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.”

USGCRP 2016. THE IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH IN THE UNITED STATES: A SCIENTIFIC ASSESSMENT
HTTPS://HEALTH2016.GLOBALCHANGE.GOV
Public health implications of rising CO$_2$ and climate change on:

**AIR QUALITY**
- Ozone
- Particulate Matter
  - PM$_{2.5}$ & 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$_2$, 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

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

Ziska et al. 2019. *Lancet Planetary Health*
Experimental impact of climate change on ragweed

More CO$_2$ = 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

Anenberg et al. 2017 *GeoHealth*
Neumann et al. 2018 *GeoHealth*
Estimated change in pollen season length by monitoring station for grass

Projected impact of climate change on oak, birch, grass
Pollen season lengths increase with time, scenario, latitude

Year
- 2030
- 2050
- 2070
- 2090

RCP scenario
- 4.5 (moderate)
- 8.5 (high)

Anenberg et al. 2017 GeoHealth
Neumann et al. 2018 GeoHealth
Projected impact of climate change on oak, birch, grass

Annual pollen-related asthma ED visits increase, by 14% in 2090 under RCP8.5

Neumann et al. 2018 *GeoHealth*
Projected impact of climate change on oak, birch, grass

Annual additional asthma emergency department visits

Pollen related emergency department visits increase, by 14% in 2090 under RCP8.5
“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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