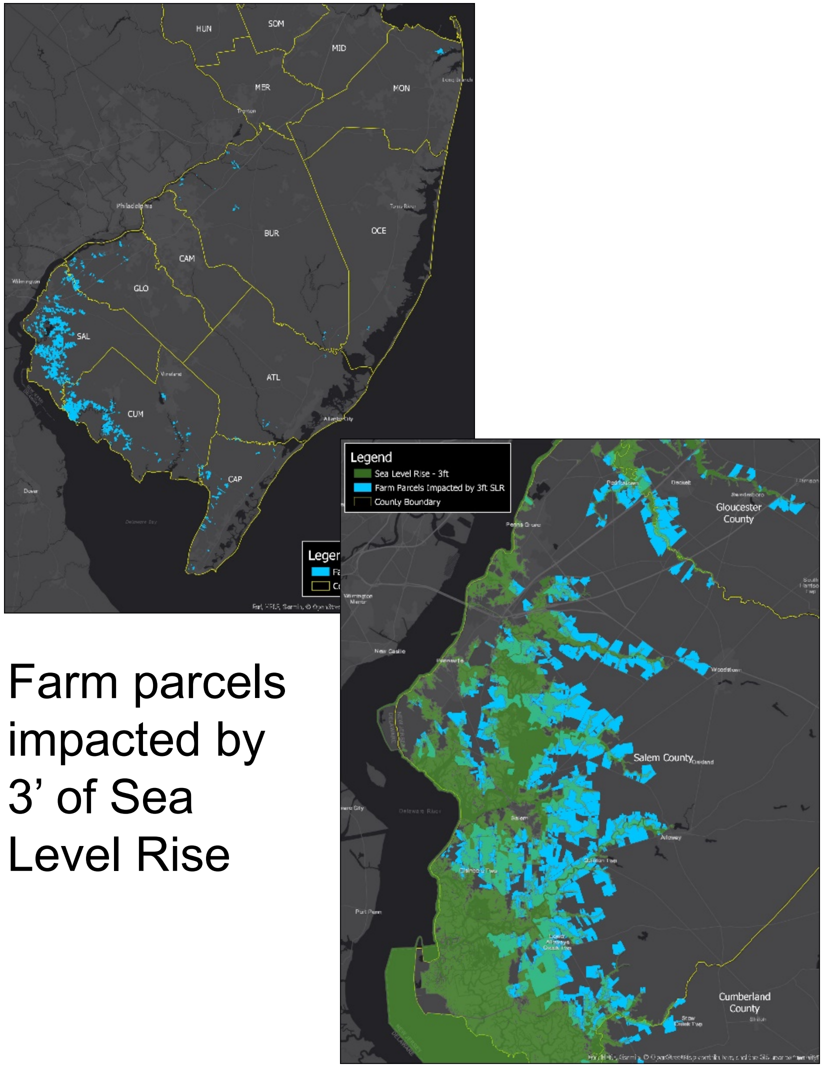
- Move the shoreline landward thus similarly moving the freshwater/saltwater interface landward potentially increasing salinity in wells just inland of this transition zone.

- *Climate-related or other conditions* could complicate *potential* for saltwater intrusion (examples):

  - Along tidal estuaries with freshwater flow normally sufficient to keep saltwater downstream (e.g., Delaware, Salem, Maurice Rivers), SLR will cause saline water to come much further upstream. Groundwater pumping in wells close to tidal streams could pull salty water from the estuary into the well.

  - Cape May: Increased demand (including population growth) led to increased gw pumping led to saltwater contaminated wells since 1940s. Although SLR does not drive this mechanism, other climate impacts such as higher heat may increase agricultural water demands.

Potential Areas of Impact



Farm parcels impacted by 3' of Sea Level Rise

NJ SLR Projections (Kopp et al. 2016)

2030: 0.8 feet (67% range: 0.6-1.0 feet)

2050: 1.4 feet (67% range: 1.0-1.8 feet)

2100 low emissions: 2.3 feet
(67% range: 1.7-3.1 feet)

2100 high emissions: 3.4 feet
(67% range: 2.4 – 4.5 feet)

Agricultural Land Acres Inundated*

1 ft 16,725 acres
3 ft 23,364 acres

Agricultural Parcels Acres at Risk *

1 ft 45,197 acres ($17.8 million)
3 ft 52, 386 acres ($21 million)

*Does not include non-qualified farmland on properties; if so, assessed value doubles (2017 property tax parcel data)

Challenges

- Accurately asessing spatial extent of current and projected impacts of sea-level rise and coastal storms to NJ agriculture including soils, crops, water supply, and infrastructure for agricultural markets.

- Understanding causal pathways for individual properties.

- Assessing potential for increased availability of phosphorous from cultivated land into adjacent waters and wetlands.

- Freshwater storage and supply needs to meet demand.

- Transitioning: new use/new markets/alternative crops/ecosystem service valuation

- Economic Loss/Property valuation.

- Policy issues? How many of these may be preserved farmland?

- Communicate clearly and build trust with internal and external constituencies.

Opportunities

- Address Challenges building on Rutgers strengths (examples):
  - Plant breeding; Aquaculture
  - Remote sensing; Climate science
  - Extension network; Ag economics
  - Ecological restoration; Civil engineering

- Address all climate impacts holistically related to agricultural vulnerability.

- Assess & articulate short term options for producers (examples):
  - crop substitutions
  - farm management practices (move upland; raise structures/septic)
  - conservation management practices (native salt-tolerant buffers)

- Evaluate feasibility and pursue research for long-term solutions (examples):
  - halophyte research and development
  - ecosystem/habitat restoration
  - conservation easements
  - seaweed farming

Opportunities (continued)

- Take Advantage of State Initiatives (examples)
  - Ag Water Use Subcommittee of Water Supply Advisory Council, has RU rep and has identified need for groundtruthing agricultural water use
  - NJ State Board of Agriculture 2019 Resolution #13 on Climate Change and Agriculture

- Partner in the region (examples)
  - USDA SW intrusion strategic planning
  - Regional Mapping
  - Research project on dredge reuse on prior sod farm in S. Jersey to elevate beds, improve soil conditions and grow plants for coastal restoration.

Leadership Lessons

- Be Adaptable
- Build a constituency internally and externally
- Have patience
- Incrementalism is ok
- Top down and bottom up approaches are complementary, not mutually exclusive

Acknowledgements

Nominator: Robin Leichenko, Co-Director Rutgers Climate Institute

Project Mentor: Brian Schilling, Sr. Associate Director, New Jersey Agricultural Experiment Station

Tony Broccoli, Co-Director Rutgers Climate Institute

Brad Hillman, Senior Associate Director, New Jersey Agricultural Experiment Station

Lucas Marxen, Associate Director, Office of Research Analytics

Erin Lane and Chris Miller, USDA NE Climate Hub

Colleagues who provided helpful consultations: Rutgers NJAES, US Department of Agriculture, US Geological Survey, NJ Geological Survey, U of Maryland, Maryland Dept of Planning.