Where in the West?

A geographer’s perspective on climate change and occupational hazards in the Western States.

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Why is a geographer’s perspective important to occupational health?

From Space to Place...“where” matters!
No two places have exactly the same climate.

United States map of Köppen climate classification

- Latitude
- Altitude
- Wind patterns
- Ocean currents
- Nearby water bodies
- Topography
- Vegetation
- Human land use/activity*

* Since agriculture began
Variations in Factors = Variations in Climate

Latitude
Altitude
Wind patterns
Ocean currents
Nearby water bodies
Topography
Vegetation

Human land use/activity*

* Since agriculture began
No two places will experience exactly the same climatic changes.

Source: NOAA NCDC/CICS-NC. Temperatures and precipitation changes from 1991-2012
Potential Effects of Climate Change

- **Health**: Weather-related mortality, infectious diseases, air-quality respiratory illnesses.
- **Temperature**: Changes in temperature can affect health and well-being.
- **Precipitation**: Changes in precipitation patterns can affect water resources and agriculture.
- **Sea Level Rise**: Impact on coastal areas, erosion of beaches, inundation of coastal lands.
- **Forests**: Changes in forest composition, geographic range, forest health and productivity, wildfires.
- **Species and Natural Areas**: Loss of habitat and species, cryosphere: diminishing glaciers.
- **Water Resources**: Changes in water supply, water quality, competition for water.
- **Agriculture**: Crop yields, irrigation demands.
- **Coastal Areas**: Erosion of beaches, inundation of coastal lands, additional costs to protect coastal communities.
- **Changing Rain and Snow Patterns**: Impact on hydrological cycles.
- **Changes in Animal Migration and Life Cycles**: Impact on biodiversity.
- **Stronger Storms**: Impact on infrastructure and property.
- **More Droughts and Wildfires**: Impact on ecosystems and livelihoods.
- **Damaged Corals**: Impact on marine ecosystems.
- **Rising Sea Level**: Impact on coastal communities and infrastructure.
- **Warmer Oceans**: Impact on marine life and fisheries.
- **Changes in Plant Life Cycles**: Impact on agriculture and ecosystems.

Source: NCA
Future Temperature and Precipitation Changes....Where in the West?

Source: Bureau of Reclamation http://www.usbr.gov/research/climate/abstracts/downscaling.html
Heatwaves….Where in the West??

Temperature Anomalies for June 17-24, 2012
Heat Wave Fueling Wildfires in Rockies

Source: NASA

Increase in heatwave duration

Source: NOAA
Workers at Risk for Heat Stress....Where in the West??

[Maps showing the distribution of heat-related fatalities and projections of extreme heat days across the USA]
Reduced Snowpack

Western Precipitation
When? Winter
Where? Mountains

Water Vulnerability
When? Summer
Where? Lowlands

Source: NOAA
2015 Drought Season Outlook

Droughts...Where in the West??

Source: Ault et al. 2014
Western Wildfires On the Rise
Warmer Temperatures Increase Fire Risk

Click on a state to see localized comparison

Western U.S.

Western U.S. wildfires have increased dramatically since 1970. Years with warmer spring and summer temperatures tend to have the most fires. In the coming decades, more warming and shrinking snowpack in the West is expected to cause even more big fires.

Wildfires...Where in the West??

Higher Temperatures Will Increase Burn Areas in the West

How much more area will burn each year if temperatures rise 1.8 °F:
- at least 6 times more
- 5-6 times more
- 4-5 times more
- 3-4 times more
- 2-3 times more
- up to 2 times more

Source: NRC 2009
Firefighters on Wildfires

- Year-round fire “season”
- Bigger
- Faster moving
- Unpredictable
- More destructive

Cool Night Air
Permafrost Thaw...Where in the West? Rather, Where in Alaska??

GIPL-2.0
Spatially Distributed Model of Permafrost Dynamics in Alaska
Source: University of Alaska Fairbanks

Mean Annual Temperature at 2 m Depth

Mean Annual Temperature at 5 m Depth

Mean Annual Temperature at 20 m Depth

Impacts of a Warming Arctic

Melting of Permafrost is having a marked Impact on Buildings and Ice Roads
Coastal Erosion and Flooding from Sea Level Rise...Where in the West??

Coastal Erosion from Sea Level Rise
Warming Oceans (Alaska)

- Declining Sea Ice
- Stormier Seas
- Threatened Coasts
  - Erosion
  - Storm Surges
  - Coastal Flooding
  - Community Relocation

Occupational Safety & Health

Increased risk of illness, injury, or death
- Heat Stress, Disaster Response,
- Hazardous Working Conditions,
- Poor Air Quality

Increased stress and associated effects on physical and mental health
- Traumatic Incident Stress, Lost Wages & Employment, Threats to Food & Water Security

The work can’t get done without them.
Takeaway Points!!!!

With an interdisciplinary approach, we have opportunity to identify....

...where occupational hazards may occur

...which occupations and industries may be most sensitive to climate change

...what measures may be implemented to protect higher risk worker groups
Thank You!!! 😊

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Cover and banner photo taken by Teri Jacobs in Denali National Park, Alaska 8/22/16