USDA

United States Department of Agriculture

Plant Protection and Quarantine Efforts to Address Climate Change

Glenn Fowler, Yu Takeuchi and Ron Sequeira
USDA-APHIS-PPQ Science and Technology

Presentation Objectives

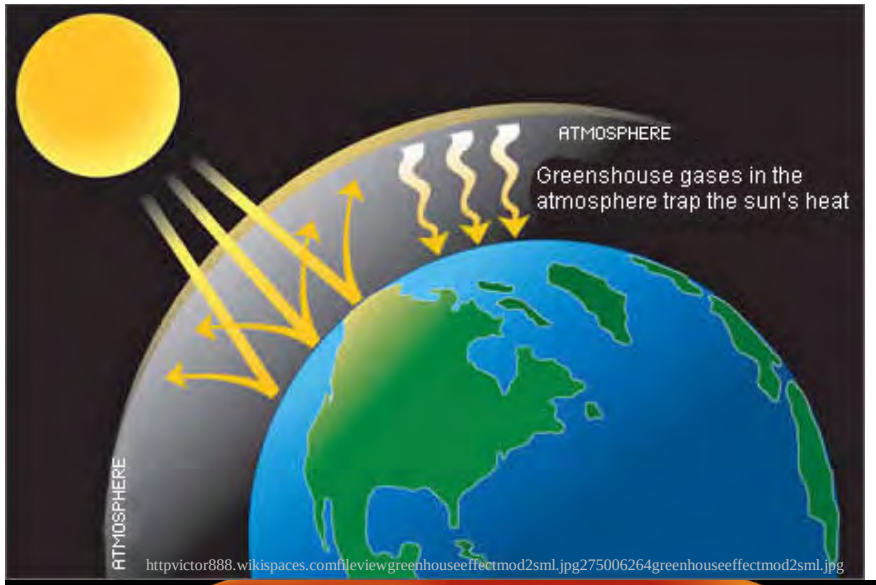
- Introduction to PPQ, climate change and how it affects PPQ
- Overview of current PPQ activities related to climate change
- Future PPQ activities to address climate change

Plant Protection and Quarantine (PPQ) Responsibilities:

1) Protect the U.S. agriculture and natural resources from invasive plant pests by preventing their entry, establishment and spread
2) Facilitate safe agricultural trade

Introduction to Climate Change

- Human activities, e.g. burning fossil fuels, are increasing levels of CO2 and other greenhouse gasses (GHGs) the atmosphere and heating the earth
- This is accelerating the rate of climate change which has direct effects on the environment and human activities
- The these effects include (Broder, 2012; IPPC, 2016; NASA, 2016; USGCRP, 2014; WHO, No Date):
  - ✓ Increased droughts
  - ✓ Increased precipitation and flooding
  - ✓ Increased storm intensity
  - ✓ Ocean acidification
  - ✓ Rising sea levels
  - ✓ Displacement of human populations
  - ✓ More disease
  - ✓ Reduced food availability
  - ✓ More conflicts



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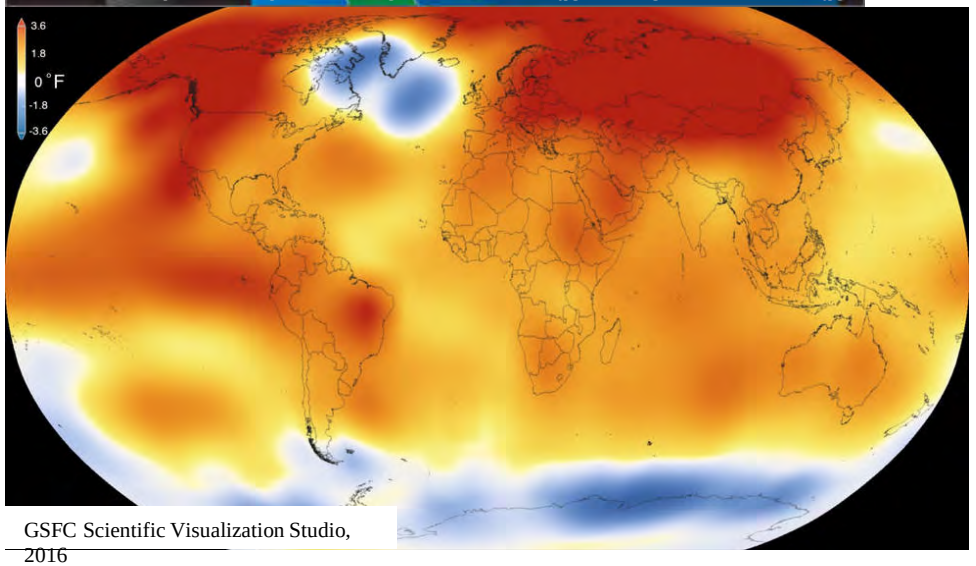


GSFC Scientific Visualization Studio, 2016

Climate Change Effects on Agriculture, Forests and Plant Pests

- Increased droughts and precipitation will cause crop losses (USGRCP, 2014)
- Increased storm intensity
- Suitable areas for crop production will change as higher latitudes become warmer
- Suitable areas for plant pest establishment will expand with warmer temperatures
- Higher temperatures could facilitate faster development of insect plant pests resulting in higher populations, more generations and increased crop and forest damage
- Generally, disturbed environments favor r-strategists like insects and weeds (Rafferty, 2016)


http://globalsolutions.org/blog/2013/06/Dont-Let-Our-Future-Dry#.V1CO2XJf3ho


http://egyptianchronicles.blogspot.com/2010/05/21/606-more-than-court-order-more-than.html

Current PPQ Efforts to Address Climate Change

Corn_Flood3 Daren Mueller, Iowa State University, Bugwood.org .jpg

1. COSTA Climate Change Working Group (C3WG)

- The working group was created by the Office of the Administrator in 2014 and is led by Dr. Wendy Hall and Dr. Marlene Cole (USDA, 2016)
- Includes representatives from AC, BRS, IS, LPA, MRPBS, PPD, PPQ, VS and WS (USDA, 2015)
- Current PPQ representatives are Dr. Ron Sequeira and Dr. Glenn Fowler from S&T

- C3WG's functions include (COSTA, 2014):
  - ✓Sharing information regarding climate change related activities among the APHIS agencies
  - ✓Providing APHIS feed back on USDA documents related to climate change
  - ✓Advising the APHIS management on issues related to climate change

Recent C3WG Accomplishments and Activities

- Commented on over 30 documents related to climate change with over 20 of those being from the USDA (2015, 2016)
- S&T and NCSU briefed C3WG on how predictive mapping, climate data and climate change are used in PPQ Risk Analyses
- The USDA Southeast, Midwest, Northeast, and Northern Plains Regional Climate Hubs gave presentations on how climate change is affecting their geographic areas
- Helped facilitate a workshop to help APHIS incorporate climate change adaptation into its work

Photo credit: Joseph Vorgetts

2. SAFARIS

- Collaborative effort between PPQ and NCSU-CIPM in cooperation with the Climate Office of NC
- Project is led by Dr. Yu Takeuchi
- Allows for the production of forecasts models and predictive mapping products for plant pests in near real time (2 week forecasts), short term (e.g. 1 to 5 years) and long term time frames (e.g. 30 to 100 years)

- PPQ uses include:
  - ✓ Informing risk analyses by identifying suitable areas of plant pest establishment
  - ✓evaluating economic and environmental impacts of plant pests
  - ✓Informing surveys, e.g. CAPS

SAFARIS: Framework

Framework Environment

Climate Data
- US and Global
- Climate Change (GCM outputs)

Pest Knowledge Base
- Biology & Life Table
- Distribution
- Growth, Mortality, Dispersal Rates
- Hosts
- Expert opinions

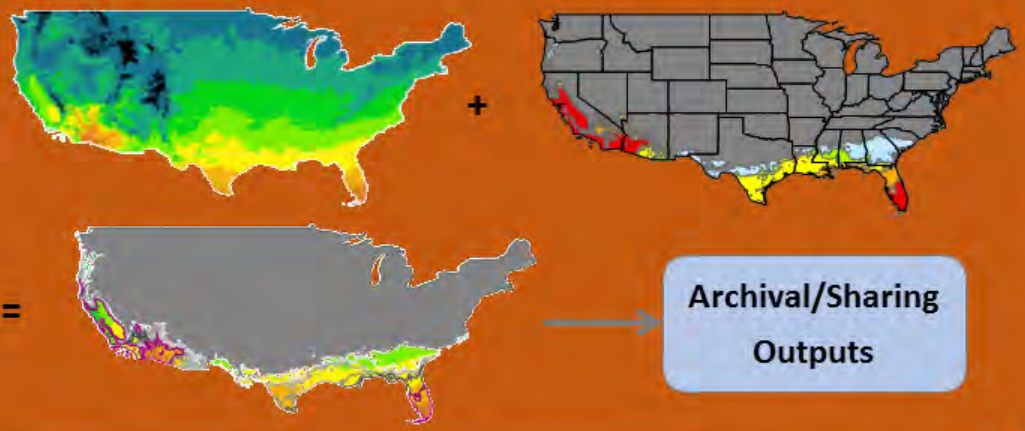
Data Sources (non-climate data)
- Hosts Plant data
- Land data
- Demographic data
- Human activity data

Models
- Phenology (Degree-day)
- Population dynamics
- Climate condition models
- Spread models (Natural/Human assisted)
- Economic analysis models

Uncertainty Analysis

Analysis Categories
- Risk assessments
- Suitability evaluation
- Economic impact evaluation
- Population dynamics
- Pathway analysis
- Climate change

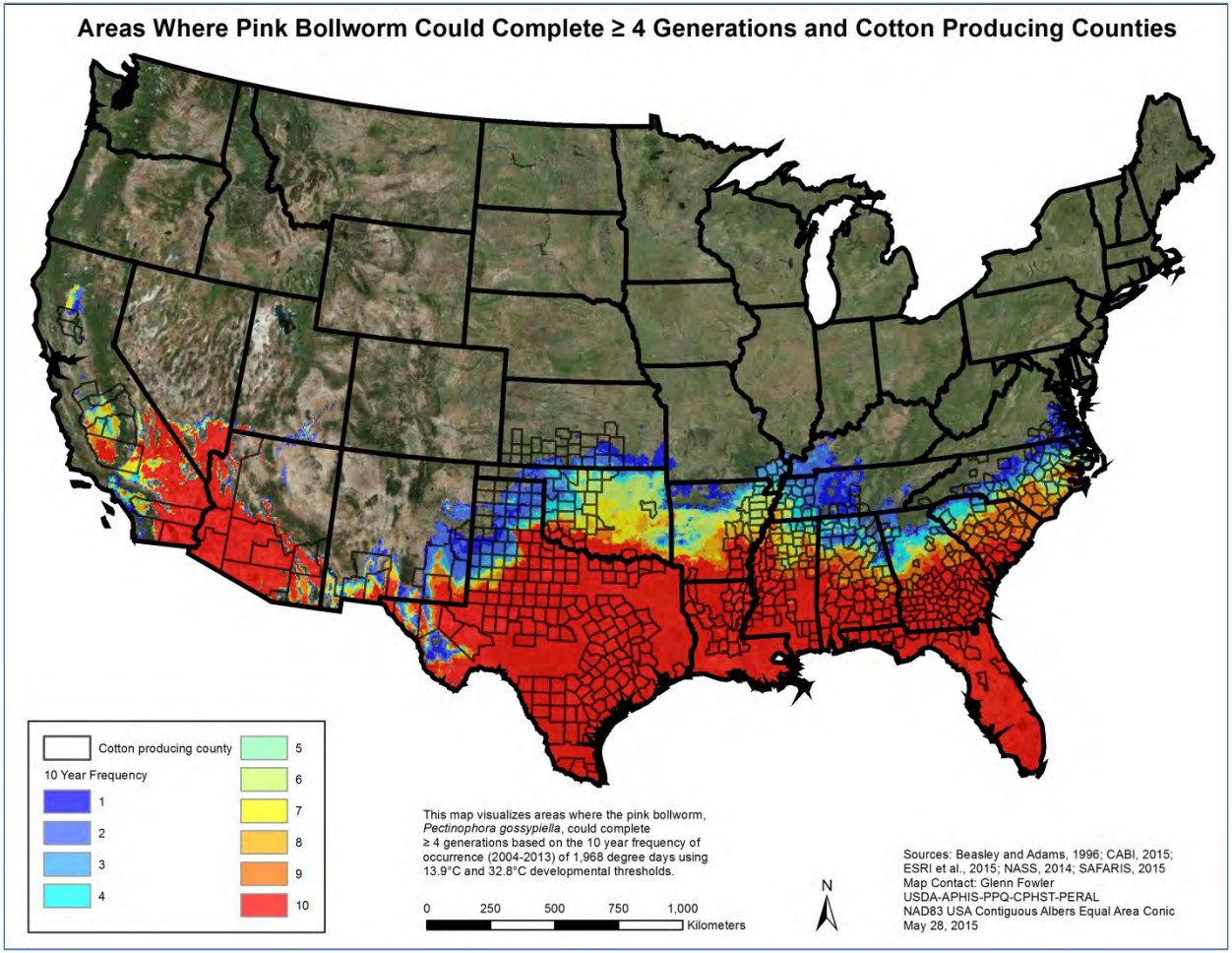
Comprehensive Analysis



Archival/Sharing Outputs

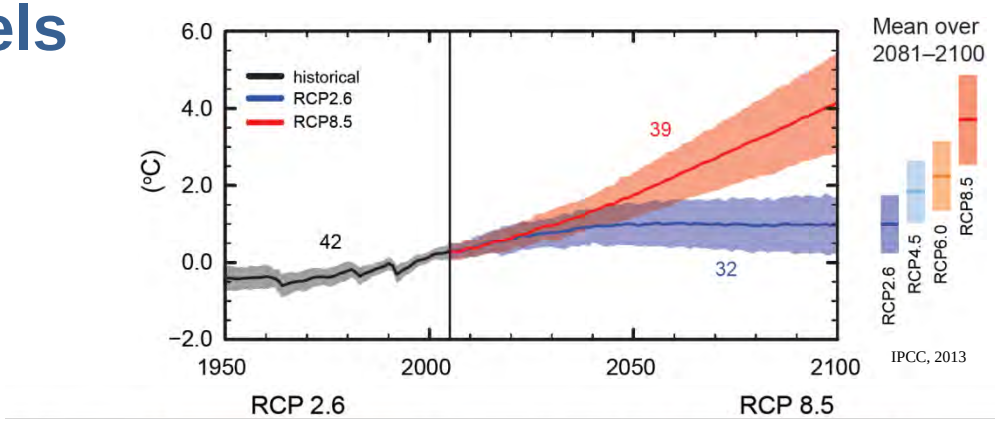
Phenology Models (Degree Days)

- Model the development of organisms whose biology is temperature dependent, e.g. insects and plants, and the timing of those events

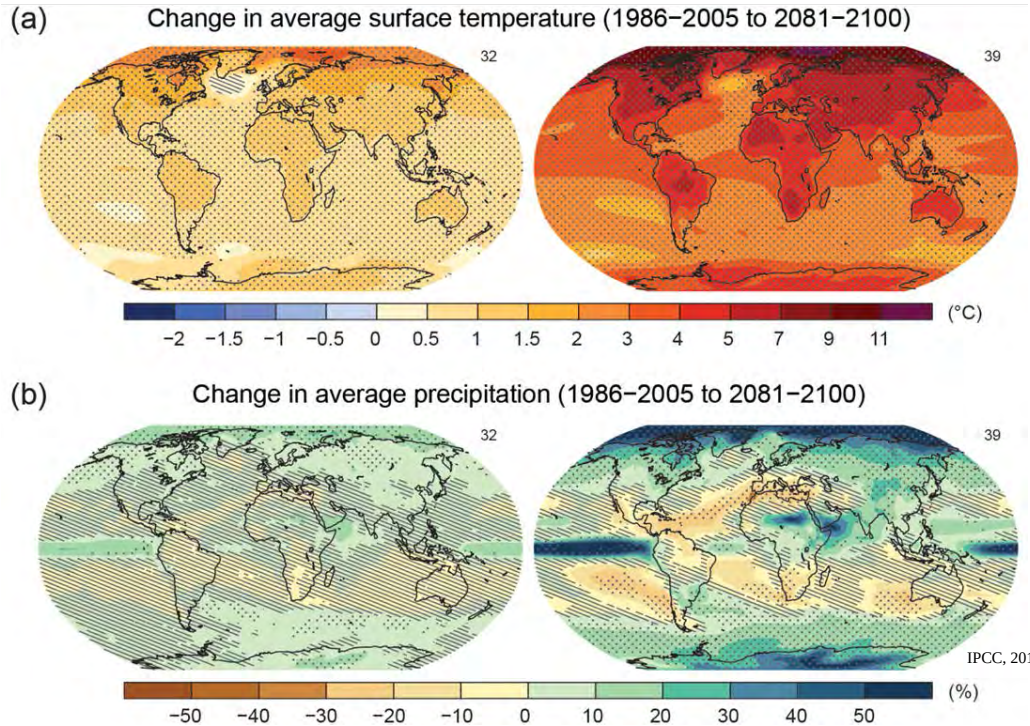


General Circulation Models

- Used to model the future climate based on projected GHG levels under different climate change scenarios (IPCC, 2016)
- SAFARIS will be able to use these data to predict areas of suitability and phenology for plant pests and hosts under climate change
- Will help PPQ anticipate and prepare for changes in plant pest impacts



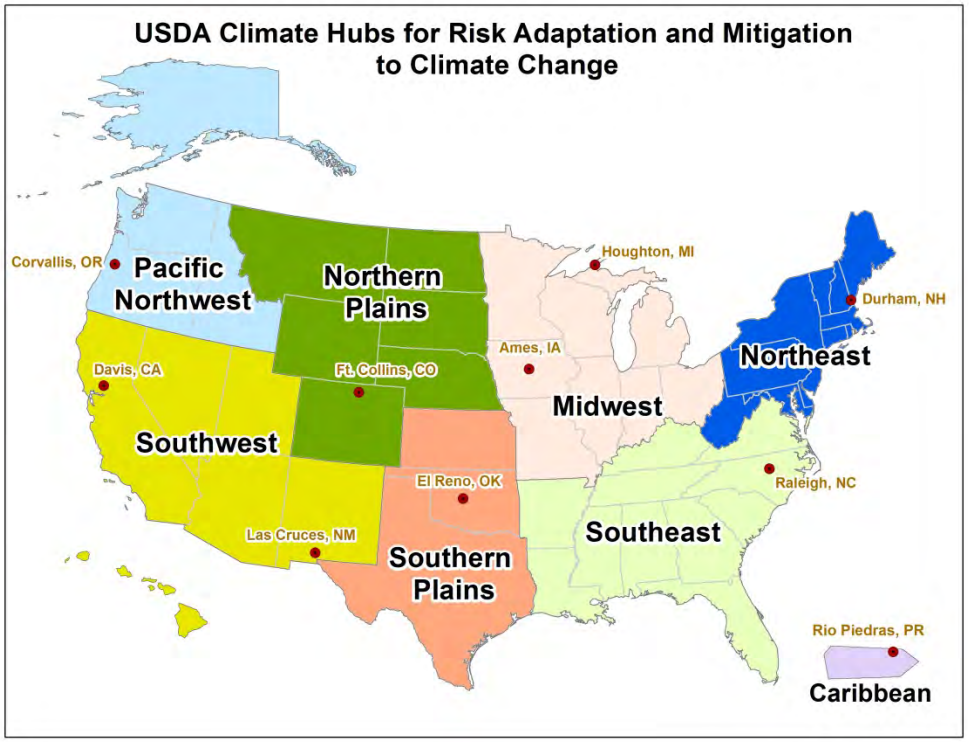
IPCC, 2013



IPCC, 2013

3. USDA Regional Climate Hubs

- The climate hubs were created by Secretary Vilsack in 2014 to assist farmers, foresters, ranchers and other stakeholders to adapt to climate change by providing science to inform decision making (USDA, 2014)
- 7 regional hubs and 3 sub-hubs located at ARS or USDA-FS facilities
- Hubs work with government agencies, academia, industry and the public to provide information to stakeholders
- Hubs also house science fellows that PPQ partially funds



Hub Liaisons

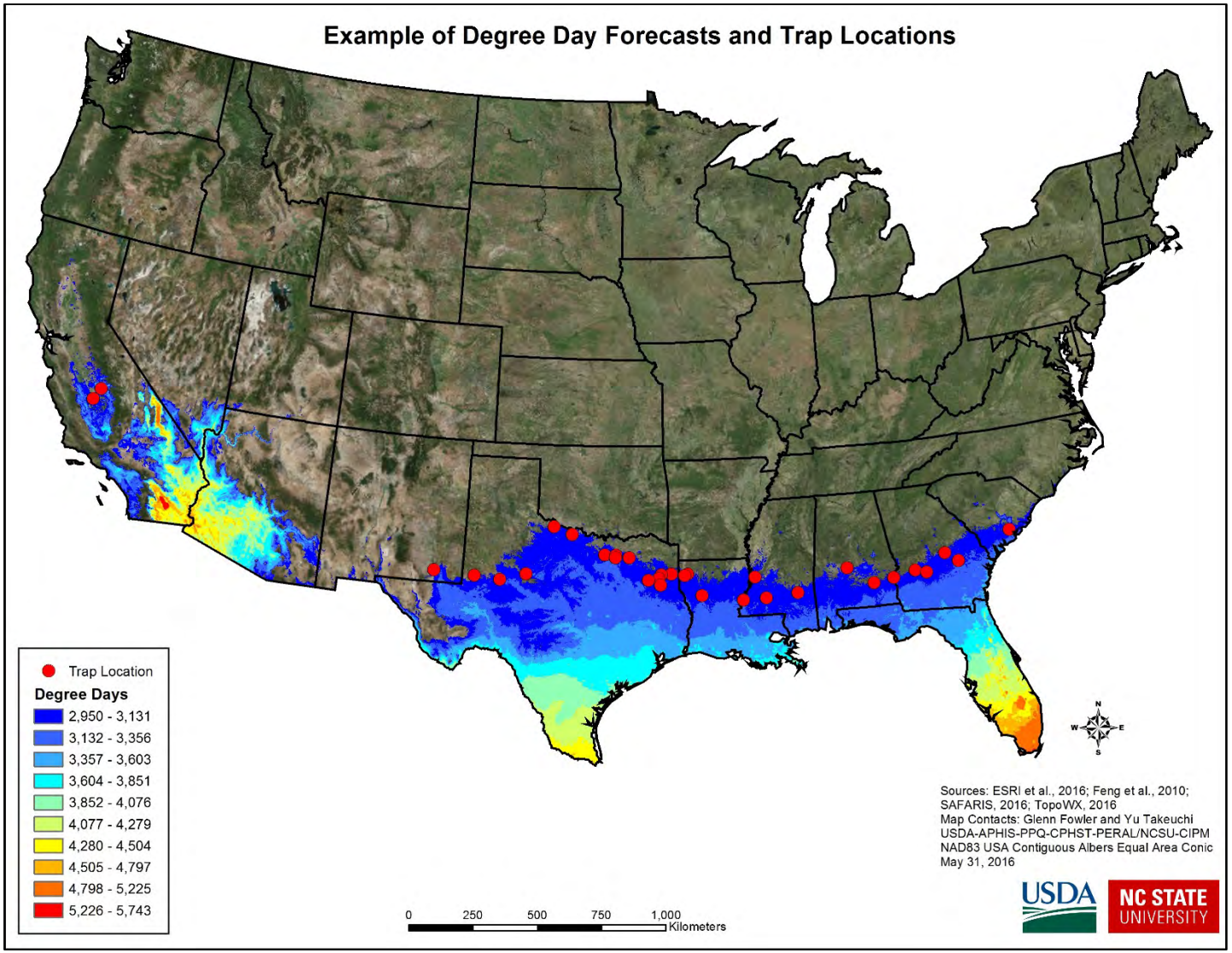
- The regional climate hubs have liaisons from federal agencies, e.g. NRCS, APHIS, FSA and RMA to assist in their mission
- APHIS and the Hubs are collaborating on projects of mutual interest
- Partners:
  - ✓ Current APHIS Liaison to the Southeast Hub (Dr. Glenn Fowler (PPQ-S&T))
  - ✓ NCSU-CIPM (Dr. Yu Takeuchi & others)
  - ✓ the National and Regional Climate Hubs (Dr. Randy Johnson, Ms. Rachel Steele, Dr. Steve McNulty, Ms. Sarah Wiener & others)
  - ✓ The State Climate Office of NC (Dr. Ryan Boyles & others)
  - ✓ S&T Management (Dr. Ron Sequeira)


Photo credit: Daniel Quick, APHIS ACQ & Asset MGMT DIV

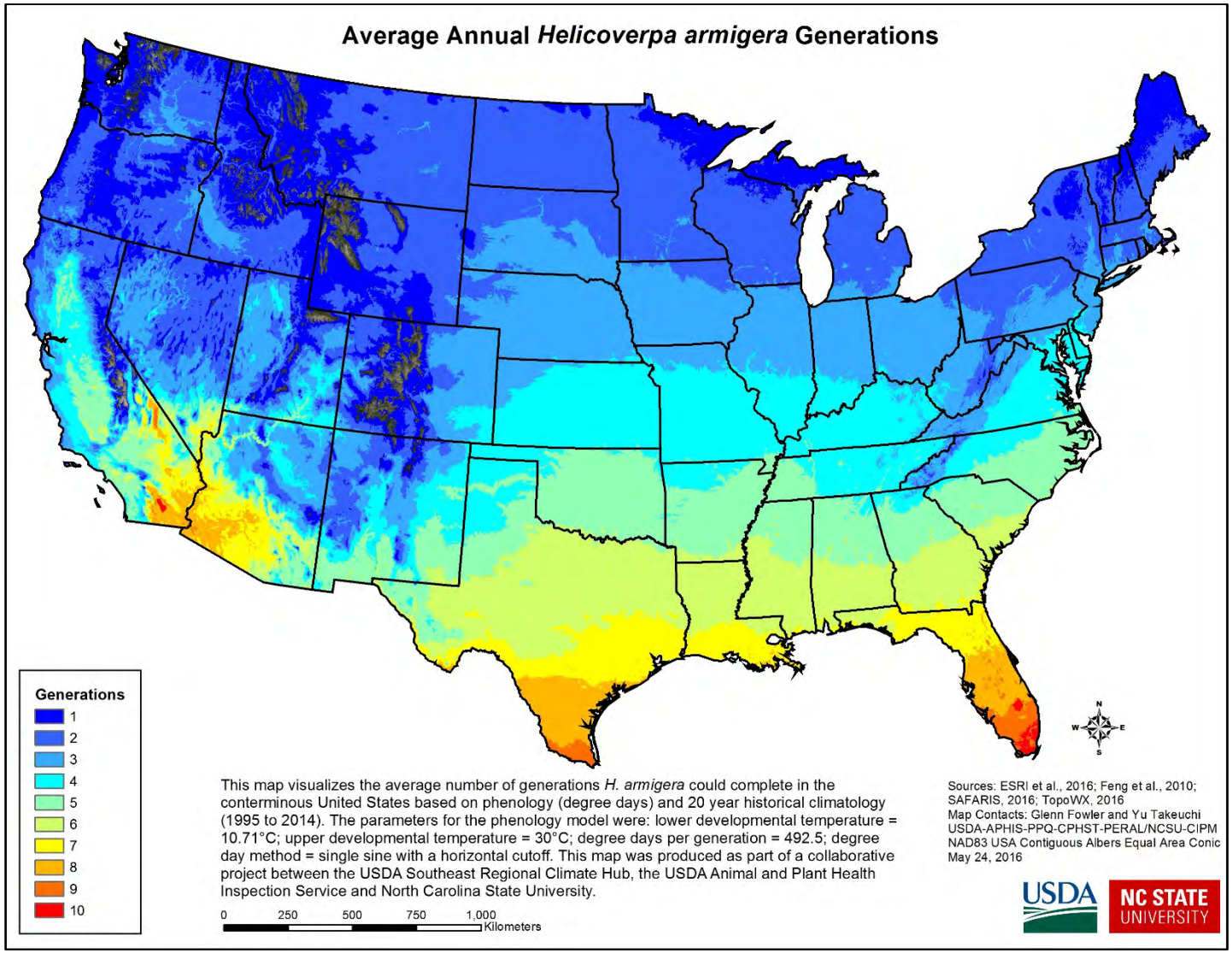
Current APHIS & Climate Hub Projects

- Submitted a work plan to the USDA Secretary's Office to collaborate on predictive modeling work for up to 5 pests of mutual interest
- Will be using SAFARIS to generate phenology models and climate change forecasts
- Deliverables include:
  - ✓ Predictive plant pest models and maps in near real time, short term and long term time frames
  - ✓ Incorporation of the near real time maps into the Southeast Regional Climate Hub Alert System: SERCH LIGHTS
- Uses include:
  - ✓ Alerting PPQ survey personnel, farmers and foresters when plant pests are a threat
  - ✓ Informing risk assessments and policy decisions
  - ✓ Helping PPQ and Climate Hub stakeholders anticipate and prepare for changes in plant pest activity under climate change

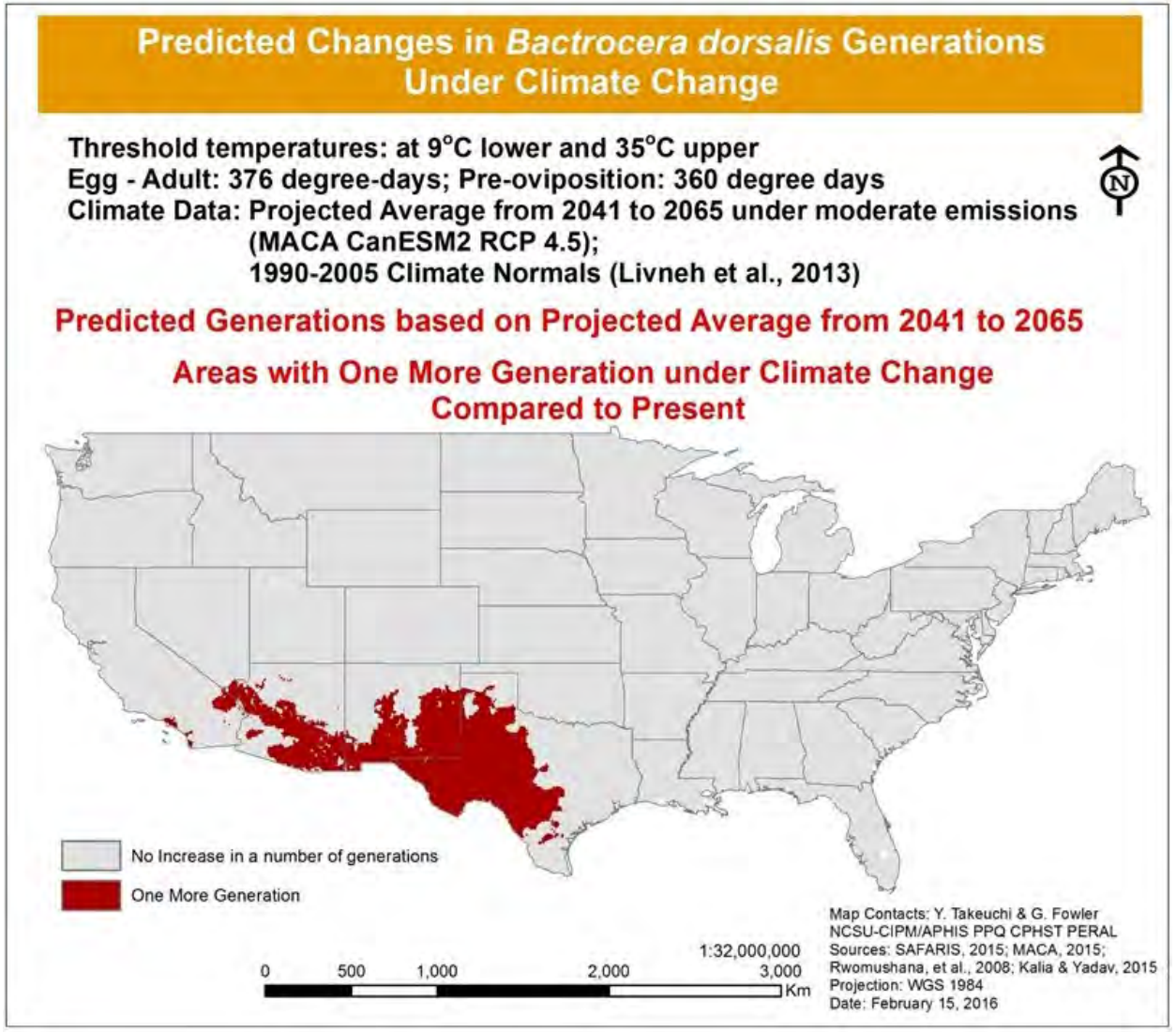
Example 1: Near Real Time Predictive Map



Example 2: Short Term Climatology Predictive Map



Example 3: Long Term Climatology Predictive Map

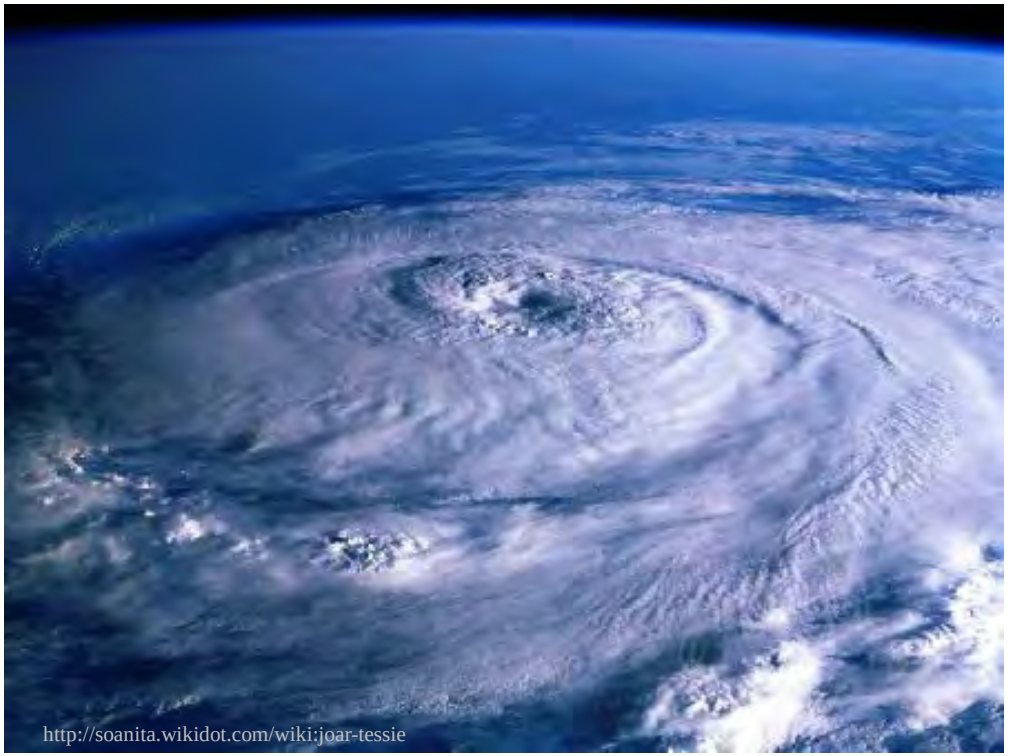


Next Steps

- PPQ will continue to participate in the C3WG and provide updates on APHIS liaison activities with the USDA Climate Hubs
- SAFARIS will continue to develop capabilities to meet PPQ's needs related to climate change and plant pest forecasting
- PPQ will work with the USDA Climate Hubs to generate modeling and mapping products for plant pests that meet the needs of our stakeholders
- A series of climate change webinars given by Field Operations, C3WG, S&T and the USDA Climate Hubs for state plant health regulatory officials are planned
- Present the collaborative work between PPQ, the Climate Hubs and NCSU at meetings and in technical publications

Summary and Conclusions

- PPQ is actively engaged with federal agencies and academia in efforts to address climate change
- As part of that effort PPQ is collaborating on development of predictive mapping systems that incorporate the effects of climate change
- PPQ is working with the USDA Climate Hubs on projects of mutual interest related to plant pests and climate change
- These efforts will continue and likely expand in scope as the effects of climate change on PPQ's mission increase



Potential Areas for PPQ Management Team Support

- Share what PPQ is doing regarding climate change with our stakeholders
- Continued support for SAFARIS
- Support for PPQ engagement and collaboration with stakeholders, NPPOs and researchers who are involved in climate change activities

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Acknowledgements

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Thanks! Questions?

Supporting climate change forecasts

- Pest forecasting modeling relies on climate data from past years to predict the establishment and spread of pest into the future.
- Not accurate to assume future climate will be the same as the past climate.
- Consequently pest forecasting not as accurate.