

CLIMATE CHANGE: VULNERABILITIES, OPPORTUNITIES, AND ADAPTATION STRATEGIES FOR NEW YORK FARMERS

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Overview:

While climate change will add to the physical and economic challenges of farming in New York, there are feasible adaptation strategies for coping with many of these challenges, and there will likely be **new opportunities as well as vulnerabilities**, such as developing **new markets for new crop options** that will come with longer growing seasons and warmer temperatures.

Warmer summers will be accompanied by an **increase in the frequency of days that exceed high temperature thresholds negatively affecting crops and livestock**. Dairy milk production declines can be mitigated to some extent by improving cooling capacity of livestock facilities and increasing the summer use of fans and sprinklers. Certainly, new barns should be designed based on the increased heat loads anticipated in the coming decades.

Increased weed and pest pressure associated with longer growing seasons and warmer winters will be an increasingly important challenge. While we can look to more southern regions for control strategies for weeds and pests moving northward, these may involve substantial increases in chemical loads to the environment. To minimize future increases in chemical use, pro-active development of non-chemical control strategies, improved regional monitoring, and rapid-response plans for targeted control of new weeds or pests before they become widespread will be necessary.

Water management will be a more serious challenge for New York farmers in the future, with projections of a continuation of the current trend for increased frequency of heavy rainfall events, as well as projections for more frequent and serious summer water deficits by mid- to late century. While we may remain relatively “water rich” compared to some other crop production regions in the U.S., supplemental irrigation for high value crops and good drainage capacity will become essential.

A challenge for farmers will be **uncertainties regarding the optimum timing of adaptation** investment, and the optimum magnitude of adaptation investment relative to the risks. Research and development of **new decision tools** that will allow exploration of various adaptation strategies (e.g., the timing of investment in new irrigation equipment) in relation to various climate change scenarios and associated risks will be important in maintaining an economically viable industry. Also, **inequities in availability of capital or information for strategic adaptation** may become an issue to resolve at the policy level.

Specific vulnerabilities and opportunities include:

- Opportunity to explore new crops, new varieties, and new markets with warmer temperatures and a longer growing season
- Milk production decline due to summer heat stress on dairy cows
- Yield or quality losses associated with summer heat stress for some crops currently dominating the New York agriculture economy (e.g., apples, potatoes, cabbage)
- Increased pressure from marginally overwintering insect pests, and northward range expansion of insect, pathogen, and weed pests
- Yield or quality losses of grapes, apples, or other woody perennials associated with variable winter temperatures and spring frost or midwinter freeze damage
- Delayed spring planting and/or crop flood damage from heavy rainfall events
- Reduced yield or quality due to late summer drought stress

Specific adaptation strategies include:

- Change varieties or crops grown; increase farm diversification
- Improve cooling capacity and use of fans and sprinklers in dairy barns
- Increase use of chemical and non-chemical techniques for controlling pests, pathogens, and weeds
- Invest in irrigation and/or drainage systems
- Develop new decision tools to allow exploration of the costs, risks, benefits, and strategic timing of various adaptation strategies in relation to various climate change scenarios and potential impacts on crops and livestock
- Develop new crop varieties for projected New York climate and market opportunities

Win-win opportunities for reducing greenhouse gas emission or sequestering soil carbon

Climate change may provide an incentive for farmers and consumers to take advantage of some win-win opportunities that benefit both the farmer and the environment. Some of these may eventually be applicable to carbon-offset payments in emerging carbon-trading markets. New York State farmers could:

- *Conserve energy and reduce greenhouse gas emissions* (increase profit margin and minimize contribution to climate change)
- *Increase soil organic matter* (this not only improves soil health and productivity, but because organic matter is mostly carbon derived from carbon dioxide in the atmosphere via plant photosynthesis, it reduces the amount of this greenhouse gas in the atmosphere)
- *Improve nitrogen use efficiency* (synthetic nitrogen fertilizers are energy intensive to produce, transport and apply, and soil emissions of nitrous oxide (a potent greenhouse gas) increase with nitrogen fertilizer use)
- *Enter the expanding market for renewable energy using marginal land* (e.g., wind energy, solar, biomass fuels, energy through anaerobic digestion of livestock manures and food processing wastes)
- *Improve manure management* (reduces nitrous oxide, methane and carbon dioxide emissions; also can be used as renewable energy in manure digesters)