



# Climate Change and Agriculture



# Outline

- 1. **Introduction**: IPNI - Who, Where and What?
- 2. **Global Warming, Climate Change, and Agriculture**
- 3. As an Agronomist and Certified Crop Advisor (CCA), **how can we assist our farm clients to adapt?**
- 4. **Questions** and Discussion

# 1. Introduction



INTERNATIONAL  
PLANT NUTRITION  
INSTITUTE

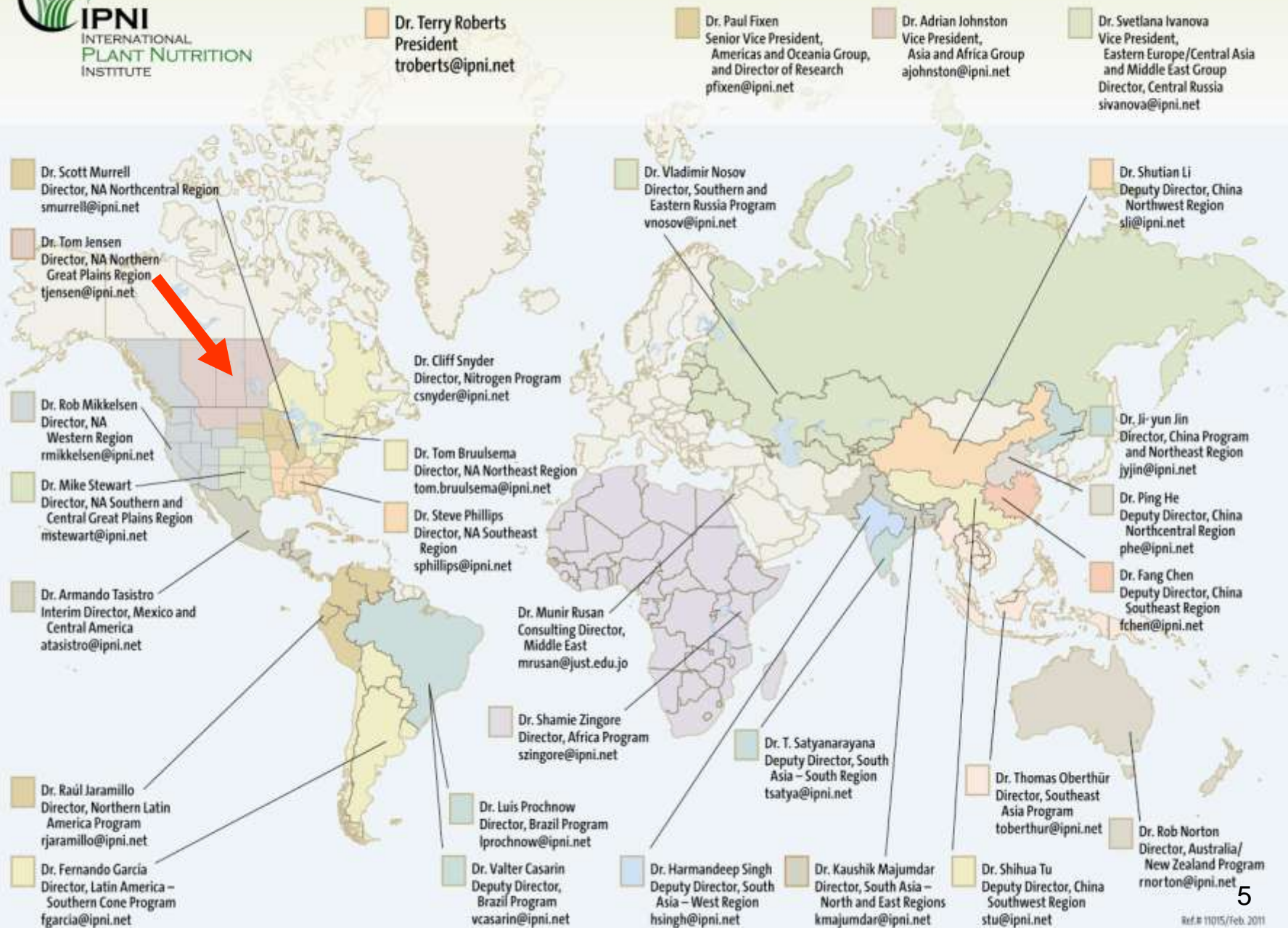


- A not-for-profit, scientific organization dedicated to responsible management of plant nutrients for the benefit of the human family
- Unified, scientific voice for the world's fertilizer industry
- Define the basis for appropriate use and management of plant nutrients, focusing on the environmental and economic aspects

# IPNI is supported by leading fertilizer manufacturers and industry associations



# Scientific Staff (31, 27 Regional Directors)



# Tom Jensen, PhD Agronomy, CCA

- Raised on a mixed irrigated farm in southern Alberta
- Studied agriculture at the University of Alberta, Edmonton, AB
  - BSc - agronomy, MSc - soil fertility, PhD - agronomy
- Career experience
  - Government applied research and extension, soil conservation , no-till cropping and cropping systems
  - Corporate Agronomist with Agrium
  - Regional Agronomist, Viterra (retail grain and crop inputs)
  - IPNI, Northern Great Plains Regional Director
- Serve on International CCA Exam Committee, and Prairie Provinces CCA Board



# Northern Great Plains

## Regional Director

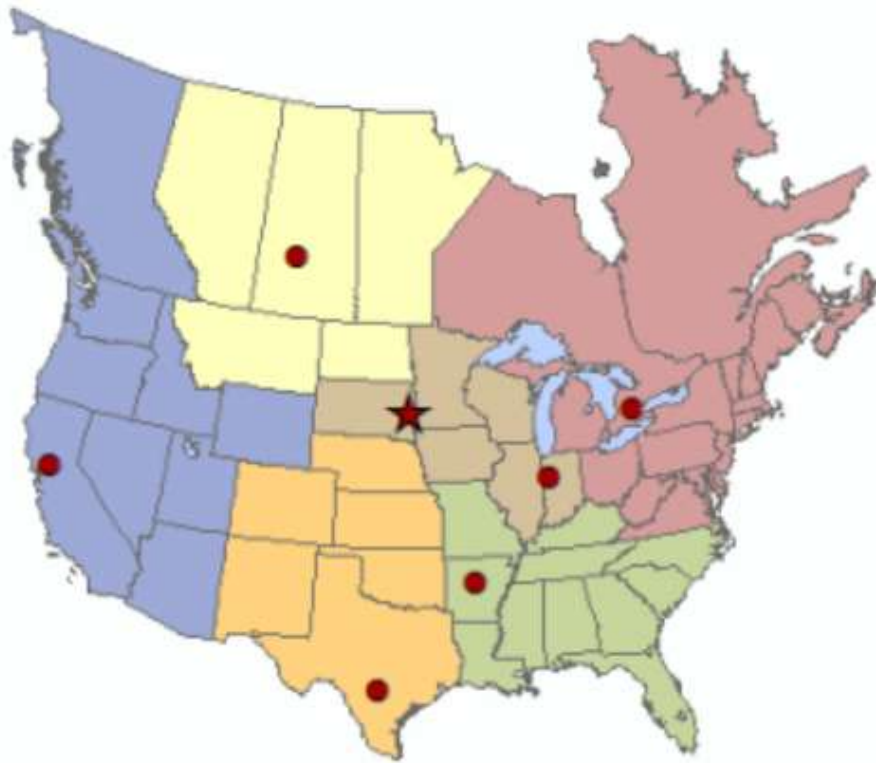


# Northern Great Plains

State/Prov	Montana	North Dakota	Manitoba	Saskatchewan	Alberta	Total NGP
Area, sq mi	147,046	70,704	250,134	251,385	255,560	974,828
Total area, acres	94,109,506	45,250,505	160,085,751	160,886,183	163,558,080	623,890,025
Land in farms, acres	60,799,999	39,674,583	19,072,325	64,251,555	52,126,001	235,924,463
<b>Cropland, acres</b>	<b>9,469,000</b>	<b>27,527,178</b>	<b>11,616,036</b>	<b>36,965,907</b>	<b>23,774,662</b>	<b>109,352,783</b>
<b>Grazing/Pastures</b>	51,330,999	12,147,405	7,456,288	27,285,648	28,351,339	126,571,680



# Corn, silage and some grain corn



# Wheat



# Canola

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# Barley



# Forages: alfalfa, and cool season grasses



# Potatoes and Sugar Beets, in irrigated and moist areas



# Oats



# Flax

for linseed oil and some edible oil



# Pulses

lentils, field pea, chick pea, dry beans



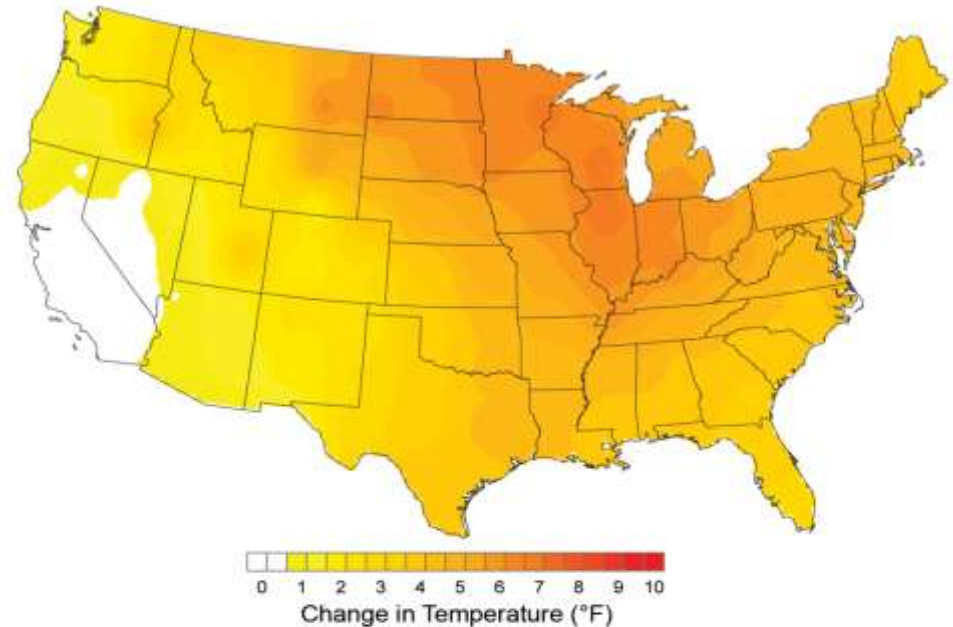
# Mustards

## yellow, oriental, brown



## 2. Global Warming, Climate Change, and Agriculture

- Average global temperature is rising.



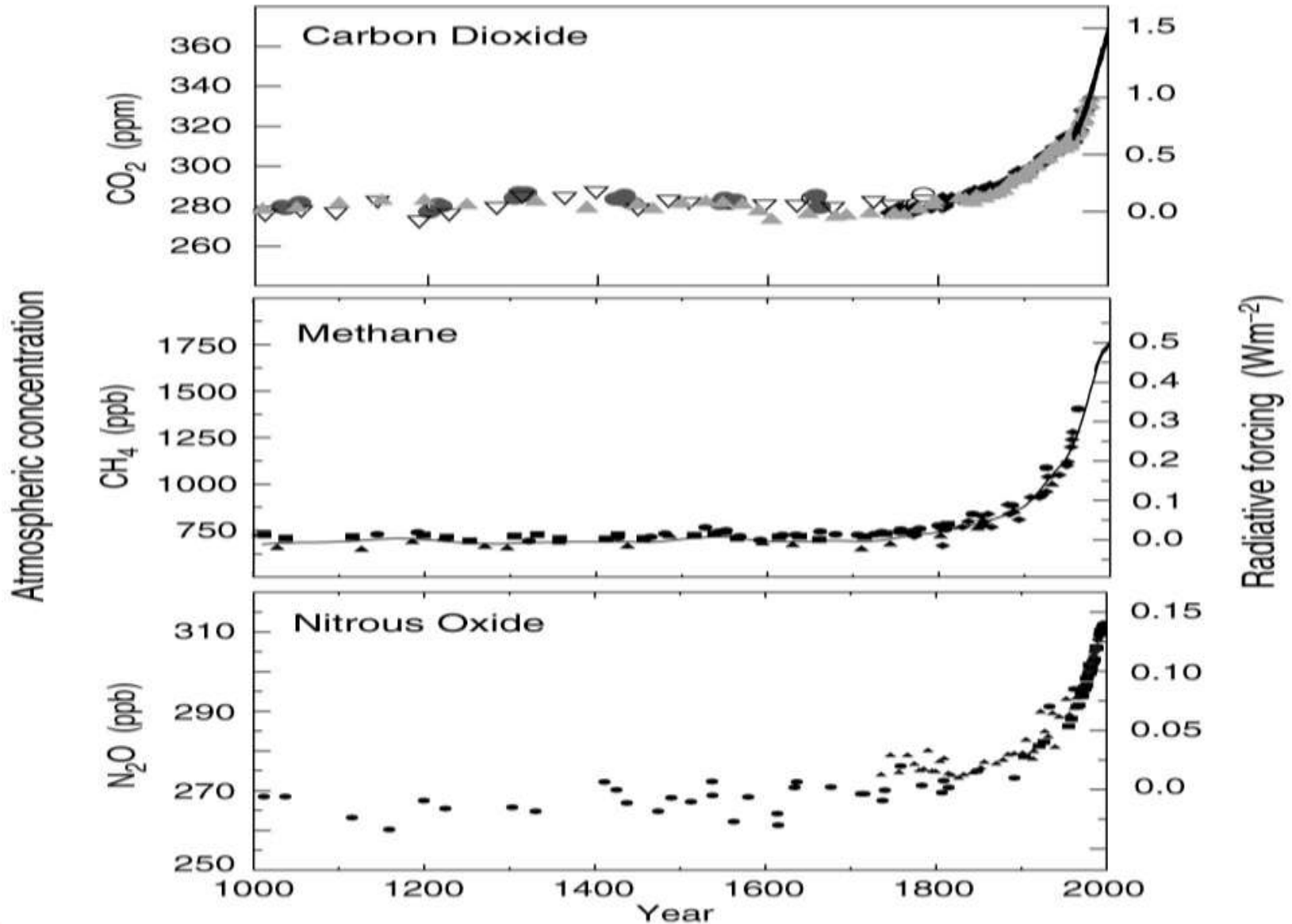
NOAA/NCDC<sup>242</sup>

Temperatures are rising faster in winter than in any other season, especially in many key agricultural regions. This allows many insect pests and crop diseases to expand and thrive, creating increasing challenges for agriculture. As indicated by the map, the Midwest and northern Great Plains have experienced increases of more than 7°F in average winter temperatures over the past 30 years.

# What causes these increases

- Fossil fuel burning release about 6 billion tons of carbon ( $\text{CO}_2$ ) each year to the atmosphere
- Methane ( $\text{CH}_4$ ) from agriculture, livestock, landfills and industry have increased by 133%
- Nitrous oxide ( $\text{N}_2\text{O}$ ) from agriculture and industry has increased by 15%
- Change in land use and land cover release 1 billion tons of carbon plus other gases

**(a) Global atmospheric concentrations of three well mixed greenhouse gases**



# Agriculture's Portion of Greenhouse Gases

- Agriculture is itself responsible for an estimated one third of climate change.
- It is generally agreed that about **25% of carbon dioxide emissions**, are produced by agricultural sources:
  - deforestation
  - use of fossil fuel-based fertilizers, and
  - the burning of biomass.
- Most of the methane in the atmosphere comes from domestic ruminants, forest fires, wetland rice cultivation and waste products,
- Conventional tillage and fertilizer use account for 70% of the nitrous oxides.
- According to the Intergovernmental Panel on Climate Change, the three main causes of the increase in greenhouse gases observed over the past 250 years have been fossil fuels, land use, and agriculture.

# Melting Glacier



# Rising Sea Level



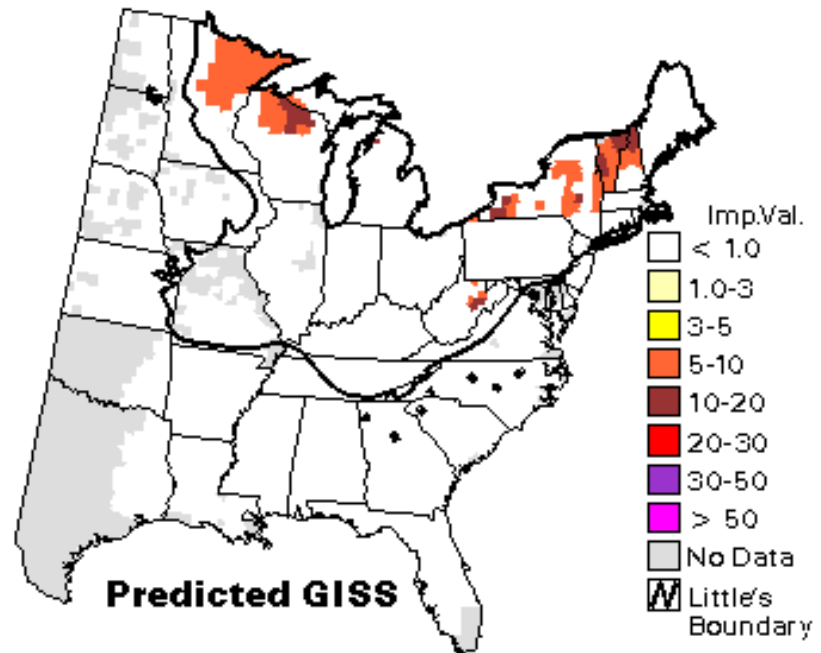
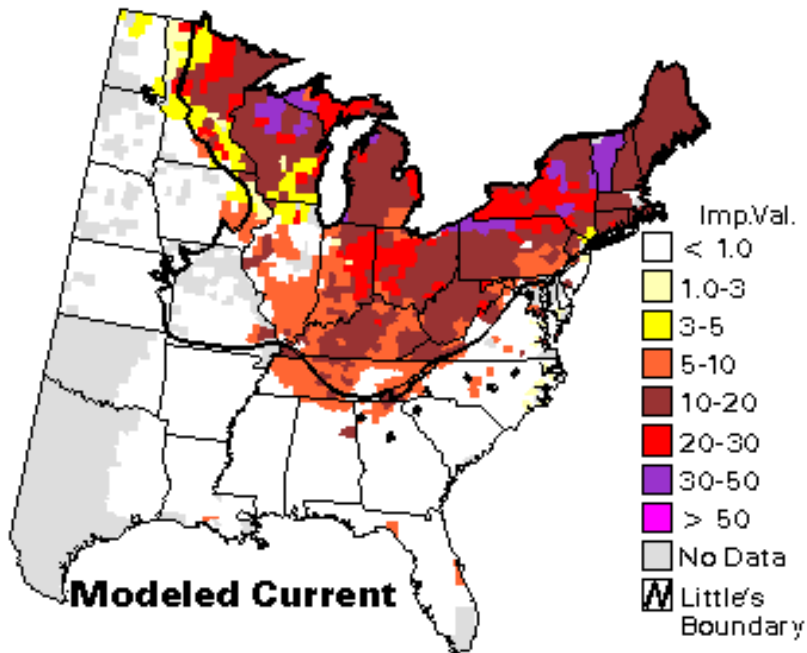


Current CO<sub>2</sub> (380 ppm)    Potential Future CO<sub>2</sub>  
(680 ppm)

The left photo shows weeds in a plot grown at a carbon dioxide (CO<sub>2</sub>) concentration of about 380 parts per million (ppm), which approximates the current level. The right photo shows a plot in which the CO<sub>2</sub> level has been raised to about 680 ppm.<sup>233</sup> (Photos by Lewis Ziska)

# Current and projected range of Sugar Maple

*Acer saccharum*



From: Margaret Davis,  
University of Minnesota

Based on projected doubling of  
CO<sub>2</sub> by 2050 and reduced precip.

# What Does a Crop Need to Grow, Well?



- **Viable, high germination seed, with good genetics**
- **Good quality seedbed, proper depth, soil contact and timing**
- **Moisture and warmth**
- **Adequate nutrients**
- **Pest control: weeds, insects and disease**

**Since weather is the primary driver of yield potential. If the climate and weather change, then yields will change and potentially the crops grown will change**

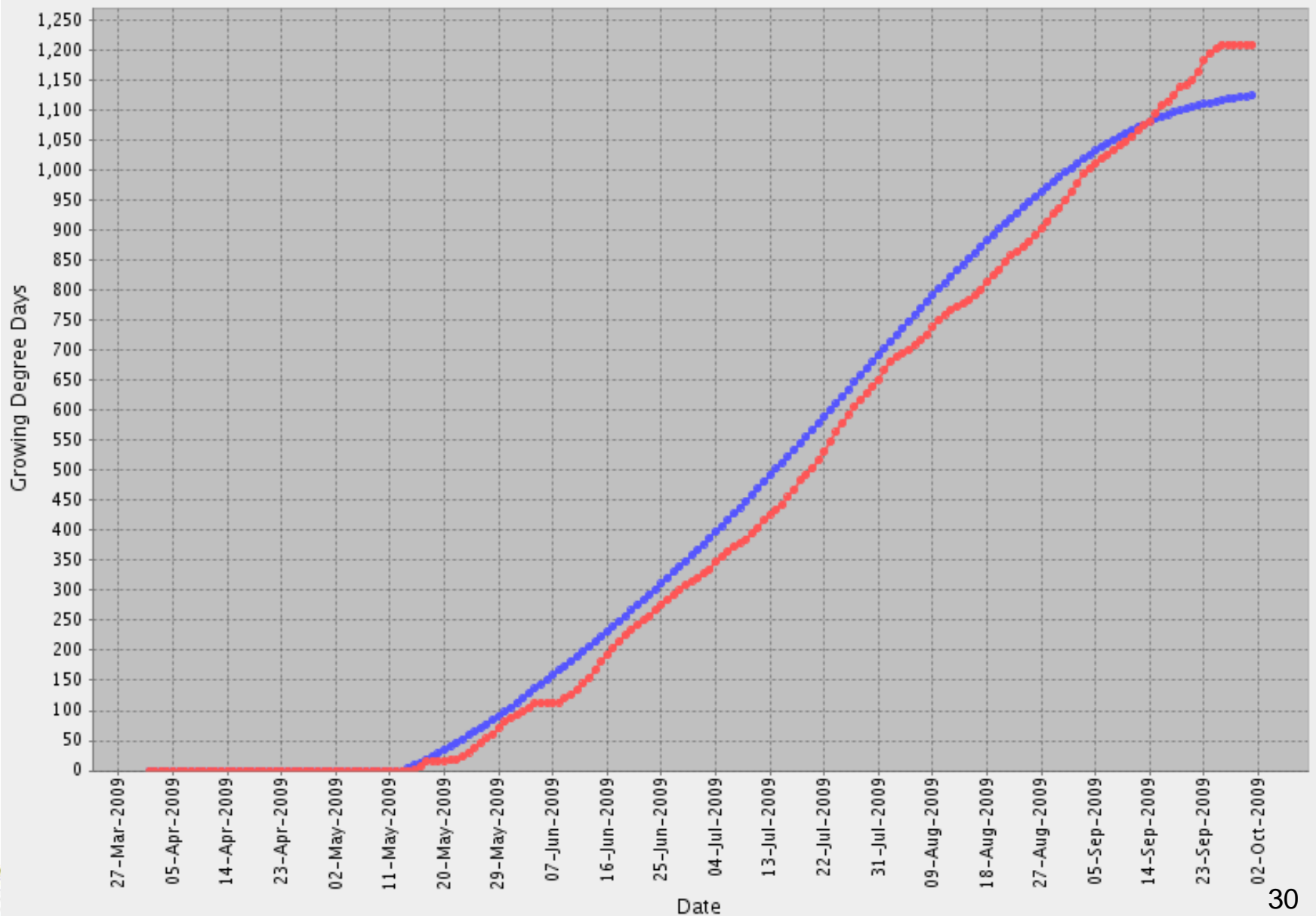


**Image: International Federation of Agricultural Producers Paris, France**

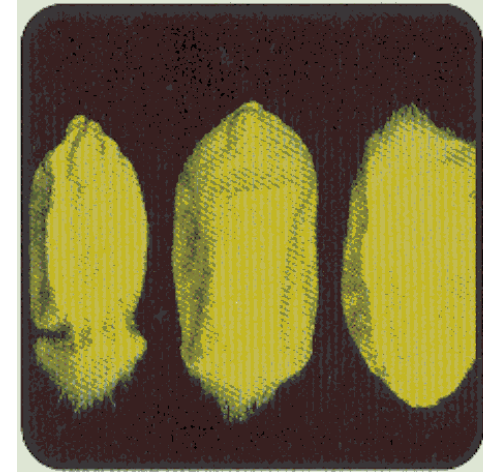
# Possible Climate Change Projections and Potential Agriculture Adaption

- Warmer and Drier
  - Need to grow more drought tolerant crops
    - Drought tolerant hybrids,
    - More corn with drought tolerant genes, sorghum?
    - Less canola, food quality *Brassica juncea* (mustards)
    - More winter wheat less spring wheat
  - More irrigation, pressure on limited water resources
  - Suite of insects and diseases will change
- Warmer and More Moisture
  - More corn and soybean
  - Longer season, higher yielding crops
  - Expansion of potential cropping areas
  - Northern expansion of cropping

# Olds, AB 2009, 5 degree C Heat Units



# Fusarium Head Blight



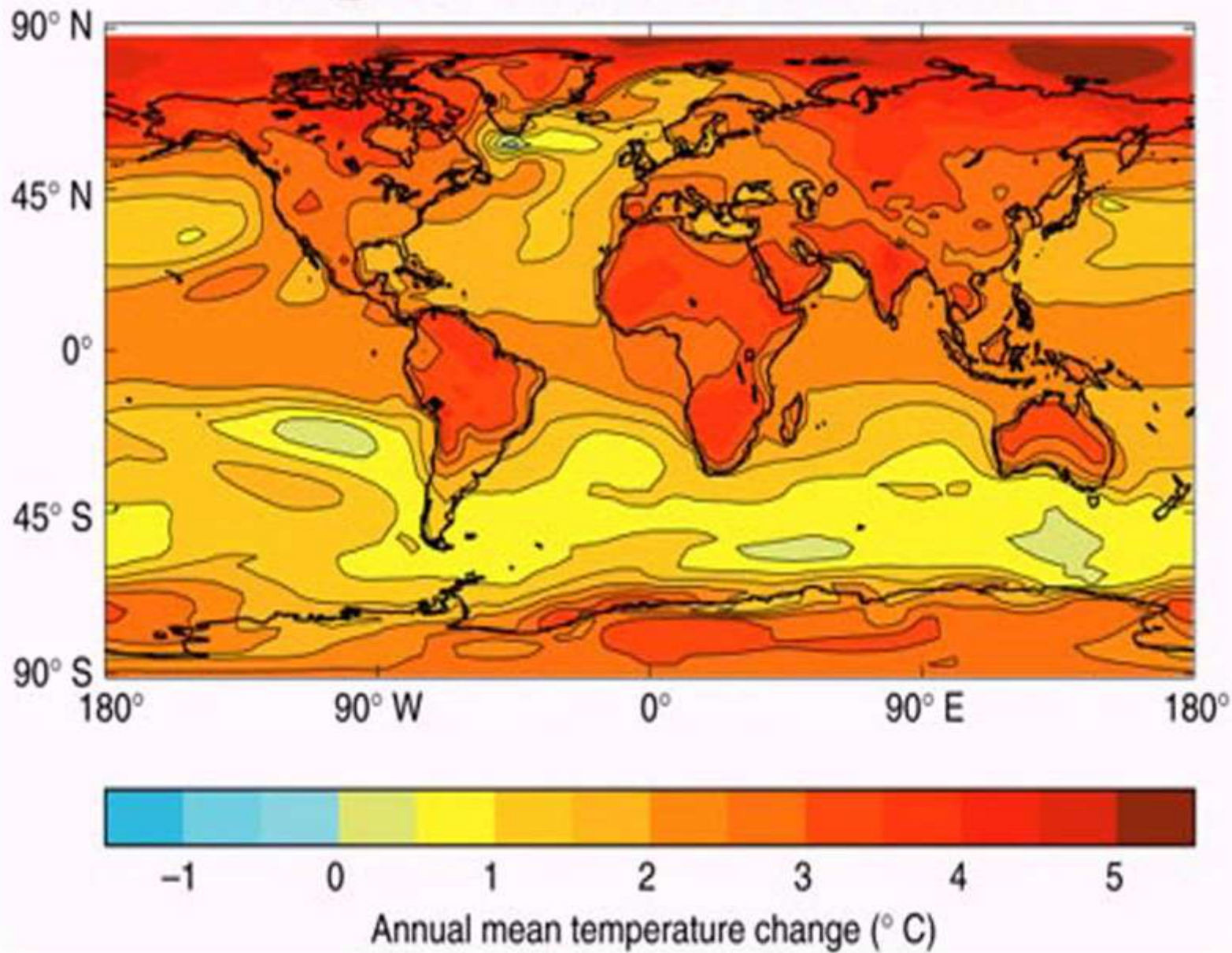
# Cabbage Seed Pod Weevil

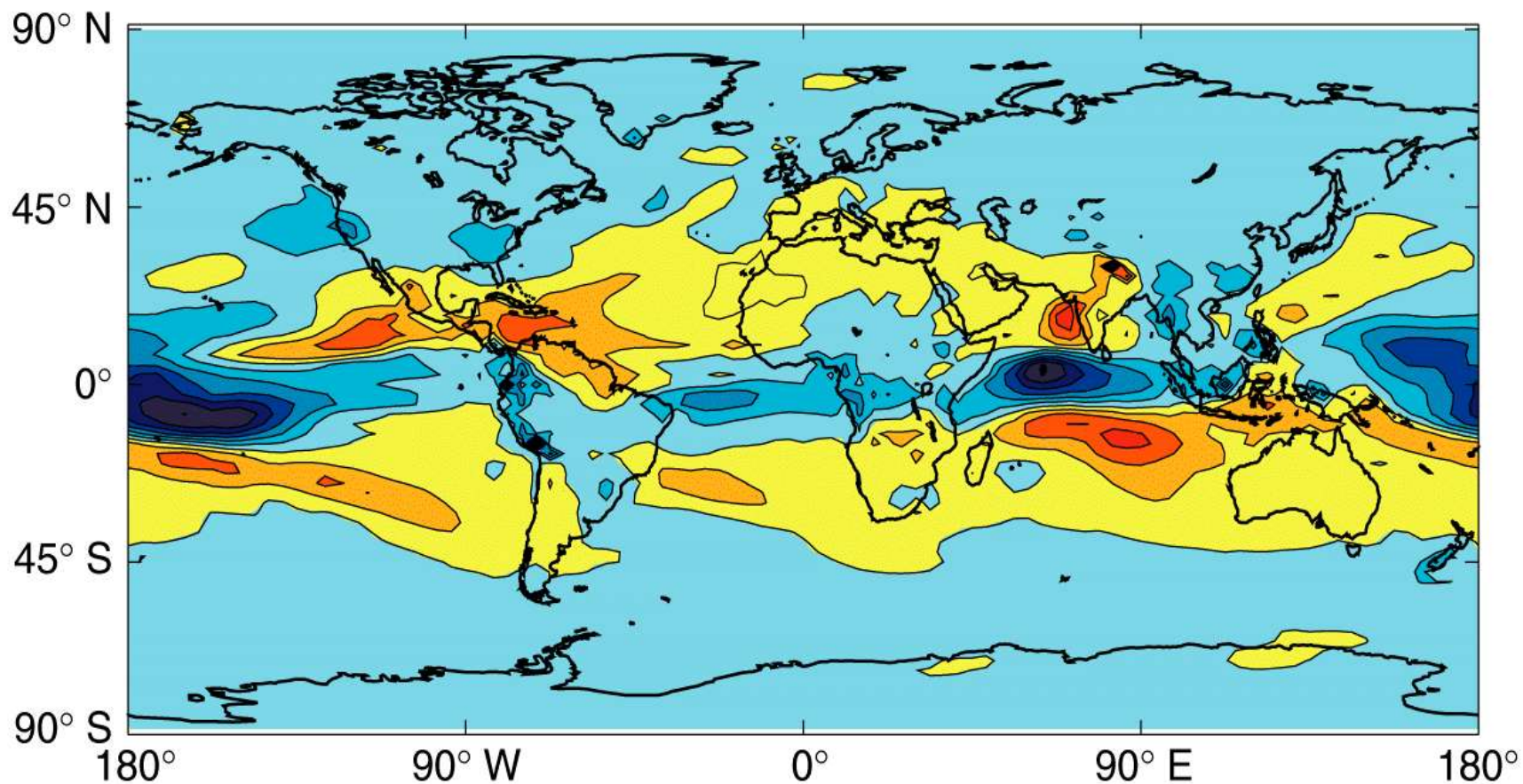


# Climate Change Effects in Our Backyard, Northern Great Plains

- **Not all bad for the northern fringes of agriculture, benefits?**
  - Corn belt moving north
  - Winter wheat zone moving north
  - More farmland available further north and at higher altitudes
- **Disadvantages**
  - Canola zone moving north, high temperatures in June cause flower blasting, more oil-mustards
  - Weather uncertainty: drought, more winter moisture, less early summer rains, more extremes e.g. cool at the wrong time
  - More forest clearing, more CO<sub>2</sub> !







-3      -2      -1      0      1      2      3

Precipitation change (mm day<sup>-1</sup>)

# 3. How can we assist our farm clients to adapt?

- Efforts to globally reduce greenhouse gases are not looking promising
- Mitigation initiatives, yes but agriculture only part of the whole picture, but some financial incentives available in some regions
  - **Reduced tillage, soil organic matter increases**
  - **More efficient N fertilizer, less N<sub>2</sub>O**
  - **Livestock feeding changes, less CH<sub>4</sub>**
  - **Improved manure handling, less N<sub>2</sub>O**
  - **Growing bio-fuels where economically feasible and environmentally sound, less net GHG per gal of fuel**
- Temperatures will continue to rise
- **Need to prepare for adaption**

# 4R Nutrient Stewardship

- **Right Source, Right Rate, Right Time, Right Place**
- Increased fertilizer use efficiency results in:
  - less CO<sub>2</sub> emitted to manufacture needed fertilizer
  - less N<sub>2</sub>O emissions
  - More efficient use of limited water
  - Greater yield per unit of fertilizer used

# Can Agriculture Adapt to Climate Change? Yes

- Shifting of crop choices and locations of crops
- Look to the south of you and see what they grow
- Crop breeding efforts
  - Growing season length, heat units
  - Pest resistance
  - Drought and heat tolerant
- Location of livestock operations
  - where economically and environmentally it is most suitable
- Look for opportunities, cease some activities that are less suitable

# QUESTIONS