Impacts of Weather and Climate on Invasive and Agricultural Pests

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Illinois Natural History Survey
What is CAPS?

• Program that focuses on safeguarding our nation’s food and environmental security from exotic pests that threaten our production and ecological systems.

• The goal is to work side by side with our respective state and federal counterparts as well as collaborate with universities, industry groups, and other stakeholders.
Components of the CAPS Program

1. Early detection of foreign plant pests
4. Expanding plant-pest preparedness and response capability
USDA – NIFA: Wide Area Monitoring Project

- Monitoring and detection of crop pests in Illinois, focusing on statewide survey and reporting
  - Insects, pathogens, and weeds of corn and soybeans
- Future grant proposes a multi-state effort for mutually important crop pests
Insect pests, weeds, and crop diseases are all sensitive to temperature and precipitation and some are responsive to CO2 concentrations.

Changes in these can facilitate:

- New species that can become invasive, will be entering new regions due to climate change
- Species hierarchies will change, leading to new dominants
- Climate-induced stress in an ecosystem will facilitate pathways.
Basics: Temperature & Insects

• Temperature is the driving force behind insect development, growth, & behavior.

• Insect development is temperature dependent
  – Increased temperature increases insect metabolism
  – Earlier appearance in spring
  – Shorter lifecycle development
  – Longer “in season” activity
  – Faster evolutionary changes
Basics: Moisture & Insects

• Moisture will also play a critical role in insect development.

• Relative humidity (or lack thereof) affect’s the insect’s ability to regulate water loss.

• Excessive or insufficient rainfall can also be detrimental to insects, while others thrive in those conditions.
Corn Rootworm Beetles

2016 Corn Survey (mean # beetles per 25 plants)

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Japanese Beetle

2016 Soybean Survey (mean # beetles per 100 sweeps)

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While year-to-year pest populations are variable, what we do know is that many crop pests and pathogens are spreading, including the introduction of new pests.
Illinois At Risk

• Central geographic location and superior transportation system
  – Largest rail gateway in the nation
  – Interstate highway system (2,000 miles) and 34,500 miles of other highways
  – O’Hare International Airport
  – >1,000 miles of navigable waterways
Pathway: Containerized Shipping & Solid Wood Packing Material

The number of shipping containers entering the U.S. each year continues to grow.

Almost 10 million enter the U.S. annually, only about 5% are physically inspected.
Invasive species continue to arrive in the US at a high rate, with an enormous & increasing impact on the economy, food security, environmental health and human health.

This trend has been not only an increase in the number of pest detections, but an increase in the variety of pests and range of states in which they are being found.
An updated Köppen–Geiger climate map[1]

- Af
- BWh
- Csa
- Cwa
- Cfa
- Dsa
- Dwa
- Dfa
- ET
- Am
- BWk
- Csb
- Cwb
- Cfb
- Dsb
- Dwb
- Dfb
- EF
- Aw
- BSh
- Cwc
- Cfc
- Dsc
- Dwc
- Dfc
- BSk
- Dsd
- Dwd
- Dfd
Climate Change and Biodiversity

• Some of the greatest impacts will come from changes in climatic events that disturb ecosystems, making them vulnerable to invasions.
  – Basically changing the space within which a species can survey/expand host range.

• Replacements of natives by invasives

• Changing relationships between predators, pathogens, and prey
Climate Change & Temperature

- Milder winters $\rightarrow$ greater survivability
- Warmer temperatures $\rightarrow$ higher rates of growth and reproduction
- Earlier migration $\rightarrow$ earlier infestations

Increased potential for greater pest populations
Scratching the Surface

• So much to cover in so little time concerning ag and invasive pests.

• Diseases and Weeds – effects on these interactions are likely to vary by region and crop type.

• IPM is going to be even more important when dealing with these ever-changing pests.
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