



# Climate and Fire (and Pests)

Northeastern Forest Fire Protection Compact/Northeastern Forest Pest Council

January 30, 2020

**Erin Lane, US Forest Service**

**Northern Research Station- Climate, Fire and Carbon**

**USDA Northeast Climate Hub**

**North Atlantic Fire Science Exchange**

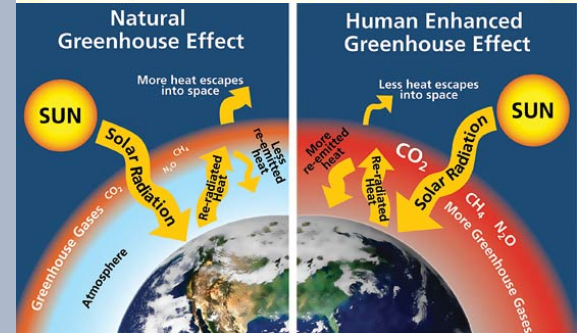


United States Department of Agriculture  
Northeast Climate Hub



# Overview

- Climate changes in the Northeast
- Impact to Forests (Pests)
- Impact to Wildfires



# U.S. Global Change Research Program Climate Science Special Report

- ✓ **Temps up 1.8F**
- ✓ **Weather extremes**
- ✓ **Ocean temps up, acidity increasing**
- ✓ **Sea levels rising**
- ✓ **Models show it will continue**
- ✓ **Increasing drought and precipitation**

## Northeast Specific

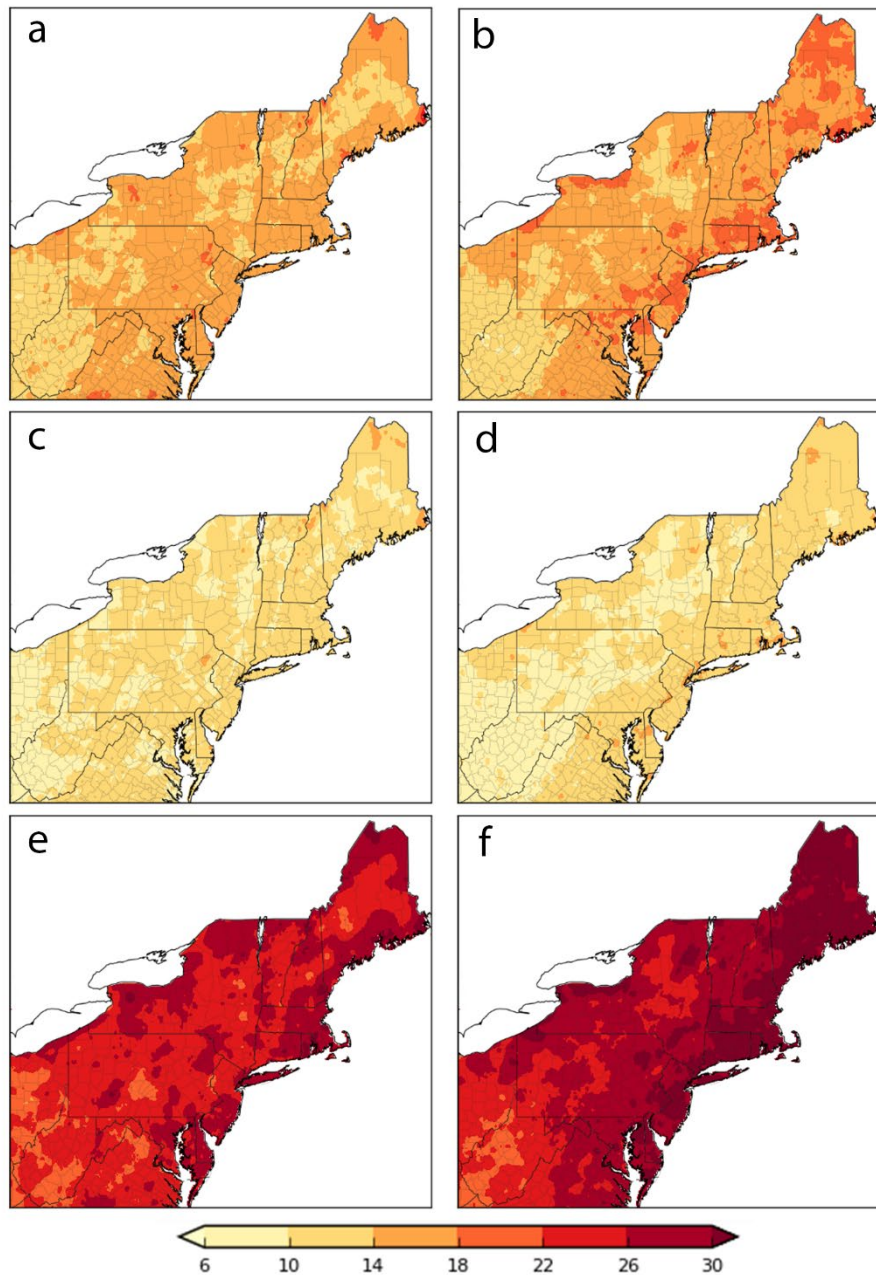


- Higher min. temperatures (winter & night)
- Earlier snowmelt and leaf-out, longer growing season, vulnerability to cold
- Greater rainfall intensity, increased precipitation, possibly more drought
- Rising sea levels

Spring

Fall

Change in Last Spring and First Fall Frosts (days)



RCP8.5 2050

Maximum daily temperatures have increased:

RCP4.5 2050

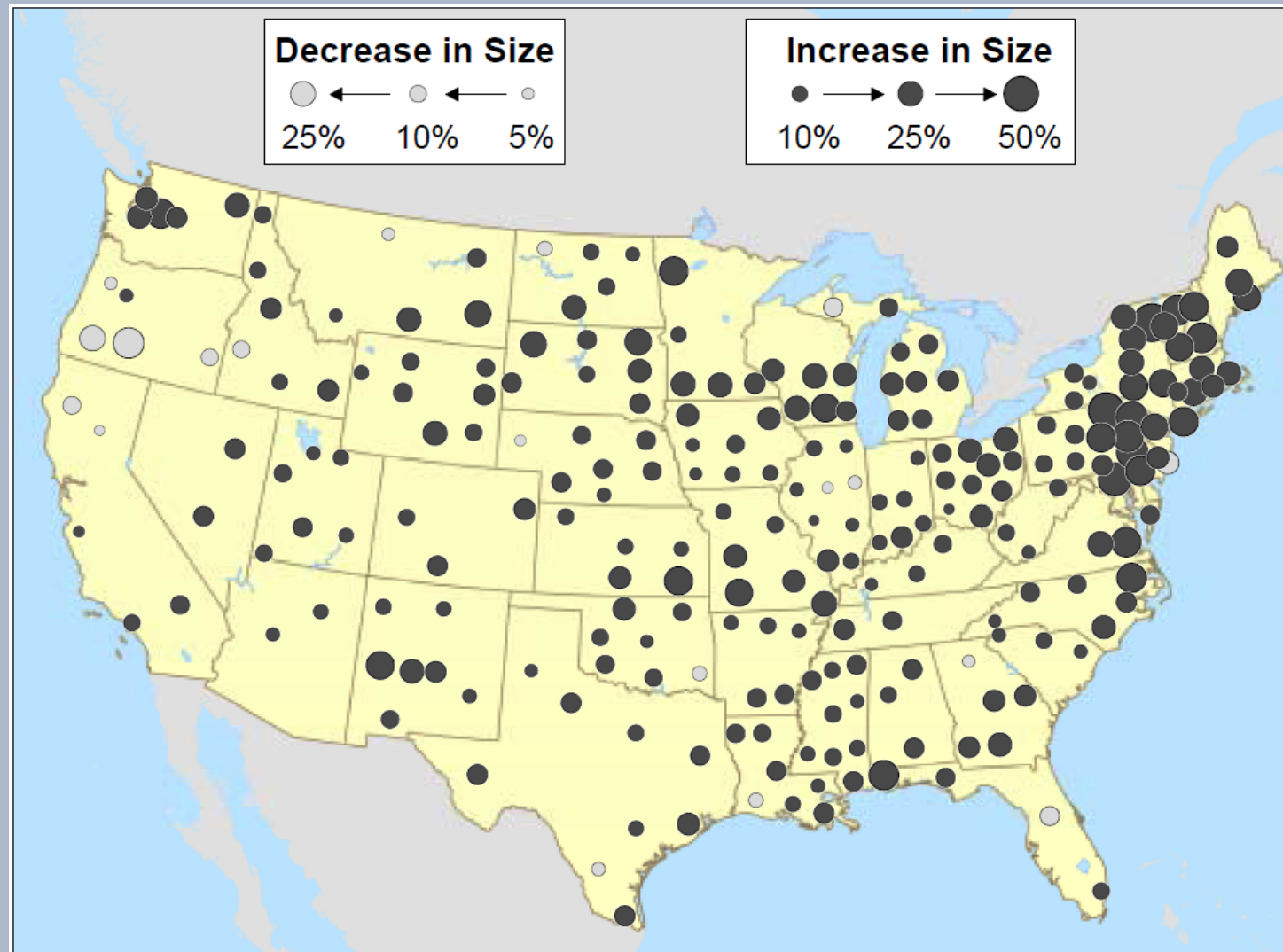
in April (especially WV, MD, DE, NJ)

RCP8.5 2100

and November (especially in VT, NH, ME, NY)

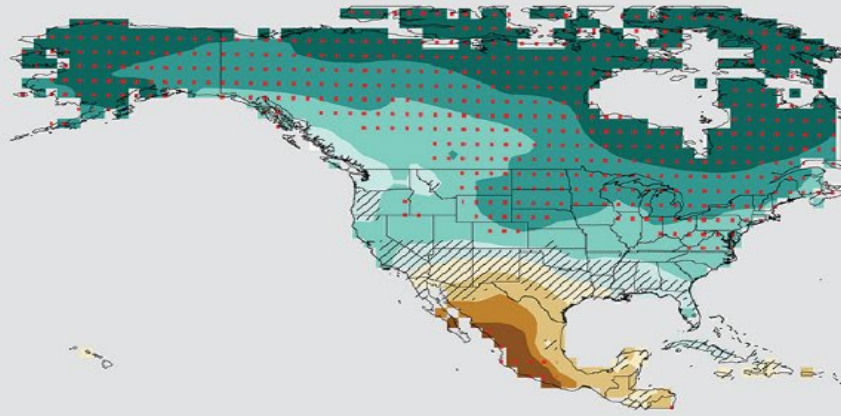
(Wolfe et al. 2017)

# Heavy rain or snow is becoming more common and storms more intense in the Northeast

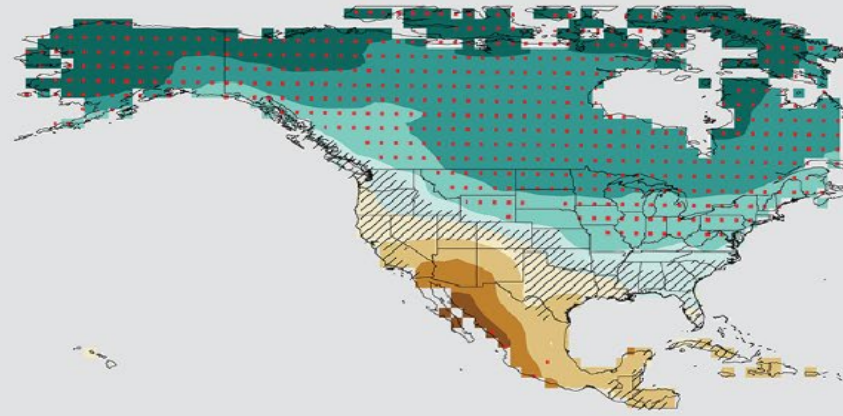


# Projected Change (%) in Seasonal Precipitation

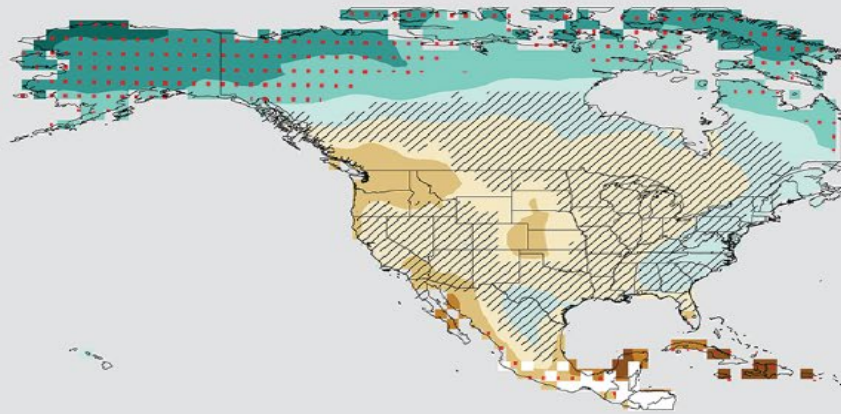
Winter



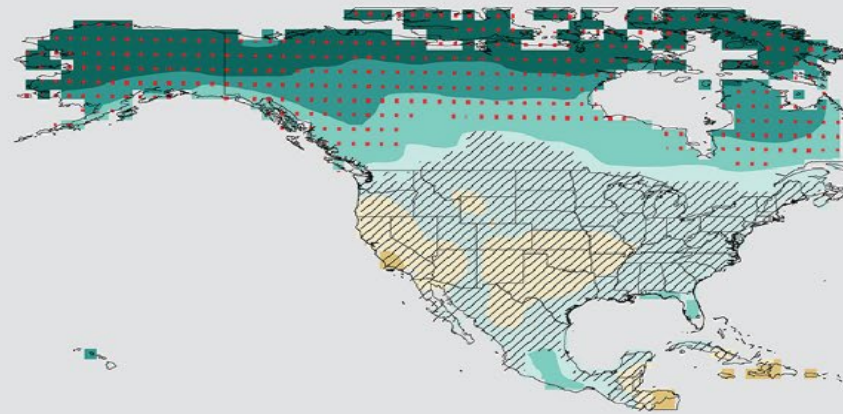
Spring



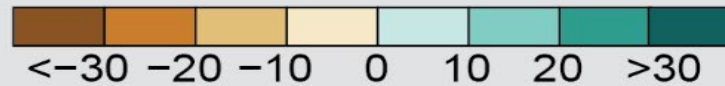
Summer



Fall



Change (%)

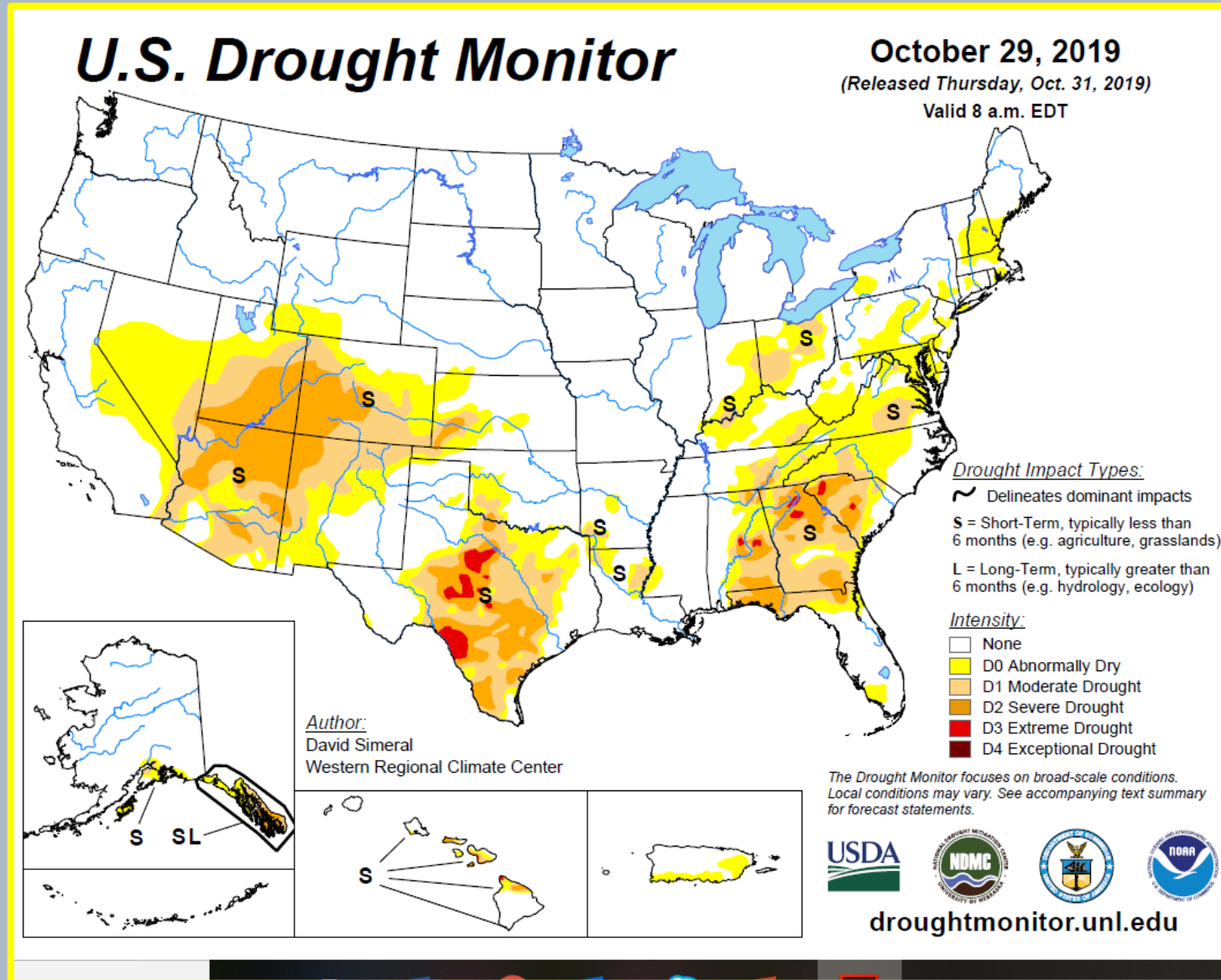


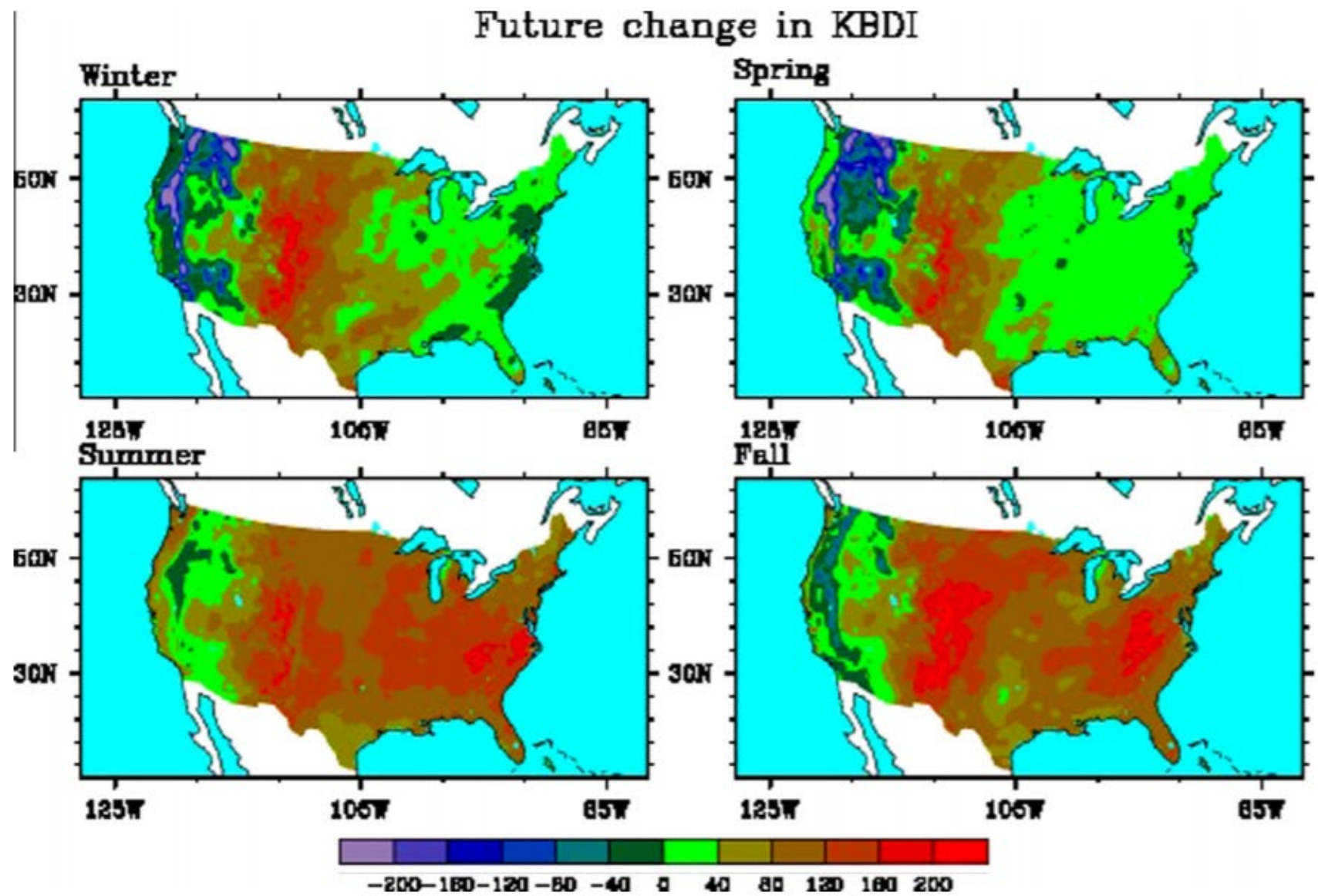
# Downpour





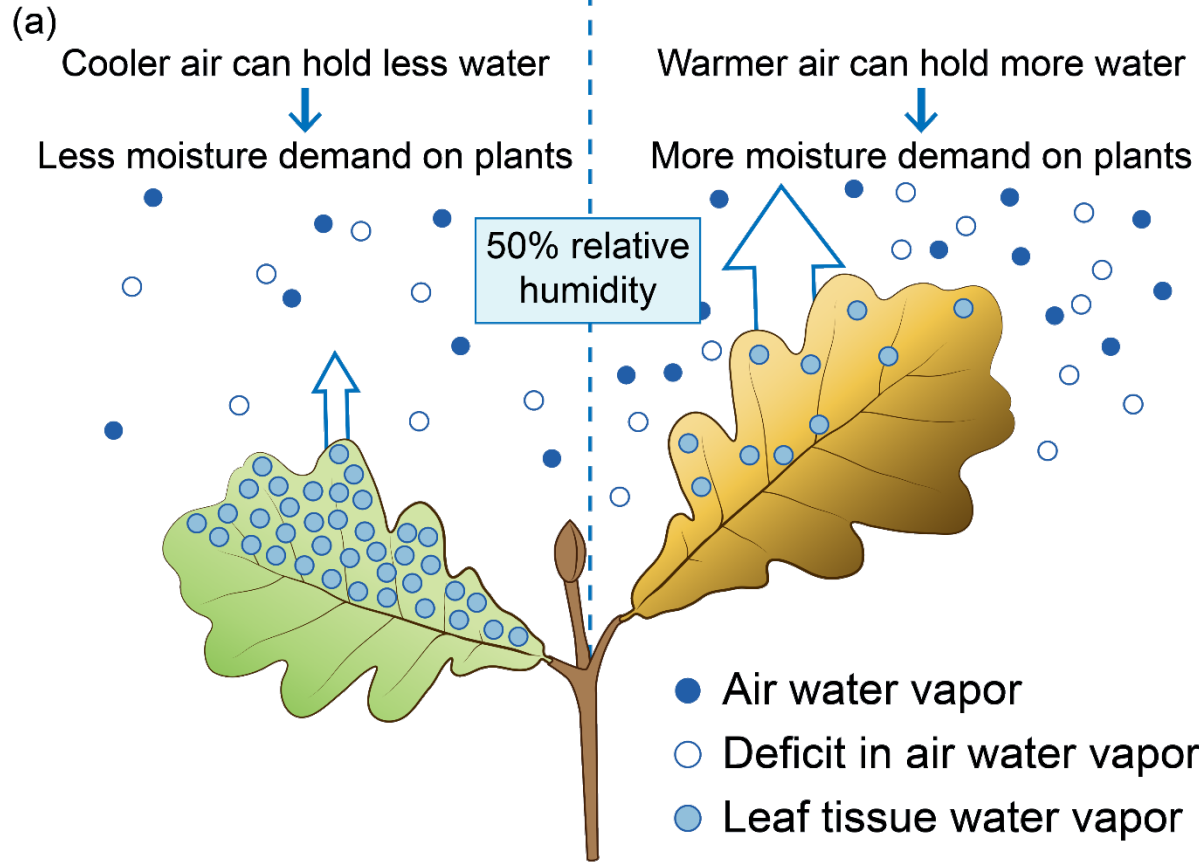
# Will there be more drought in the Northeast?



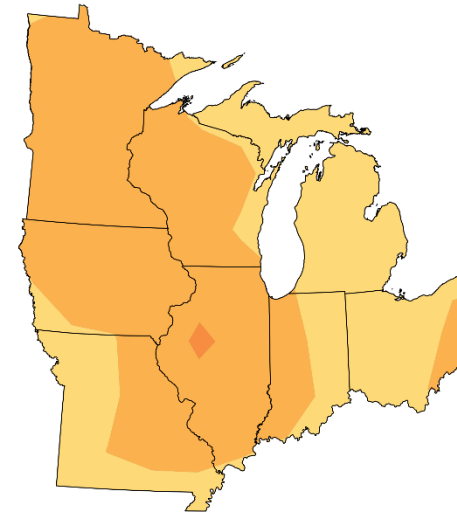


**Fig. 10.** Change in KBDI of North America for winter, spring, summer, and fall seasons between 2041–2070 and 1971–2000 calculated using the data obtained from the NARCCAP (from Liu et al., 2012).

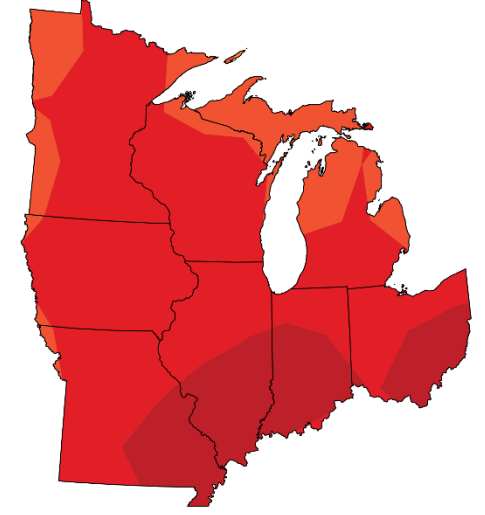
# Vapor Pressure Deficit



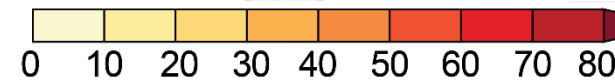
(b) Lower Scenario (RCP4.5)



(c) Higher Scenario (RCP8.5)



Percent Change

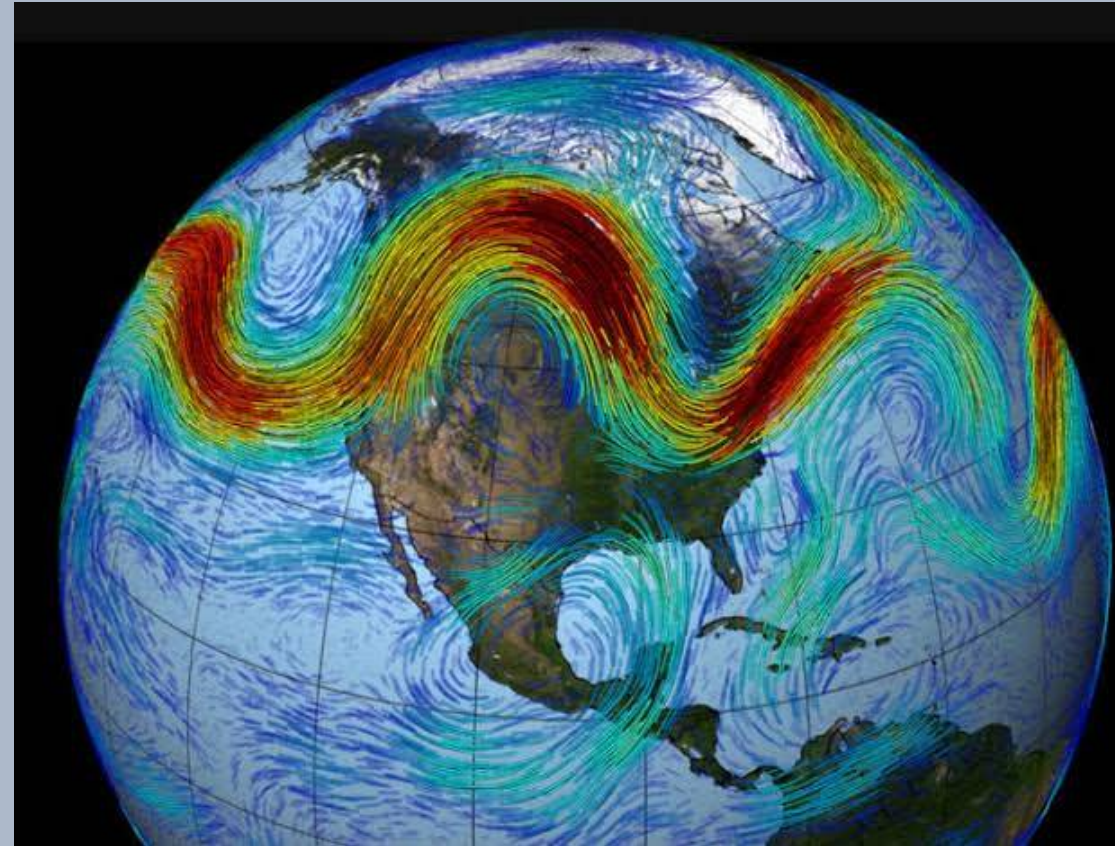
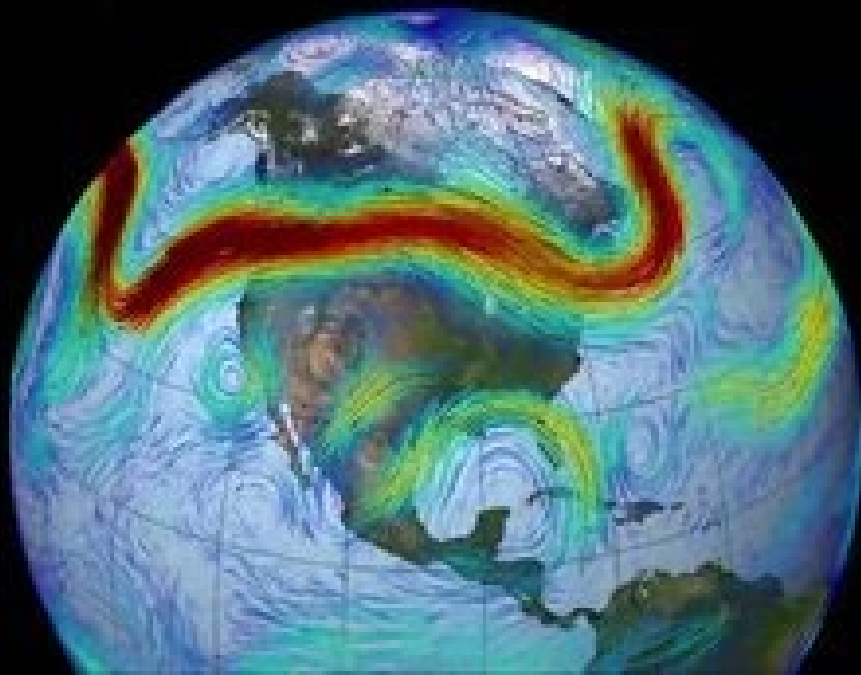


Higher values = drier plants and soils

# Global Stilling



# Wacky Jet Stream





# MASSACHUSETTS



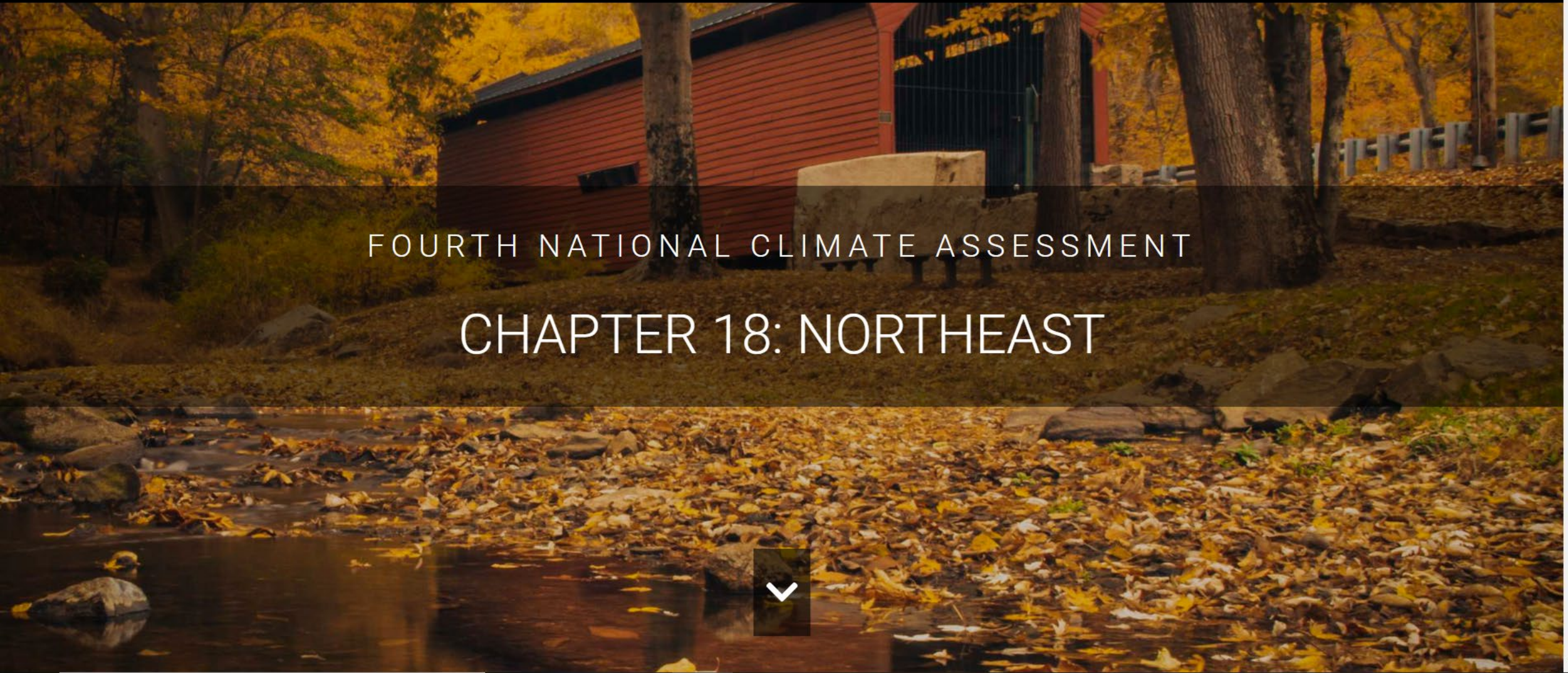
## KEY MESSAGES

Average annual temperatures have increased almost 3°F in Massachusetts over the past century. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century, with associated increases in heat wave intensity and decreases in cold wave intensity.

Precipitation has increased during the last century, with a record-setting number of extreme events occurring over the last decade. Winter and spring precipitation is projected to increase, as well as heavy precipitation events.

Global sea level has risen approximately 8 inches since reliable record keeping began in 1880. It is projected to rise another 1 to 4 feet by 2100. Sea level rise poses significant risks, including inundation and erosion-induced land loss and greater flood vulnerability due to higher storm surge.

<https://statesummaries.ncics.org/ma>



# FOURTH NATIONAL CLIMATE ASSESSMENT CHAPTER 18: NORTHEAST

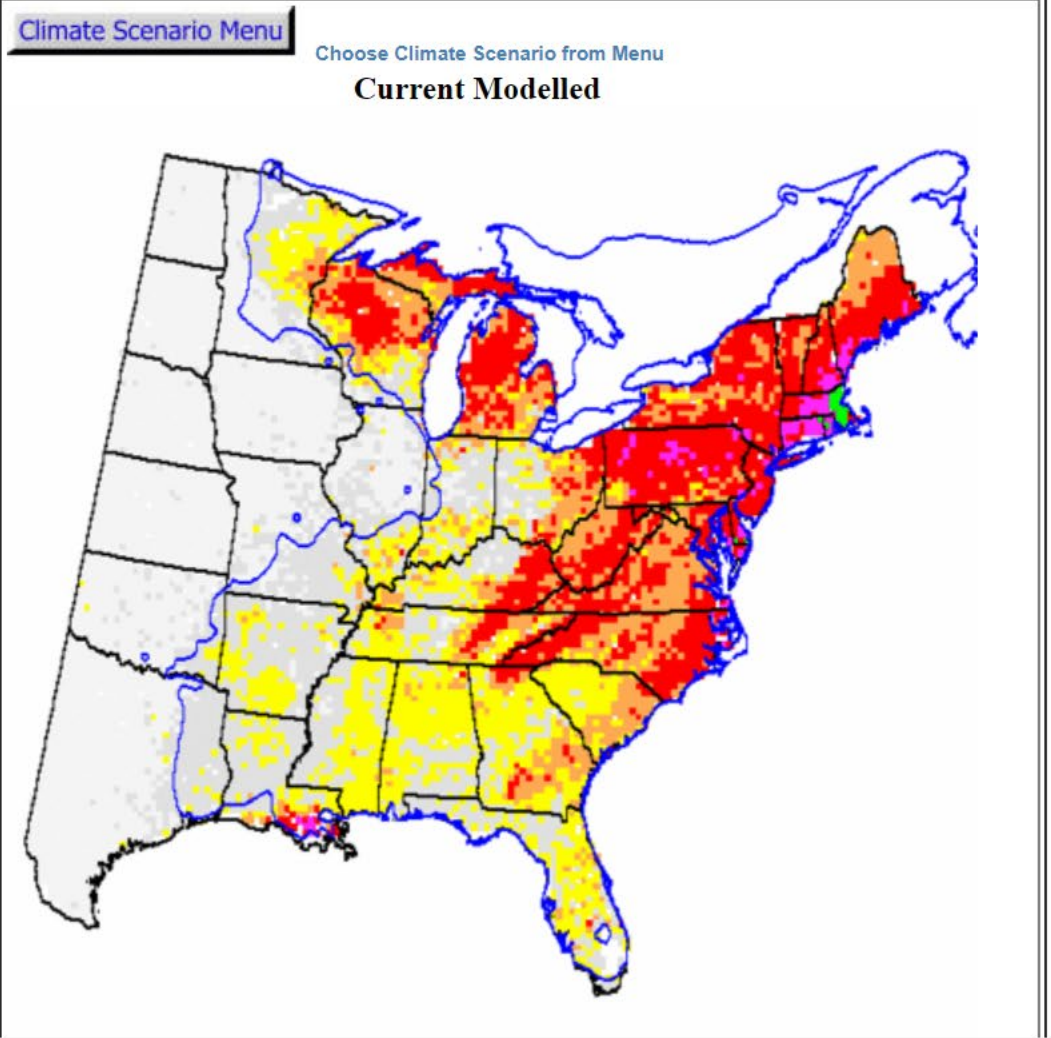
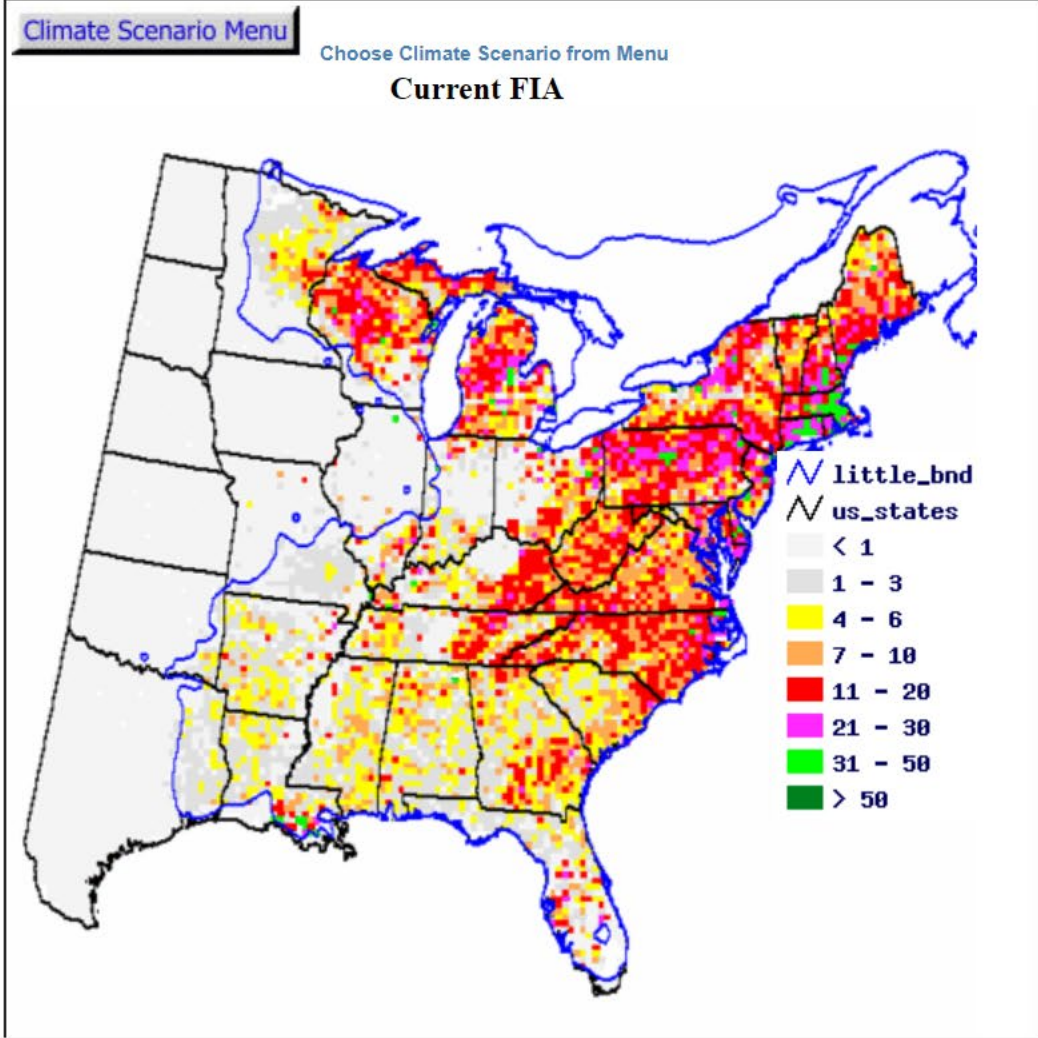


# Impacts to Forests

- Drought mortality
- Flood mortality
- Salinization mortality
- Shifting seasonality- alters ecosystems, plant-animal interactions, plant productivity
- Pest/Wildfire increases







ghost.jpg

Show all

# Forest Health

Pest ranges often limited by minimum winter temperatures

Shifting seasons disrupts life cycles and pest-host matches



The New York Times


## Long Island Confronts Destructive Southern Pine Beetles

By TATIANA SCHLOSSBERG OCT. 28, 2014

It happens all over the South, and started in [New Jersey](#) more than a decade ago: the needles fading from green to yellow to red until the tree dies. It is the work of [southern pine beetles](#), which invade the bark, lay eggs that hijack the tree's... aling its

...r first appearance ptember, when ng Island, asing northward march and a result, scientists say, of increasingly balmy winters.

No one yet knows the extent of the invasion on Long Island, but according

Robin Donohue, a wildlife biologist, inspected a pitch pine at the Wertheim National Wildlife Refuge in Shirley, N.Y., this week. Gordon M. Grant for The New York Times

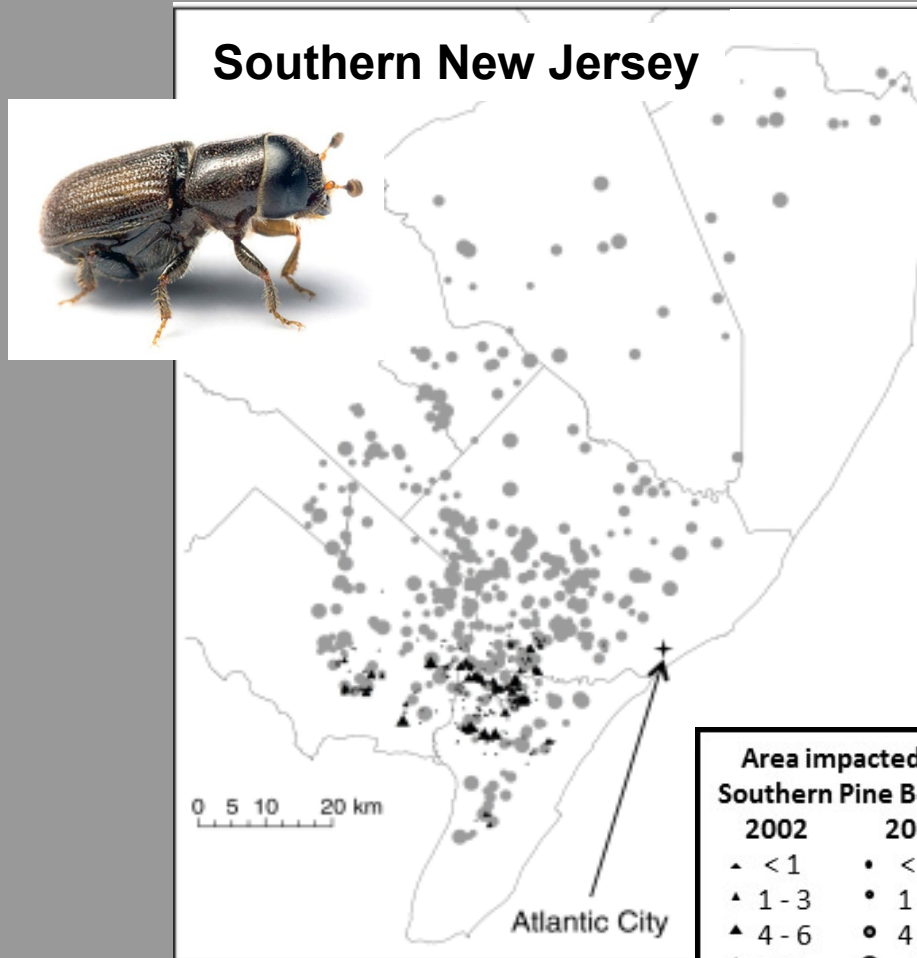
Table 6.—Modeled responses of six nuisance species to climate warming. Impact refers to the severity of impact within the three species range. Adapted from Dukes et al 2009.

	Range	Impact	Confidence
Hemlock woolly adelgid	+		
Tent caterpillar	+ or 0		
Root rot	0		
	+		
	+		
	0		

Weakened trees may be more susceptible to pest damage and diseases



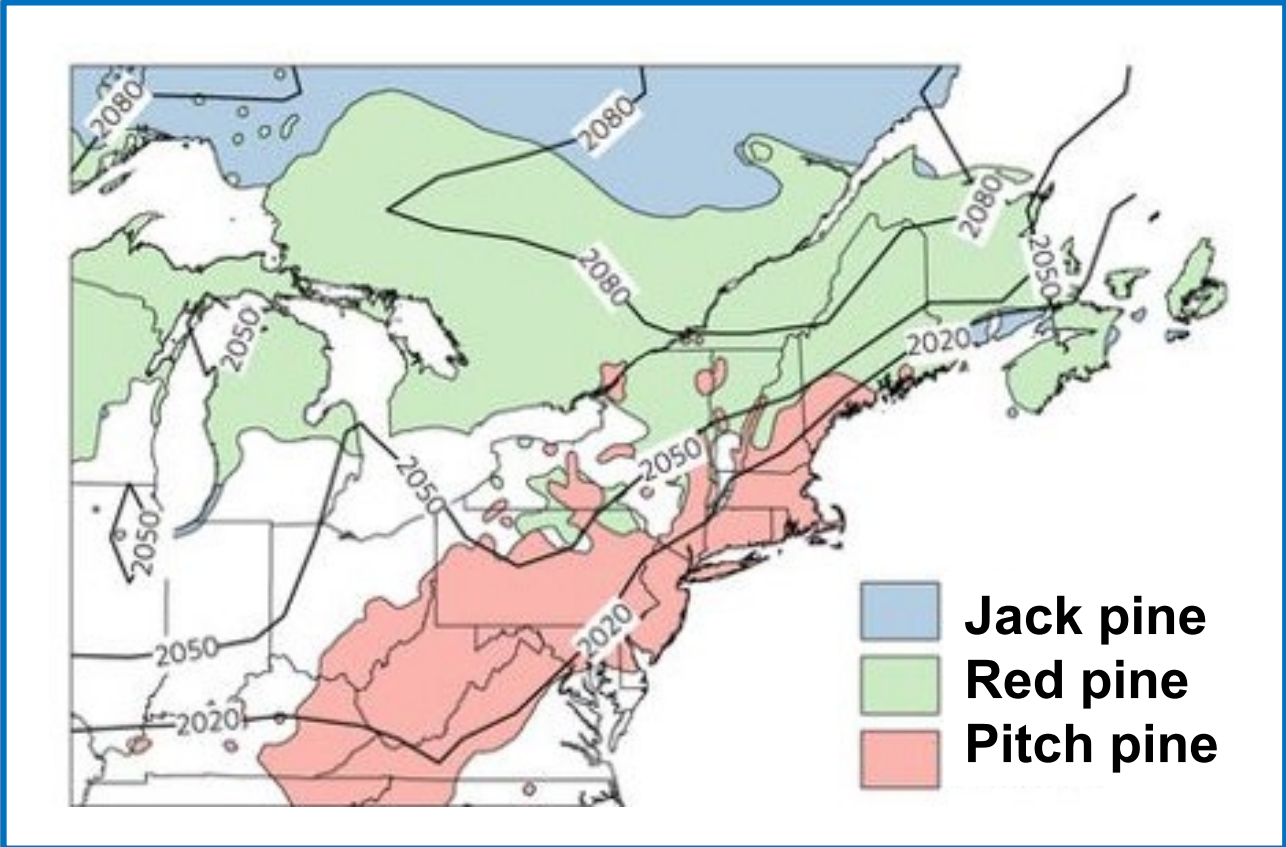
# Southern pine beetle in Southern New Jersey



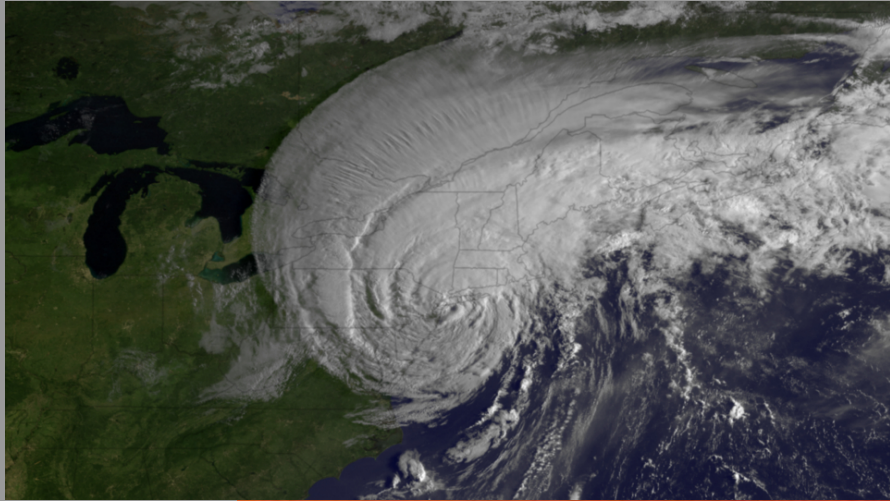
Area impacted by Southern Pine Beetle	
2002	2010
▲ <1	● <1
▲ 1-3	● 1-3
▲ 4-6	● 4-6
▲ >6	● >6



# Predicted migration of Southern pine beetle in NE US

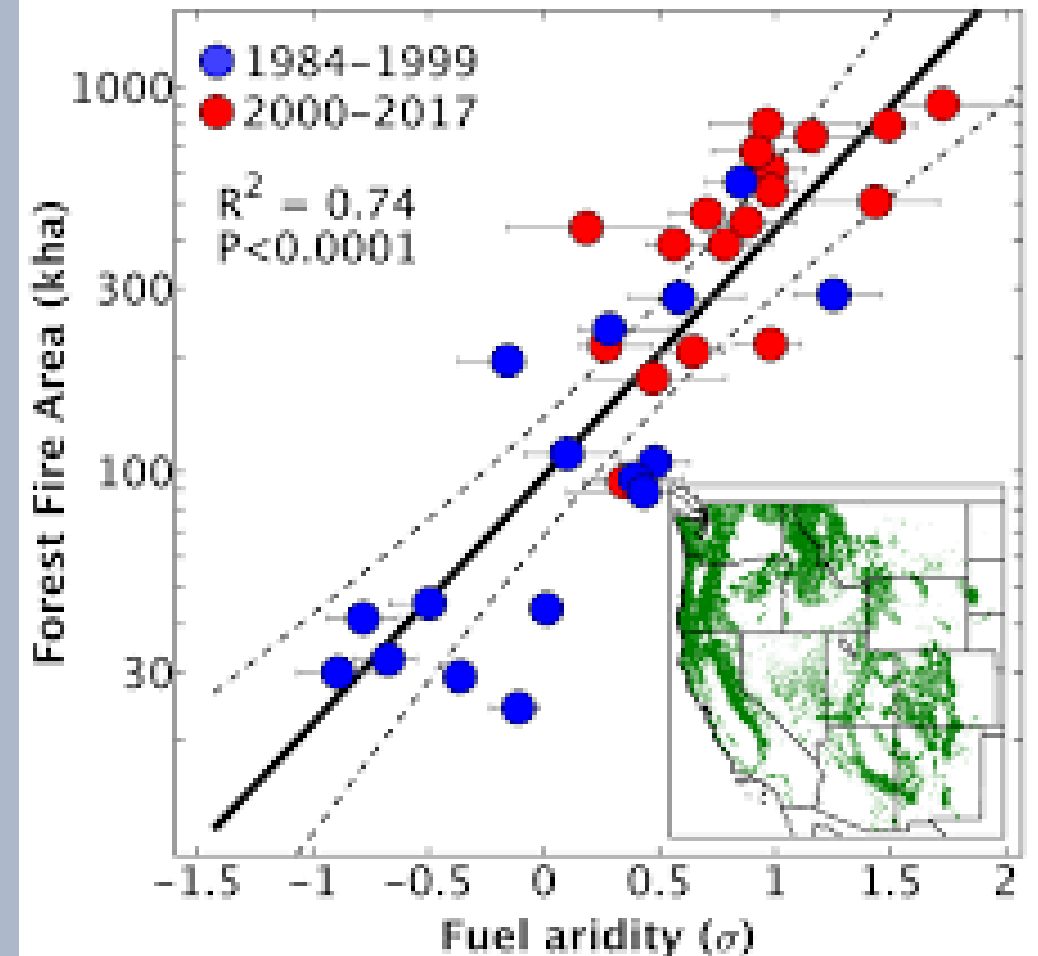


Lesk *et al.* 2017 *Nature Climate Change*



# Climate Change Impact on Fire

- Climate and fuels determine fire patterns.
- Variable and ecosystem specific
- Warming in general is linked with increase in fire season and large fires
- Complicating factors– changes in fuel types, fuel loads, fire regimes, storms, drought, season shifts, pests



lightning



Earlier  
snowmelt



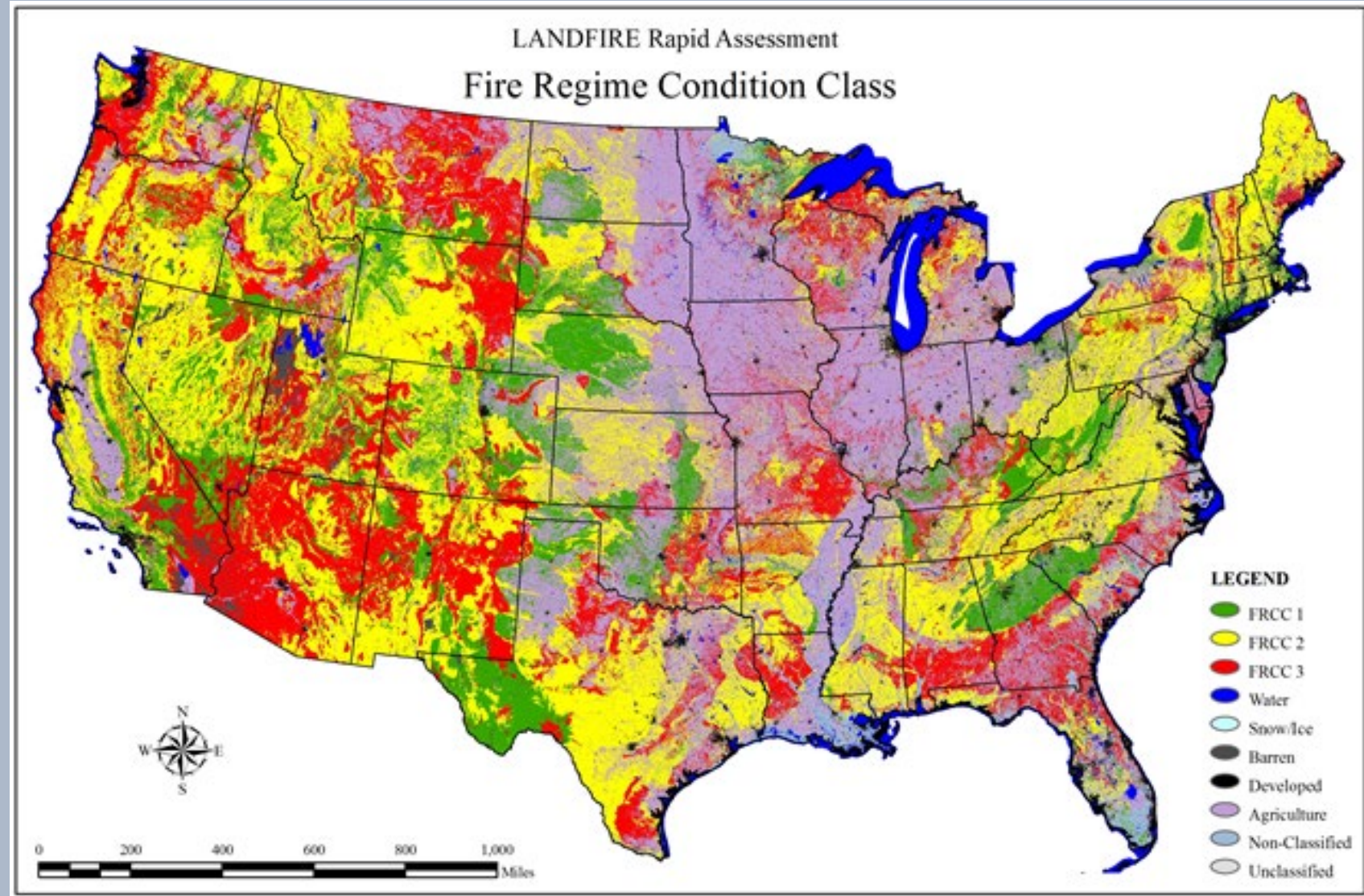


# Drought in areas of increased Precipitation



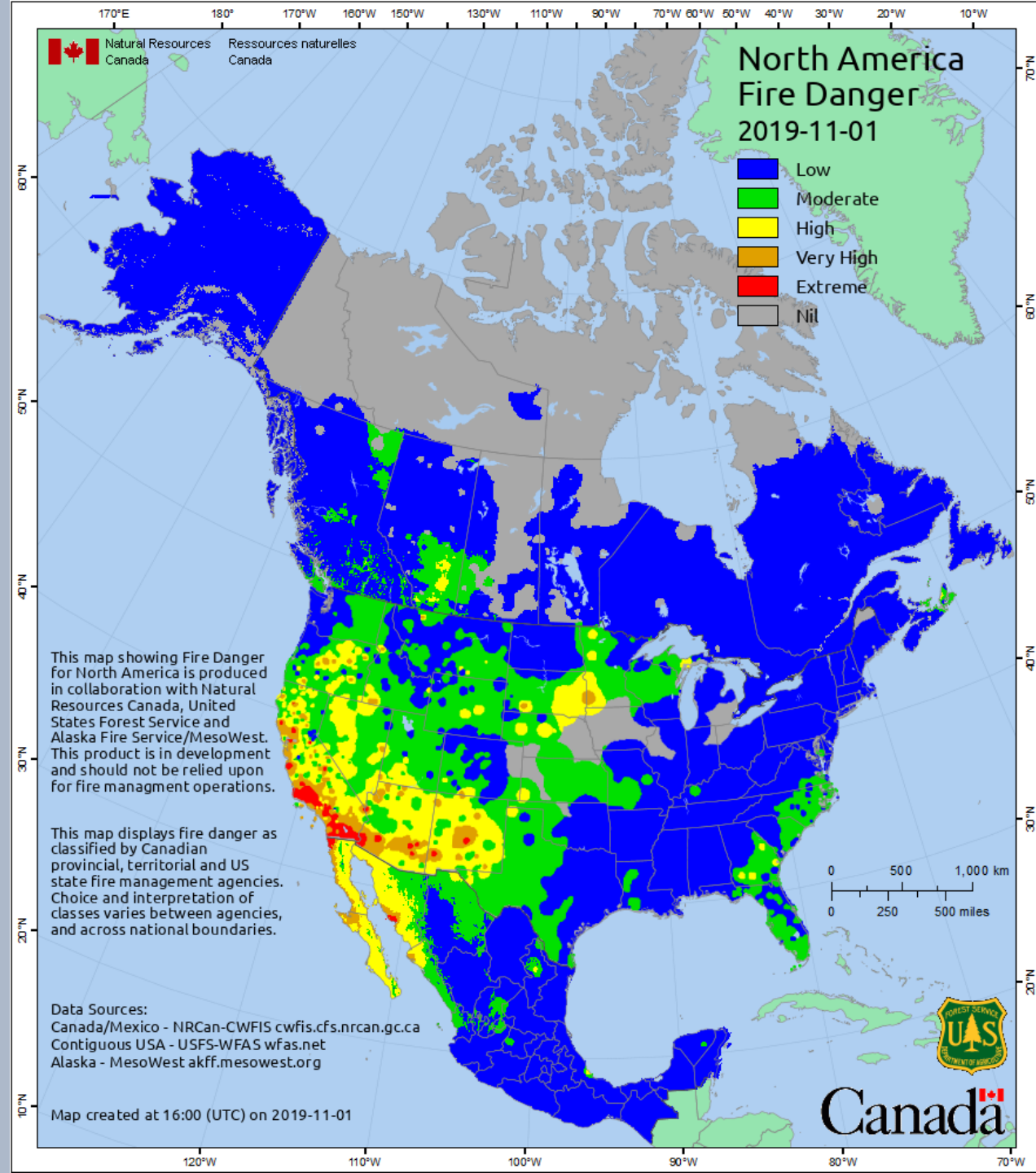
Photo credit: Jim Guldin, US Forest Service

# Changing Climate. Changing Regimes.



# Regional Climate Impacts to Fire

- Alaska/Northern Provinces: permafrost thaw, fire regime
- NW: biomass consumed
- SW: drought, pests, erosion
- Great Plains: forest health
- Midwest: drought
- Southeast: longer season

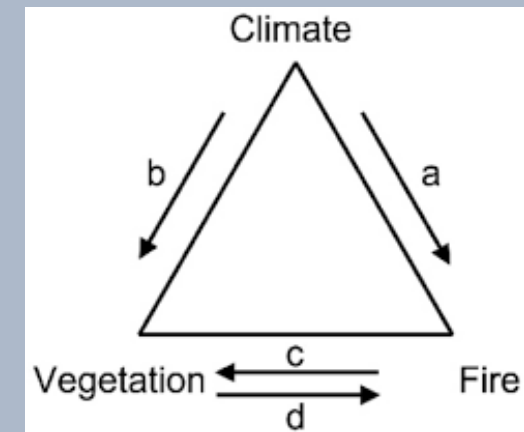


# Climate Feedback Loop

- Fires emit gases, some contribute to GHG effect (mostly CO<sub>2</sub>).
- Fires kill vegetation (which would have removed CO<sub>2</sub> from the air)
- Fires contribute soot and aerosols that have a complex effect.



- Wildfires are not the leading cause of global warming (it's burning fossil fuels).



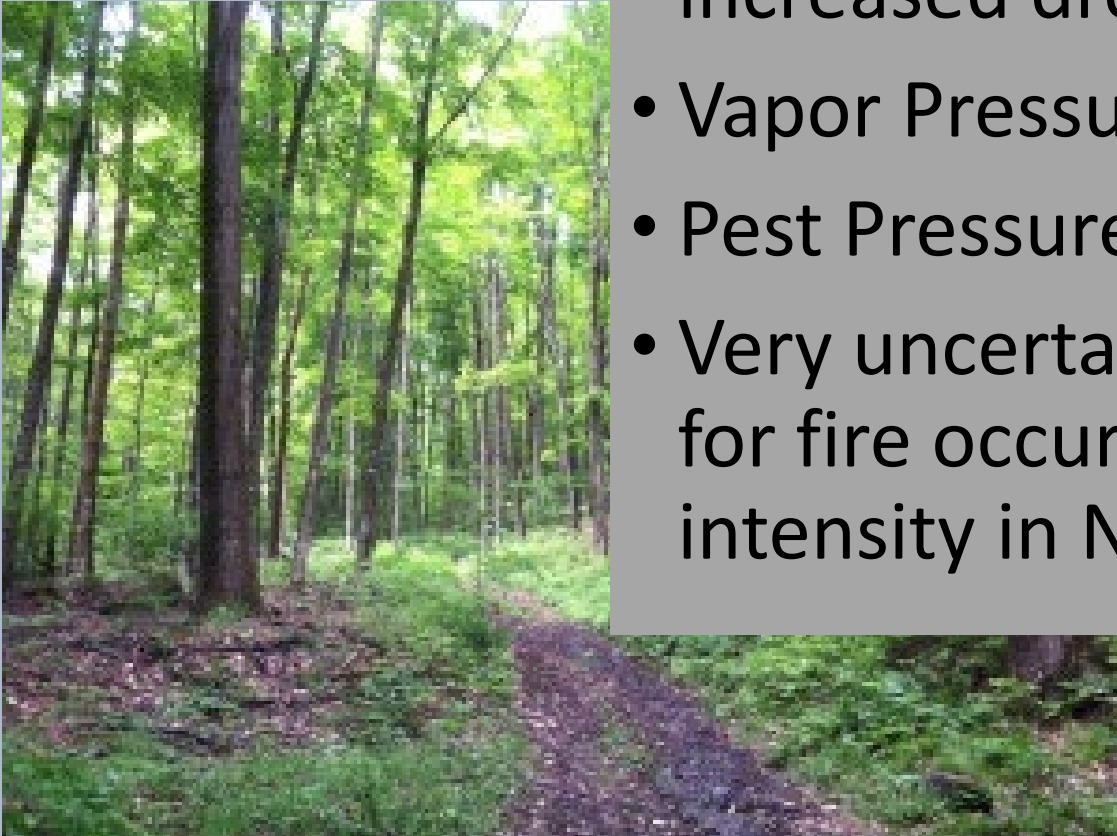


Roger Ottmar/USFS



Durango Herald

# Northeast



- Warmer Temperatures
- Increased rain, but increased drought.
- Vapor Pressure Deficit
- Pest Pressures increasing
- Very uncertain predictions for fire occurrence or intensity in NE.

# Conclusion

