CLIMATE CHANGE AND AGRICULTURE: ADAPTATION STRATEGIES

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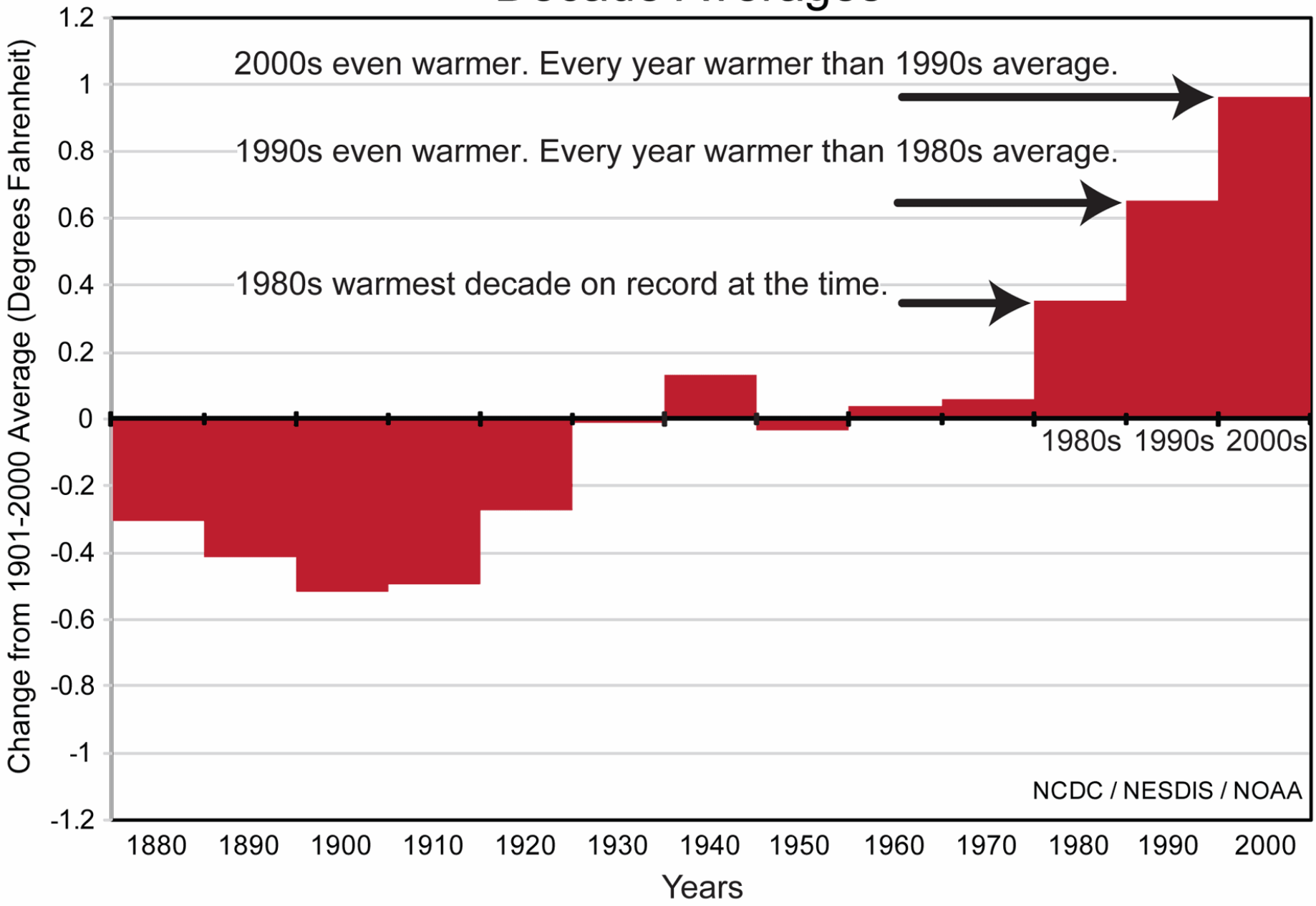
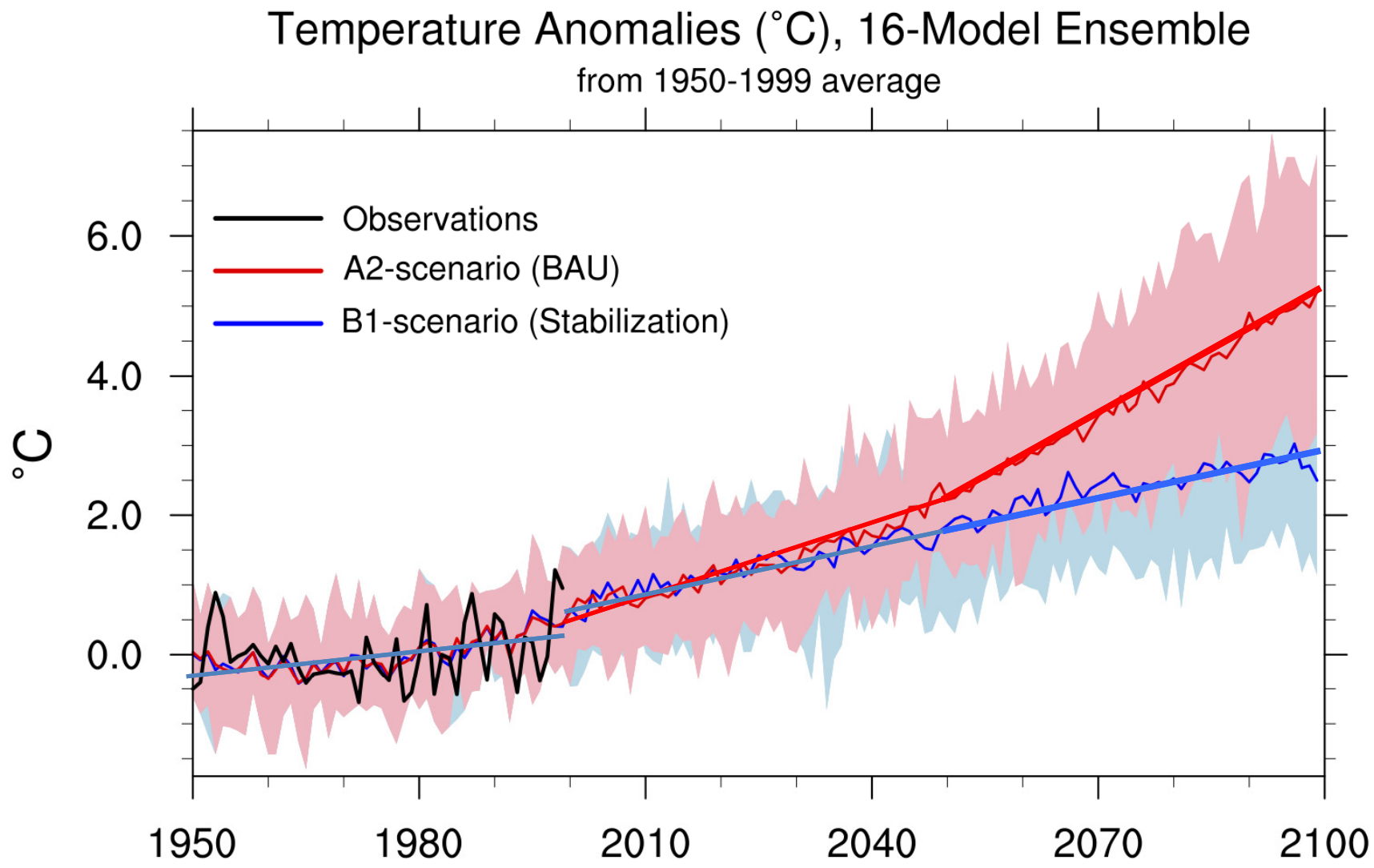
Why should farmers and ranchers care about climate change?

- **Climate variability, and climate change** have effects on agriculture and land use.
- Crops and grazing lands exist in an atmosphere that is **increasing in concentration of CO2.**
- Agricultural and forest systems are **important sources of greenhouse gases and carbon sinks**
- Forest and agricultural emission reductions and carbon sinks offer **potentially significant low-cost opportunities** to address climate change


Global Temperature Change
Decade Averages
2000s even warmer. Every year warmer than 1990s average.
1990s even warmer. Every year warmer than 1980s average.
1980s warmest decade on record at the time.
1980s
1990s
2000s
NCDC / NESDIS / NOAA
Change from 1901-2000 Average (Degrees Fahrenheit)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Years

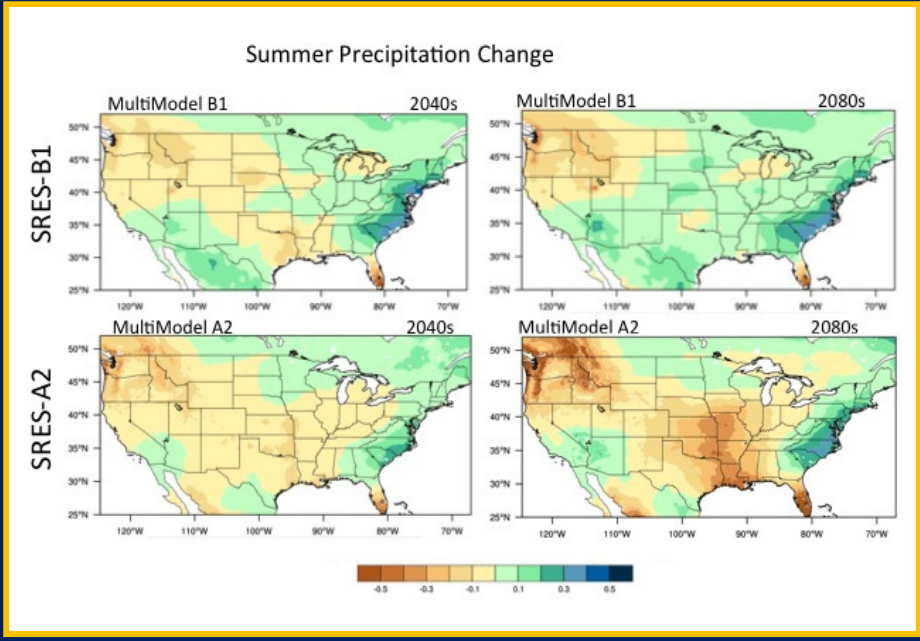
NCAR

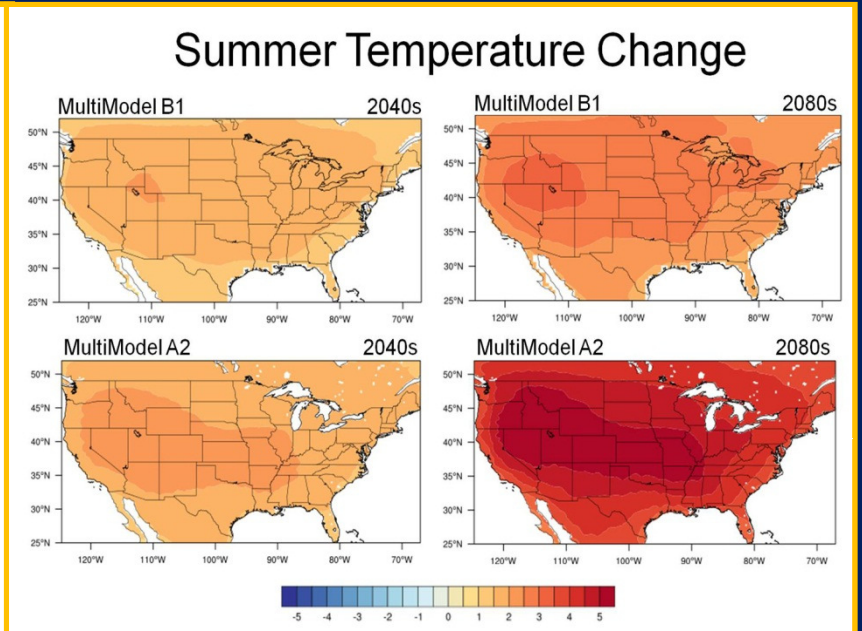
Projection US Surface Temperature



http://usda.gov/oce/climate_change/effects.htm

Changing Climate Conditions



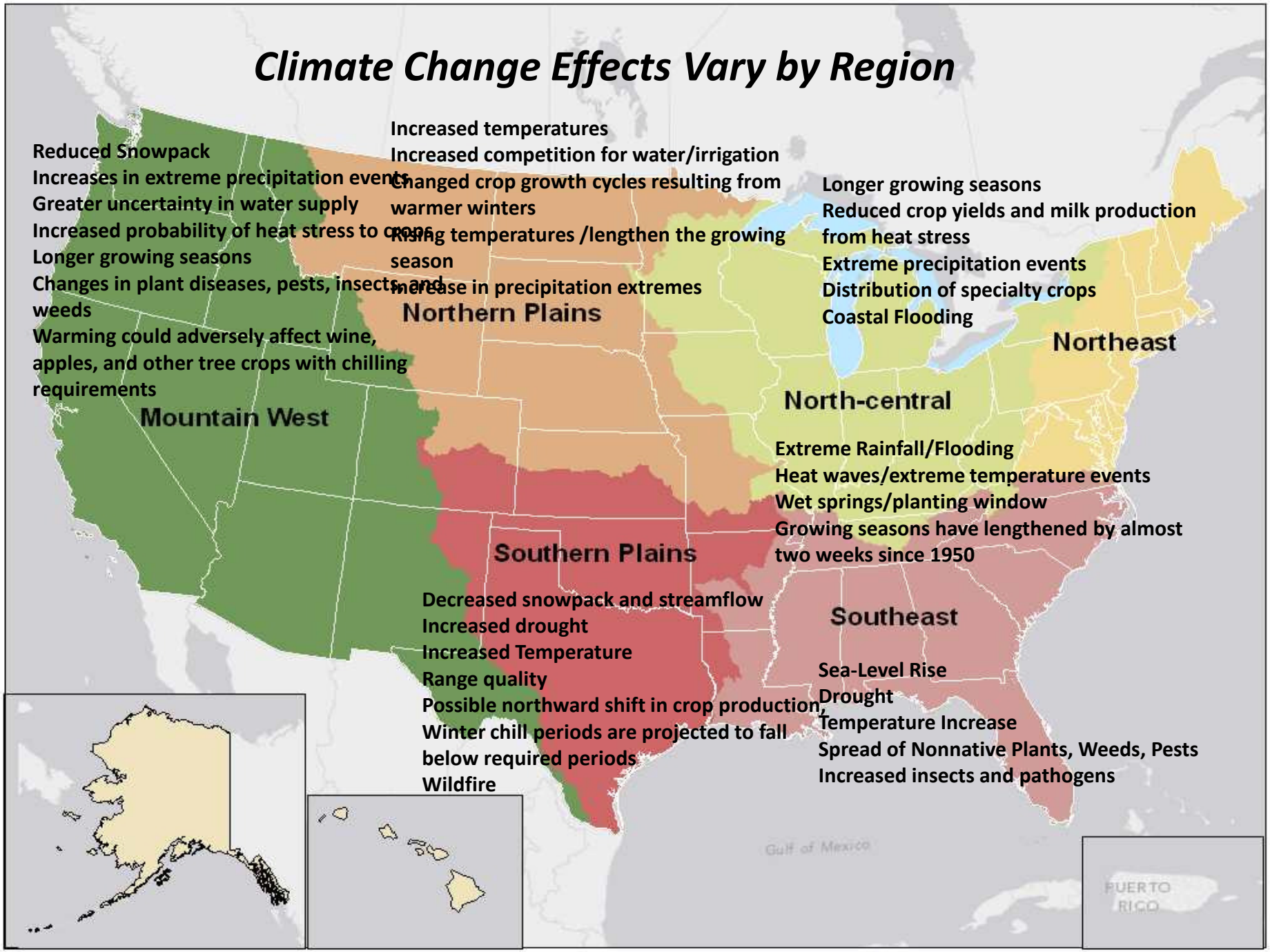


- Temperature increases: longer growing seasons, less frost, warmer nights
- Precipitation changes: deficits, excesses, timing shifts, changing mix of rain/snow
- Increased intensity of precipitation events: more flooding and more droughts
- Increasing carbon dioxide concentrations

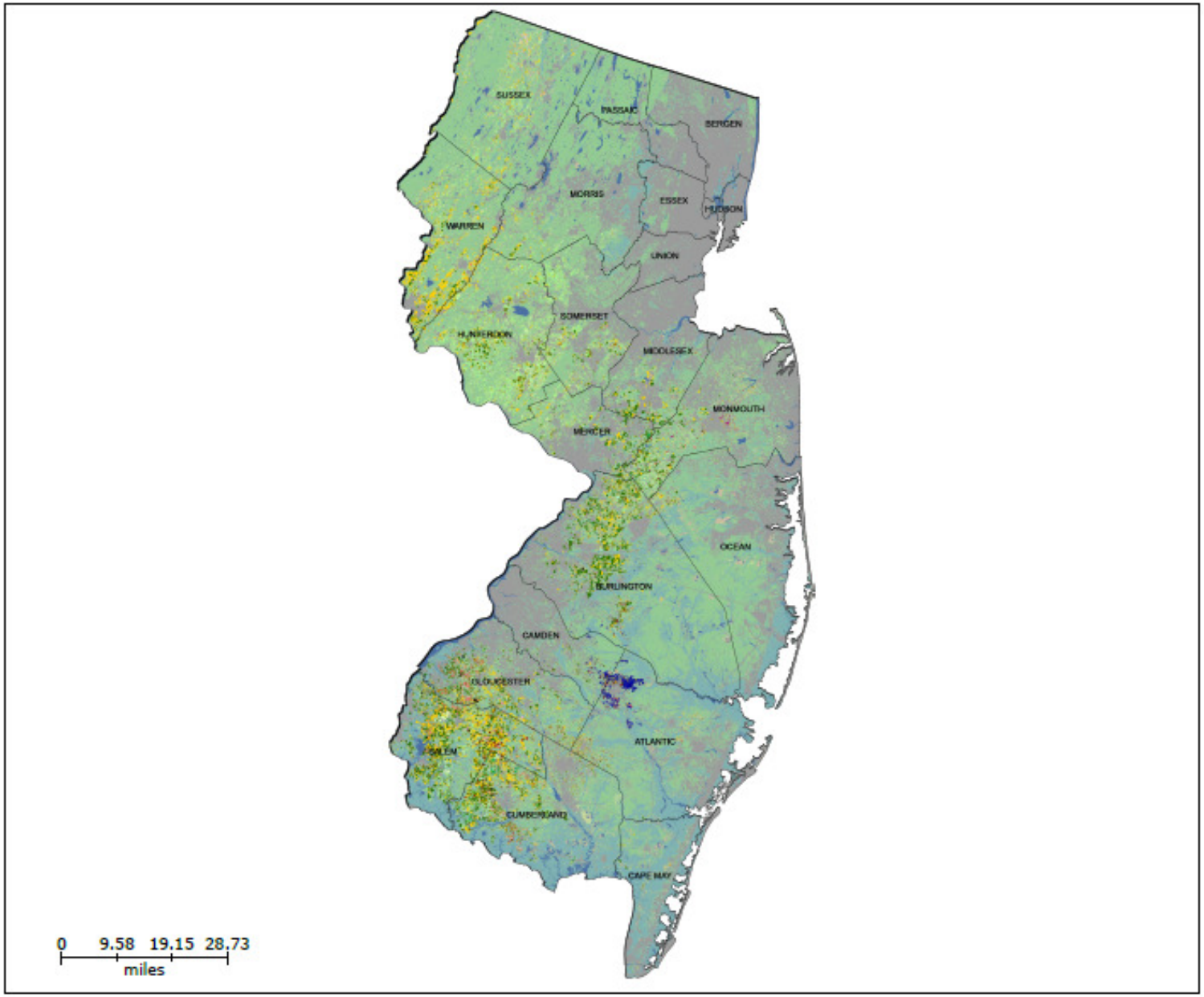
Effects and Sensitivity Vary by Commodity

- Corn: high nighttime temperatures, high temperatures during pollination, water stress
- Soybean: water stress, high temperatures
- Wheat and small grains: extreme events, frost during flowering, water stress
- Rice: temperature extremes during pollination, water management
- Cotton: high temperatures during boll fill
- Pasture and rangeland: water stress
- Fruit trees: chilling requirements not met, high temperatures during fruit development
- Specialty crops: water stress, high temperatures

Climate Change Effects Vary by Region



2012 New Jersey



Land Cover Categories

(by decreasing acreage)

AGRICULTURE*

- Other Hay/Non Alfalfa
- Corn
- Soybeans
- Fallow/Idle Cropland
- Dbl Crop WinWht/Soybeans
- Pasture/Grass
- Blueberries
- Alfalfa
- Other Crops
- Winter Wheat
- Tomatoes
- Peaches
- Sod/Grass Seed
- Potatoes
- Peppers
- Rye

NON-AGRICULTURE**

- Deciduous Forest
- Developed/Open Space
- Woody Wetlands
- Developed/Low Intensity
- Developed/Medium Intensity
- Evergreen Forest

Produced by CropScape - http://nassgeodata.gmu.edu/CropScape

* Only top 16 agriculture categroies are listed. ** Only top 6 non-agriculture categroies are listed.

Strategies for Improving Resilience to Climate Change

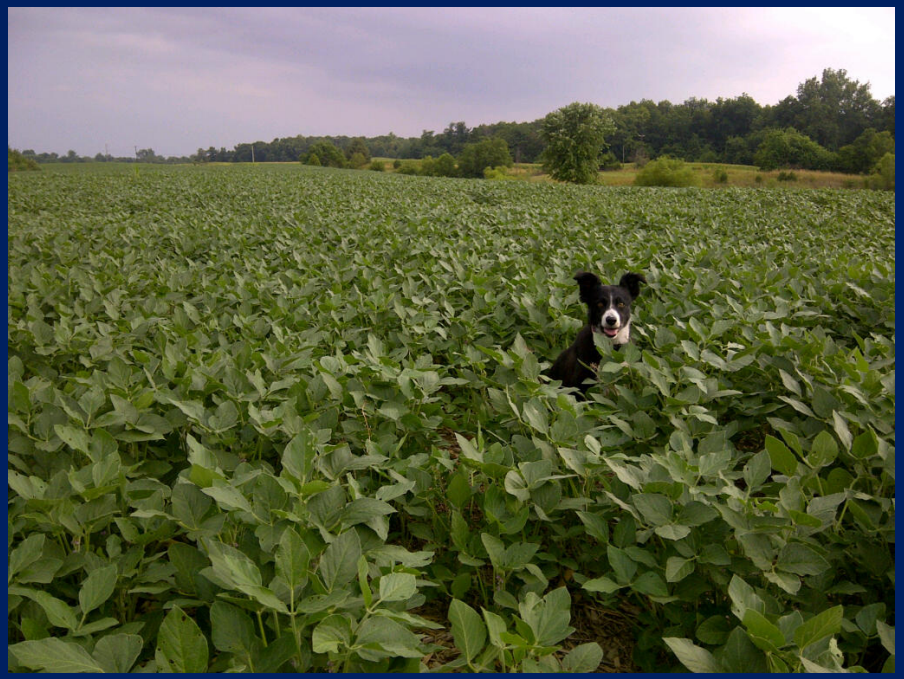
- Row Crop Management
  - Breeding for drought and temperature tolerance
  - Shifts to earlier planting dates
  - Increasing organic content of soils
  - Use conservation tillage or no-till to decrease runoff and increase infiltration
  - Establish and maintain buffers, filter strips, and grassed waterways near water sources
  - Shift to cropping systems that are less water dependent

2012 Drought Comparison: Soybeans

Greencastle, Indiana, July 2012—Side-by-Side Fields

USDA Promotes Soil Health Management Systems to Improve Water Quality, Combat Drought, Mitigate Flooding, and Improve Productivity

11-year continuous no till plus 5 years of cover crops



Minimum / vertical till

Strategies for Improving Resilience to Climate Extremes

- Specialty Crop Management
  - Breeding for drought and temperature tolerance
  - Crop load adjustments
  - Canopy pruning
  - Irrigation
  - Particle films and shading
  - Cultivar selection

Strategies for Improving Resilience to Climate Change

- Livestock Management
  - Selection of breeds and types
  - Improved nutritional management during periods of high heat load
  - Sunshades, evaporative cooling, mechanical ventilation
  - Rotational grazing systems to minimize damage to range and pasture
  - Actively manage forage stocks and reduce herd size when droughts occur

Strategies for Improving Resilience to Climate Change

- Water Management
  - Install more efficient irrigation systems or make existing irrigation systems more efficient
  - Water storage in ponds and tanks
  - Manage water use and apply water only when needed
  - Install watering facilities to ensure livestock have access to water

Strategies for Improving Resilience to Climate Change

- Improving access to information
  - Drought early warning system
- Research and development
- Programs to help farmers manage risk
- Regional outreach, extension, education