

A VIRTUAL TOUR FOR PUBLIC EDUCATION: HIGH TUNNEL FOR SUSTAINABLE CROP PRODUCTION



Gulnihal Ozbay¹, Rose Ogutu¹, Jennifer Volk², and Erin Lane³

¹Delaware State University, College of Agriculture & Related Sciences, Cooperative Extension, Dover, DE 19901

²University of Delaware, College of Agriculture & Natural Resources, Cooperative Extension, Dover, DE 19901

³U.S. Forest Service, USDA Northeast Climate Hub, North Atlantic Fire Science Exchange, Durham, NH 03824



INTRODUCTION

Climate change is a critical issue that poses risks to growers and creates a greater need to adopt resilient farm practices that can endure environmental problems. Responses to the risks can be anticipatory, concurrent or responsive. A far more powerful mitigation tool for climate change is the education. Figure 1 below provides a projection on the crops by year 2030.

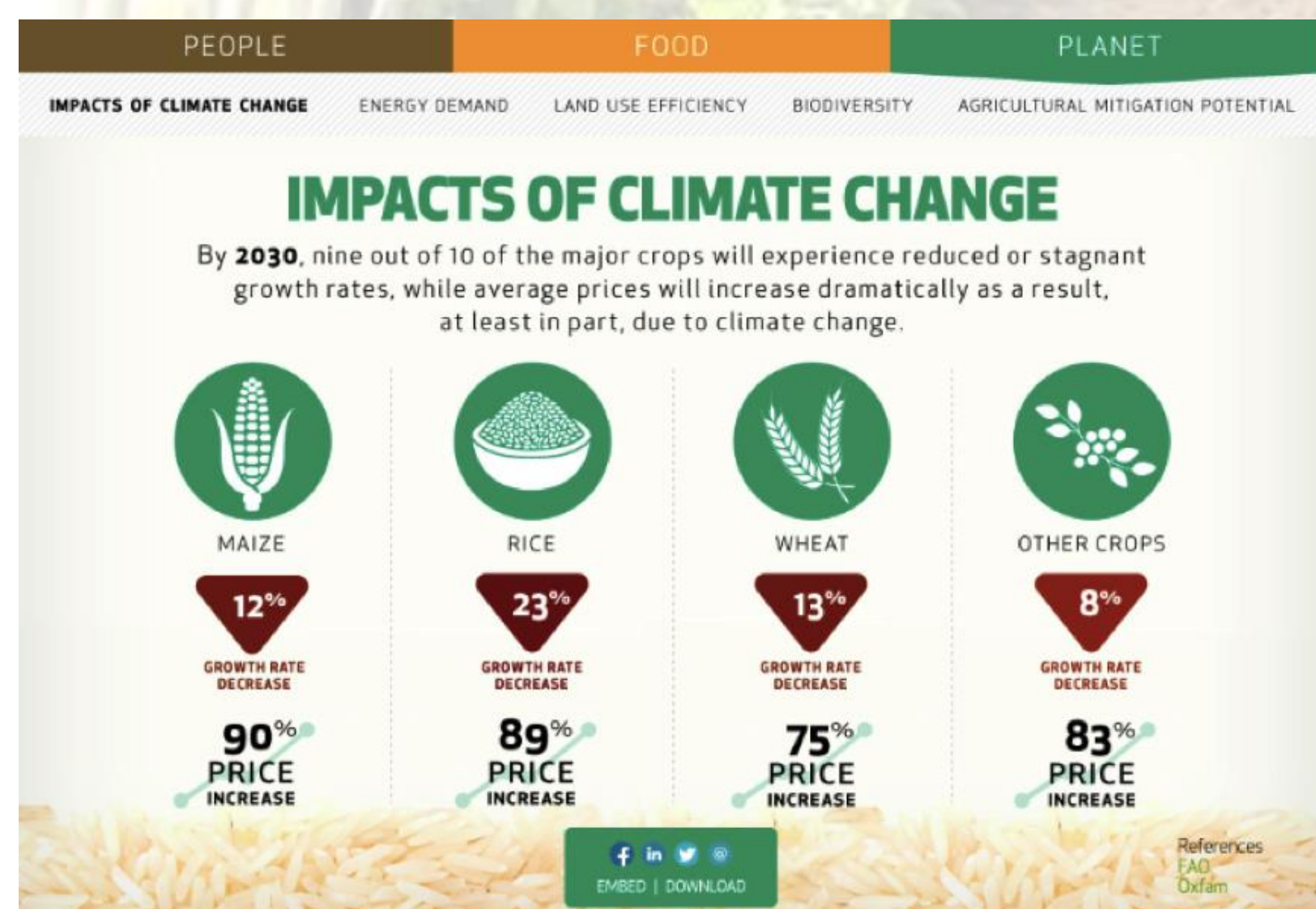
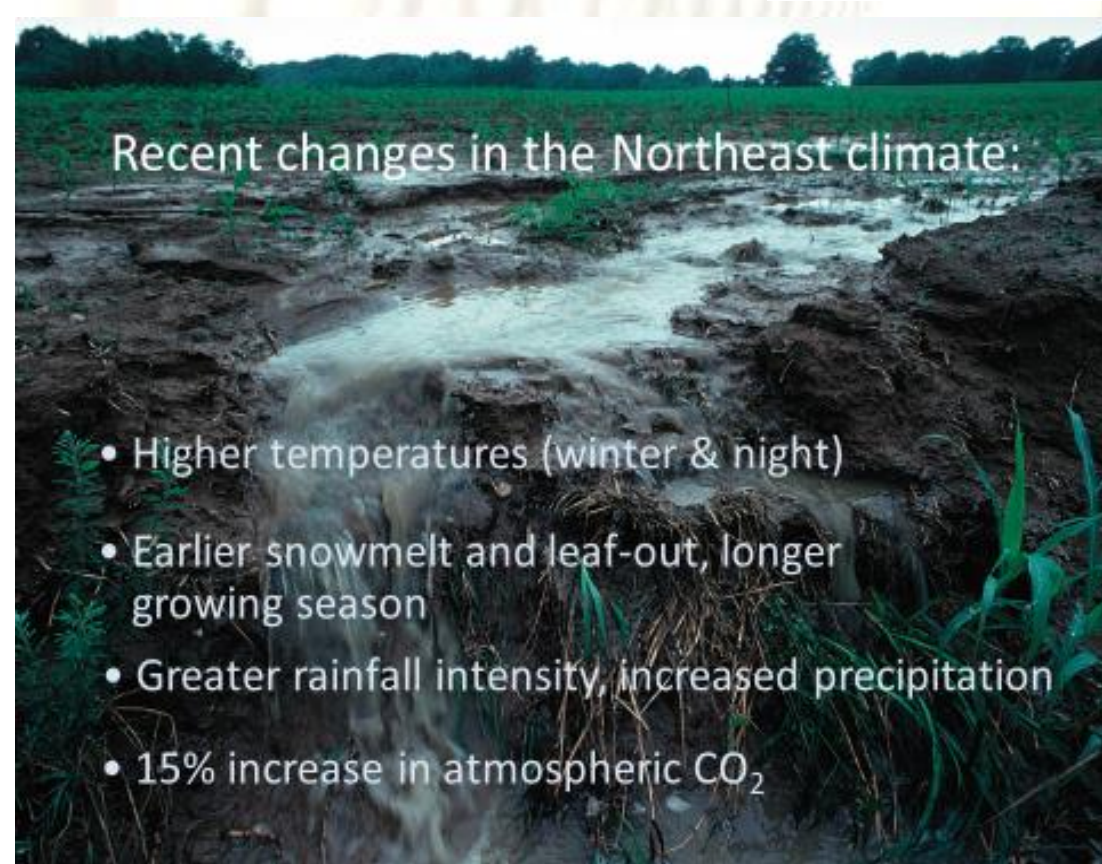
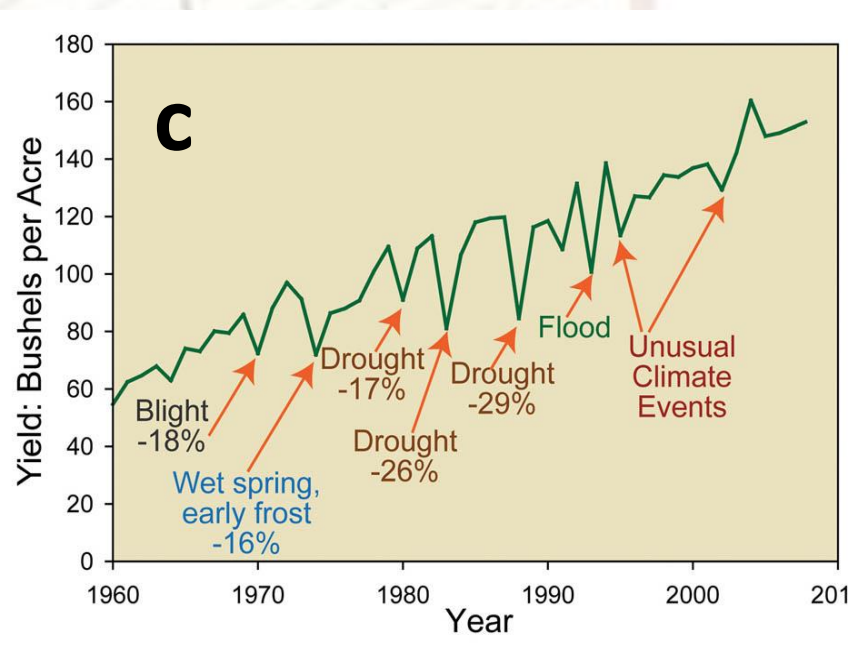


Figure 1. Decrease crop production and increase prices as a result of climate change (<https://achangingclimate.org/2015/01/02/visualising-climate-change/impacts-of-climate-change-on-crops/>).

Knowledge on climate change will substantially improve the farm practices and better prepare farmers for natural and catastrophic events. Before adopting a new practice, farm and forest managers may want to see the new technique being effectively utilized Figures 2a and 2b,c below.



Figure 2.a. Climate variability resulting in low crop productivity (<https://onlyzerocarbon.wordpress.com/agriculture/>); 2b. Increase in warming causing soil moisture loss (<https://www.epa.gov/climate-impacts/climate-impacts-agriculture-and-food-supply>); 2c. extreme weather events have caused significant yield reductions (USGCRP 2009).



Concerning decisions related to climate change, managers and other stakeholders want to gain awareness of, and learn more about, adaptation and mitigation practices; much can be gained by seeing the strategy in action.

Visiting the array of sites that demonstrate successful examples of climate adaptation and mitigation practices is especially challenging because sites are often varied and geographically dispersed.



Figure 3. Northeast Climate HUB online links and picture of high tunnel.

The virtual network of field demonstration sites serve as a critical tool for technology transfer, showcasing a variety of climate change adaptation and mitigation strategies that have been implemented across public and private lands in the Northeast.

ABSTRACT

The USDA Northeast Climate Hub and all our land grant partners have worked together on the production of a robust, detailed, and innovative digital experience that can engage people in climate informed decision-making, and immerse the user into a digital field 'visit' that feels "as if you were there". We envision that this project will help build a bridge to climate adaptation strategies. Field visits are a powerful teacher, and we believe virtual field trips can achieve similar results with greater accessibility. DSU's Smyrna Outreach and Research Center is our pilot site for this project by using high tunnels vegetable production and transitioning into organic vegetable and small fruits production. High tunnels have proven to be very innovative for managing environmental conditions and pests efficiently. The virtual video and other outreach educational efforts have been promoting high tunnel vegetable production in the state of Delaware and beyond. Those educational efforts provide necessary information growers need to sustain their production and prepare them for fast changing climate conditions and disasters.

NORTHEAST CLIMATE HUB

The Northeast Climate Hub, building on capacity within USDA, delivers science-based knowledge and practical information to farmers, ranchers and forest landowners in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Delaware, West Virginia and D.C.

Top 5 Adaptation Issues (N=554)	
Research	Extension
1) Water management (16.8%) (UVM, Penn State, Cornell)	Water management (22.9%) (Cornell, Penn State, Maryland, UVM)
2) Cropping systems management (15.0%) (Penn State, Cornell)	Integrated Pest Management (20.4%) (Cornell, Maryland, Rutgers, Penn State)
3) Ecosystem restoration (13.9%) (Cornell, Rutgers)	Soil conservation (19.9%) (Cornell, Penn State, UVM, Maryland)
4) Biodiversity conservation (12.6%) (Cornell)	On-farm diversification (17.9%) (Cornell, Penn State Maryland, UVM)
5) Changes in attitudes/behaviors among land managers (10.8%)	Cropping systems management (17.7%) (Penn State, Cornell, Maryland)

Its mission is to develop and deliver science-based, region-specific information and technologies to agricultural and natural resource managers that enable climate-smart decision-making and provide assistance to enable land managers to implement those decisions (Figure 4).

VIRTUAL TOUR

Virtual demonstrations of climate adaptations using 360° photography and videos!

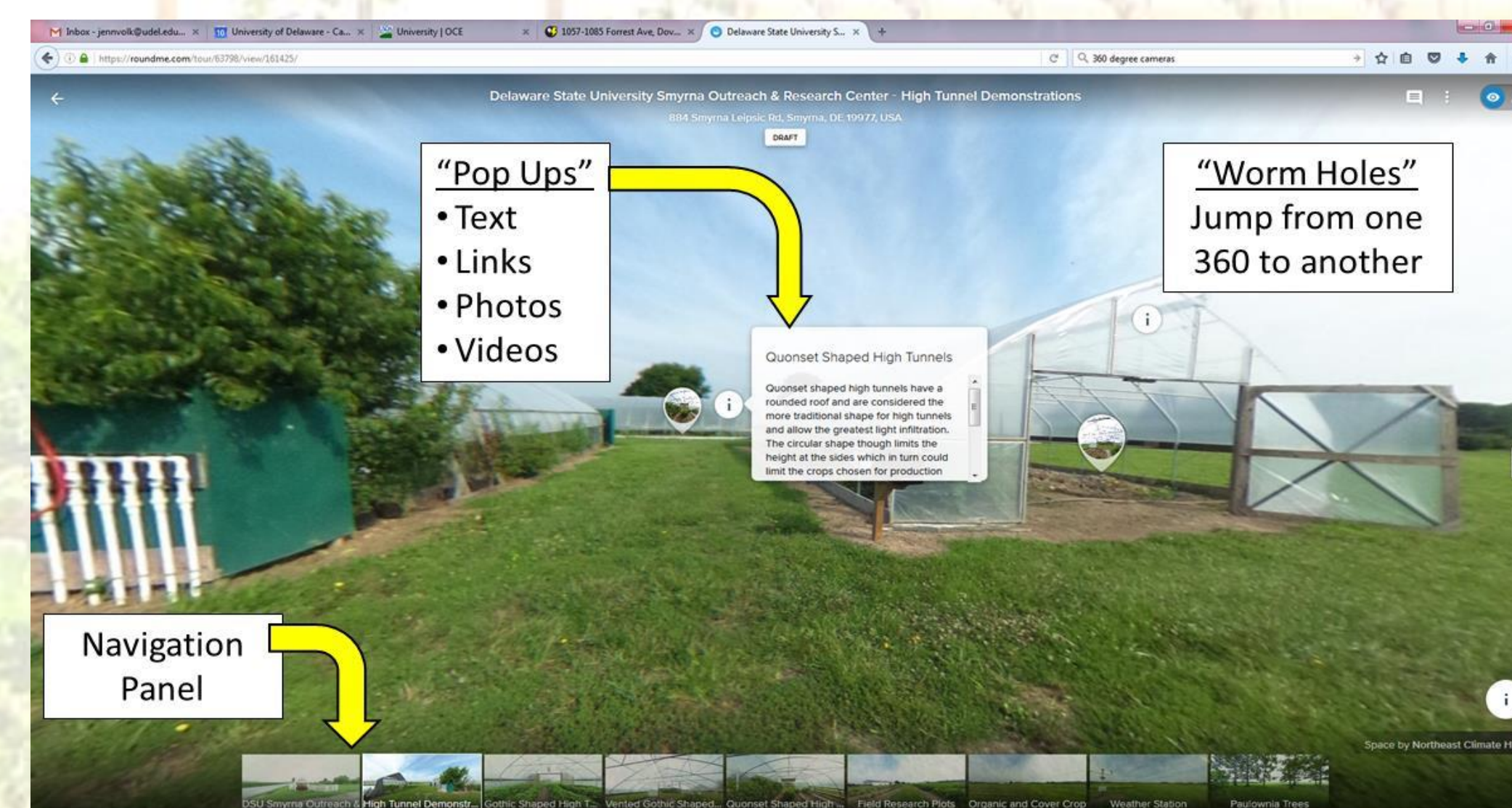


Figure 5. Virtual Tours Made Simple. World's most hassle-free 360° VR publishing and panoramic tours authoring platform.

Virtual tour becomes a critical extension tool. Helps our colleagues and clientele see, understand, and become comfortable with new technologies, practices, and systems. Education occurs before adoption.

High Tunnel Pilot Project at DSU!



This pilot site in DSU included high tunnel vegetable production and its management.

Acknowledgements

Special thanks to U.S. Forest Service and UD Cooperative Extension video crews. Project is funded by the Northeast Climate Hub.



Figure 6. High tunnel facility tour and interview with Dr. Rose Ogutu. Pictures taken by Erin Lane.



HIGH TUNNELS

High tunnels are polyethylene covered structures (Figure 7a)



constructed in the field to protect crops (Figures 7b and 7c) from the weather and sometimes, pests.



They confer some level of environmental control, hence their use for season extension. They can be considered a climate change mitigation strategy. The standard production practices include; raised beds (Figure 7d) and drip irrigation, use of various mulches (Figure 7e)



and cover cropping, passive ventilation through side and roof vents (Figure 7f), use of insect screens for pest exclusion etc.



High tunnels as an adaptation tool!

High tunnels create an environment that is a hybrid between the field (uncontrolled) and a functional greenhouse (controlled). Many growers in Delaware are very enthusiastic about them as season extension tools that confer better pest management compared to field production. High tunnel management is very important for consistent crop production and good cash flow (Figure 8). **We suggest:**

- ❖ Crop diversity, disease-resistant plant varieties, vertically growing plants for efficient use of space and informed scheduling of crops.
- ❖ Sanitation within and around the high tunnel, including banker plants, adequate trellising and timely pruning, crop rotation and cover cropping.
- ❖ Water and nutrient management mainly through drip irrigation and fertigation.
- ❖ Weed control using mulches—black plastic, straw, and landscape fabric.
- ❖ Passive ventilation through side and roof vents, use of insect screens for pest exclusion and shading nets for temperature management.



Figure 8. Healthy multi-crop production using the best management practice in the high tunnel. <http://gardenseason.com/high-tunnel-garden-ideas>.

