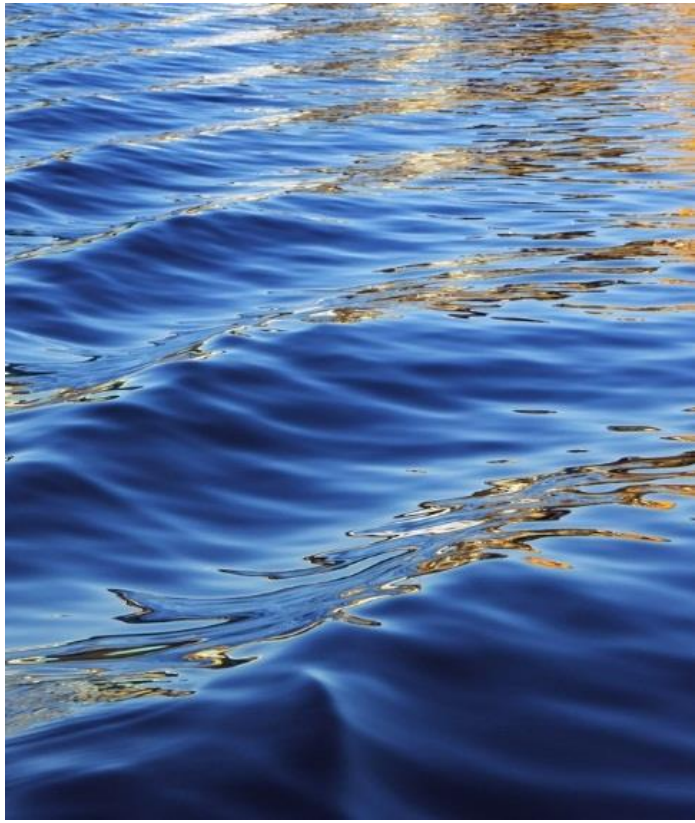
Changing Climate Exposures and Impacts; Temperature Extremes & Wildfire

Tribal Climate and Health Adaptation Webinar #2



Since Last Webinar

- Pre-assessment survey
- Groups.io
  - Accept invitation

Suggested action steps (complete before next webinar)

- Identify other members of your team or region that may benefit from taking the training
- Connect with your local Tribal Epidemiology Center
- Review work being done by tribes in your region on the BIA's U.S. Indigenous Peoples Resilience Actions Map

Suggested reading (complete before next webinar)

- Fourth National Climate Assessment: Regional Reports

Regions

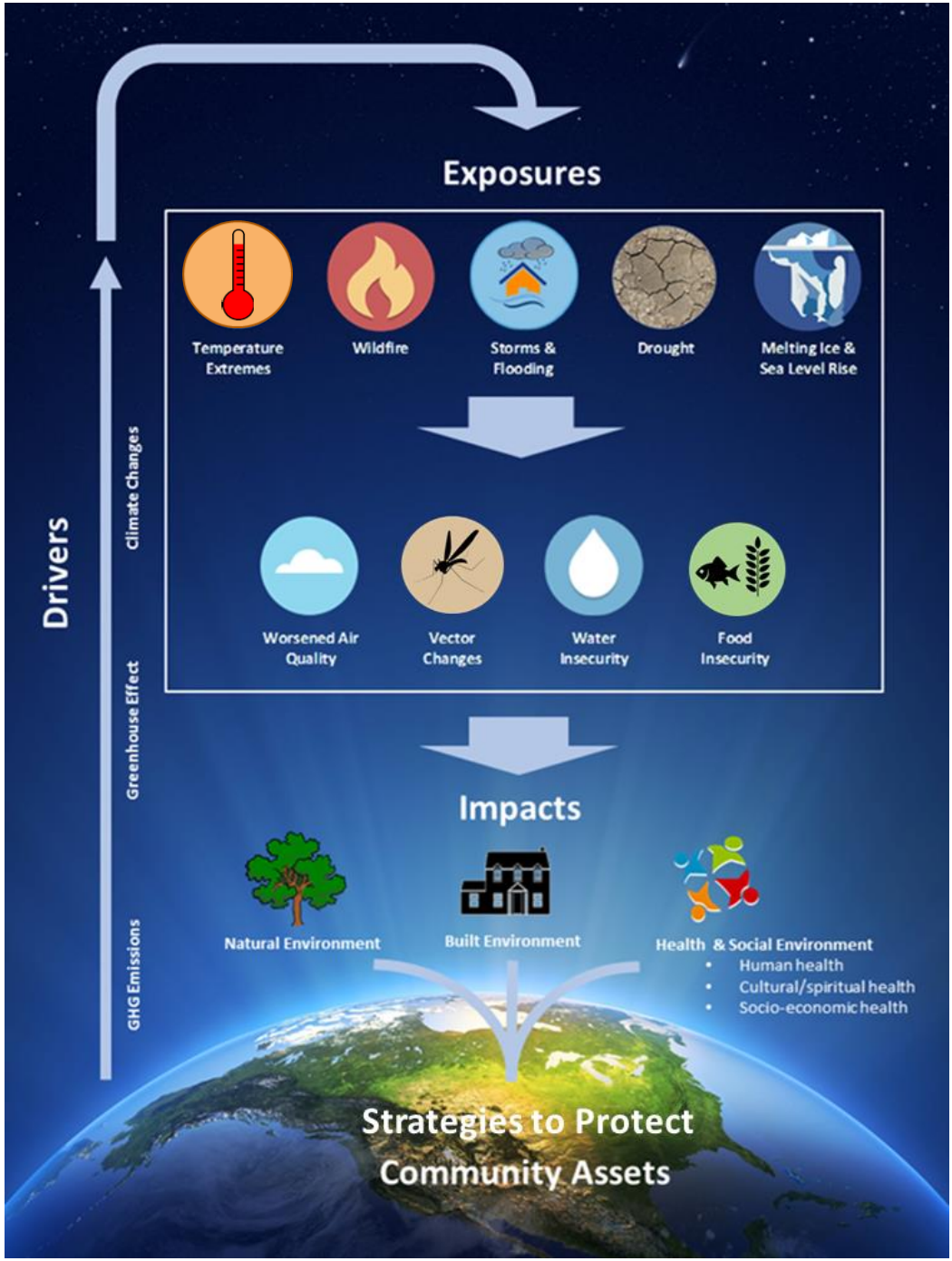
18. Northeast
19. Southeast
20. U.S. Caribbean
21. Midwest
22. Northern Great Plains
23. Southern Great Plains
24. Northwest
25. Southwest
26. Alaska
27. Hawai'i & U.S.-Affiliated Pacific Islands

Chat Discussion:

Did you make contact with your TEC? What did you read about that surprised you?

TCHP Framework

- Illustrates the cascading effects of climate change and how communities can protect assets against harmful impacts (basis for training)
- For example, communities that expect greater levels of flooding may look out for contaminated water and indoor mold spores.
- Not every exposure is applicable to every community, or to the same extent



TCHP Framework

Secondary exposures

Worsened Air Quality

- Ozone
- Smoke/Particulate matter
- Dust/Fungus
- Allergens
- Indoor mold

Vector Changes

- Disease-carrying ticks
- Disease-carrying mosquitos
- Disease carrying mice
- Forest Pests

Water Insecurity

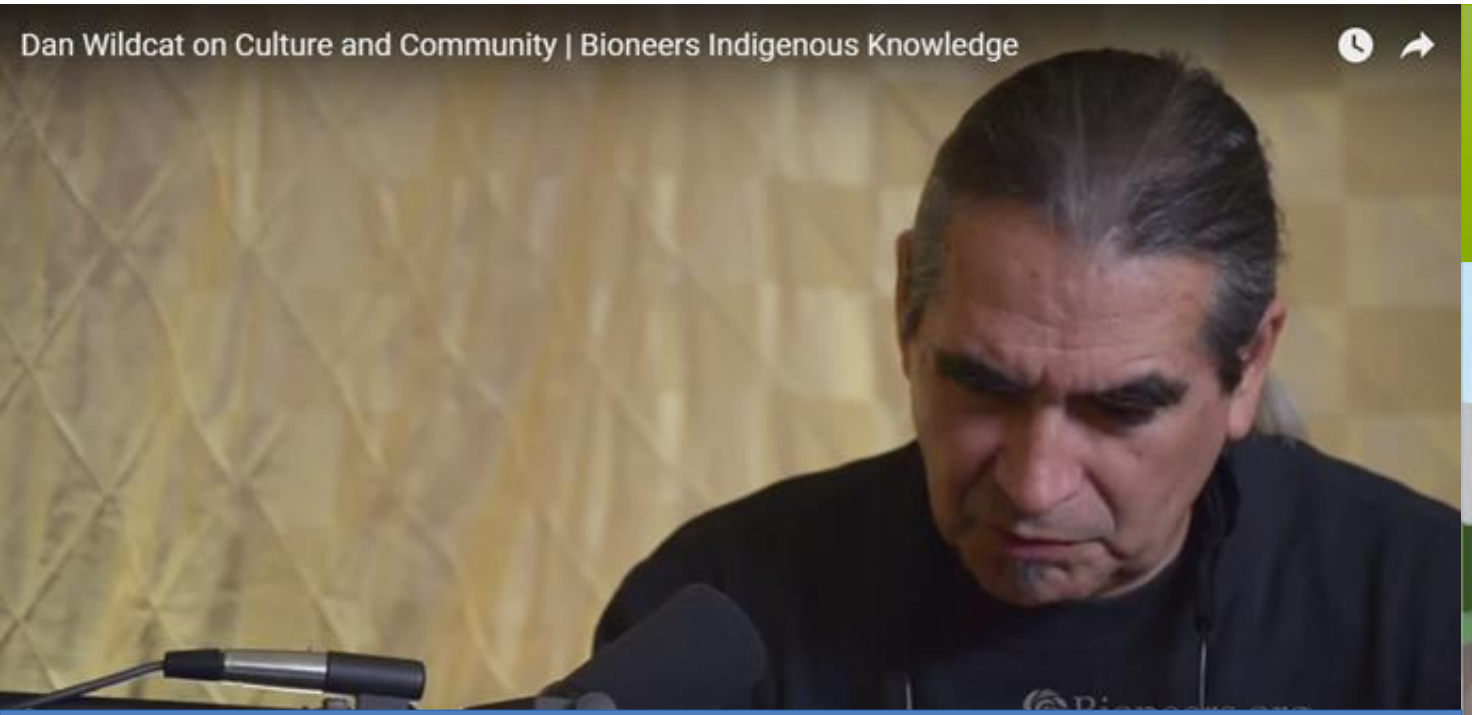
- Contamination
- Supply shortage
- Distribution disruption

Food Insecurity

- Supply shortage
- Distribution disruption

What is Health and Wellbeing?

Western and tribal communities often define health differently

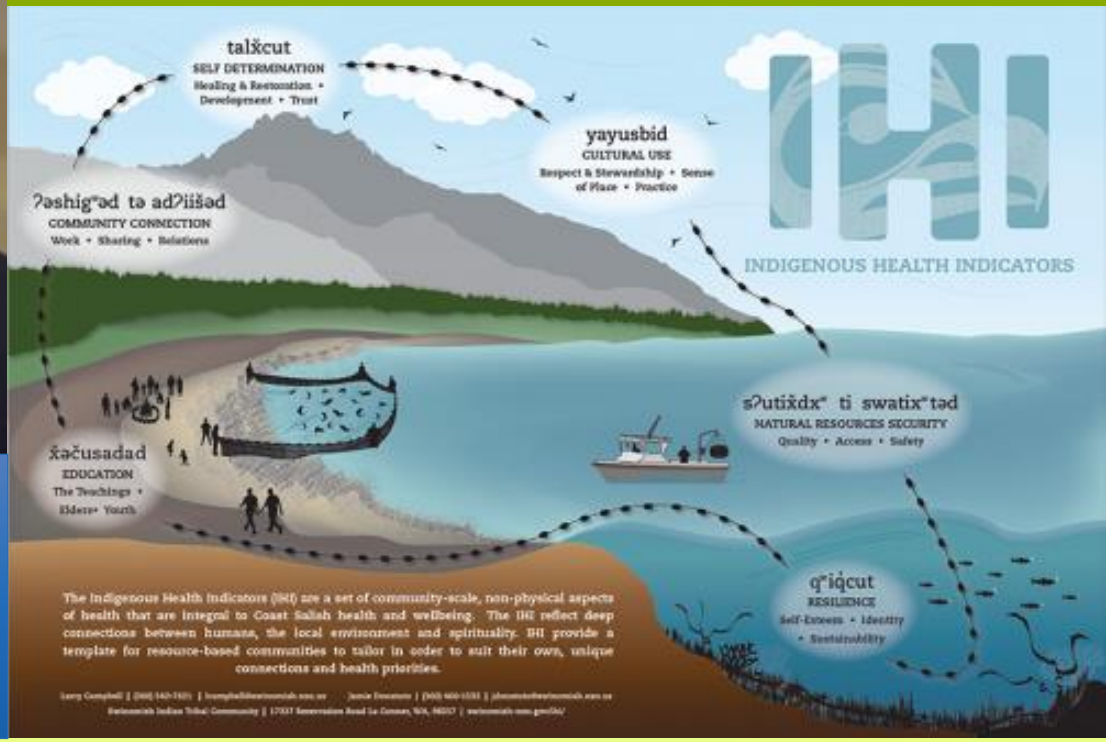


"Mission: By providing whole-person health services in medical care, preventative wellness programs, rural community infrastructure development and statewide solutions, we are able to protect and perpetuate our Alaska Native culture and traditions"

Alaska Native Tribal Health Consortium

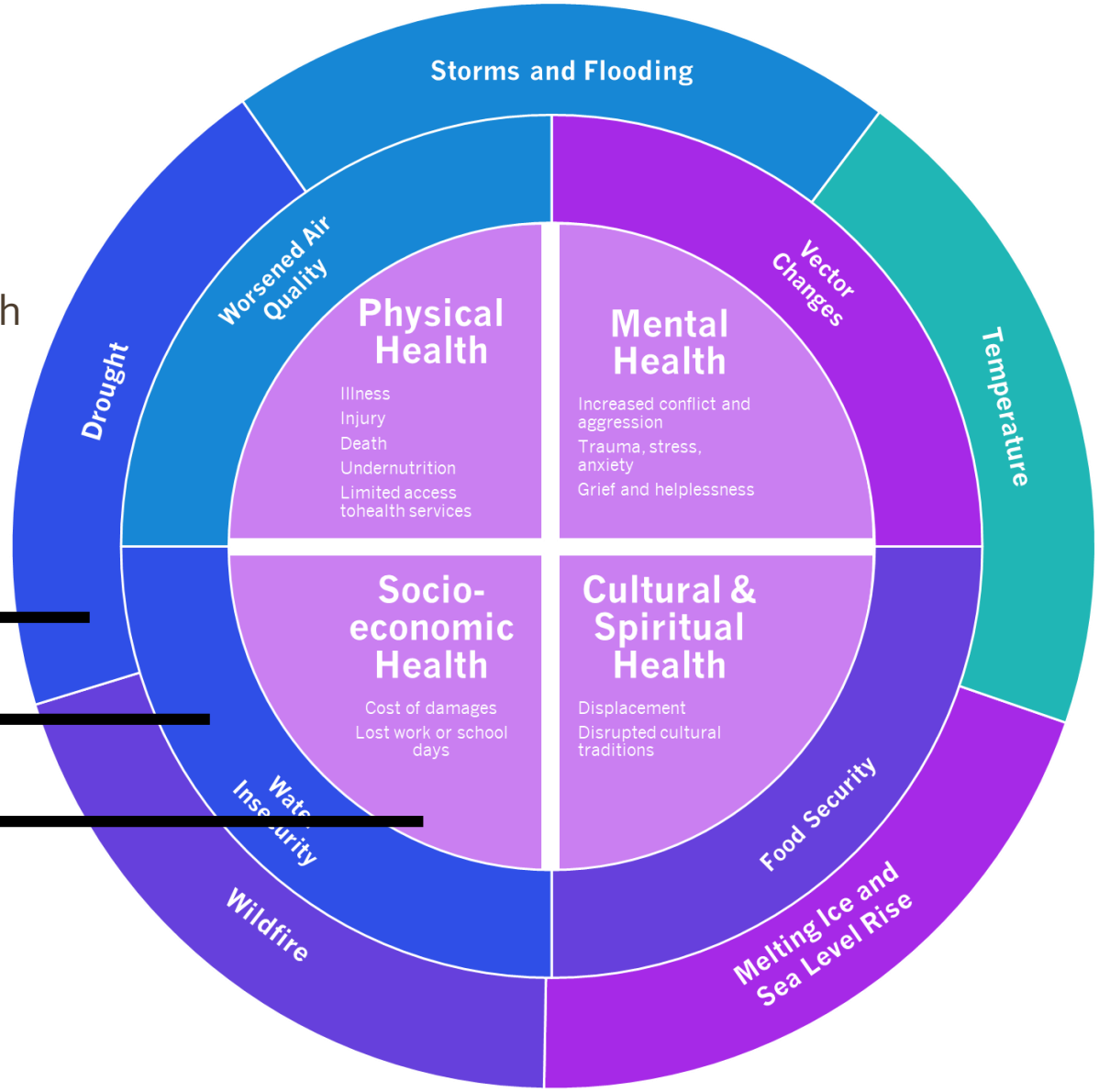
"Nobody can be in good health if he does not have all the time fresh air, sunshine and good water."

Flying Hawk (Chief) 1854 – 1931, Oglala Lakota



What is Health?

Tribal Climate Health Project defines health more broadly than the absence of medical disease:



Exposures

Secondary Exposures

Health Impacts Summary

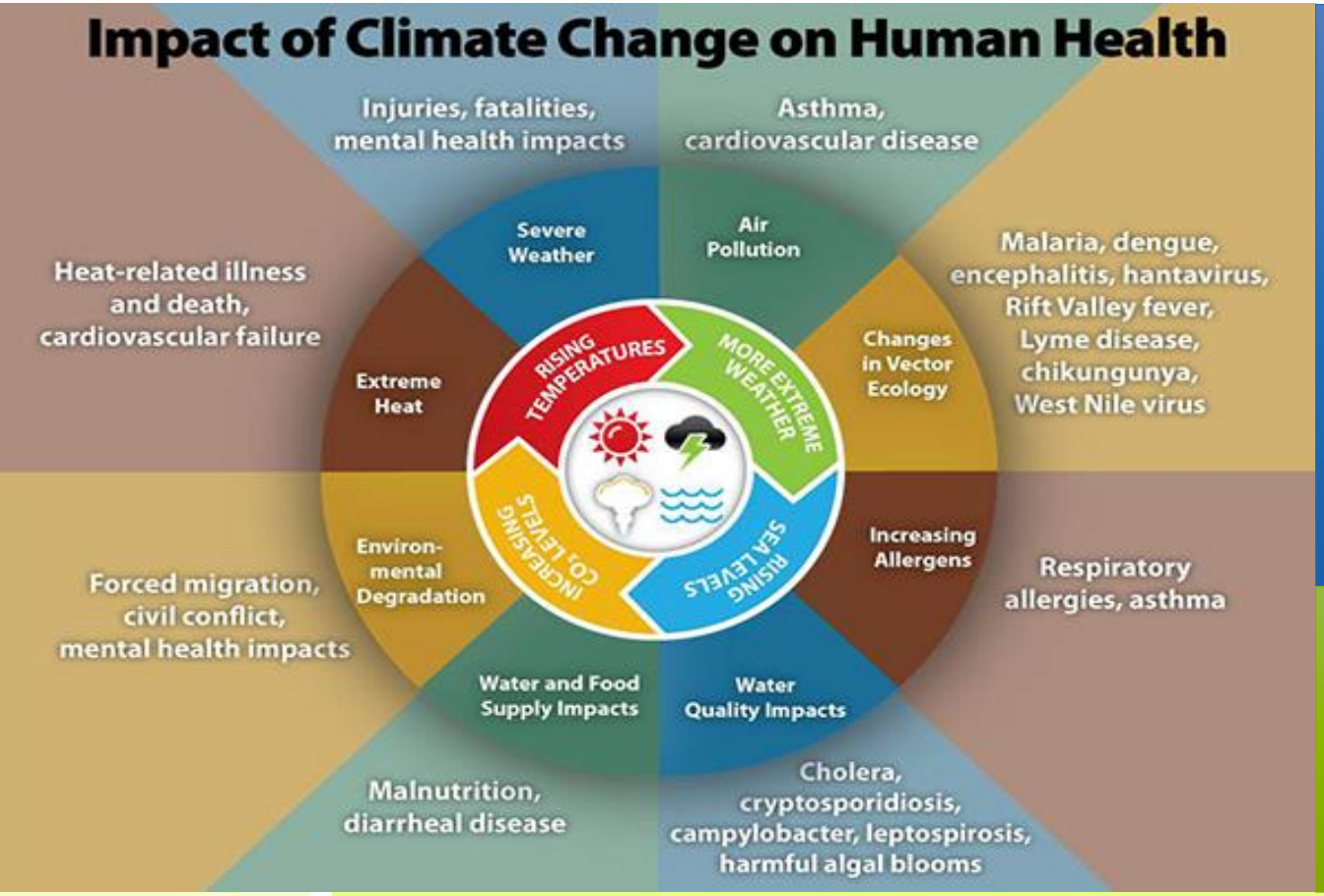
Poll

Group Discussion:

Please share stories, observations and examples about climate related health impacts for your tribe

Climate Change and Human Health

Climate change is increasing the number of people at greater risk of human health threats such as **illness, injury, death, trauma and other mental and psychosocial consequences**



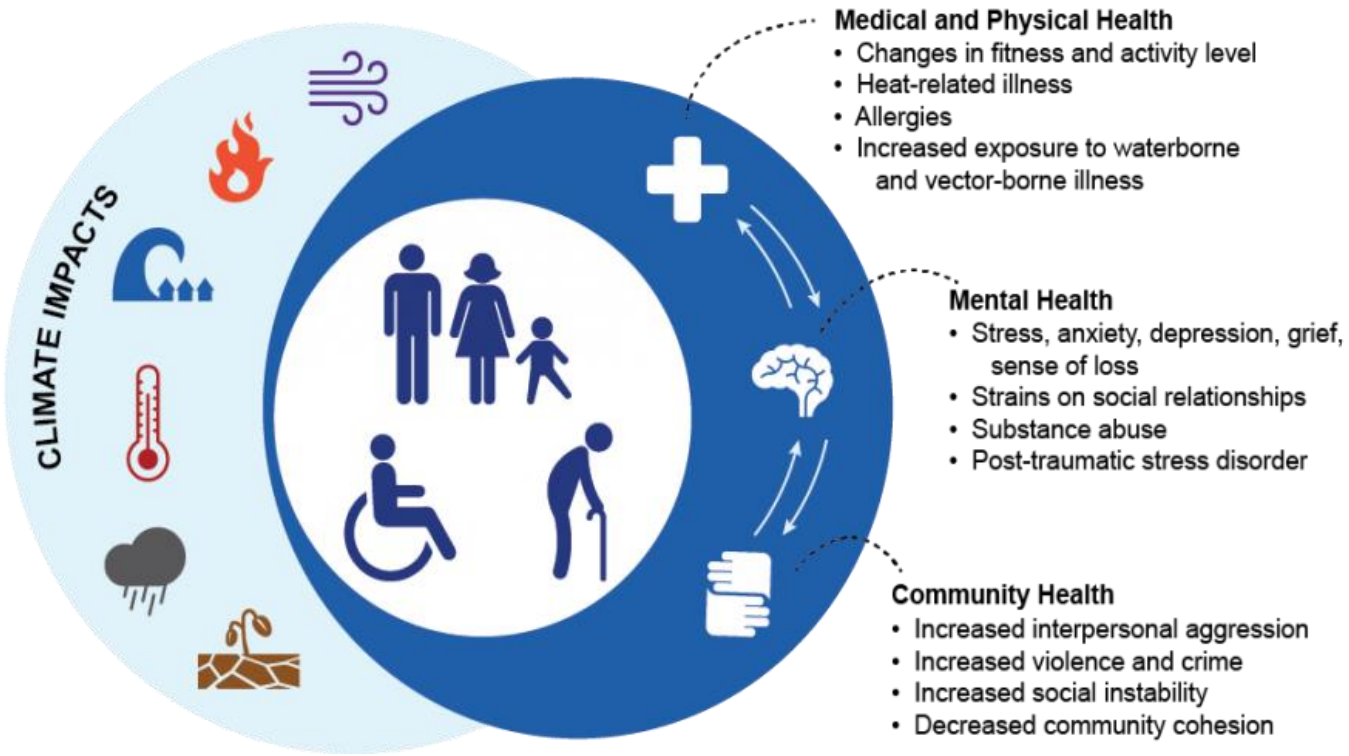
USGCRP Climate and Health Assessment Key Findings

- Increased exposure to extreme events and coastal flooding will effect health
- Disruptions to essential infrastructure can limit access to healthcare and emergency response services

"Our environment was rich in the wealth of natural resources, providing all our needs, allowing us to live healthy happy lives!"

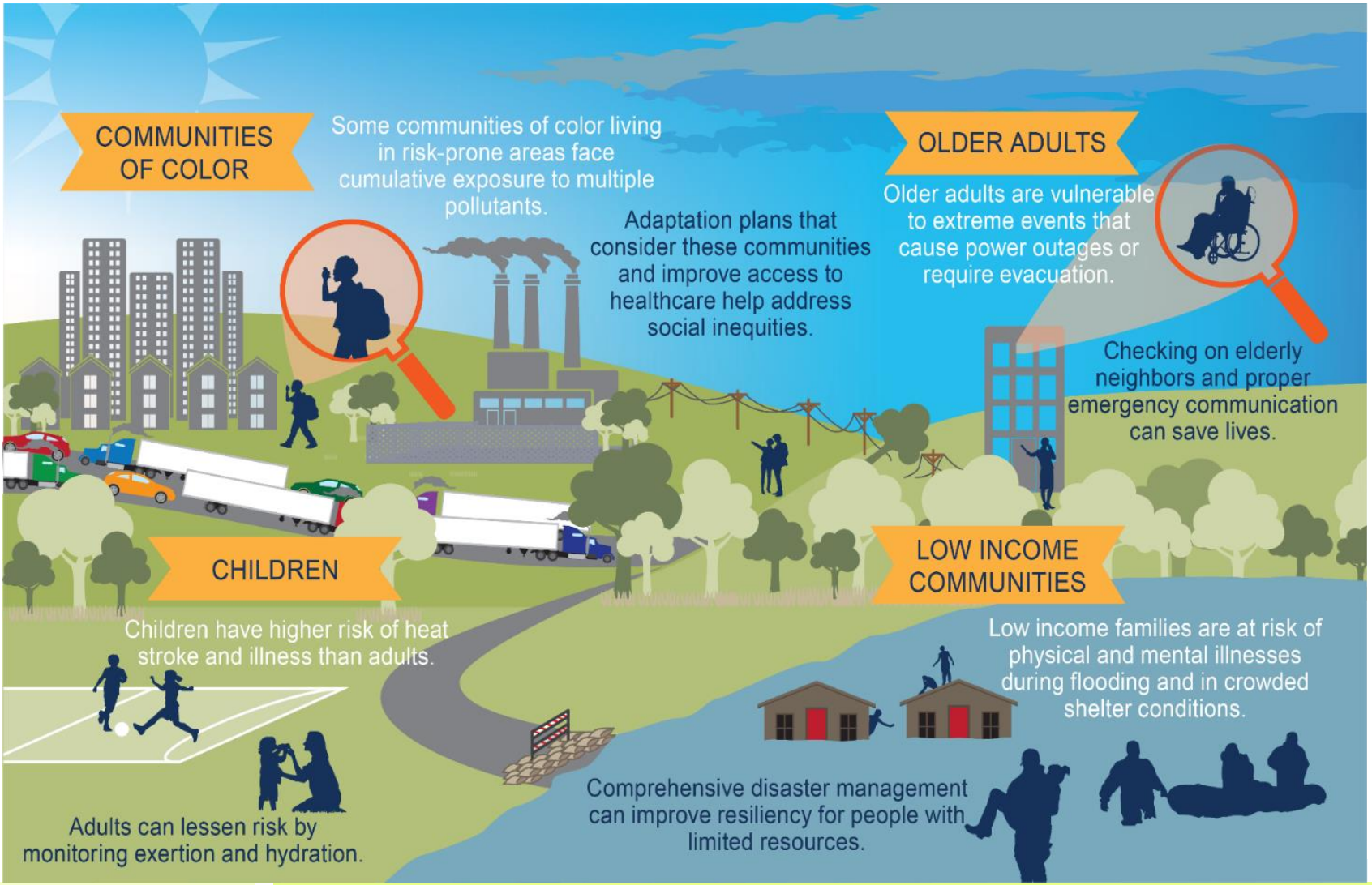
Puyallup Tribe

Climate Change and Human Health



	Climate Driver	Exposure	Health Outcome	Impact
Extreme Heat	More frequent, severe, prolonged heat events	Elevated temperatures	Heat-related death and illness	Rising temperatures will lead to an increase in heat-related deaths and illnesses.
Outdoor Air Quality	Increasing temperatures and changing precipitation patterns	Worsened air quality (ozone, particulate matter, and higher pollen counts)	Premature death, acute and chronic cardiovascular and respiratory illnesses	Rising temperatures and wildfires and decreasing precipitation will lead to increases in ozone and particulate matter, elevating the risks of cardiovascular and respiratory illnesses and death.
Flooding	Rising sea level and more frequent or intense extreme precipitation, hurricanes, and storm surge events	Contaminated water, debris, and disruptions to essential infrastructure	Drowning, injuries, mental health consequences, gastrointestinal and other illness	Increased coastal and inland flooding exposes populations to a range of negative health impacts before, during, and after events.
Vector-Borne Infection (Lyme Disease)	Changes in temperature extremes and seasonal weather patterns	Earlier and geographically expanded tick activity	Lyme disease	Ticks will show earlier seasonal activity and a generally northward range expansion, increasing risk of human exposure to Lyme disease-causing bacteria.
Water-Related Infection (*Vibrio vulnificus*)	Rising sea surface temperature, changes in precipitation and runoff affecting coastal salinity	Recreational water or shellfish contaminated with *Vibrio vulnificus*	*Vibrio vulnificus* induced diarrhea & intestinal illness, wound and bloodstream infections, death	Increases in water temperatures will alter timing and location of *Vibrio vulnificus* growth, increasing exposure and risk of waterborne illness.
Food-Related Infection (*Salmonella*)	Increases in temperature, humidity, and season length	Increased growth of pathogens, seasonal shifts in incidence of *Salmonella* exposure	*Salmonella* infection, gastrointestinal outbreaks	Rising temperatures increase *Salmonella* prevalence in food; longer seasons and warming winters increase risk of exposure and infection.
Mental Health and Well-Being	Climate change impacts, especially extreme weather	Level of exposure to traumatic events, like disasters	Distress, grief, behavioral health disorders, social impacts, resilience	Changes in exposure to climate- or weather-related disasters cause or exacerbate stress and mental health consequences, with greater risk for certain populations.

Vulnerable Populations



The Good News

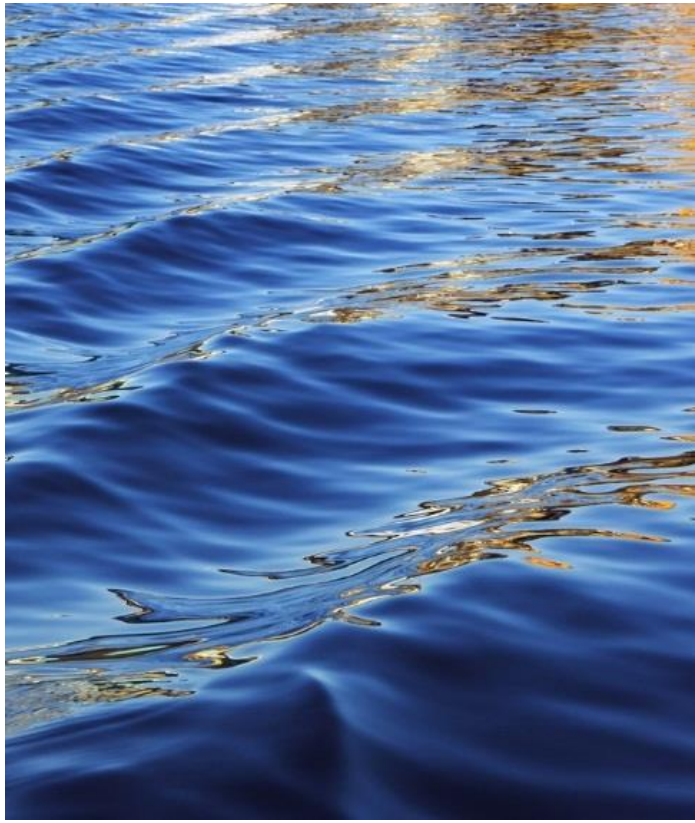
Adaptation is the process of taking actions to reduce or manage risks associated with climate change.

TRIBAL CLIMATE HEALTH PROJECT

Chat Discussion:

What has kept your tribe from acting on climate and health threats?

Temperature Extremes



EXPOSURES

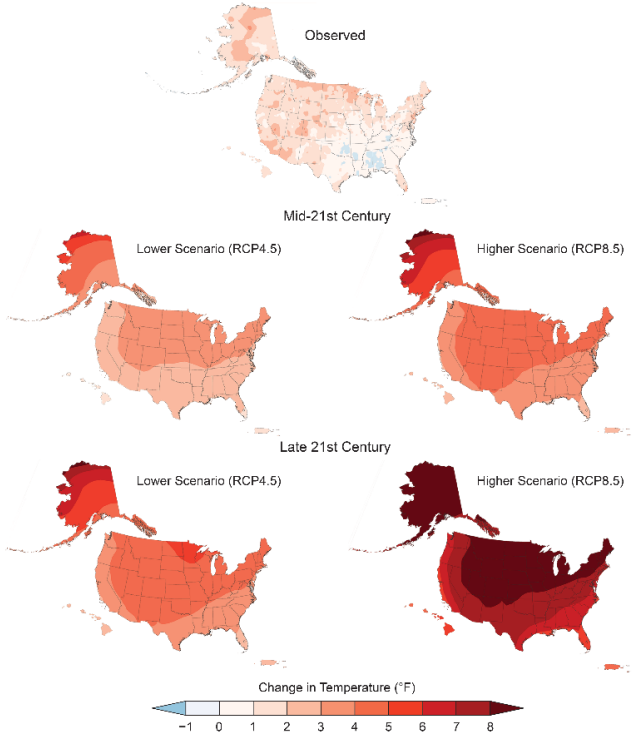
Temperature Extremes

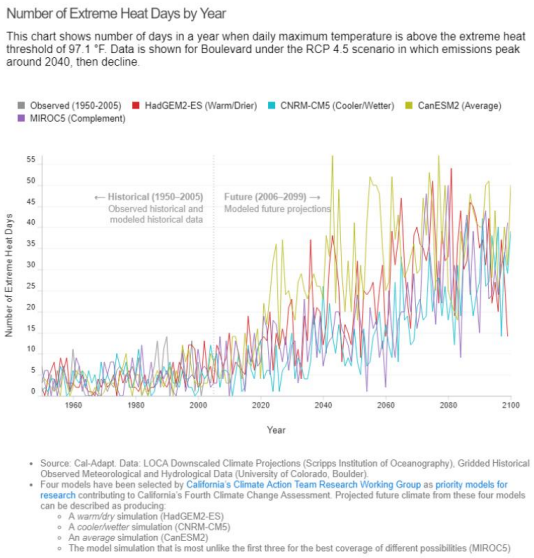
Key Climate Exposure Facts

- Increased **1.8 degrees F** from 1895 - 2016
- Projected to increase **2.8 – 7.3 degrees F** by 2071 – 2100
- Season shifts, more extreme heat and extreme cold events, sea temperatures

Regions Affected

All – Southwest particularly vulnerable to extreme heat





Group Discussion:

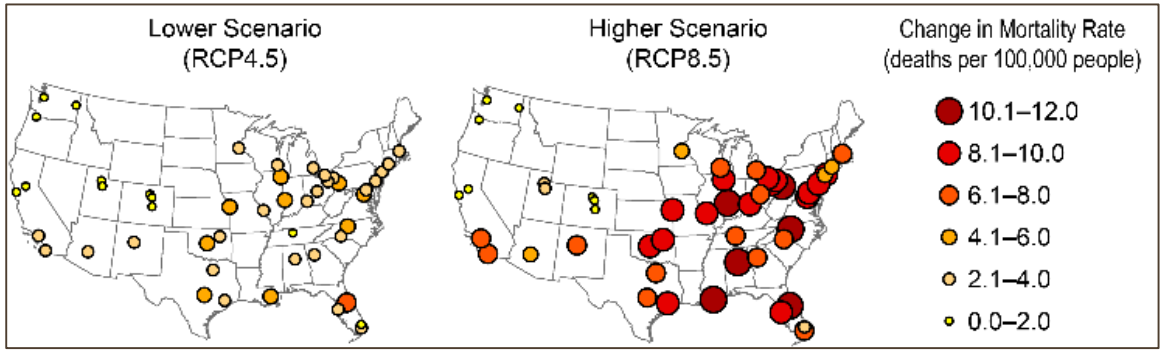
What health impacts can you anticipate?

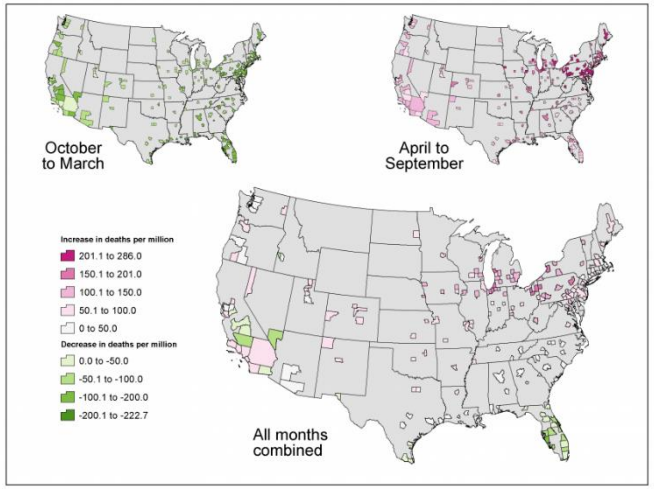
Temperature Extremes

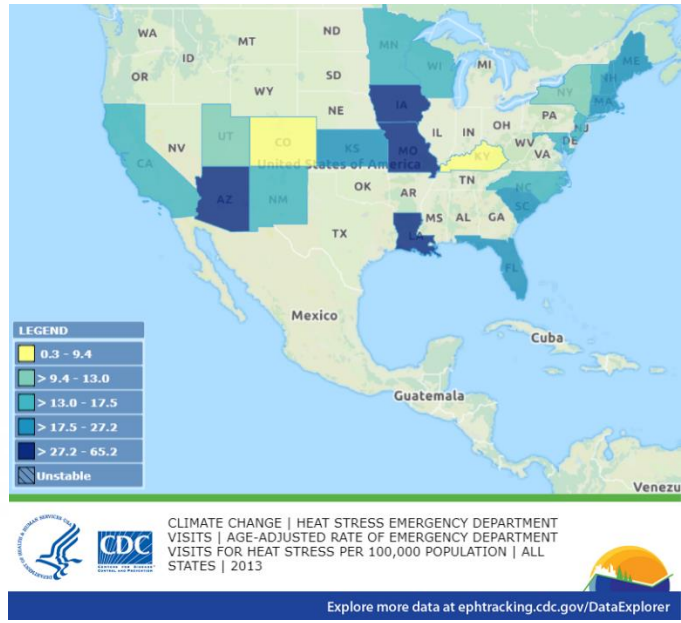
IMPACTS

Possible Health Impacts

- Heat-related illness and death
- Decrease in fitness activity level
- Mental, behavioral and cognitive wellbeing
  - Increased conflict violence and aggression



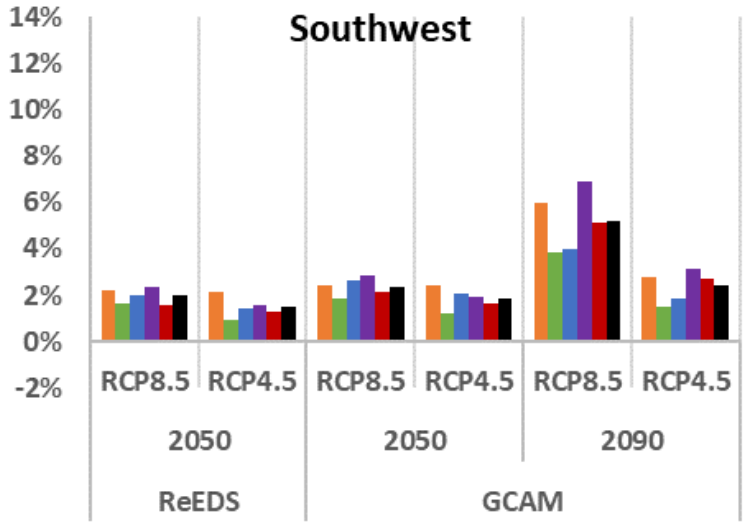


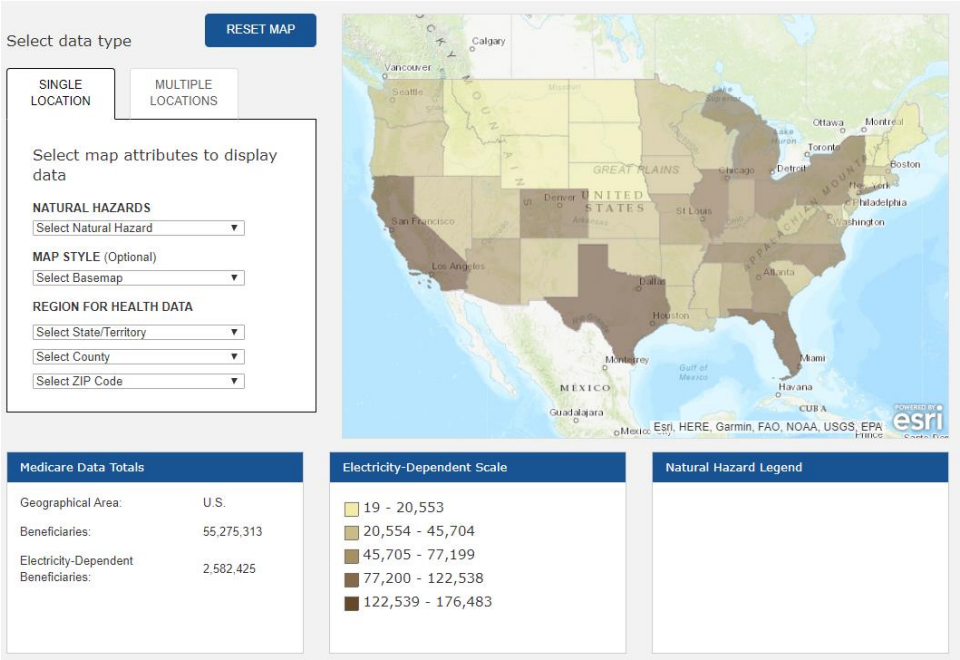


Temperature Extremes

Possible Health Impacts

- Power outages limit access to health services, can result in carbon monoxide poisoning
  - E.g. Those that rely on electricity-dependent medical equipment (e.g. ventilator, dialysis) are especially vulnerable





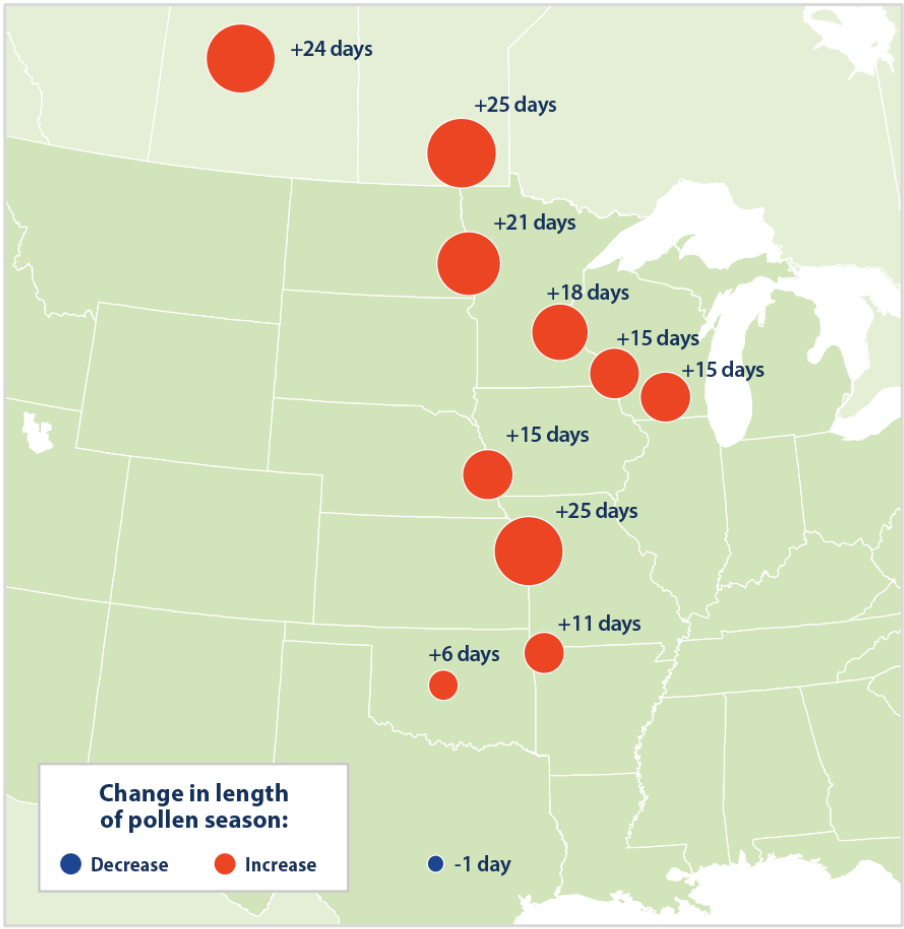
Temperature Extremes

Related Exposures

- Contributes to wildfire and drought
- Triggers the following **secondary exposures**:

- Ozone
- Allergens
- Ticks, Mosquitos
- Water contamination and supply disruption
- Food contamination and supply disruption

EXPOSURES



Data source: Ziska, L., K. Knowlton, C. Rogers, National Allergy Bureau, Aerobiology Research Laboratories, Canada. 2016 update to data originally published in: Ziska, L., K. Knowlton, C. Rogers, D. Dalan, N. Tierney, M. Elder, W. Filley, J. Shropshire, L.B. Ford, C. Hedberg, P. Fleetwood, K.T. Hovanky, T. Kavanaugh, G. Fulford, R.F. Vrtis, J.A. Patz, J. Portnoy, F. Coates, L. Bielory, and D. Frenz. 2011. Recent warming by latitude associated with increased length of ragweed pollen season in central North America. P Natl. Acad. Sci. USA 108:4248–4251.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

Chat Discussion:

What health impacts can you anticipate?

IMPACTS

Temperature Extremes

Possible Health Impacts

- Respiratory illness
- Allergic symptoms from pollen

Figure 3.2. Change in Ozone-Related Premature Deaths

Maps show county-level estimates for the average change in ozone-related premature deaths over the summer months in 2050 (2045-2055) and 2090 (2085-2095) compared to 2000 (1995-2005).

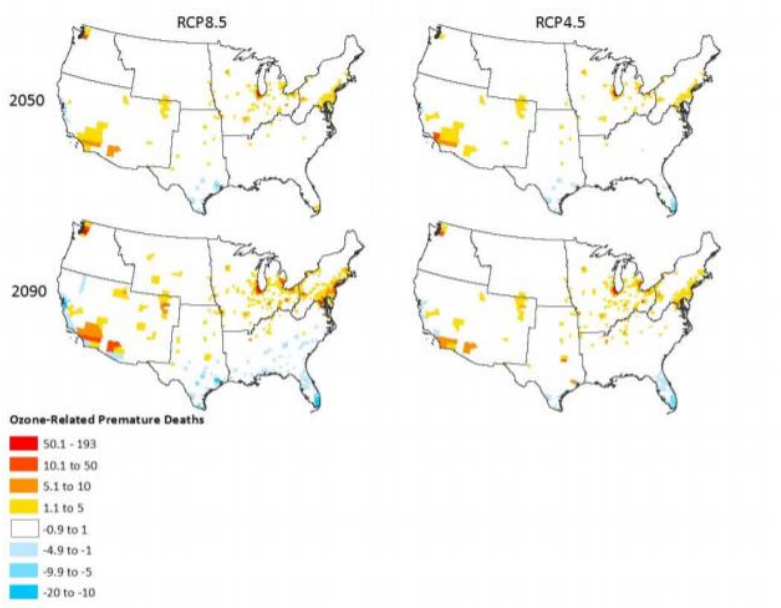
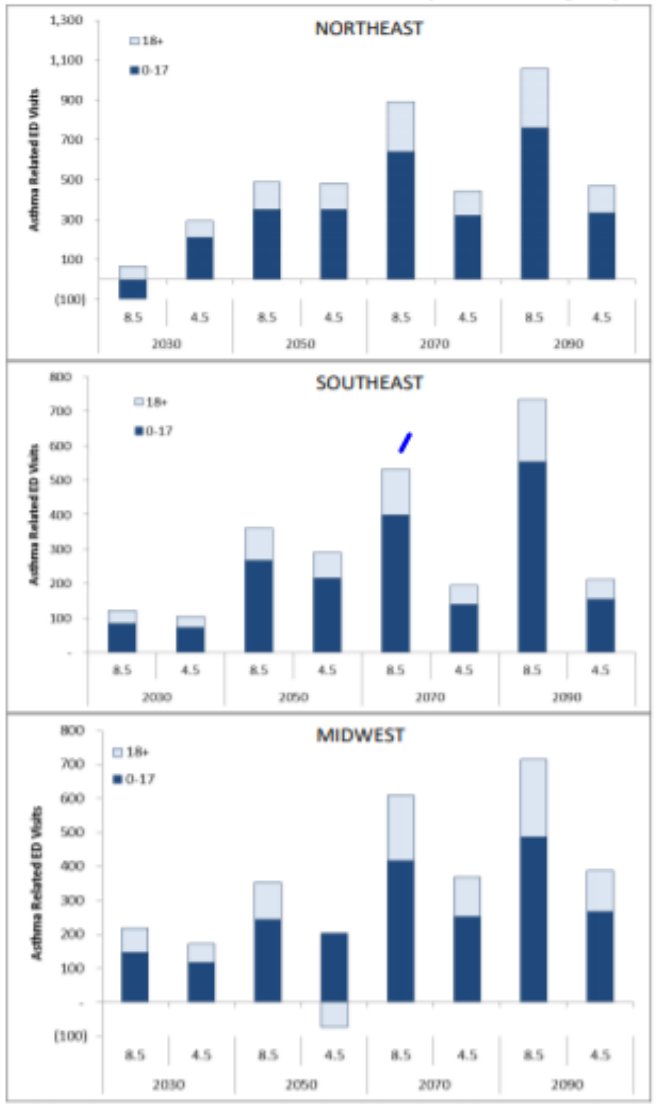


Figure 4.2. Change in Asthma-Related Emergency Department Visits

The graphs show change from the reference period (1994-2010) by age groups for the three regions studied under RCP8.5 and RCP4.5. Results represent averages of the five GCMs.



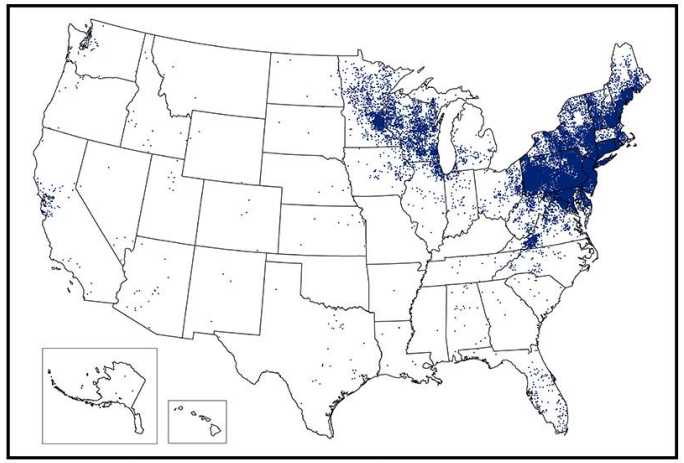
IMPACTS

Temperature Extremes

Possible Health Impacts

Vector-borne disease (e.g. Lyme, West-Nile, Zika, Dengue)

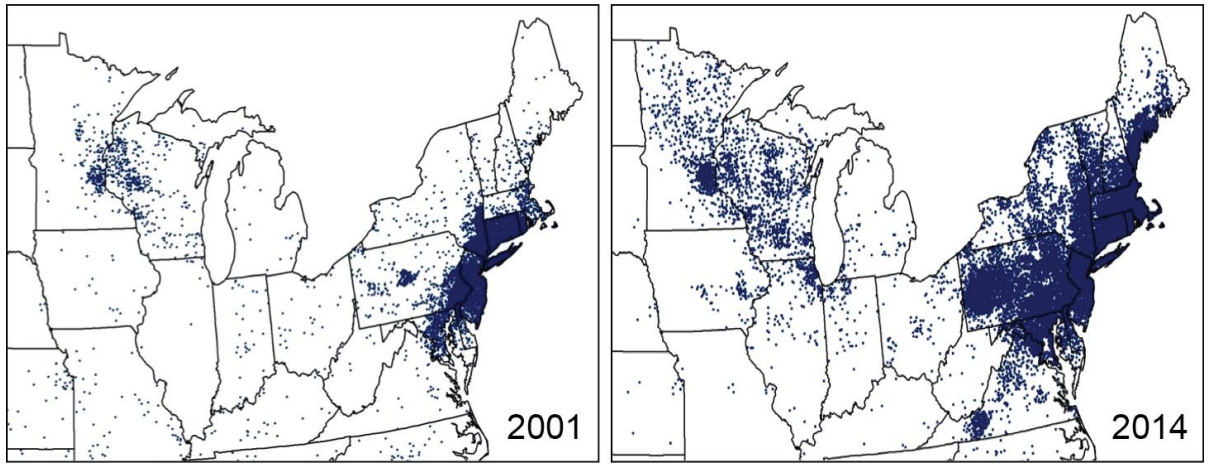
Reported Cases of Lyme Disease — United States, 2017



1 dot placed randomly within county of residence for each confirmed case

In 2016, Massachusetts transitioned to a surveillance method that relies primarily on laboratory reports. This method does not currently align with the national surveillance case definition as set by the Council of State and Territorial Epidemiologists (CSTE). Therefore, information on most Lyme disease cases occurring in Massachusetts is not sent to CDC. Please contact the MA Department of Public Health for case numbers.

Changes in Lyme Disease Case Report Distribution



Temperature Extremes

IMPACTS

Possible Health Impacts

- Infections and illness from contaminated water and food (e.g. algal blooms)
- Lack of nutritional and medicinal abundance

> "Climate change is very likely to affect global, regional, and local food security by disrupting food supply availability, decreasing access to food, and making utilization more difficult." - EPA

Figure 21.1. Projected Percent Change in National Crop Yields

Results shown represent the average of the five GCMs under RCP8.5 and RCP4.5 compared to the reference period (1986-2005). Results are weighted averages of the individual irrigated and rainfed values from the EPIC model.

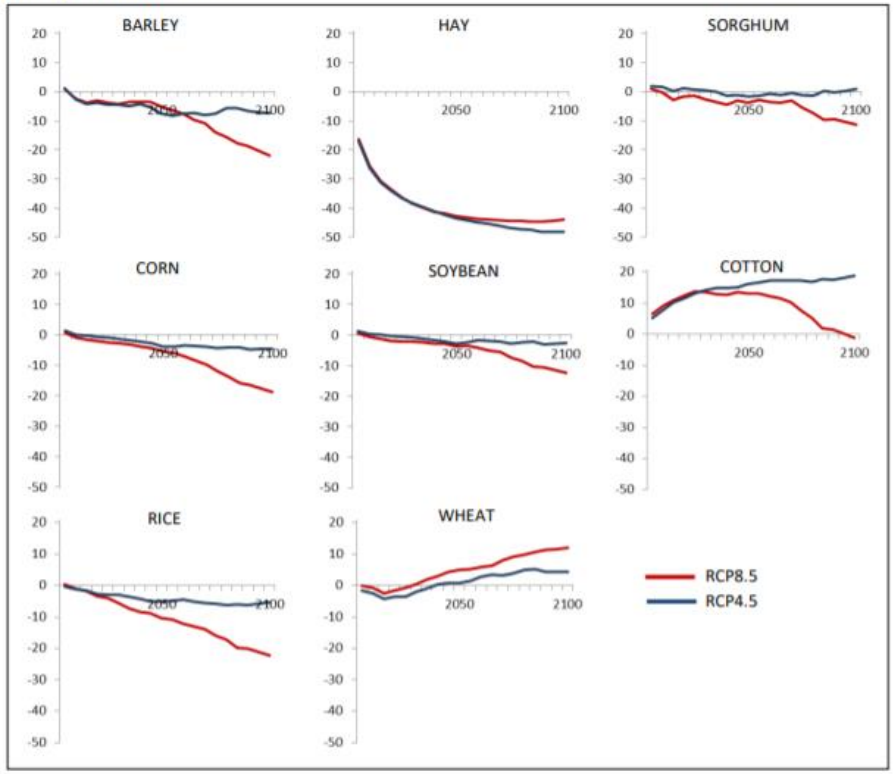


Figure 21.2 shows the projected change in national yield under RCP8.5 for the three largest U.S. crops (by area and production volume, not including hay) under the five different climate models, along with the ensemble average. In general, there is agreement in the direction of yield effects across the GCMs, although the magnitude of change varies by climate model and crop. In addition, the magnitude of change, whether positive or negative, increases over time in almost all cases. The largest change from reference yields is projected under the HadGEM2-ES model, which is the hottest model used in this analysis, with the exception of wheat where yield changes under this GCM are the most positive.

Group Poll

Temperature Extremes

IMPACTS

Vulnerable Populations

- Children and elders
- Neighborhoods lacking green space
- People susceptible to health impacts from poor air quality
- People with mental, behavioral, and cognitive disorders
- Populations lacking access to AC
- Residents living in older homes
- Electricity-dependent populations
- Outdoor workers

Sample of Population Sensitivity and Adaptive Capacity Factors

- Urban heat island
- Tree canopy
- Households with air-conditioning
- Population size of vulnerable individuals

IMPACTS

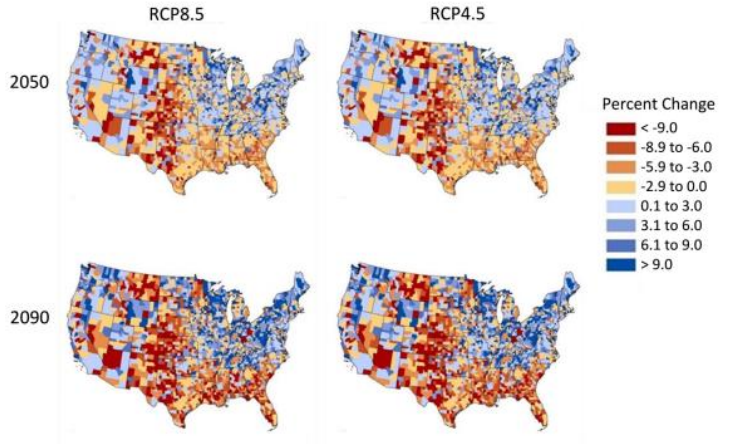
Temperature Extremes

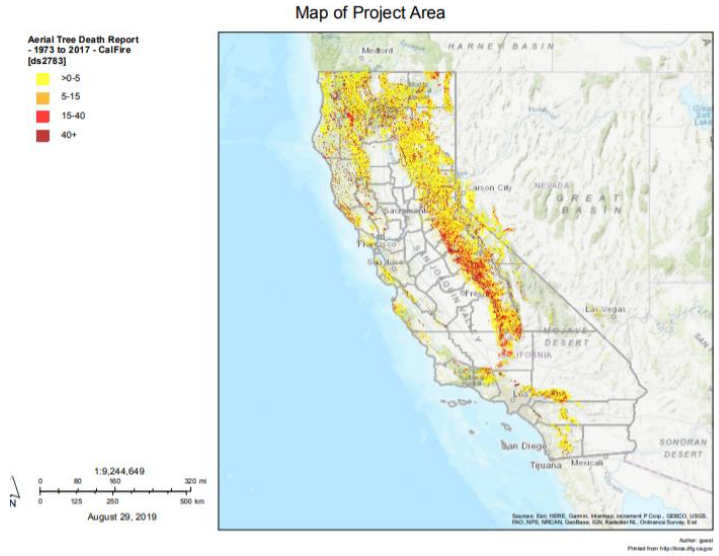
Possible Impacts to Social, Economic and Cultural Health

- Displacement
- Lost school days and business revenues
- Disruptions to culturally important activities and species (e.g. outdoor traditional events, Oak loss)
- Economic damage
  - E.g. In CA by 2050
    - $50 billion/year associated with human mortality from high temperatures
    - Increased electricity demand = $200M/year

Figure 9.1. Climate Change-Induced Domestic Migration

Relative net differences in county-level population projections by RCP and year. Values represent the average percentage change across the five GCMs compared to a "no climate change" control scenario.





Chat Discussion:

How might cultural wellbeing and traditional ways of life be disrupted by temperature extremes?

IMPACTS

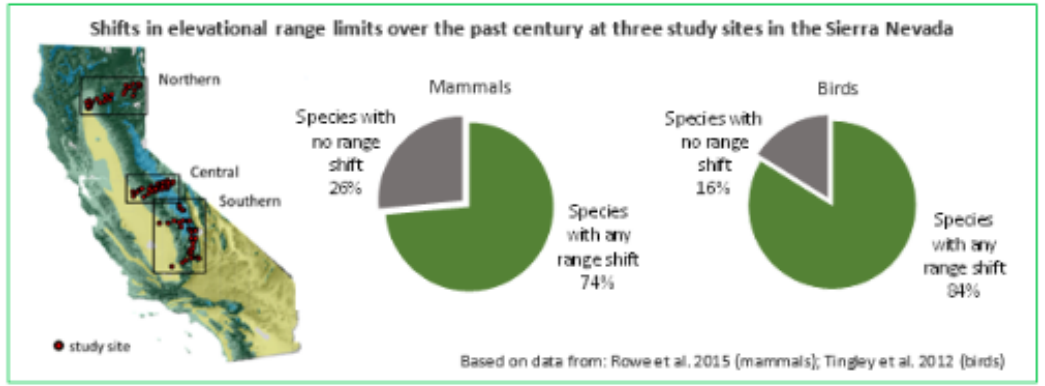
Temperature Extremes

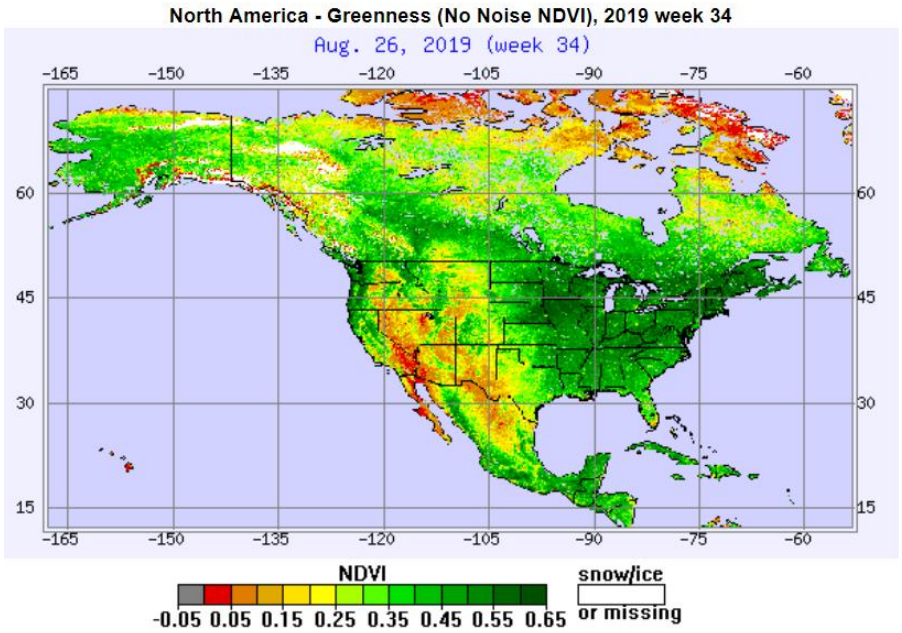
Possible Natural Environment Impacts

- Heat or season shift related disruptions, declines and stresses to habitats, waterways, and important or sensitive plant and wildlife species
  - E.g. tree mortality, global vegetative health, range shifts, algal blooms, increases in the presence and prevalence of invasive species)

Possible Built Environment Impacts

- Disruption to public services and infrastructure (e.g. power outages)
- Disruption to agricultural operations





Chat Discussion:

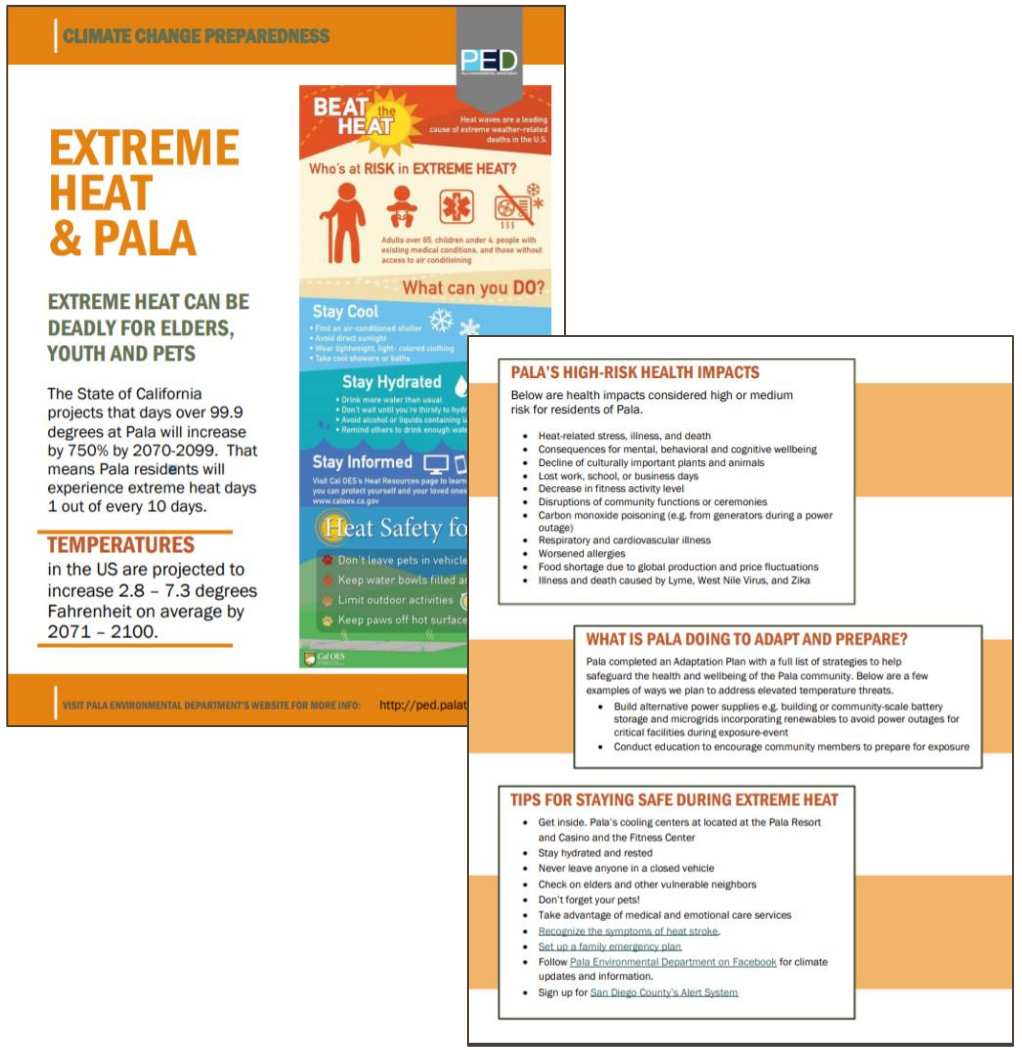
What adaptation strategies may be able to reduce negative impacts to your community?

STRATEGIES

Temperature Extremes

Sample Strategies to Address Impacts

- Develop an emergency or heat health management plan to anticipate and prepare public services for heat risks.
- Notify community about heat events, heat-related illness systems, cooling centers and tips
- Promote food sovereignty and resilience through tribal food cooperatives, seed banks, and protected gardens
- Stress test facilities for heat tolerance
- Increase urban forestry and green infrastructure
- Implement advanced surveillance of air and water quality
- Improve energy resilience to avoid power outages (e.g. microgrid)



Temperature Extremes

Tribal Case Study

Mescalero Apache Tribe (New Mexico)

- Some of the highest temperatures ever recorded in the region all occurred since 2011.
- Working with a range of federal, state, and local government agencies and academia to maintain forest health and resiliency.
- Constructed hoop houses and greenhouses to protect produce from climate extremes and solar systems at the fish hatchery

Temperature Extremes

Trainee Examples

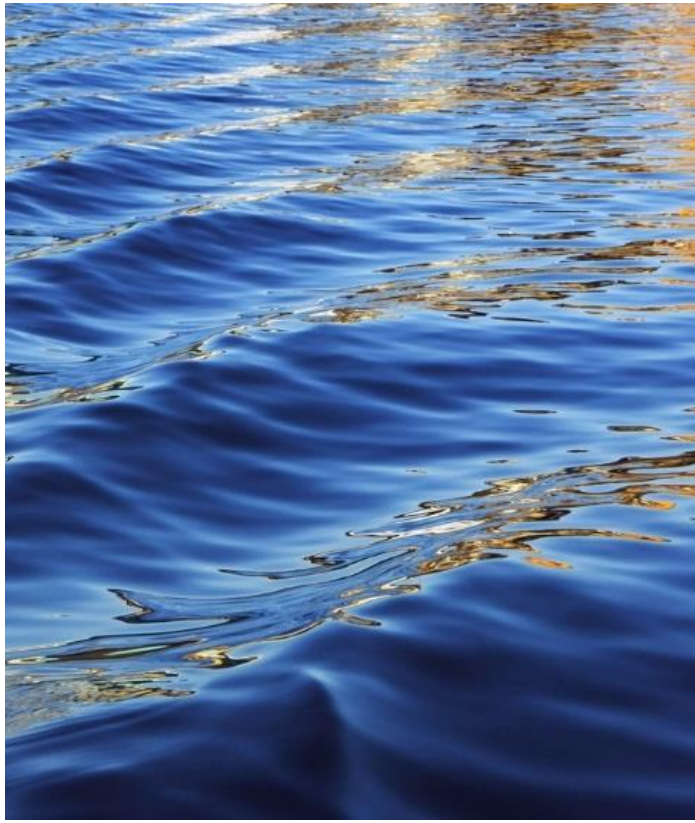
"Just in the last 100 years the temperature has changed. My grandmothers **never had AC** and we did fine, but now the elderly do not work like they used too. Its too hot for everyone. We really do not have long periods of freezing weather here anymore which increases the **bug population**." - *Paula Wayman, Choctaw Nation Health Services (Southeast Oklahoma)*

"My family's village (Kotzebue, AK) which I frequent, has been experiencing an increase in **summer heatwaves** over the years." - *Ethan Lawton, SNH*

"Extreme temperatures impact me physically as I have a **disease that is worsened** by high temperatures." – *Laurie Montserrat, OEHHA*

"Temperatures have been all over the place and has become **less predictable** than in the past." – *Natalene Cummings, Forest Couty Potawatomi Community (Crandon, WI)*

Wildfire



EXPOSURES

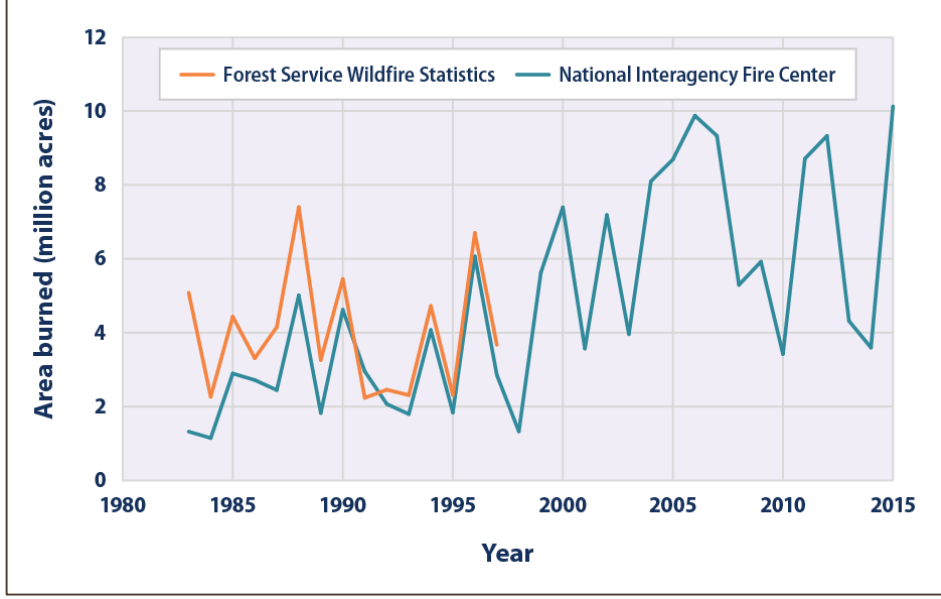
Wildfire

Key Climate Exposure Facts

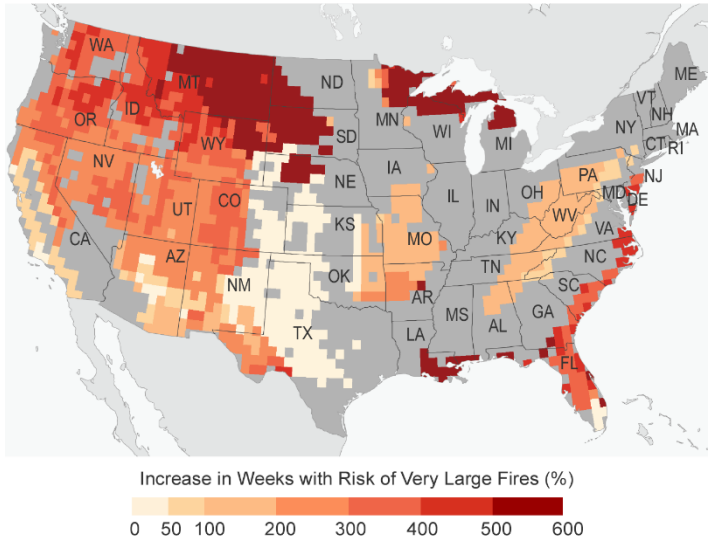
- Incidence of large forest fires in the western US and Alaska increased since early 1980s
- Projected to further increase (frequency and intensity) in those regions as the climate warms/dries, with profound changes to certain ecosystems (e.g. more fuel)
- Longer burn season

Regions Affected

Alaska, Northwest, Southwest



Projected Increase in Risk of Very Large Fires by Mid-Century



Increase in Weeks with Risk of Very Large Fires (%)

0 50 100 200 300 400 500 600

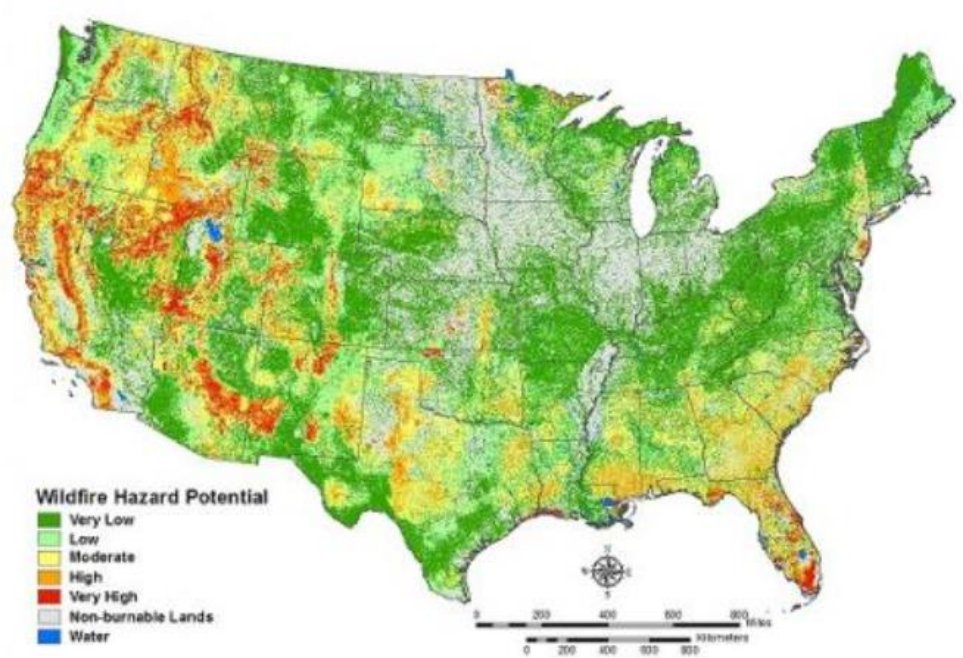
Group Discussion:

What health impacts can you anticipate?

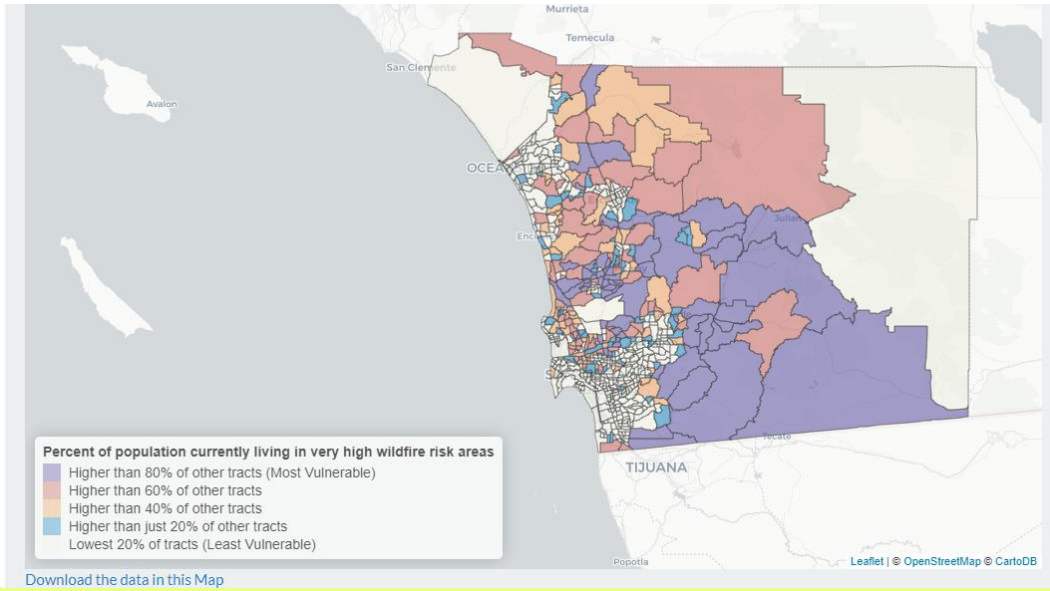
Wildfire

Possible Health Impacts

- Wildfire-related injury and death
  - E.g. Camp Fire, Paradise, CA 2018
    - Deadliest fire in CA history = 86 people died



Classified wildfire hazard potential map



Download the data in this Map

IMPACTS

IMPACTS

Wildfire

Possible Health Impacts

- Mental health impacts including post-traumatic stress, depression, anxiety and grief
  - A Rand study found that one-third of the adult survivors of California wildfires in 2003 suffered depression and one-quarter suffered PTSD.

What happens when people experience a disaster or traumatic event?

Shock and denial are typical responses to large-scale natural disasters, especially shortly after the event. Both shock and denial are normal protective reactions.

Once the initial shock subsides, reactions vary from one person to another. The following are common responses to a traumatic event:

- **Feelings become intense and sometimes are unpredictable.** You may become more irritable than usual, and your mood may change back and forth dramatically. You might be especially anxious or nervous, or even become depressed.
- **Thoughts and behavior patterns are affected.** You might have repeated and vivid memories of evacuating or seeing the fire approach. These flashbacks may occur for no apparent reason and may lead to physical reactions such as rapid heartbeat or sweating. You may find it difficult to concentrate or make decisions, or become more easily confused. Sleep and eating patterns also may be disrupted.
- **Recurring emotional reactions are common.** Reminders or "triggers" such as smoke, ash, sirens or fire trucks can create anxiety.
- **Interpersonal relationships can become strained, particularly if you are living in temporary housing.** You may experience arguments with family or friends. On the other hand, you might become withdrawn and isolated and avoid your usual activities.
- **Physical symptoms may accompany the extreme stress.** For example, headaches, nausea and chest pain may result and may require medical attention. Pre-existing medical conditions may worsen due to the stress.

It is important to realize that there is no one 'standard' pattern of reaction to the extreme stress of traumatic experiences.

Wildfire

Possible Health Impacts

- Damage to infrastructure limits access to health services, can result in carbon monoxide poisoning
    - Power outages & de-energization
    - Road closures
    - Damaged health and emergency facilities
    - Emergencies can overwhelm health and emergency services
    - Can also lead to school and business closures and economic damages

IMPACTS

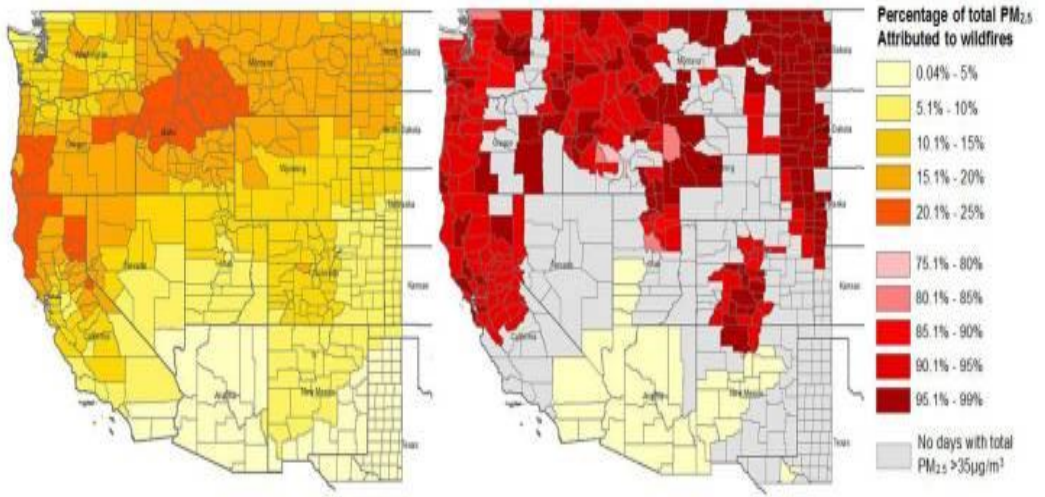
EXPOSURES

Wildfire

Related Exposures

- Contributes to storms and flooding (increased risk of landslides, erosion and mudslides)
- Triggers the following secondary exposures:

- Smoke/particulate matter
- Ticks, Forest Pests
- Water contamination and supply disruption
- Food contamination and supply disruption



Chat Discussion:

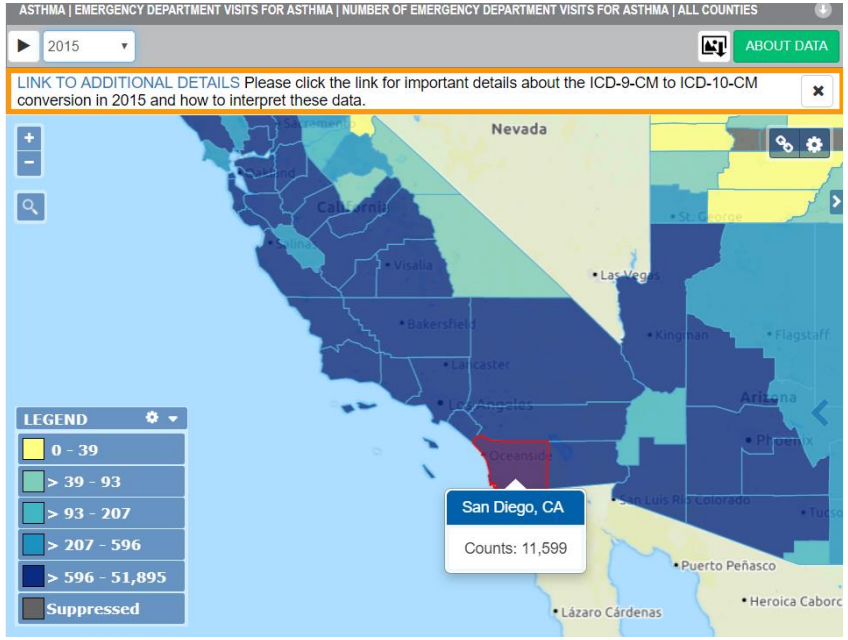
What health impacts can you anticipate?

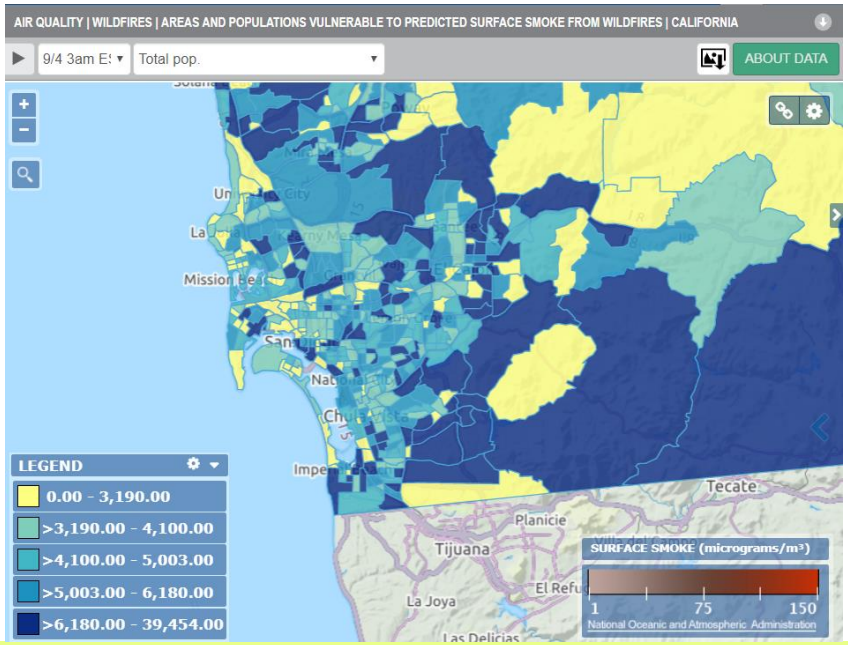
IMPACTS

Wildfire

Possible Health Impacts

- Respiratory and cardiovascular illness
  - Exposure to smoke-related air pollutants, including particulate matter (PM) from wildfires has been associated with a wide range of human health effects
  - Smoke hazard can last for weeks
- Valley Fever



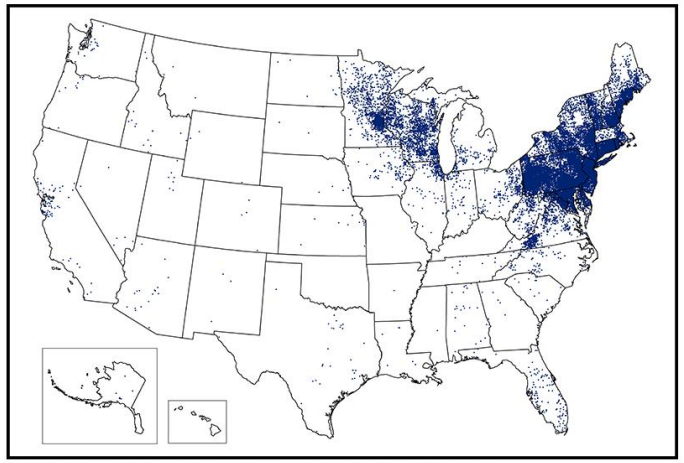


Wildfire

Possible Health Impacts

- Vector borne disease (Lyme)

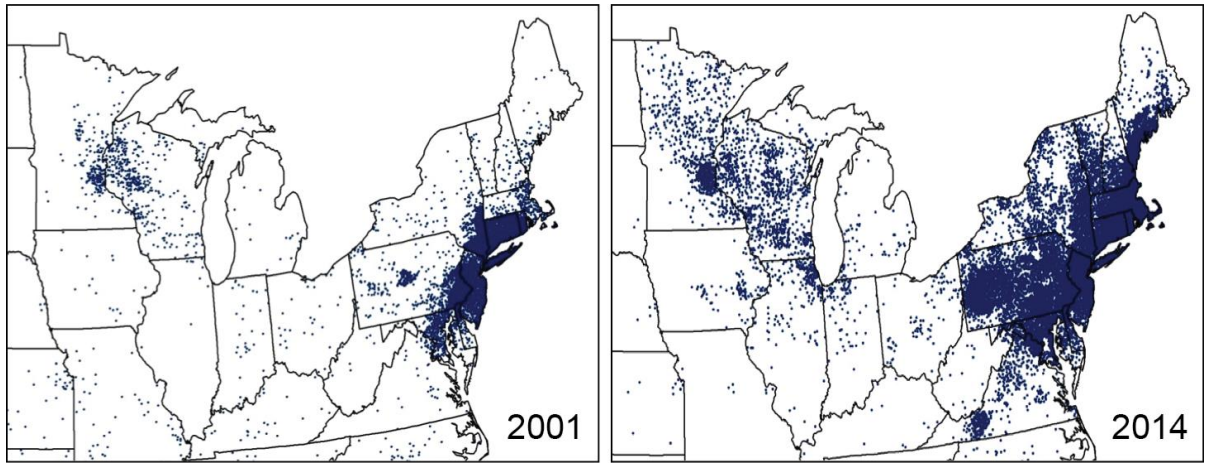
Reported Cases of Lyme Disease — United States, 2017



1 dot placed randomly within county of residence for each confirmed case

In 2016, Massachusetts transitioned to a surveillance method that relies primarily on laboratory reports. This method does not currently align with the national surveillance case definition as set by the Council of State and Territorial Epidemiologists (CSTE). Therefore, information on most Lyme disease cases occurring in Massachusetts is not sent to CDC. Please contact the MA Department of Public Health for case numbers.

Changes in Lyme Disease Case Report Distribution



Wildfire

Possible Health Impacts

- Infections and illness from water
- Drinking water supply interruption
  - Tribe may need to use water supply to fight fire
  - Further stress to many tribes that rely on limited groundwater sources
  - Wildfire may limit transport of water supplies
- Lack of nutritional and medicinal abundance
  - Wildfire may limit transport of food supplies

IMPACTS

Wildfire

IMPACTS

Vulnerable Populations

- Children and elders
- Transit-dependent populations
- Neighborhoods in a fire severity zone or wildland urban interface
- Households lacking defensible space
- People susceptible to health impacts from poor air quality
- People with mental, behavioral, and cognitive disorders
- Electricity-dependent populations
- Outdoor workers

Sample of Population Sensitivity and Adaptive Capacity Factors

- Population in high-risk wildfire area
- Percent of land covered by forest
- Hospitals per 100,000
- Economic hardship or social vulnerability index
- Size of water supply

Wildfire

IMPACTS

Possible Impacts to Social, Economic and Cultural Health

- Displacement, destruction of historical or cultural sites/assets
- Disruptions to culturally important activities and species (e.g. outdoor traditional events, Oak loss)
- Lost school days and business revenues
- Economic damage (e.g. wildfire response and recovery costs; timber losses, insurance premiums)

Chat Discussion:

How might cultural wellbeing and traditional ways of life be disrupted by wildfire?

IMPACTS

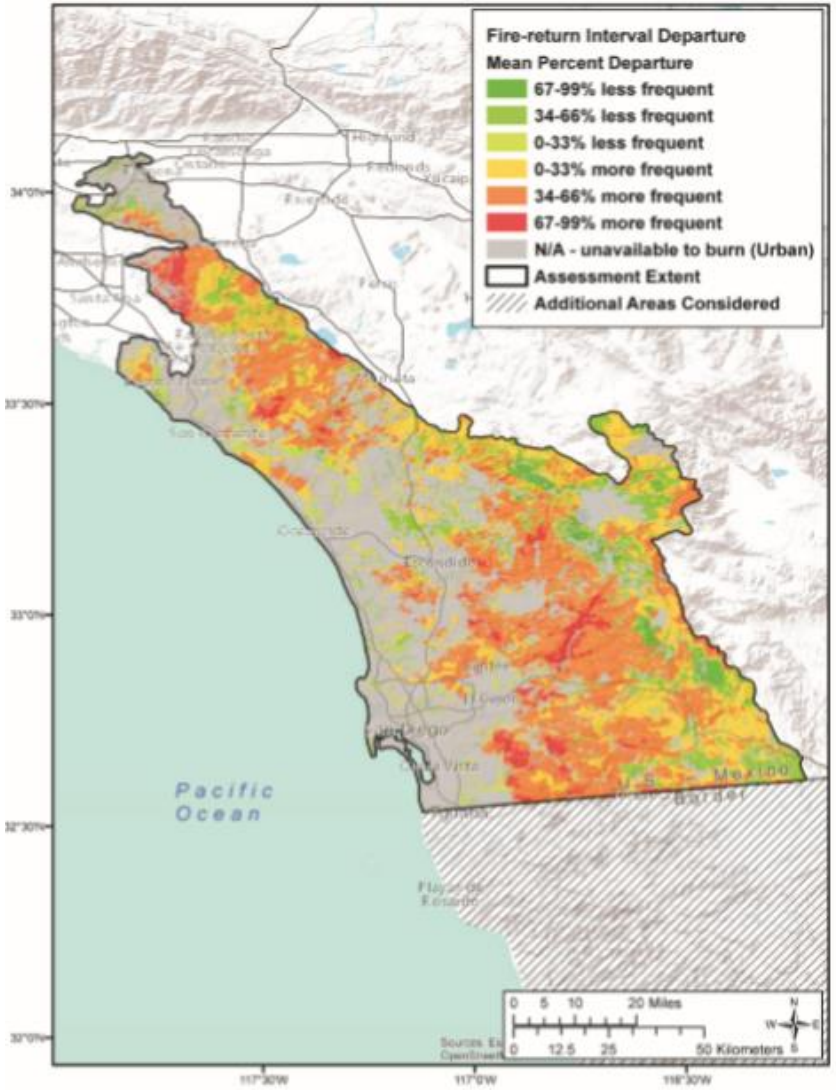
Wildfire

Possible Natural Environment Impacts

- As many tribes know, wildfire is part of a natural cycle
- Wildfire related disruptions, declines and stresses to habitats, waterways, and important or sensitive plant and wildlife species (e.g. invasive forest pests, conversion to flammable grasses, wildlife migration)

Possible Built Environment Impacts

- Damage to homes, business, and critical facilities Disruption to public services and infrastructure (e.g. power, telecommunications, roads)
- Stress on water supplies



Chat Discussion:

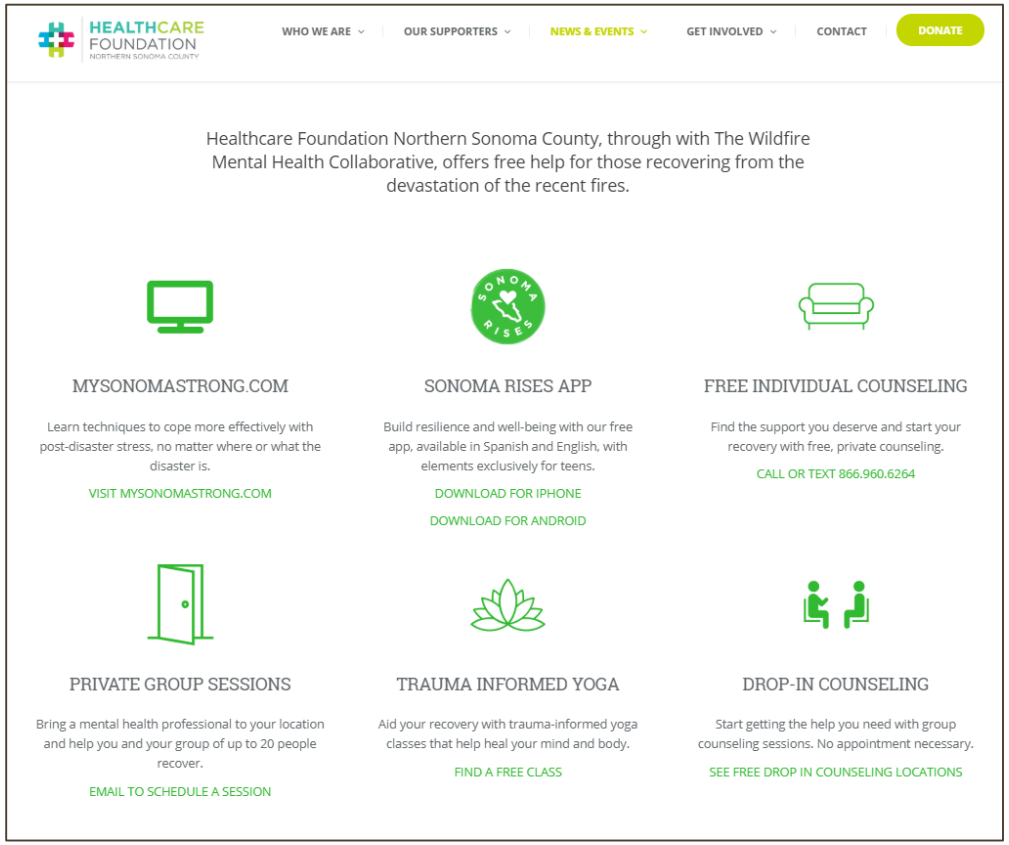
What adaptation strategies may be able to reduce negative impacts to your community?

STRATEGIES

Wildfire

Sample Strategies to Address Impacts

- Develop an emergency or health management plan to anticipate and prepare public services and evacuation plans for wildfire risks. Include procedures for post-disaster repairs and needs.
- Update air quality improvement plans to include exposure to wildfire
- Conduct outreach to encourage residents to sign up for emergency communication resources
- Conduct wildfire management strategies in adjacent forest lands such as prescribed burns and thinning to reduce wildfire risk
- Collaborate to enhance training and capacity of emergency tribal response teams



Group Discussion:

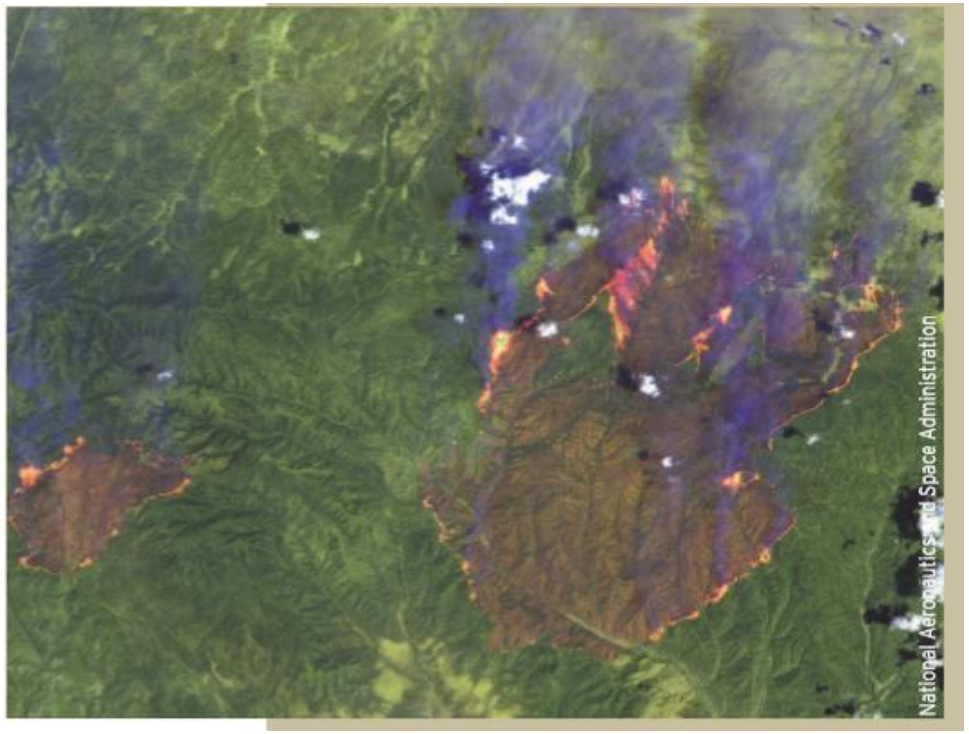
What partners in your community are already working on wildfire response?

Wildfire

Tribal Case Study

White Mountain Apache Tribe (Arizona) and the Rodeo Chediski Fire

- Reputation for skilled fire management
- Apache tribe burned approximately 462,000 acries, 59% on Fort Apache Reservation
- Burned half of Tribe's timber lands (valued at $237M)



Wildfire

Trainee Examples

"In this area wildfires have increased dramatically in **intensity and size**. The fires burn hotter and quicker." – *Teresa Romero, Santa Ynez Band of Chumash Indians (Santa Barbara area, CA)*

"I work for the Shoalwater Bay Indian Tribe in Tokeland, WA; they have over 4,000 acres including the re-location site that is mostly **timbered**. Wildfire is a concern for the Tribe and they are working on strategies to address the wildfire danger." – *Cynthia Toop, Shoalwater Bay Indian Tribe (Tokeland, WA)*

"In Alaska, our worst fire season was in 2004, where we lost **6,523,182 acres** to wildfires." *Ethan Lawton, SHN*

"I watched the pine/tree mortality rate climb in areas across the state, (but saw the worst of it happening in my limited experiences in the "North Bay" division). Much of the tree decline was contributable to the **bark beetle**... all of those dead trees are fuel for the increased wildfires we've been seeing in the last few years… We all **smelled and felt** the effects of the fires that burned in CA this season... even though most of them were outside of our county lines." – *Stephanie Smith, Tejon Indian Tribe (Kern County, CA)*

Wrapping Up

Thank you for being part of our training community!

Suggested action steps (complete before next webinar)

- Identify which temperature and wildfire related indicators are being tracked for your region (e.g. tribal environment or health department, intertribal health organization, or other agency)
- Take a moment to talk to elders and consider how wildfire and temperature changes have affected your tribe.
- *Activity*: Input your location into The Climate Explorer to see temperature data and projections for your community

Suggested reading (complete before next webinar)

- Pick one chapter (2-8) of Impacts of Climate Change on Human Health in the United States

Next webinar:

March 17, 2019 (10AM PST / 1pm EST)

Drought, Melting Ice & Sea Level Rise, Storms & Flooding (Module 2)

Questions?