

PENNSTATE



Climate impacts on Pennsylvania

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PA Climate Assessments and Updates



2015 advances in modeling techniques:

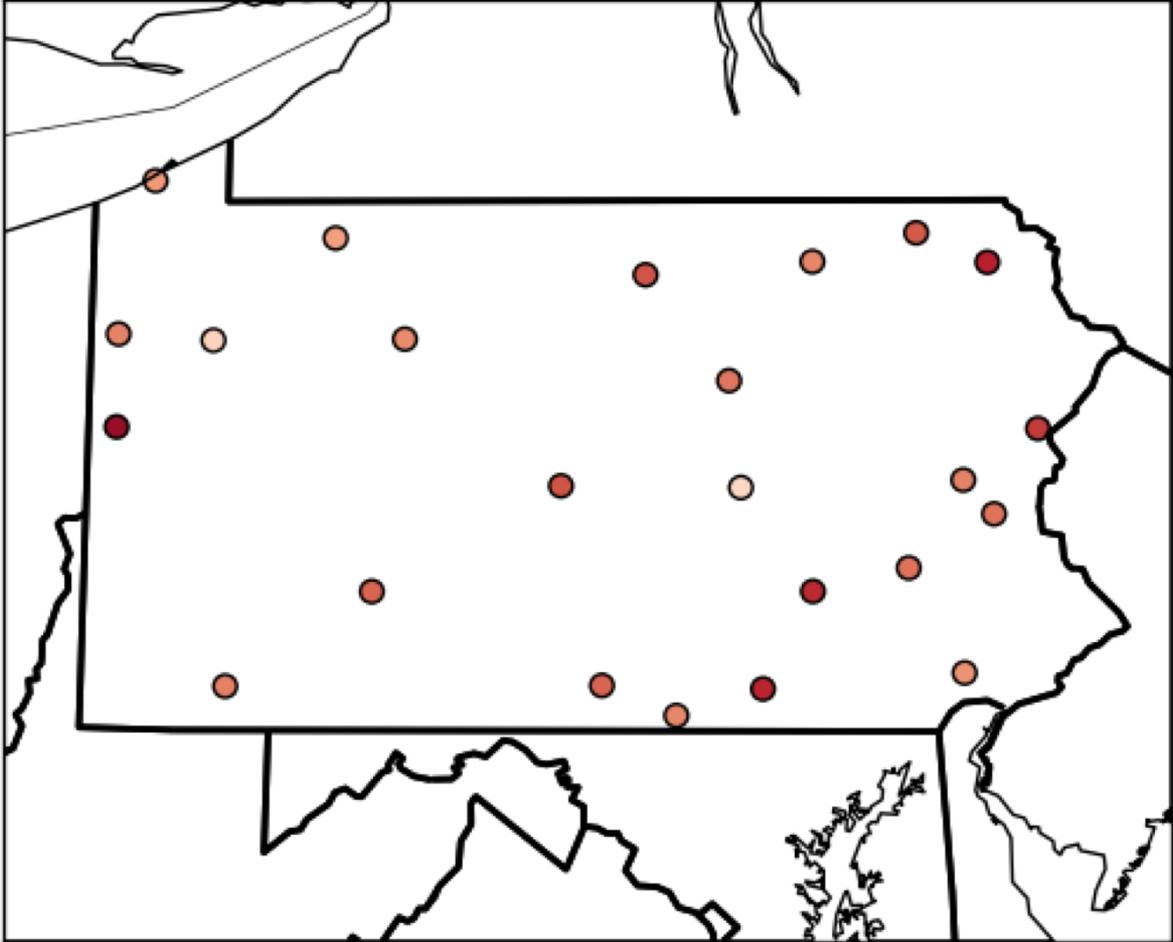
- New greenhouse gas scenarios;
- New global climate models
- New downscaling techniques

18-person team led by Jim Shortle

Report at psiee.psu.edu/climate-impacts

Pennsylvania is warming by 0.5 °F per decade

1981-2010 mean temperature trends (°F/decade)



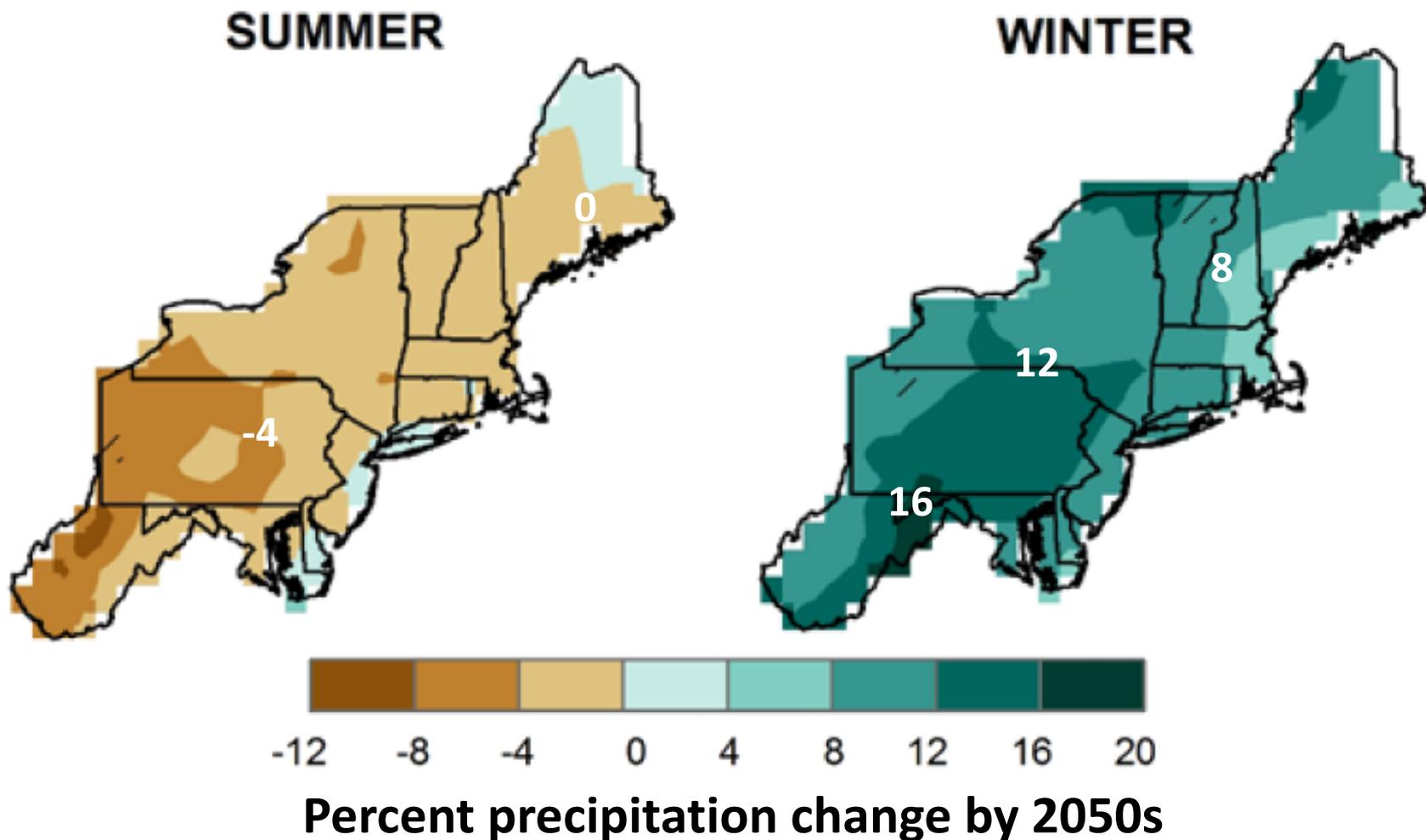
Shortle et al. (2013)



Summers in Pennsylvania will feel like those of the Southeast US by mid-century if heat trapping emissions trends continue

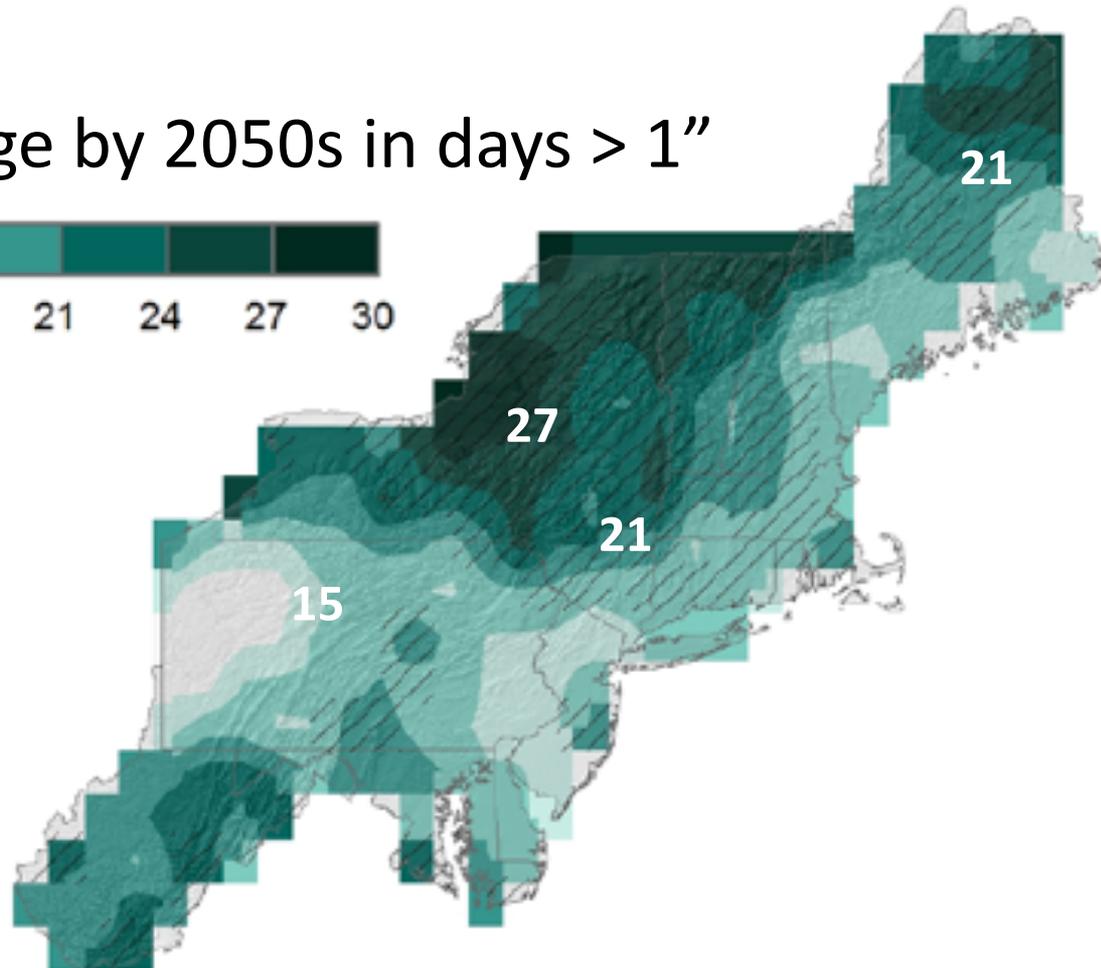
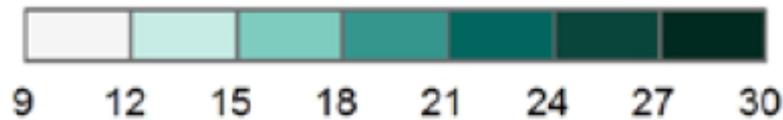
**Expect summers to
be drier ...**

**... and winters to
be wetter**



Expect heavy downpours to continue to increase

Percent change by 2050s in days > 1"



Sectors

- ❖ Energy
- ❖ Agriculture
- ❖ Forestry
- ❖ Water quantity & quality
- ❖ Human health
- ❖ Tourism & outdoor recreation



Energy impacts

Increased energy consumption due to more summer cooling (outweighs less winter heating)

Reduced availability of cooling water for electric power generation

Reduced grid reliability due to stronger storms and floods

Energy

How Can Pennsylvania Prepare?

Increase the application of **energy-efficient technologies**

Adopt policies to encourage **shift of electricity demand** to non-peak times

Encourage efficient **building-integrated sources of backup power**

Develop **smart energy micro-grids** to increase resilience of the energy system

Tourism & Outdoor Recreation impacts

Longer warm season for outdoor activities but extreme heat periods will increase

Some rivers and streams will **no longer be suited for cold-water fishing**

Higher snow-making costs may make ski resorts economically unviable

Tourism and Outdoor Recreation

How Can Pennsylvania Prepare?

- Expect an **increased demand for summer outdoor recreation opportunities**
- More educational programs **to avoid insect-borne and water-borne diseases**
- People with **respiratory diseases and allergies** should take extra precaution

Water Quality and Quantity Impacts

Peak flows will continue to rise, likely causing **higher bank erosion**, lower stream health, impaired habitat, and higher sediment outputs

Flood risks to infrastructure will increase

Ability of wetlands to improve water quality, flood storage, and habitat will be **diminished**

Warming will **counteract improvements in dissolved oxygen levels** made under the Clean Water Act

Water Quality and Quantity

How Can Pennsylvania Prepare?

Strengthen **flood management infrastructure**

Improve non-point source pollution control to reduce nutrient and pathogen loading to rivers and streams.

Increase programs for monitoring, assessing, and abating **water channel degradation**.

Enhance **wetland conservation** to maintain/increase the adaptive capacity that these systems provide for stream water quality and quantity.

Factsheets for Public Education

<http://psiee.psu.edu/climate-impacts>

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Pennsylvania Climate Impact Assessment Report Topics In Focus:

Energy

A team of researchers from Penn State assessed the effects of changing weather conditions on agriculture, health, tourism, forestry, and energy in the 2015 Pennsylvania Climate Impact Assessment Update. The report also provides recommendations to help Pennsylvanians prepare and respond.

What's Changing?

- Warmer weather. By 2050 the annual average temperature is forecast to be 5-6 °F warmer than it was from 1971 to 2000.
- Increased energy consumption, increased demands for summer time cooling are expected to outweigh decreased energy demands for winter time heating.

How Can Pennsylvania Prepare?

- Improve energy efficiency.
- Consider the impact of energy demands on the environment.

Learn More

The Penn State Climate Institute 814-863-4287

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Pennsylvania Climate Impact Assessment Report Topics In Focus:

Forestry

A team of researchers from Penn State assessed the effects of changing weather conditions on agriculture, health, tourism, forestry, and energy in the 2015 Pennsylvania Climate Impact Assessment Update. The report also provides recommendations to help Pennsylvanians prepare and respond.

What's Changing?

- Suitable habitat for tree species in Pennsylvania is expected to move to higher latitudes and elevations.
- In the near term at least, the average tree growth rates in Pennsylvania should increase because of higher atmospheric carbon dioxide concentrations, longer growing seasons, and increased precipitation.

How Can Pennsylvania Prepare?

- Mortality and pest ranges.
- As of now, most tree species are not at risk.

Learn More

The Penn State Climate Institute 814-863-4287

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Pennsylvania Climate Impact Assessment Report Topics In Focus:

Human Health

A team of researchers from Penn State assessed the effects of changing weather conditions on agriculture, health, tourism, forestry, and energy in the 2015 Pennsylvania Climate Impact Assessment Update. The report also provides recommendations to help Pennsylvanians prepare and respond.

What's Changing?

- Increase in respiratory illness due to increased summer ozone formation and longer pollen and mold seasons.
- Increase in water-borne pathogens leads due to increased surface runoff from livestock farms, sewer overflows, and resuspension of pathogens in shallow water bodies during low water periods.

How Can Pennsylvania Prepare?

- Improve water quality.
- Reduce water consumption.

Learn More

The Penn State Climate Institute 814-863-4287

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Pennsylvania Climate Impact Assessment Report Topics In Focus:

Tourism & Recreation

A team of researchers from Penn State assessed the effects of changing weather conditions on agriculture, health, tourism, forestry, and energy in the 2015 Pennsylvania Climate Impact Assessment Update. The report also provides recommendations to help Pennsylvanians prepare and respond.

What's Changing?

- Longer warm season suitable for outdoor activities, but higher temperatures will occasionally limit outdoor activity.
- Shorter, warmer winters with less snow.

How Can Pennsylvania Prepare?

- Water recreation.
- Some fishing.

Learn More

The Penn State Climate Institute 814-863-4287

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Pennsylvania Climate Impact Assessment Report Topics In Focus:

Agriculture

A team of researchers from Penn State assessed the effects of changing weather conditions on agriculture, health, tourism, forestry, and energy in the 2015 Pennsylvania Climate Impact Assessment Update. The report also provides recommendations to help Pennsylvanians prepare and respond.

What's Changing?

- Warmer weather: By 2050 the annual average temperature is forecast to be 5-6 °F warmer than it was from 1971 to 2000.
- More frequent extremely high temperatures.
- Higher average precipitation, particularly in winter and spring.
- Increases in heavy precipitation.
- Longer growing season.

How Can Pennsylvania Prepare?

- Dairy production. Producers need to mitigate heat stress to maintain milk yields and forage quality.
- Meat production. Producers may need to provide less heating to livestock houses in the winter, but more cooling in the summer.
- Wine. Growers may consider replacing some native American grapes with European varieties.
- Plan for potential business opportunities: A warmer climate could stimulate a movement of poultry and hog production from southern states to Pennsylvania, expand double cropping beyond southeast Pennsylvania, improve chances of successfully establishing winter cover crops, and increase corn and soybean yields.
- All crop and livestock producers should strengthen pest, weed and diseases management practices.

Learn More

These are just a few points of interest regarding changes to agriculture in Pennsylvania. Explore this Topic in Focus further, plus other topics of interest to you, by visiting <http://psiee.psu.edu/climate-impacts> or call the Penn State Environment and Natural Resources Institute at 814-863-4287.

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Pennsylvania Climate Impact Assessment Report Topics In Focus:

Water Management

A team of researchers from Penn State assessed the effects of changing weather conditions on agriculture, health, tourism, forestry, and energy in the 2015 Pennsylvania Climate Impact Assessment Update. The report also provides recommendations to help Pennsylvanians prepare and respond.

What's Changing?

- Rising peak flows in river systems as well as wetter soils at higher elevations and greater runoff from snowmelt are expected.
- Flood risks to urban and rural infrastructures would be more substantial because of the rising peak flows in river systems with predicted higher precipitation in winter and spring.
- Main significant seasonal wetting in wetland hydrologic conditions, affecting the ability of wetlands to improve water quality, provide habitat, and provide flood storage.
- Sea-level rise and salt water intrusion have the potential to exacerbate the currently highly stressed state of southeastern Pennsylvania's tidal wetlands.
- Warming would counteract the improvements in dissolved oxygen levels made under the Clean Water Act.

How Can Pennsylvania Prepare?

- Strengthen flood management infrastructure to cope with more extreme and frequent floods, including increasing the use of pervious surface and green infrastructure.
- Strengthen flood preparedness in municipalities and communities.
- Reduce nutrient and pathogen loads to rivers and streams.
- Increase programs for monitoring, assessing, and abating water channel degradation.
- Enhanced wetland conservation, to maintain/increase the adaptive capacity that these systems provide for stream water quality and quantity.

Learn More

These are just a few points of interest regarding changes to water quantity and quality in Pennsylvania. Explore this Topic in Focus further, as well as other topics of interest to you, by visiting <http://psiee.psu.edu/climate-impacts> or call the Penn State Environment and Natural Resources Institute at 814-863-4287.