Climate Smart Agriculture Work Group Interim Report
March 2018

Mission: *Explore the potential impacts of changing climatic conditions on Ohio agriculture, and develop recommendations for both mitigation and adaptation to these changes, including ways to: maintain sustainable production of food, feed, fiber and energy, while also ensuring the integrity of natural resources; improve the resilience of production systems and particularly their capacity to adapt to unanticipated and unpredictable change in the environment; mitigate present and future risks by building natural, human and social capital in Ohio agriculture.*

Preliminary Findings:

a) Extreme and unpredictable weather and changing climatic conditions are happening, and they present challenges and opportunities in meeting the Ohio Smart Agriculture goals;
b) OSA's vision cannot be realized without innovation and adaptation;
c) Ohio as a whole, as well as most producers individually, do not have an adaptive management strategy or plan to improve resilience and address future conditions that science based research is telling us to expect, which will be a threat multiplier to the economic viability of Ohio agriculture and forestry;
d) Ohio farms and forests have the capacity to deliver high-value mitigation services;
e) There is a readiness to take on this issue on (while farmers do not hold uniform views of what is causing the climate to change, farmers generally accept that the climate is in fact changing); and
f) The best way to engage the ag sector on this subject is through economic viability.

Initial Recommendations:

a) Conduct a climate opportunity and vulnerability assessment;
b) Create a "futuring document" for Ohio that:
    i. Identifies vulnerabilities and opportunities that increasingly erratic weather extremes and a changing climate present; and
    ii. Recommends an array of solutions to enable Ohio agriculture become climate smart (sustainably increase production, adapt/improve resiliency and mitigate impacts);
c) Design a process for:
    i. Engaging wider communities of interest in climate smart agriculture conversations;
    ii. Developing a climate smart action plan for Ohio agriculture.

Potential Solution Pathways Include:

a) Research
    i. Support governmental, academic, and private research designed to create more accurate climate forecasting and scenarios at the spatial and time scales need to inform producer decisions;
    ii. Engage in public and private research to determine the impact of anticipated changes on crops and animals;
    iii. Examine the economic, political, and social barriers to adaptation facing producers;
    iv. Expand private research into new bioengineered species more resilient to anticipated changes while preserving heritage varieties;
    v. Develop new crop management tools, such as pesticides and herbicides, for anticipated changes;

vi. Conduct research on water management, in particular irrigation methods, technology and/or feasibility;
vii. Explore drought resistant cultivars and adaptive cover cropping systems that can improve soil and nutrient management for production and practice systems across all production platforms (i.e. specialty crops, commodity crops, etc.);
viii. Design and manufacture new equipment and facilities to meet the changing needs of producers.

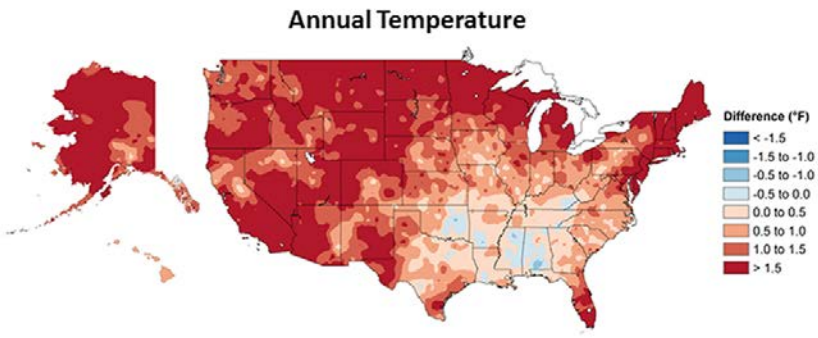
b) Changes to Production and Conservation Systems/Practices
   i. Implement conservation practices designed to maintain the productive capacity of land;
   ii. Adopt new production practices designed to address climate-related challenges;
   iii. Develop new private and public sector programs and markets for creating additional value for ecosystem services;
   iv. Create new and upgrade existing infrastructure to meet climate challenges.

c) Risk Management Tools
   i. Maintain a robust federal crop insurance program;
   ii. Ensure that there are adequate disaster relief programs available to producers for natural disasters;
   iii. Consider a "Risk Management Collaborative" for the agricultural and forestry industries to collect and share information on policies and programs, and that will help steer adjustments in programs to reflect changing conditions;
   iv. Explore how new markets can serve as a risk management option for creating product demand and increasing revenues;
   v. Provide multiple avenues for funding adaptation measures.

d) Planning and Decision Support Tools
   i. Develop new tools to take advantage of how producers will use and access information in the future;
   ii. Provide regular updates to decision tools dependent upon climate data;
   iii. Incorporate climate change information and data into existing tools;
   iv. Integrate tools to provide a more comprehensive picture for decision-making;
   v. Engage in local- and watershed-level planning with all relevant stakeholders, and recognize that it is important that localized decision-making tools and technical assistance be tailored to each of Ohio's recognized geographical regions.

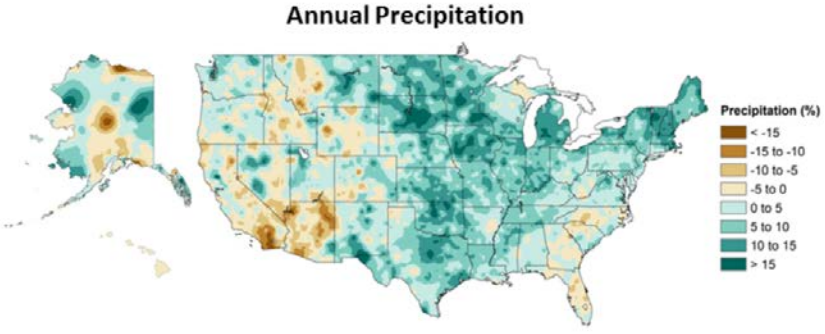
e) Communications, Outreach, and Education
   i. Engage in producer-to-producer dialogues to connect producers in areas experiencing changing conditions with those already accustomed to addressing similar challenges;
   ii. Encourage ongoing dialogue between scientists, policymakers, and agricultural organizations;
   iii. Involve producers and trade associations in research decisions and implementation;
   iv. Address the challenges of reaching landowners;
   v. Conduct cross-disciplinary efforts in research and communicating adaptation measures;
   vi. The best technologies, research findings, programs and planning tools to implement adaptation strategies must find their way to producers, and if producers are not involved in the development and delivery of adaptation strategies, the success rate of the adaptation strategies will drop;
   vii. Provide additional support for existing outreach networks such as agricultural extension, state government agencies, and universities to provide timely and accurate precision agriculture information, utilization support and technical knowledge.

Ohio Climate Change Fact Sheet



Average Annual Mean Temperature (1986-2016) minus (1901-1960)

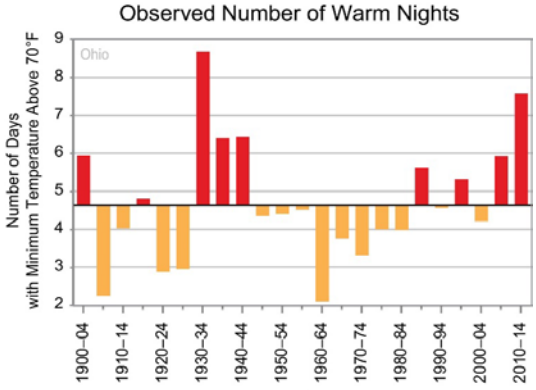
- Annual mean temperatures in Ohio are 0.5 to 2ºF warmer now compared to the early 20th century (Fig. 1).
- Winters have warmed about twice as fast (0.2°F per decade) compared to summer since the late 1800s.
- Observed number of nights above 70°F have increased significantly over the last six decades.



- Annual precipitation in Ohio is 5-15% greater across the state now compared to the early 20th century (Fig. 3).
- Ohio has experienced its greatest increase in precipitation during autumn, followed by summer and spring seasons.
- Since the mid-90s, the frequency of extreme precipitation events (>2") is greater than nearly any other period in Ohio's precipitation record. The only other periods are highlighted by Ohio's major flood years of 1913, 1937, and 1959.

Fig. 1 (Left) Annual average temperature change over the contiguous United States for the period 1986–2016 relative to 1901–1960: National Climate Assessment CCSR: https://science2017.globalchange.gov/

Fig. 2 (Below) Observed number of warm nights (minimum temperature above 70°F) for 1900–2014, averaged over 5-year periods; these values are averages from 26 available long-term reporting stations. The dark horizontal line represents the long-term average. Source: CICS-NC and NOAA NCEI. https://statesummaries.ncics.org/oh



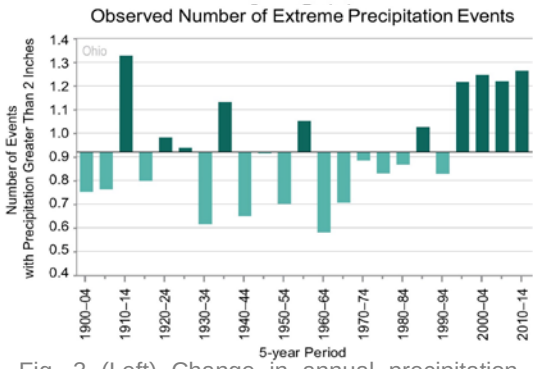


Fig. 3 (Left) Change in annual precipitation over the contiguous United States for the period 1986–2016 relative to 1901–1960: National Climate Assessment CCSR: https://science2017.globalchange.gov/

Fig. 4 (Above) Observed number of days with extreme precipitation events (precipitation greater than 2 inches) for 1900–2014, averaged over 5-year periods; these values are averages 25 long-term reporting stations. The dark horizontal line represents the long-term average. Source: CICS-NC and NOAA NCEI. https://statesummaries.ncics.org/oh

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OSU Extension
Byrd Polar and Climate Research Center
State Climate Office of Ohio (SCOO)

Climate Driver	Vulnerabilities
Warmer temperatures, especially during the winter and at night during the summer	Additional heat-stress on humans and livestock
	Accelerated pace of growing degree day accumulation may lead to changes in regional crop rotations and yields
	Increased pressure from weeds, diseases, and insect pests
	Changes in timing and coincidence of pollinator lifecycles will affect growth and yields.
	Northward shifts in optimum crop productions zones
	Degraded pasture and forage crop quality
Increased precipitation, changes in seasonal precipitation and extreme events.	Soil movement and erosion.
	Field nutrient maintenance, loss, and degraded surface water quality
	Loss of field work days; Delayed planting and harvests
	Seasonal disruptions during critical threshold periods of crop and livestock development.

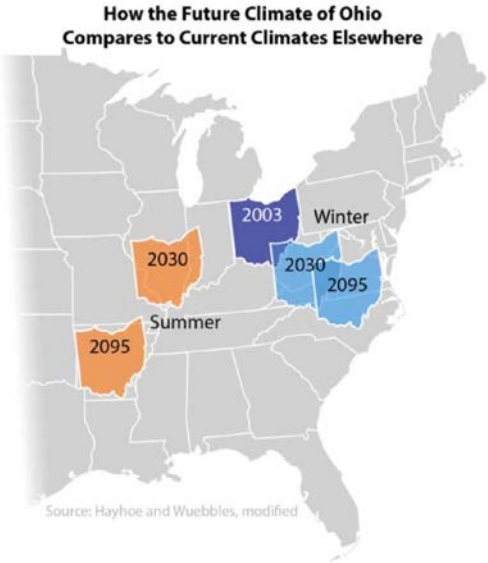
Table 1: Selection of climate change drivers impacting Ohio and associated agricultural vulnerabilities. Note this is not an exhaustive list. This and additional information may be found in the USDA *Climate Change and Agriculture in the United States: Effects and Adaptation* report (https://www.usda.gov/oce/climate_change/effects_2012/effects_agriculture.htm). Some of the vulnerabilities are impacted by both temperature and precipitation drivers.

Explore the Solution Pathways toward Adaptation and Mitigation

As Ohio's future climate is expected to shift toward one more like our contemporary southern states (right), what steps are necessary for Ohio Ag to build resilience?

- Minimize soil disruption?
- Incorporate manure and other nutrient sources?
- Diversify crop production?
- Improve timing and placements of fertilizer?
- Improve cost-efficient livestock cooling systems?
- Improve water use efficiency?
- Other measures and practices?

Engage with other agriculture peers throughout Ohio to help build a plan for Ohio's Ag future, one that maintains profitability and sustainability throughout the 21st century.



Based on temperature, humidity, and precipitation, future summers in Ohio might resemble those in Arkansas, and winters may become similar to those in Virginia.

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