

The Health Impacts of Air Pollution from a Changing Climate



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The presenter has no conflict of interest with
any corporate organizations relating to this
presentation.

Air pollution – Then and now



Air pollution – Then and now



Air pollution still a problem

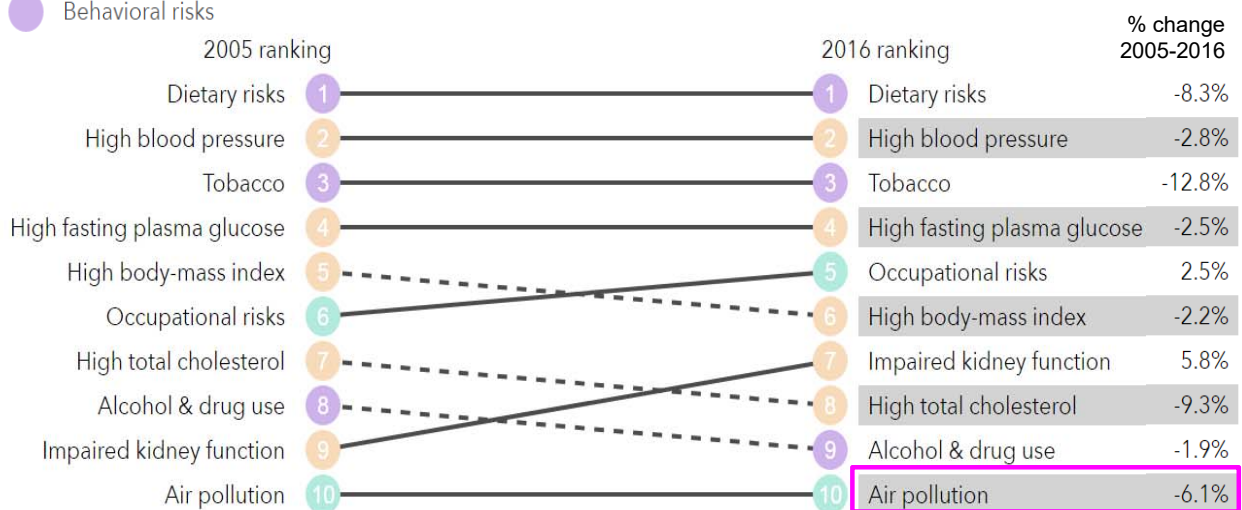




Death and Disability Risk Factors: Japan

- Metabolic risks
- Environmental/occupational risks
- Behavioral risks

Air pollution is a major health risk factor



Potential Climate Change Impacts

Agriculture



- Crop yields
- Irrigation demands

Forests



- Composition, health
- Geographic range
- Productivity

Species and Ecosystems



- Shift in ecological zones
- Loss of habitat and species

Water Resources



- Water supply
- Water quality

Coastal Areas



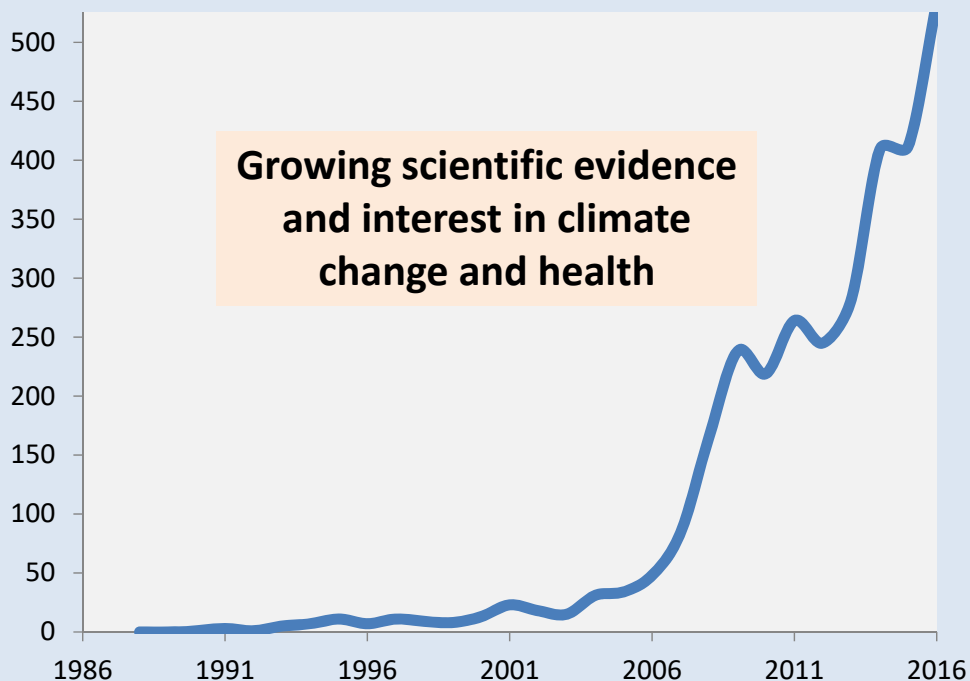
- Erosion of beaches
- Salt water intrusion

Human Health



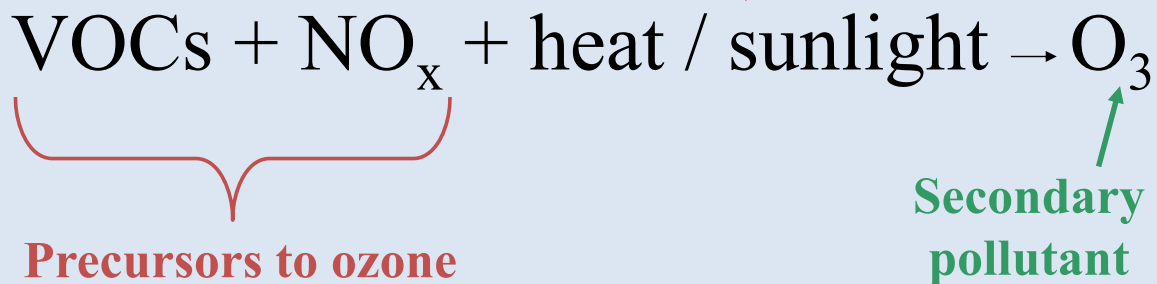
- Weather-related illness
- Infectious disease
- Air quality effects

Climate Change and Health Scientific Publications

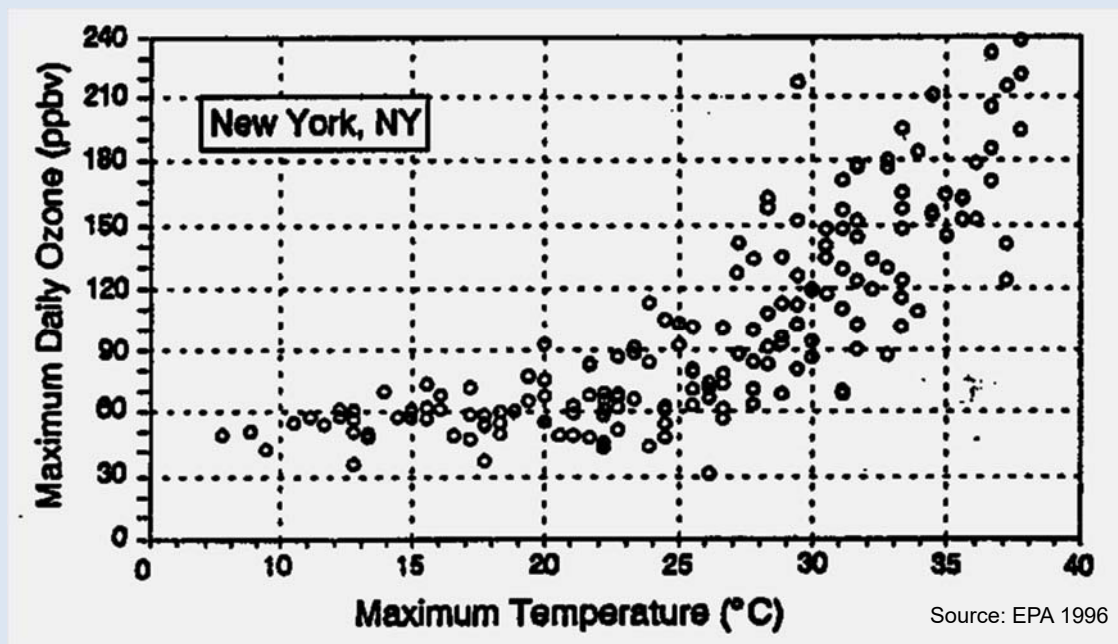


Tropospheric ozone chemistry (simplified)

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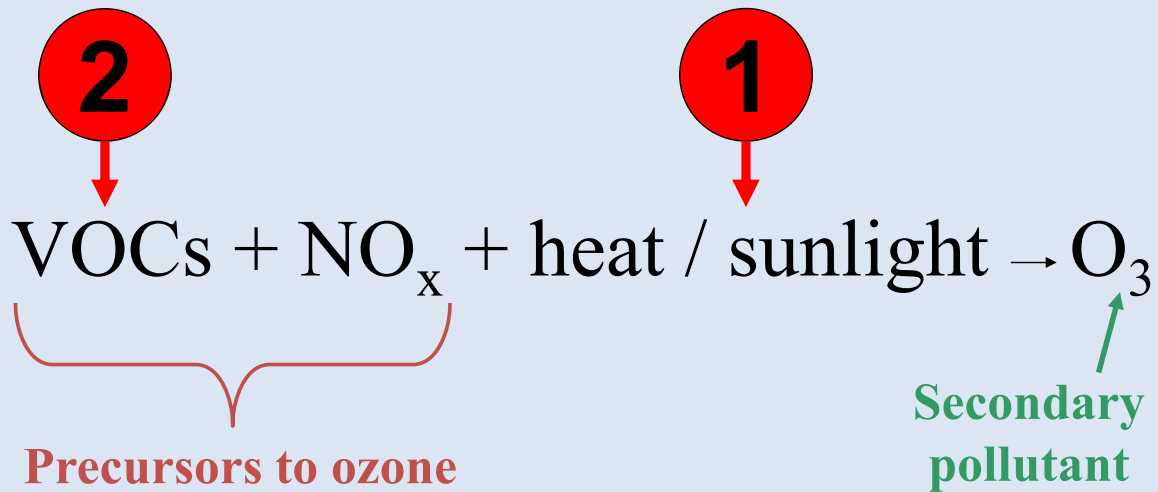


Temperature and Ozone Formation

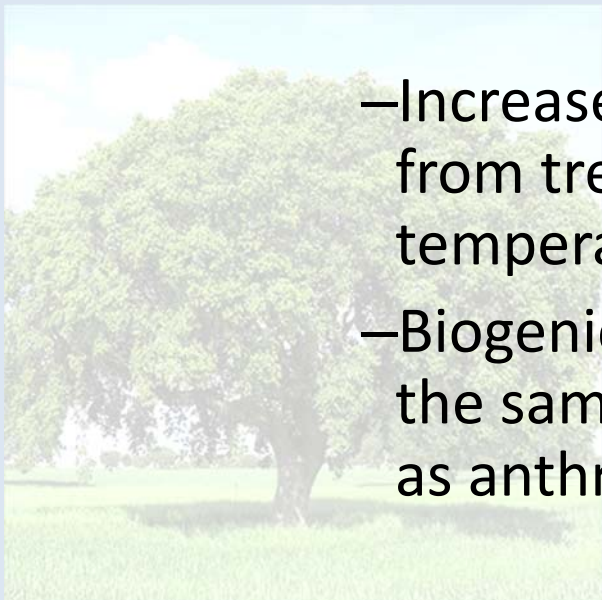


Higher temperature means higher ozone levels

Tropospheric ozone chemistry (simplified)

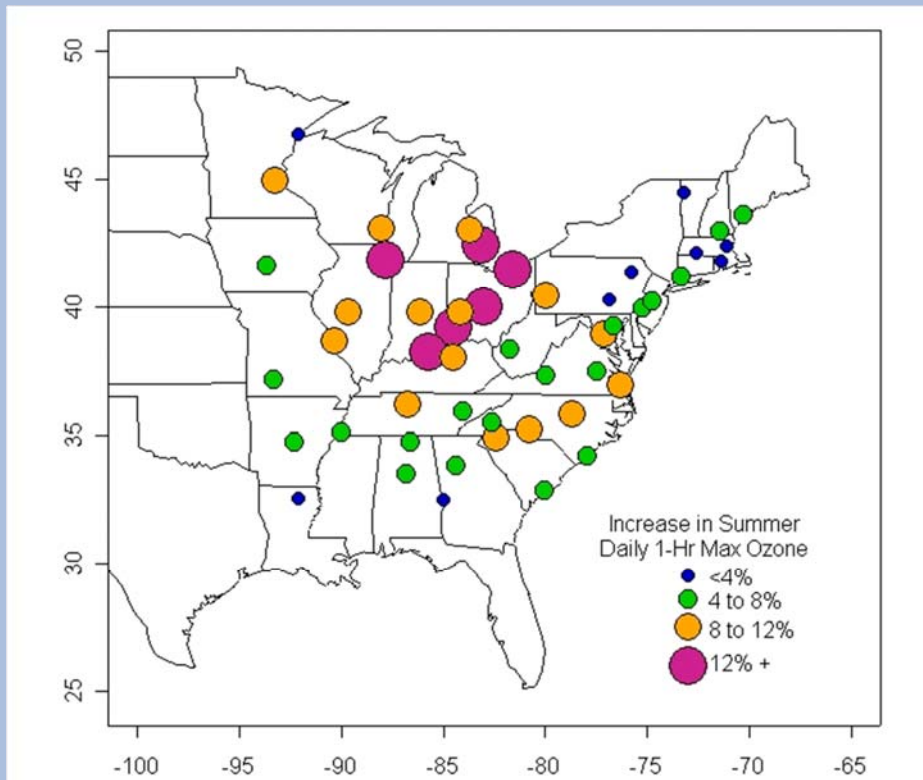


Climate Change Impacts on Biogenic Emissions



- Increased VOC emissions from trees with higher temperature
- Biogenic emissions can be on the same order of magnitude as anthropogenic emissions

Increase in Ozone (1990s to the 2050s)



Climate change means higher ozone levels

Wildfires under a Changing Climate



Forest Fire Pollution and Health

- Forest fire smoke hazardous to human health (USFS)
- U.S. (2000-2010)
 - Almost \$7 billion in property damage and \$58 million in crop damage (NOAA)

Damages underestimated. Little known about health impacts.
(Liu et al. *Environ Res* 2015)

7.2% increase in respiratory hospital admissions (95% CI 0.25, 14.6%) during smoke waves compare to non-smoke waves

- "Smoke wave" = ≥ 2 days with wildfire-specific $PM_{2.5} > 37 \mu\text{g}/\text{m}^3$

Wildfire smoke associated with risk of respiratory hospitalizations.
(Liu et al. *Epidemiology* 2017)

Estimate $PM_{2.5}$ Specifically from Forest Fires

- GEOS-Chem model (Dr. Loretta Mickley, Harvard)
 - May-Oct 2004-2009 (present day) and 2046-2051 (future under climate change)
 - Generates daily estimated $PM_{2.5}$
- "Smoke Wave" (SW)
 - Defined as ≥ 2 days with daily wildfire- $PM_{2.5} > 20 \mu\text{g}/\text{m}^3$ (98th percentile of all daily wildfire- $PM_{2.5}$ in 561 US Western counties)
 - Each county-day defined as a SW or non-SW day

Study of Wildfire and Climate Change

– Western United States



Concluding Thoughts

- Growing evidence that climate change will impact human health
- Ambient air pollution: still an important health concern worldwide
- Tropospheric ozone and wildfire pollution: Two examples of air pollution concerns anticipated to increase under climate change
- Overlaps between air quality and climate change policy – a step towards solutions



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