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Extreme smoke events: climate change and human health in western Montana

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Extreme smoke: climate change and human health in western Montana

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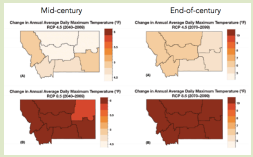
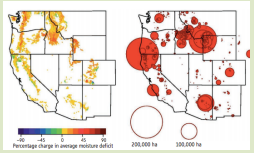
Introduction

Projections of climate change show that the western Montana will experience hotter and drier summers that may extend fire seasons. Extended fire seasons can lead to extreme smoke, which is harmful to human health. There is not extensive research on these health impacts or on adaptation strategies for smoke exposure. My report draws on available research to synthesize the relationship between climate change, smoke, and human health impacts, as well as explore possible adaptation strategies and identify areas for further research.

Climate Change and Forest Fire in Montana

- Increased temperatures
- Decreased summer precipitation
- More frost free days
- Earlier snowmelt





In 34 years of western US wildfire data, the 14-year period from 1987 – 2003 had:

- Four times greater frequency of large fires than preceding years.
- Total area burned was six times greater
- Length of fire seasons was longer by 78 days.

Anthropogenic climate change accounted for :

- 55% of increases in fuel aridity in (1979-2015)
- 75% more fuel aridity (2000-2015)
- An additional 4.2 million hectares of forest fire area burned

Health Impacts

Smoke from wildfire consists of a mixture of water vapor, particulate matter, carbon monoxide, hydrocarbons, nitrogen oxides, and other organic chemicals. Fine particulate matter is the main pollutant of concern.

Fine particulate matter deposits into the alveoli of the lungs and triggers an inflammatory response. This impairs gas exchange function while immune cells attempt to rid the lungs of the pollutants. Inhaled particulates also interact with neuron receptors that communicate with the autonomic nervous system. The resulting signals and chemical interactions can cause increases in blood pressure and changes to heart rhythm.

Respiratory and Cardiovascular Risk

Wildfire smoke exposure is significantly correlated with all – cause mortality, respiratory morbidity including infection and asthma, and chronic obstructive pulmonary disease. Some evidence suggests correlations with cardiovascular morbidity, low birth weight, and psychological impacts. Emergency room visits for respiratory and cardiovascular complaints increase significantly during and following heavy smoke.

Montana Particle Pollution

Eight different counties including Missoula received an F grade for short term particle pollution in a recent American Lung Association Report.

The report did not include data from the 2017 summer.

Summer Smoke 2017

Air quality in Missoula county rose to harmful and hazardous levels for over one month. The EPA quantifies healthy air as having particulate matter levels below 35 u/m^3.

Seeley Lake – 50 consecutive days of smoke, 44 with air quality designated 'harmful', 35 designated 'hazardous'

Adaptation Strategies

Forest Management

Prescribed burning and mechanical removal have known benefits for forest health and wildfire severity reduction. However, recent cost-analyses of these methods show they have little impact on overall location, frequency, size, and severity of fires in the western US.

Clean Air

Portable HEPA filters
HVAC systems
N95 Respirators

Recommendation

Focus on distribution strategies for HEPA filters, community education, and upgrading public an commercial HVAC systems

Questions to be Addressed

- How many filters should be kept as an emergency cache
- Where will these filters be stored?
- How will filters be distributed during emergencies?
- What is the hierarchy of populations at risk?
- How will at risk individuals access these services
- How will filters be properly maintained (through health departments, through education and outreach)
- Assessment of HVAC systems in schools and public buildings
- Possibility of future smoke safe infrastructure laws or building codes

Sources

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