



# Climate change effects on plant allergens

ALLISON CRIMMINS

U.S. ENVIRONMENTAL PROTECTION AGENCY

HEALTH IN A CHANGING CLIMATE 10/5/19



“Climate change exacerbates some existing health threats and creates new public health challenges.”

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USGCRP 2016. THE IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH IN THE UNITED STATES: A SCIENTIFIC ASSESSMENT

[HTTPS://HEALTH2016.GLOBALCHANGE.GOV](https://health2016.globalchange.gov)

# Public health implications of rising CO<sub>2</sub> and climate change on:

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## AIR QUALITY

- Ozone
- Particulate Matter
  - PM<sub>2.5</sub> & wildfire emissions
  - **Aeroallergens**
  - Dust
  - Harmful Algal Blooms
- Mold & other indoor pollutants

## PLANTS

- Agriculture and Forestry
- Food security/ food safety
- Nutrition
- **Aeroallergens**
- Contact dermatitis
- Medicine/ narcotics
- Increased pesticide use

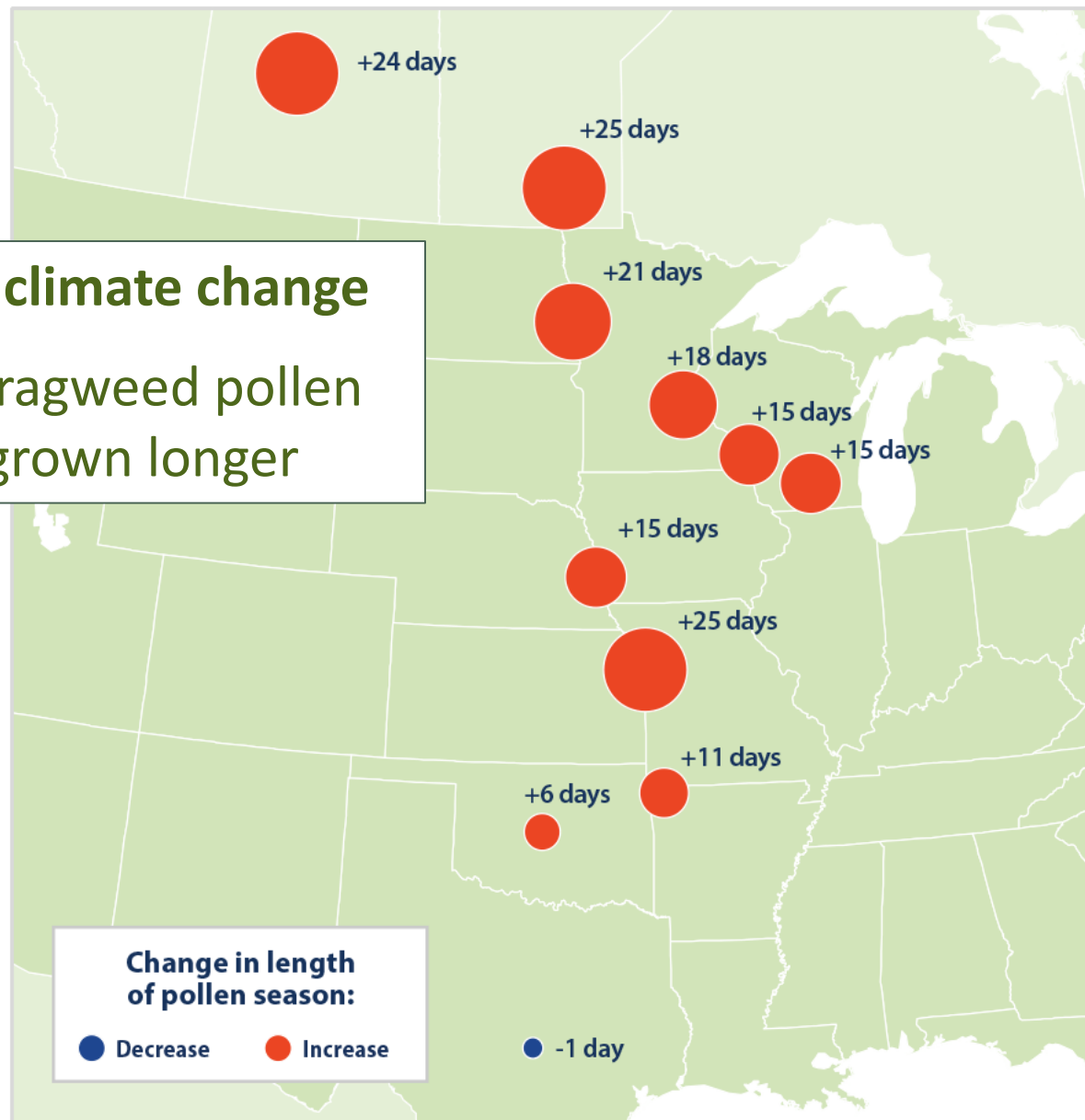
# Climate change impacts on aeroallergens

Rising CO<sub>2</sub>, higher temperatures, and changes in precipitation patterns may alter the production, allergenicity, distribution, and timing of airborne allergens (aeroallergens) in four main ways:

- 1. Longer growing seasons**
- 2. More pollen production**
- 3. Higher allergenicity**
- 4. Expanded geographic distribution of pollens**

## Indicator of climate change

Since 1995, ragweed pollen season has grown longer



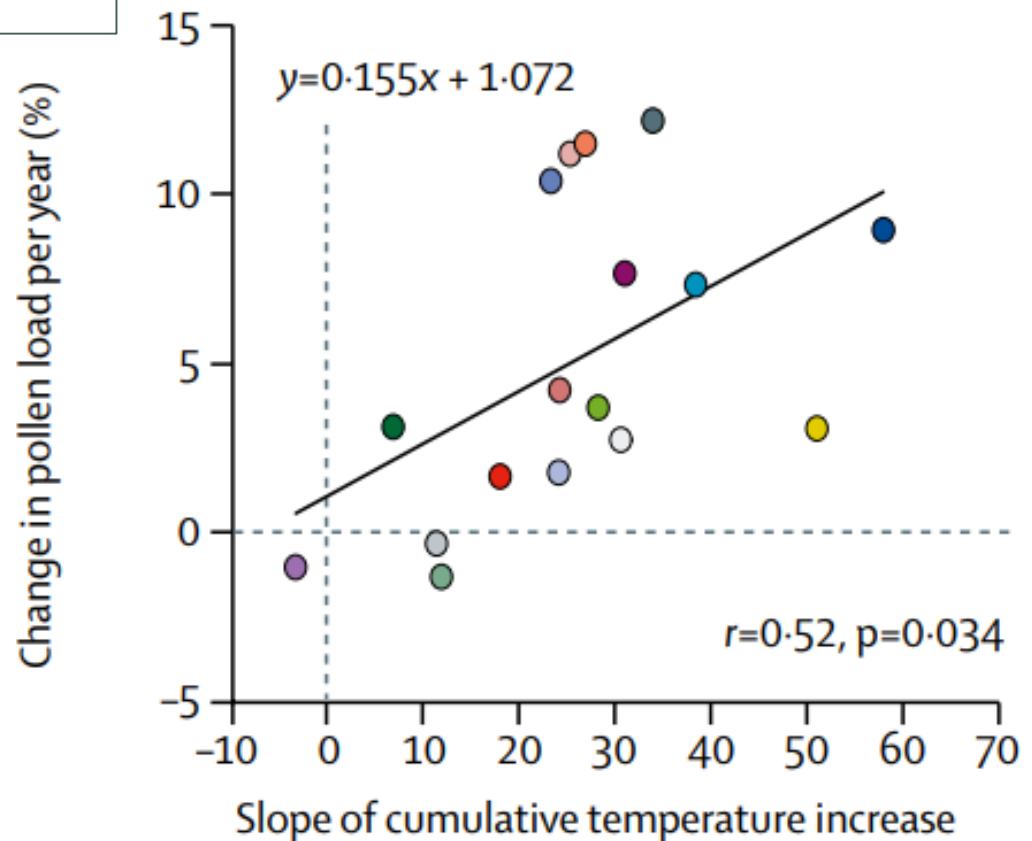
<https://www.epa.gov/climate-indicators>

## Indicator of climate change

Observed increases in annual pollen load and extended pollen seasons in N. Hemisphere

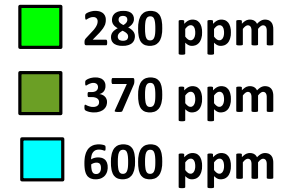
- |                       |                        |
|-----------------------|------------------------|
| ○ Belgium, Brussels   | ○ Greece, Thessaloniki |
| ● Canada Saskatoon    | ● Iceland, Reykjavik   |
| ● Canada, Winnipeg    | ○ Italy, Legnano       |
| ● Finland, Kevo       | ● Korea, Busan         |
| ● Finland, Turku      | ● Korea, Seoul         |
| ● France, Amiens      | ● Poland, Krakow       |
| ● Russia, Moscow      |                        |
| ● Switzerland, Geneva |                        |
| ● USA, Fairbanks      |                        |
| ● USA, Minneapolis    |                        |
| ● USA, Papillion      |                        |

Change in annual pollen load (%) as a function of daily maximum temperature

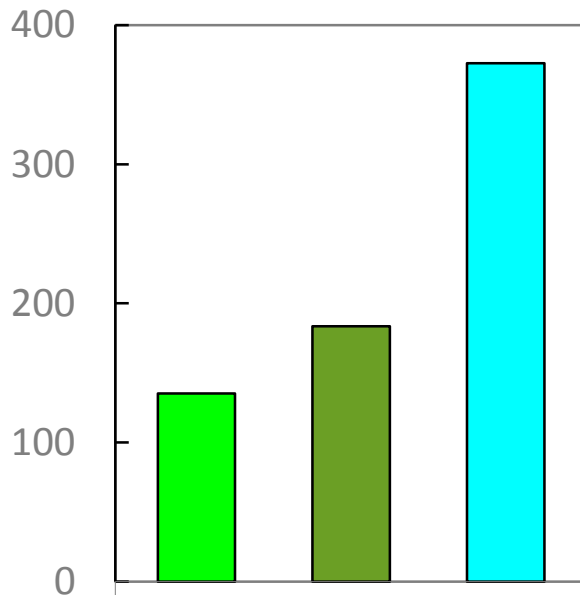


## Experimental impact of climate change on ragweed

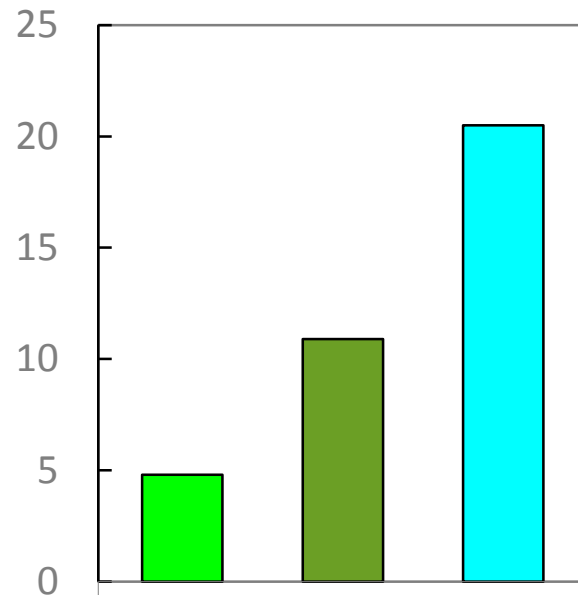
More CO<sub>2</sub> = more plant, more pollen, more protein (antigen)



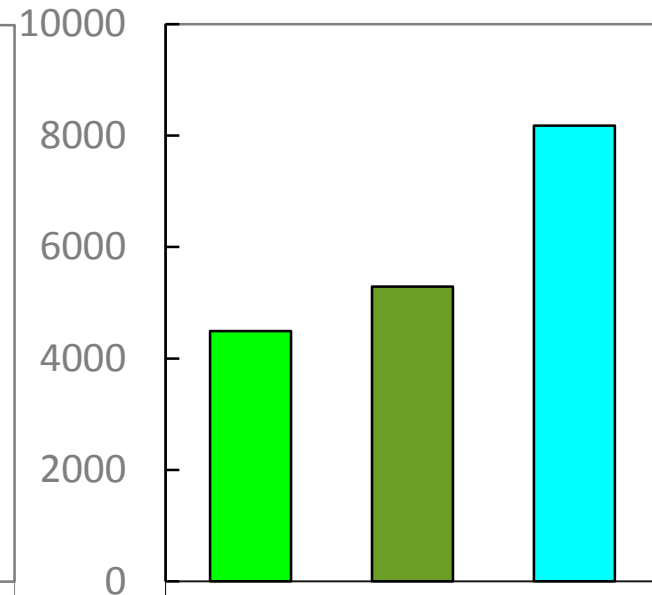
**Changes in plant weights**  
(leaf, stem, roots in grams)



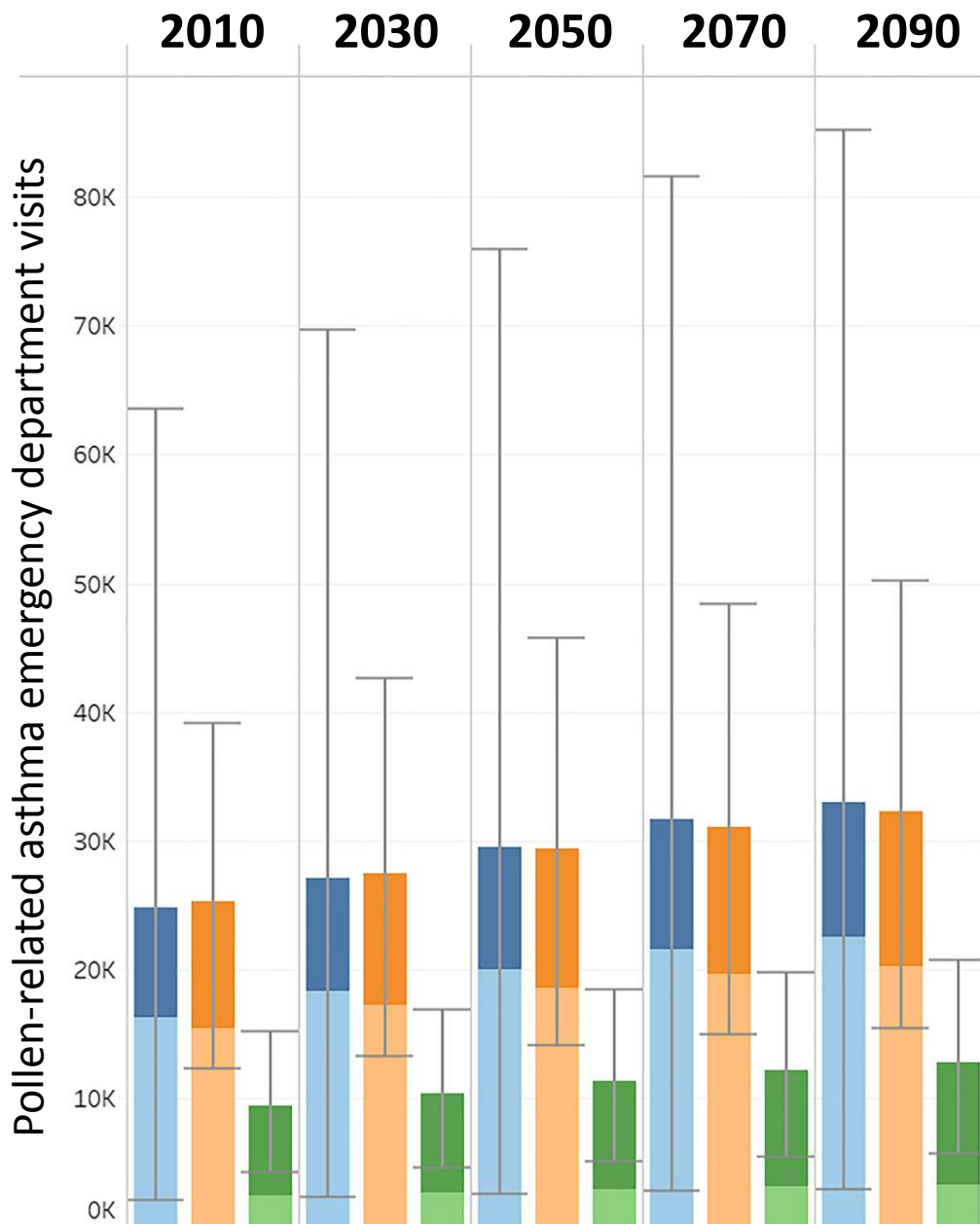
**Pollen Production**  
(grams)



**Antigen Amb a1**  
(ELISA/mg protein)



*Functional Plant Biology 27:893-898 and 32:667-670*



## Projected impact of climate change on oak, birch, grass

Future asthma emergency department visits shown here are only due to population

Pollen, Age Group

- Oak, 18-99**
- Oak, 1-17**
- Birch, 18-99**
- Birch, 1-17**
- Grass, 18-99**
- Grass, 1-17**

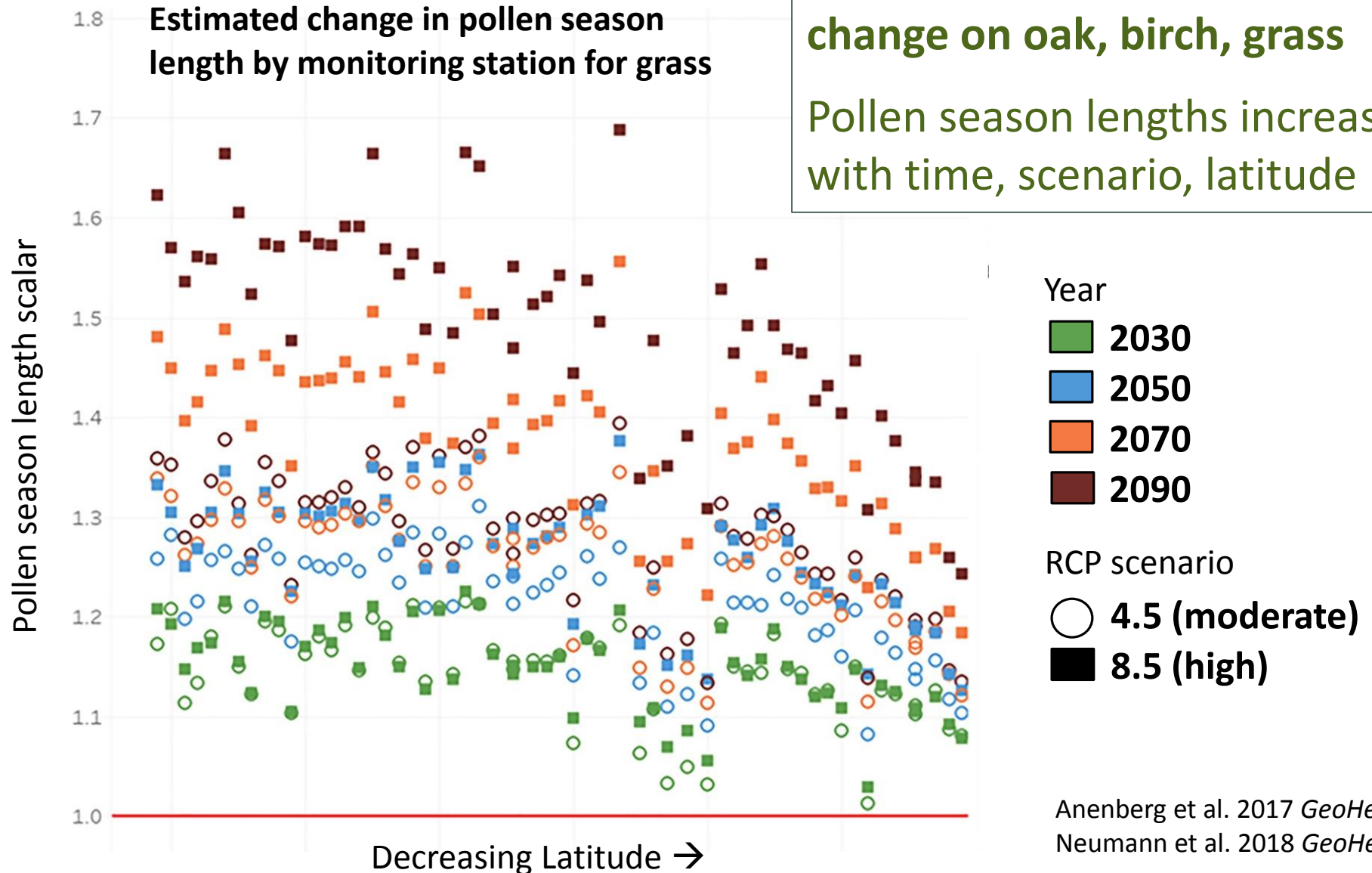
Anenberg et al. 2017 *GeoHealth*  
Neumann et al. 2018 *GeoHealth*



## Projected impact of climate change on oak, birch, grass

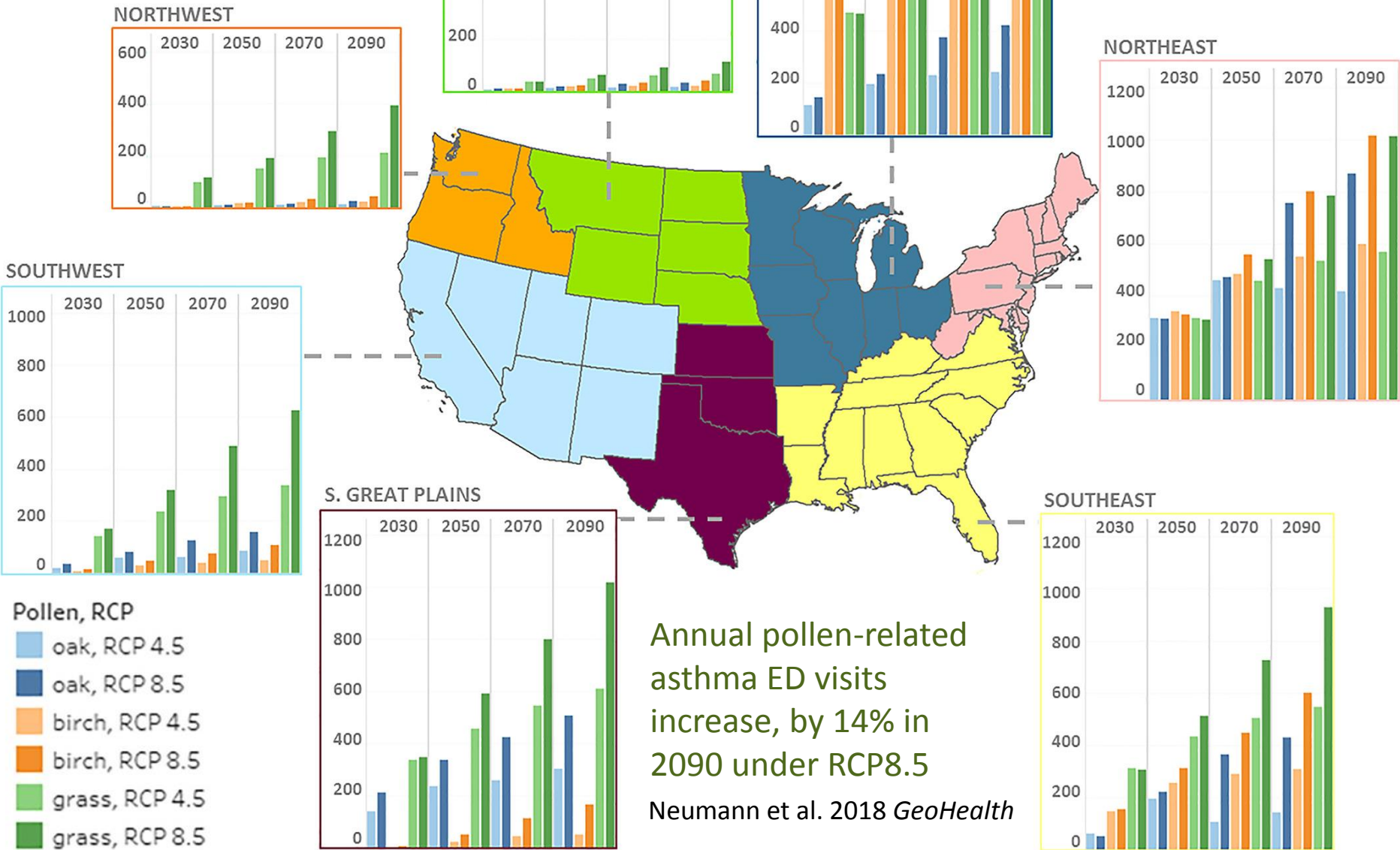
Pollen season lengths increase with time, scenario, latitude

Estimated change in pollen season length by monitoring station for grass



Anenberg et al. 2017 *GeoHealth*  
Neumann et al. 2018 *GeoHealth*

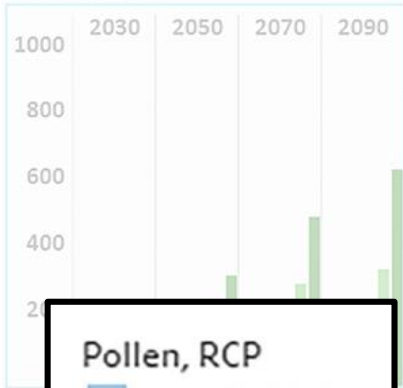
# Projected impact of climate change on oak, birch, grass



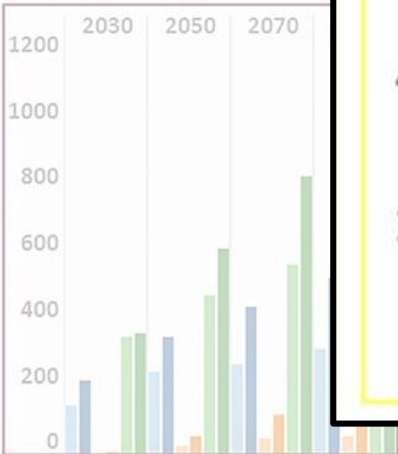
# Projected impact of climate change on oak, birch, grass

Annual additional  
asthma emergency  
department visits

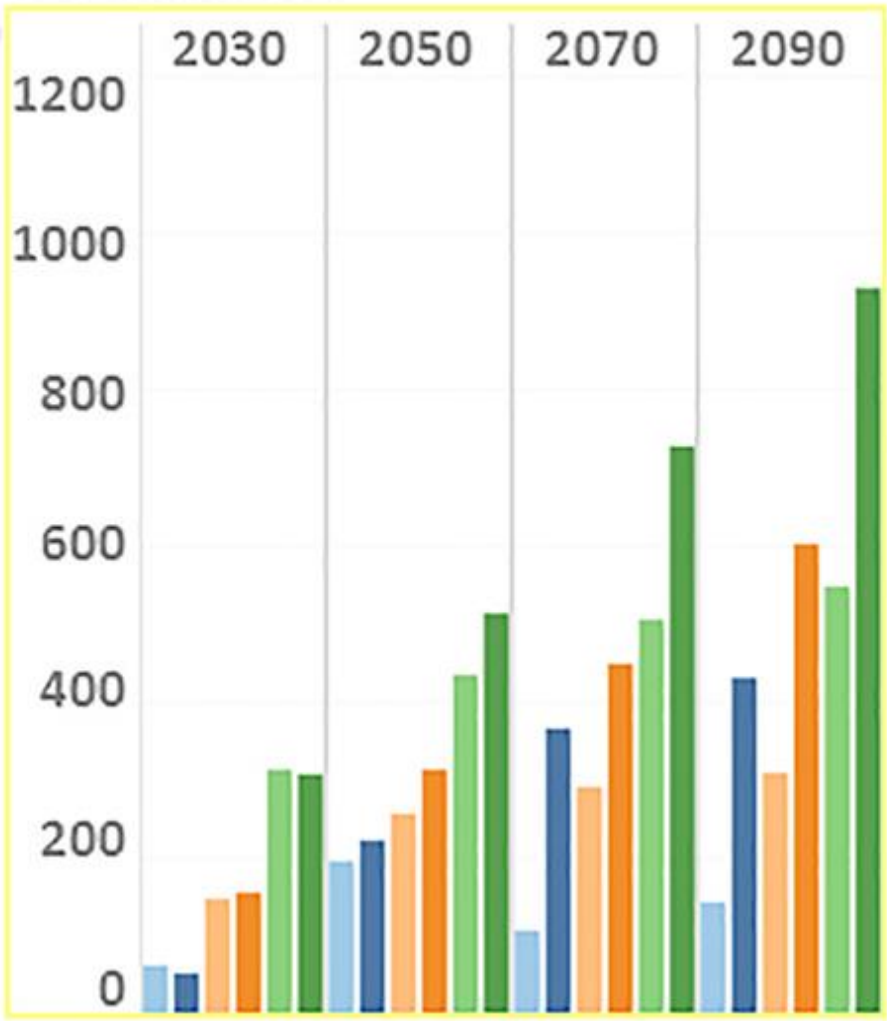
SOUTHWEST



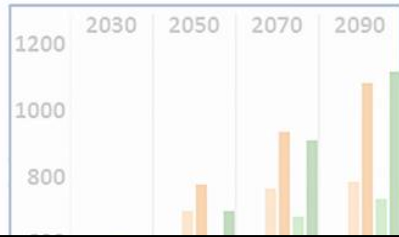
S. GREAT PLAINS



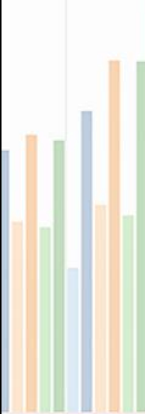
SOUTHEAST



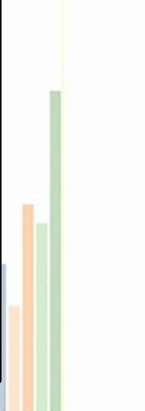
MIDWEST



2070 2090



2090



“Climate and health impacts do not occur in isolation, and an individual or community could face multiple threats at the same time, at different stages in one’s life, or accumulating over the course of one’s life.”

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