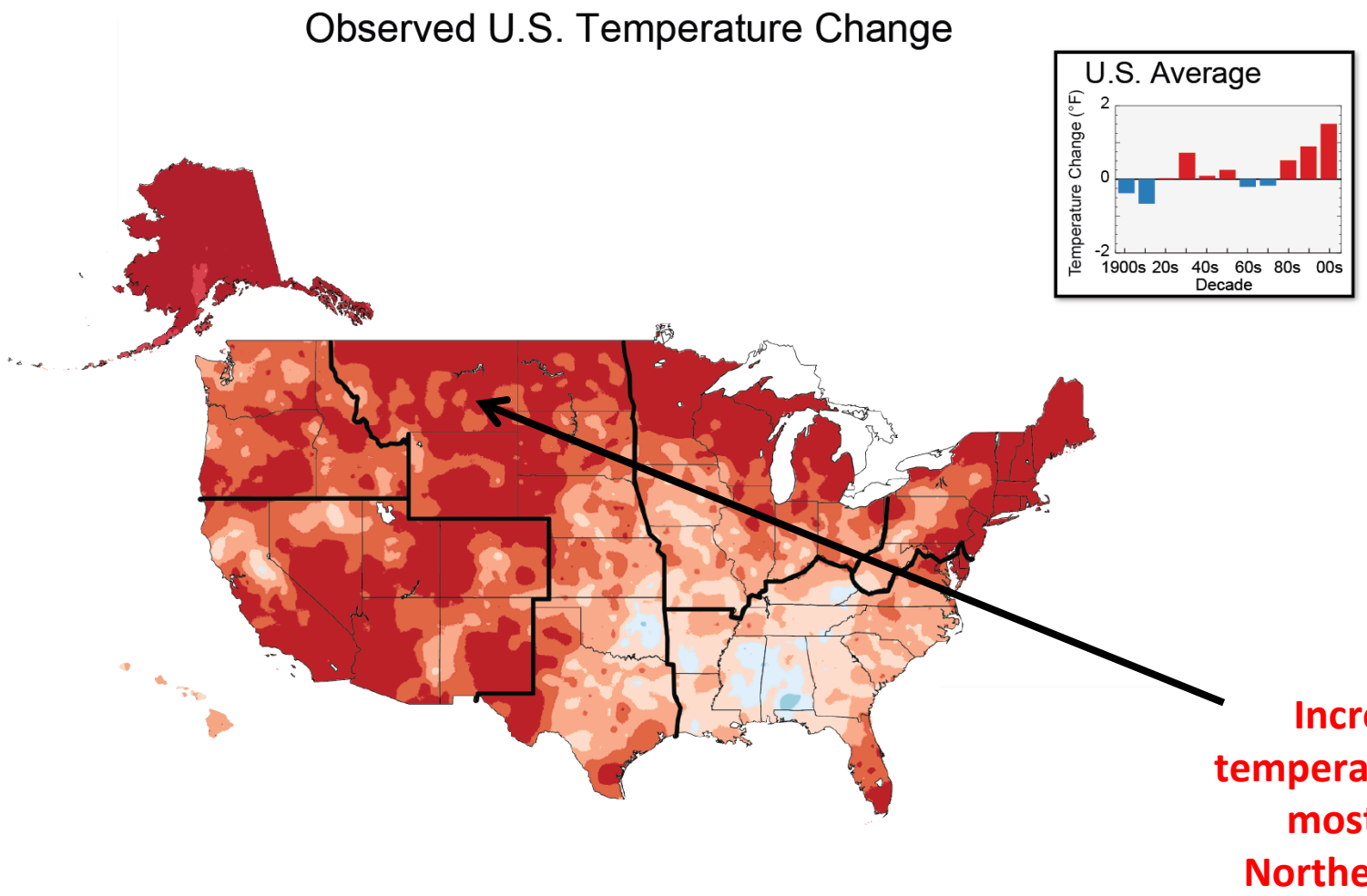
Climate change

Implications for Montana agriculture

Fabian Menalled, Irene Grimberg, Tim Seipel, Sue Ishaq,
Selena Ahmed, Zach Miller, and Elis Colter
menalled@montana.edu
406-994-4783

THE CLIMATE IS CHANGING

Temperature change (from 1991) relative to 1900-1960



Increase in temperature across most of the Northern Plains.

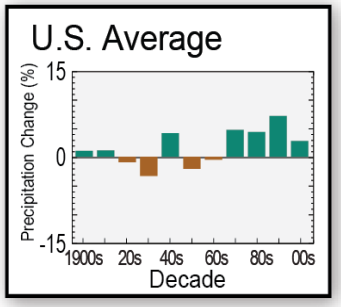
National Climate Assessment 2014

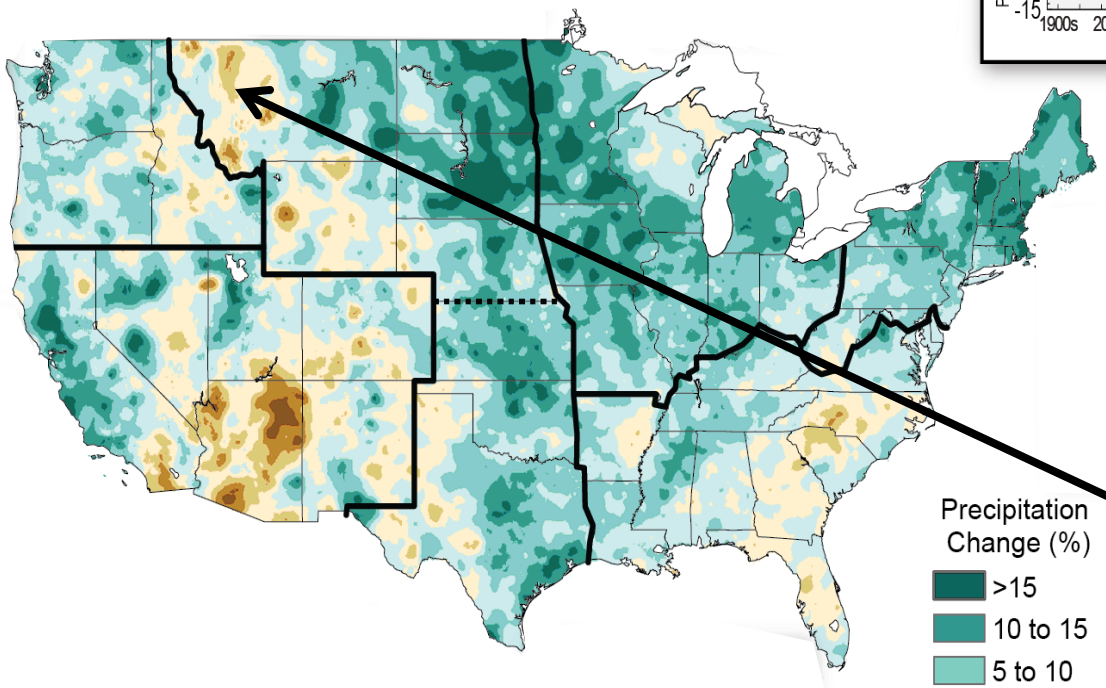
Boulder Glacier, 1932

Boulder Glacier
Hileman photo, GNP Archives, 1932

Boulder Glacier, 2005

Precipitation change (from 1991) relative to 1900-1960



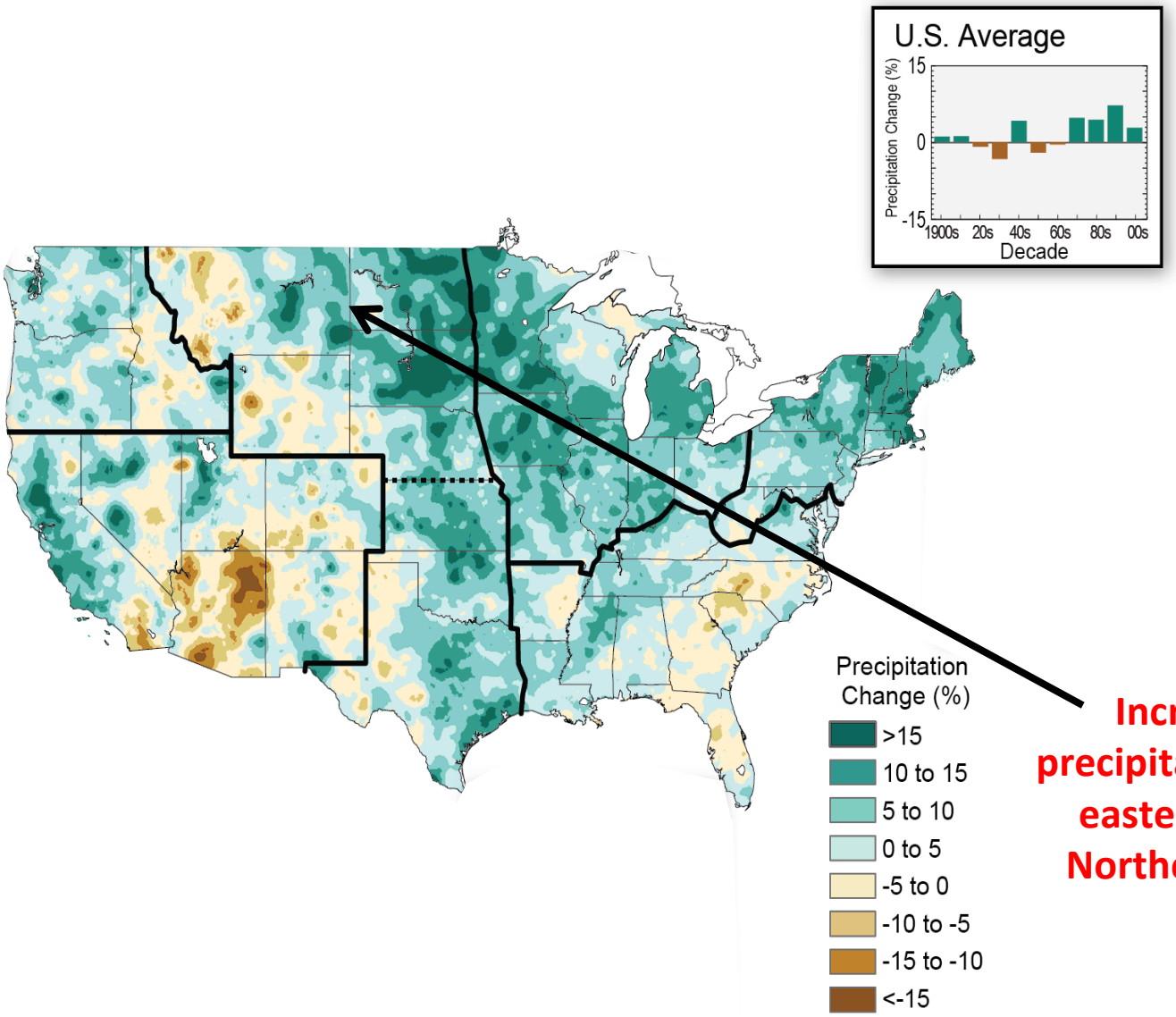


Precipitation Change (%)
- >15
- 10 to 15
- 5 to 10
- 0 to 5
- -5 to 0
- -10 to -5
- -15 to -10
- <-15

Decrease in precipitation across western part of Northern Plains.

National Climate Assessment 2014

Precipitation change (from 1991) relative to 1900-1960



Increase in precipitation across eastern part of Northern Plains.

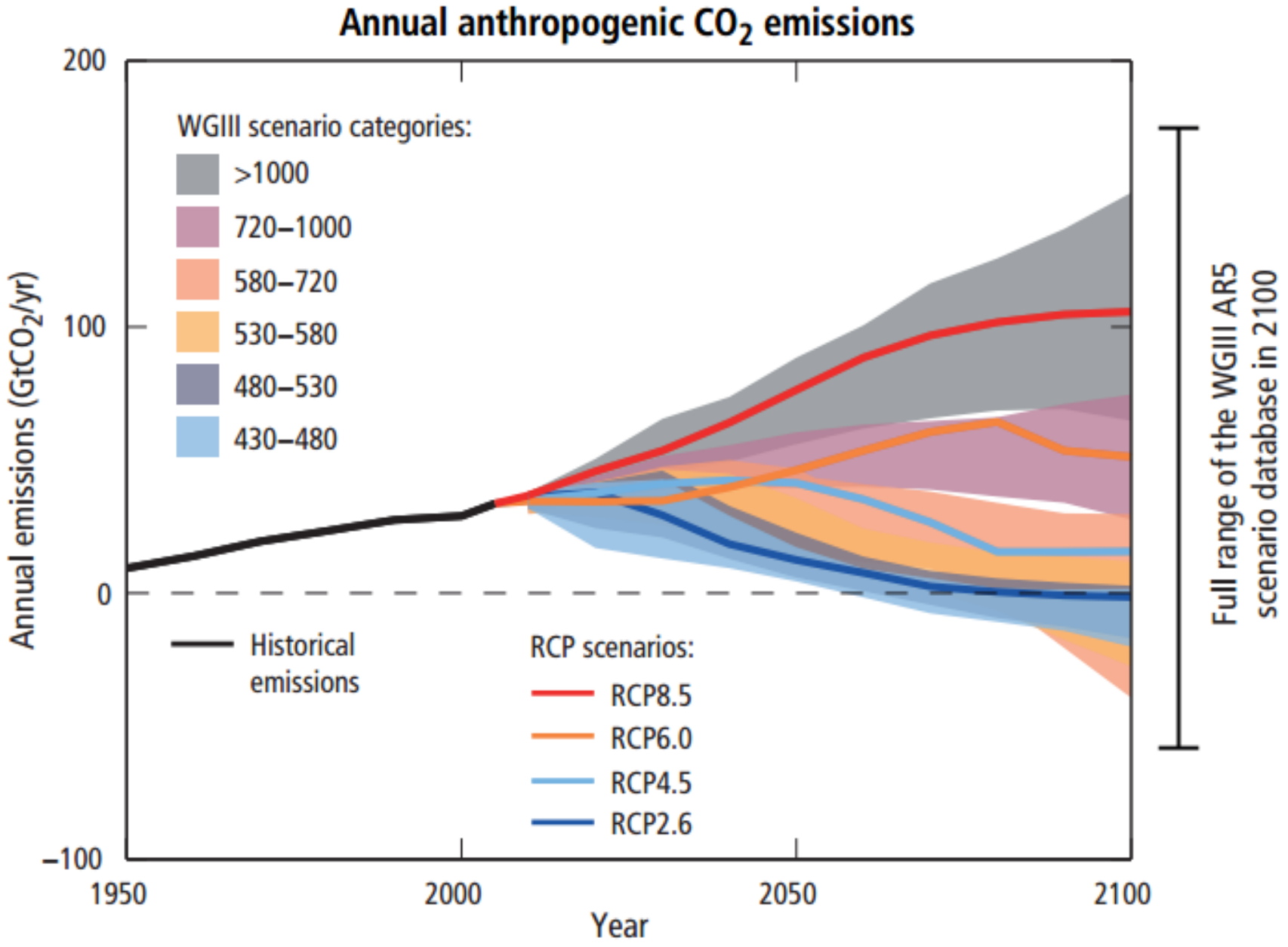
National Climate Assessment 2014

THE

CLIMATE

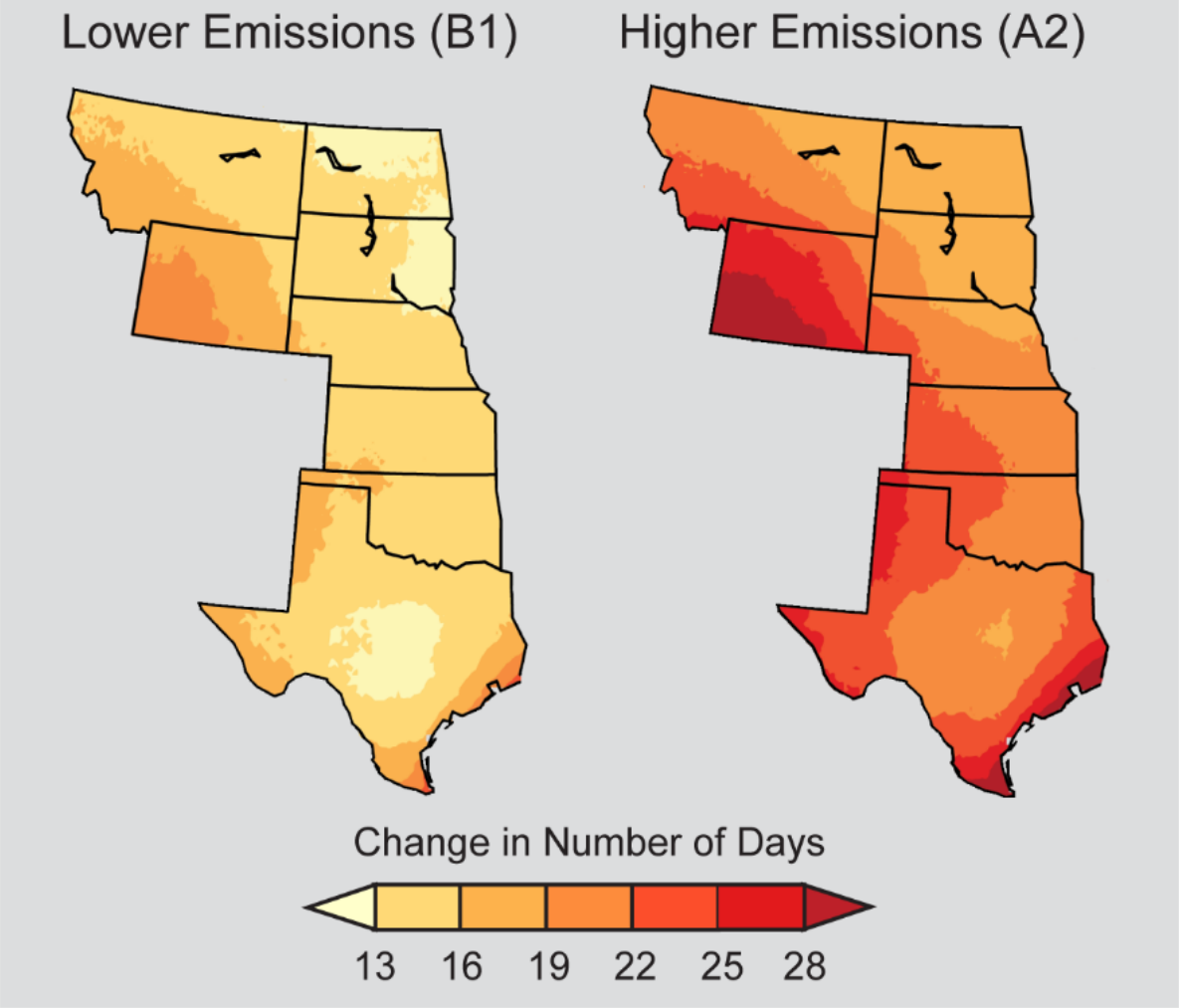
WILL CONTINUE

CHANGING



http://www.ipcc.ch/

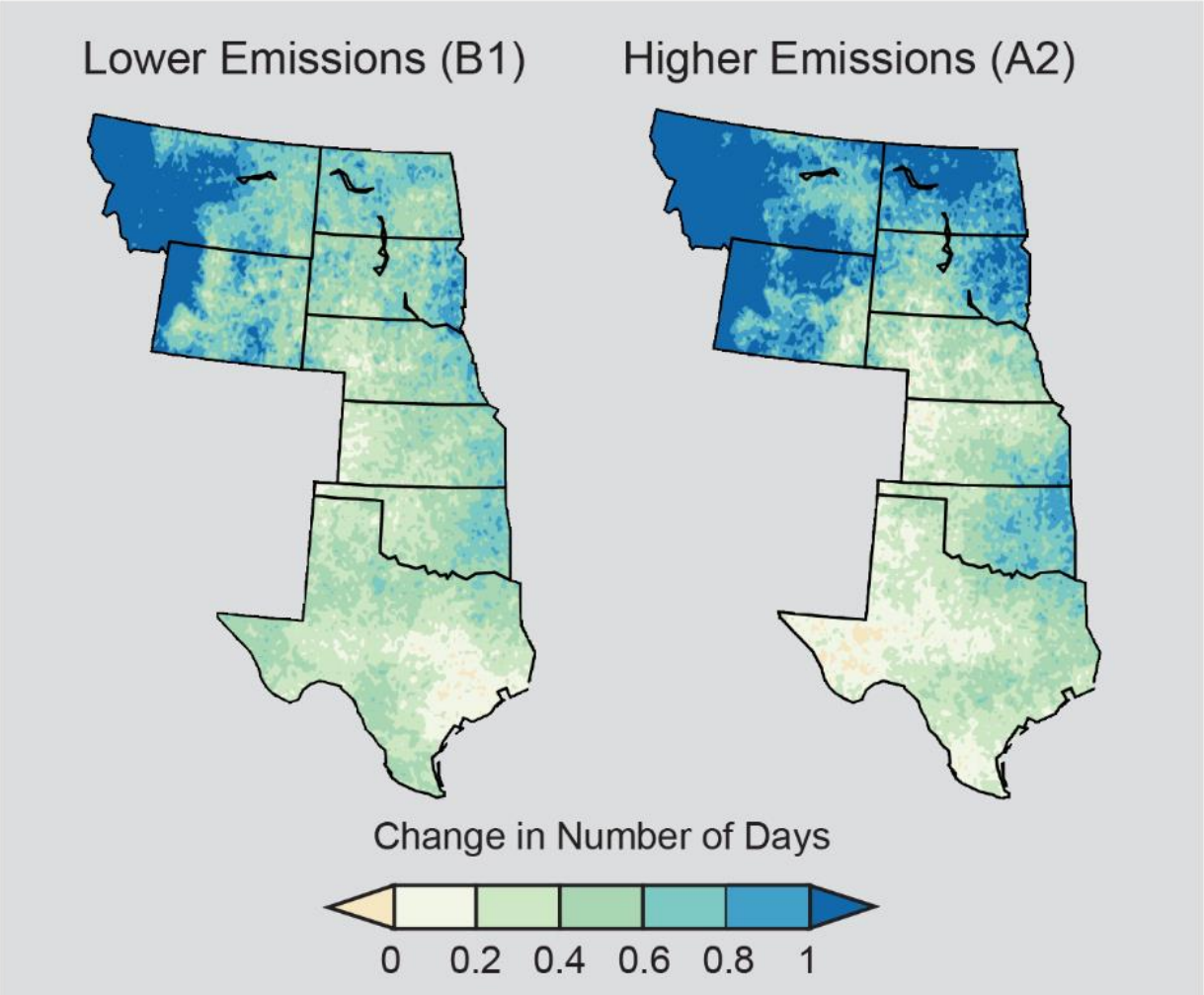
Projected Change in Number of Warm Days



Projected changed by mid-century (2041-2070) as compared to 1971-2000

National Climate Assessment

Projected Change in Number of Heavy Precipitation Days



Projected changed by mid-century (2041-2070) as compared to 1971-2000

National Climate Assessment

What does this mean for Montana ag?

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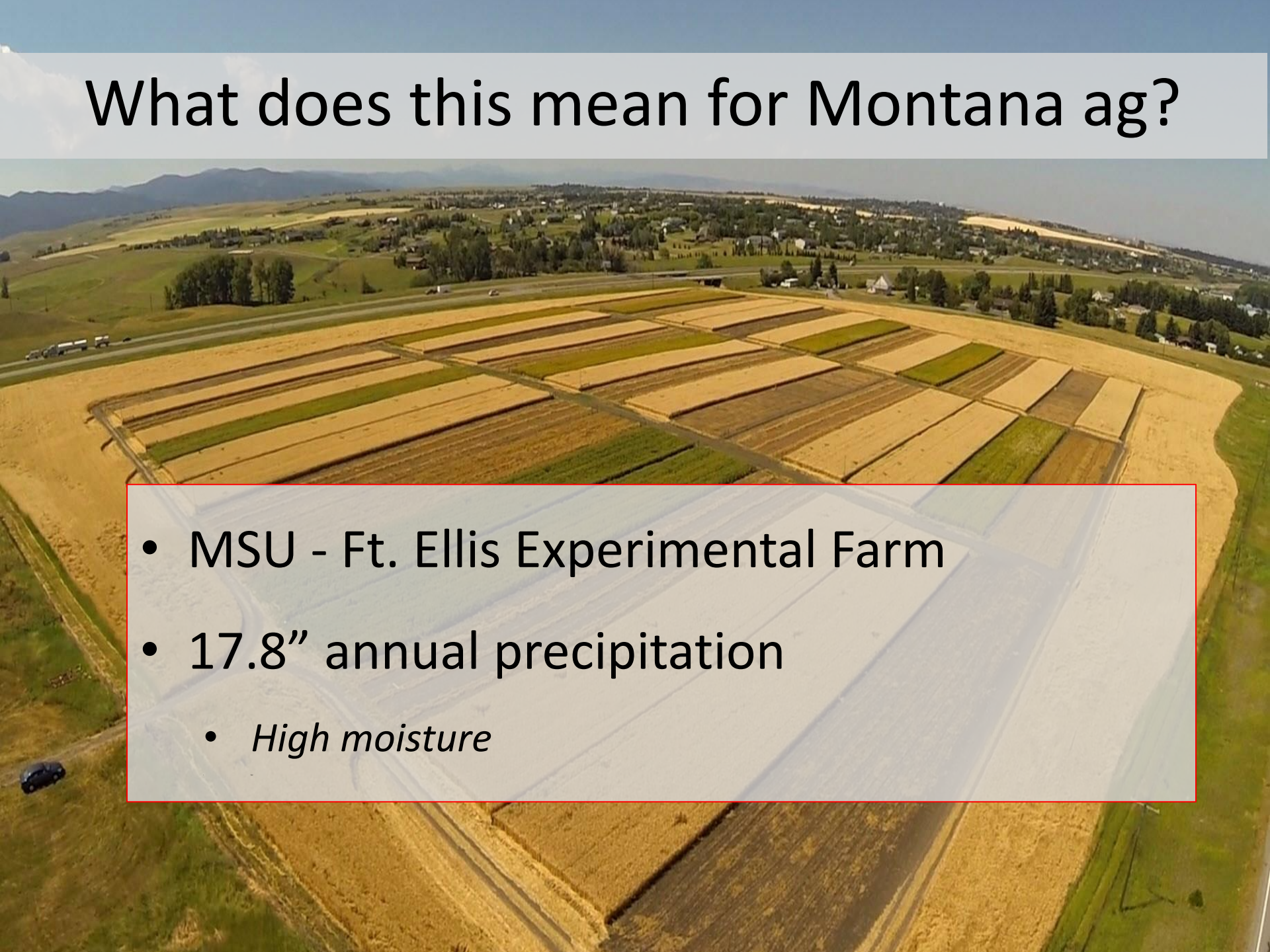
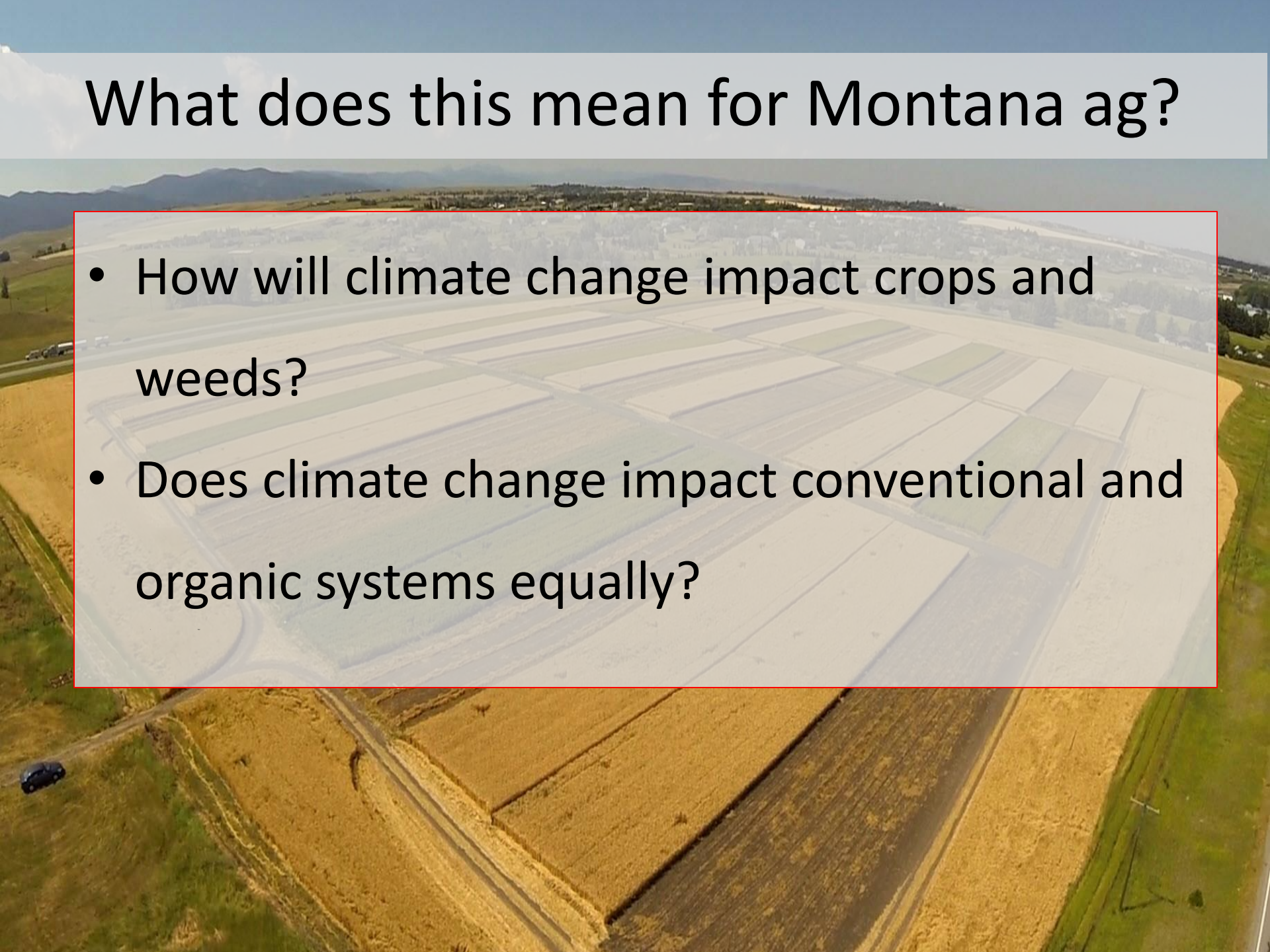
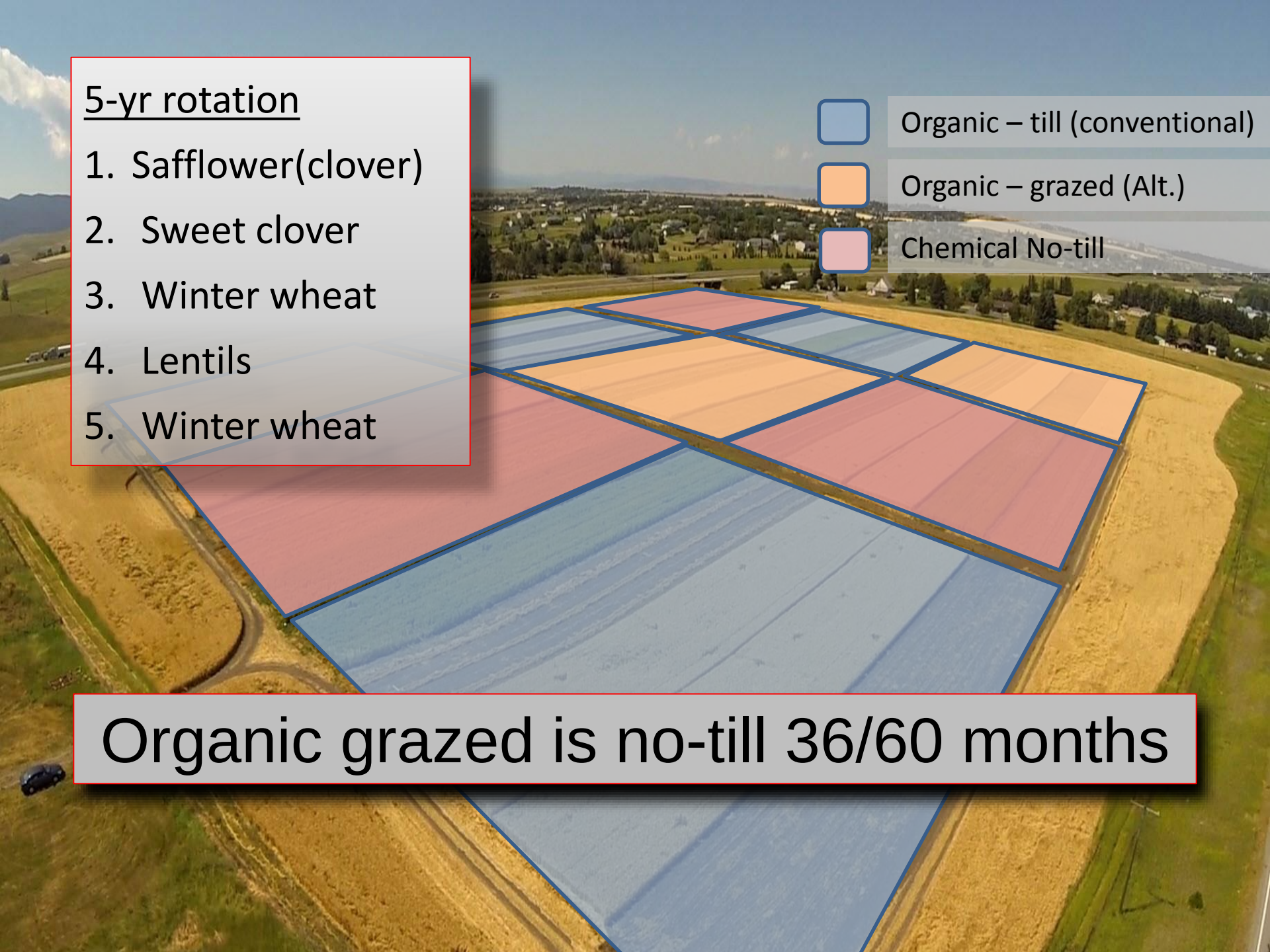


- MSU - Ft. Ellis Experimental Farm
- 17.8” annual precipitation
  - *High moisture*

What does this mean for Montana ag?

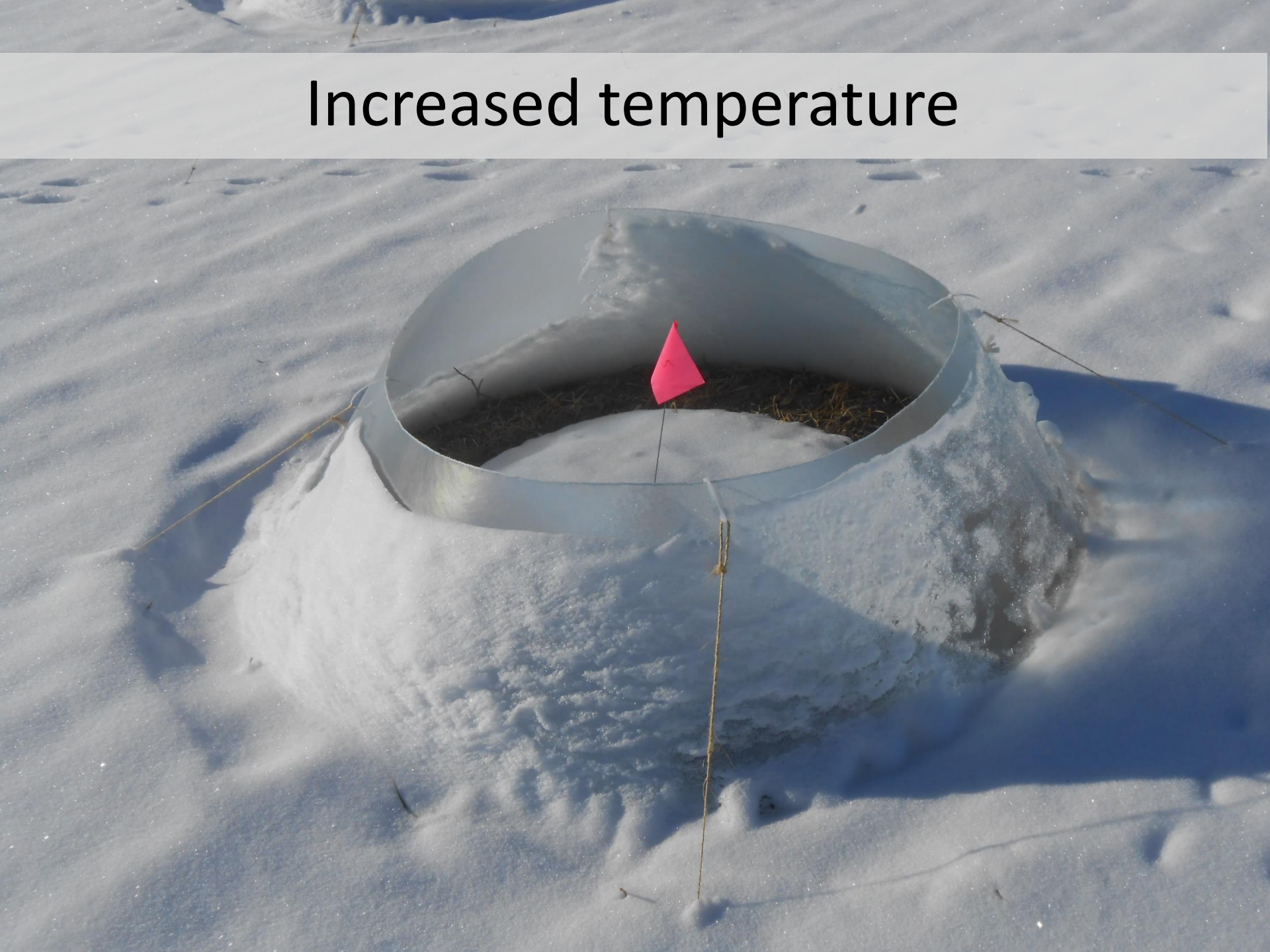


- How will climate change impact crops and weeds?
- Does climate change impact conventional and organic systems equally?


5-yr rotation
1. Safflower(clover)
2. Sweet clover
3. Winter wheat
4. Lentils
5. Winter wheat
Organic – till (conventional)
Organic – grazed (Alt.)
Chemical No-till
Organic grazed is no-till 36/60 months

Increased temperature

Increased temperature

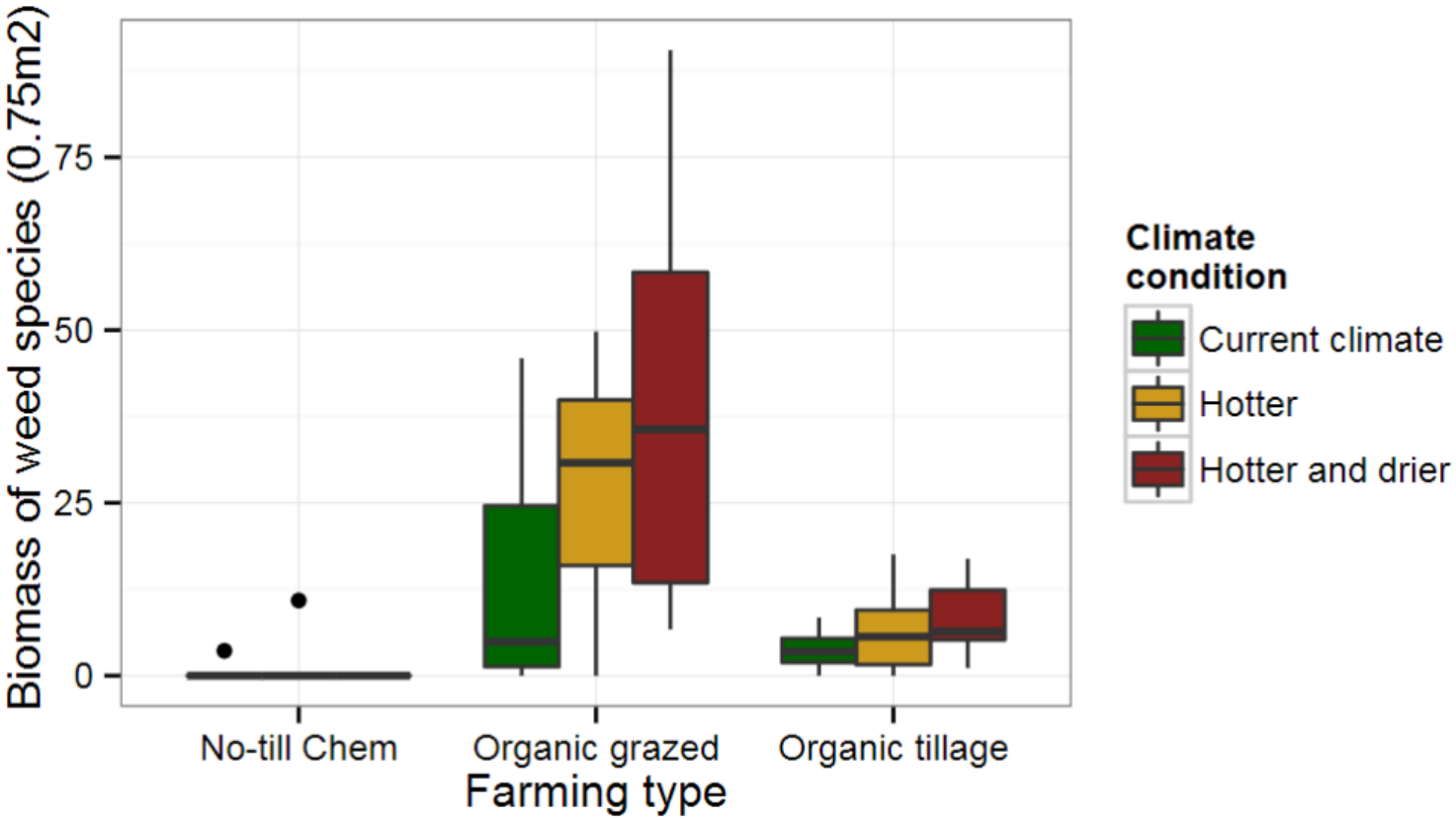


Increased temperature and reduced moisture

Increased temperature and reduced moisture

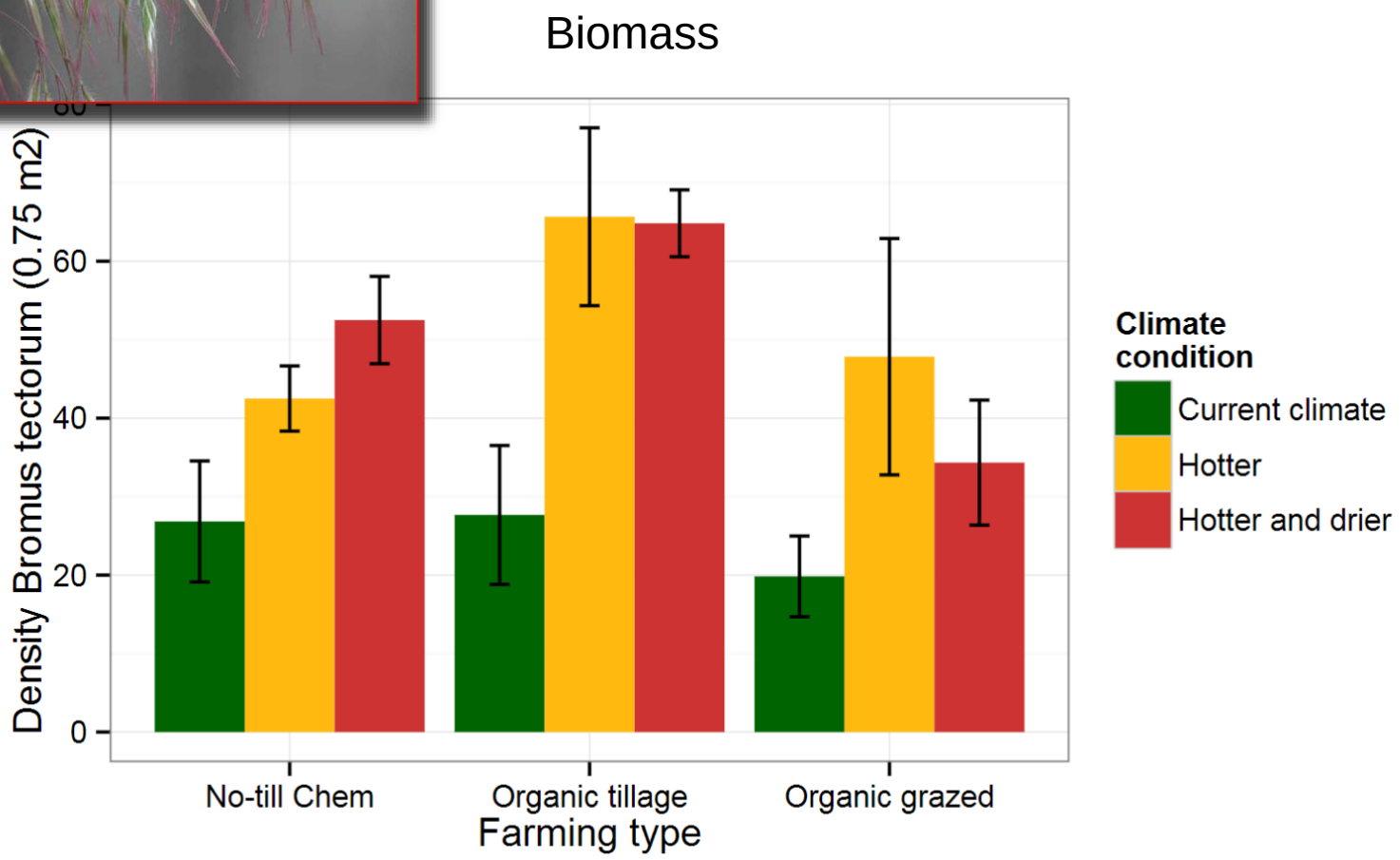
Weeds and climate

Biomass

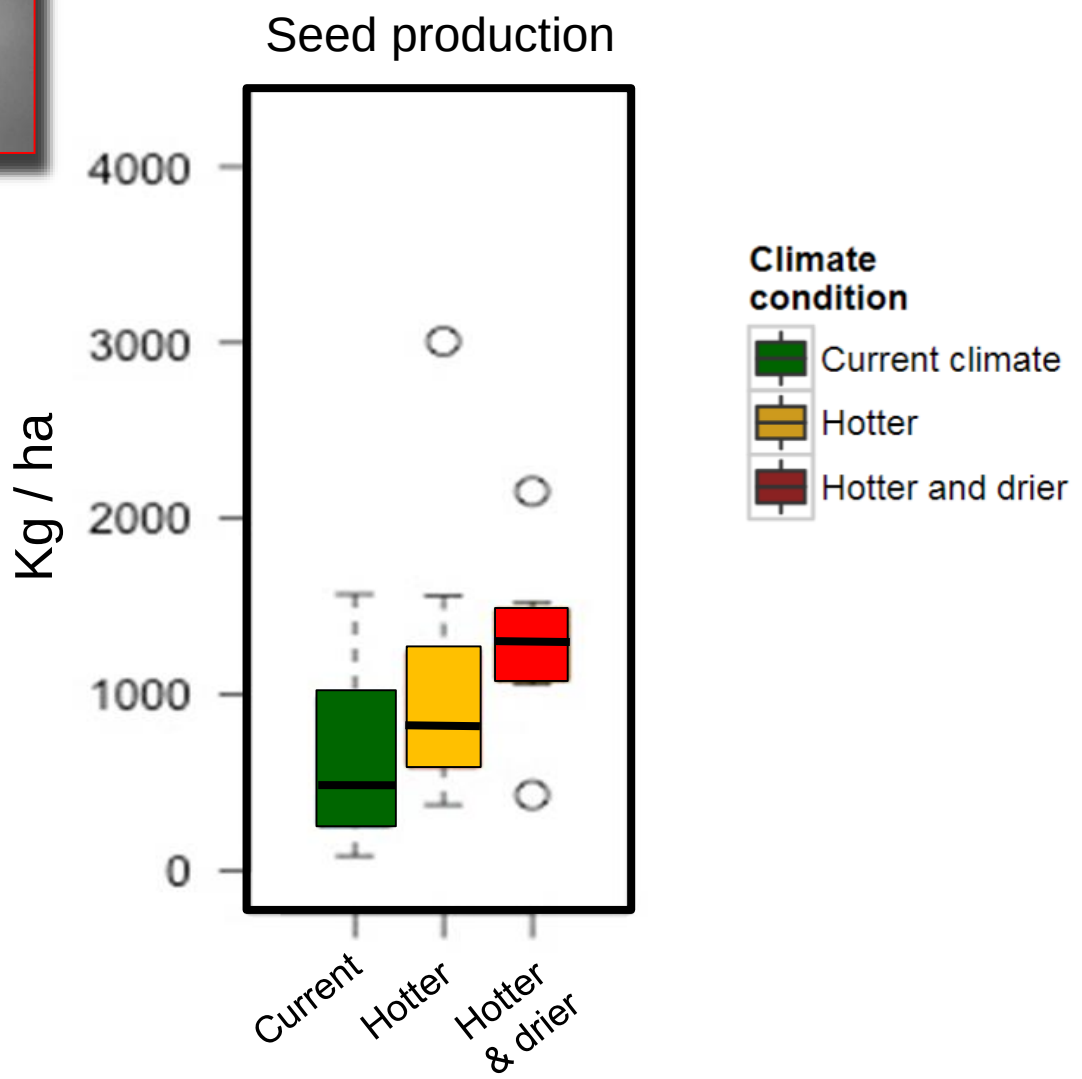


Farming systems P= 0.08

Cheatgrass and climate

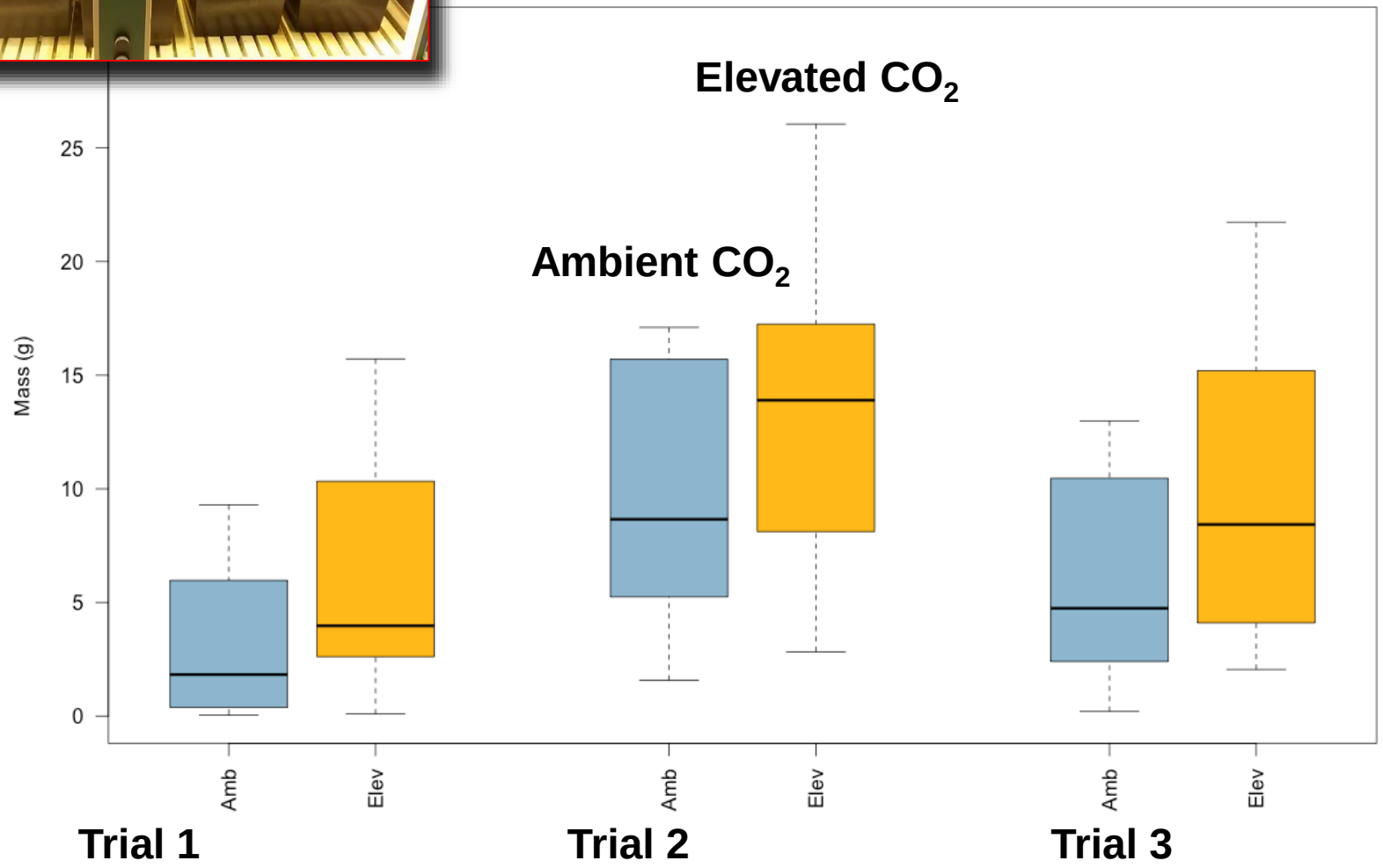


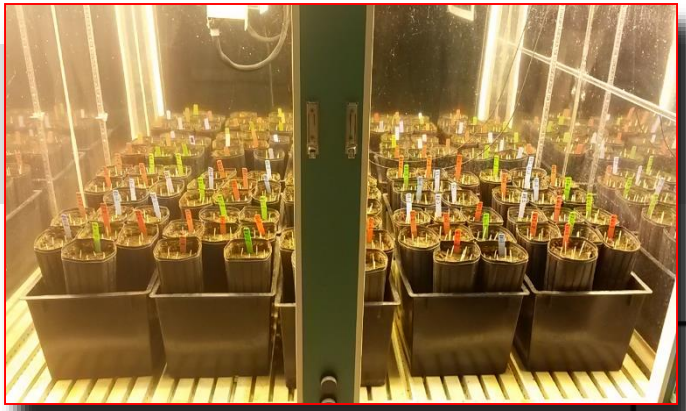
Cheatgrass and climate



Cheatgrass and CO_2

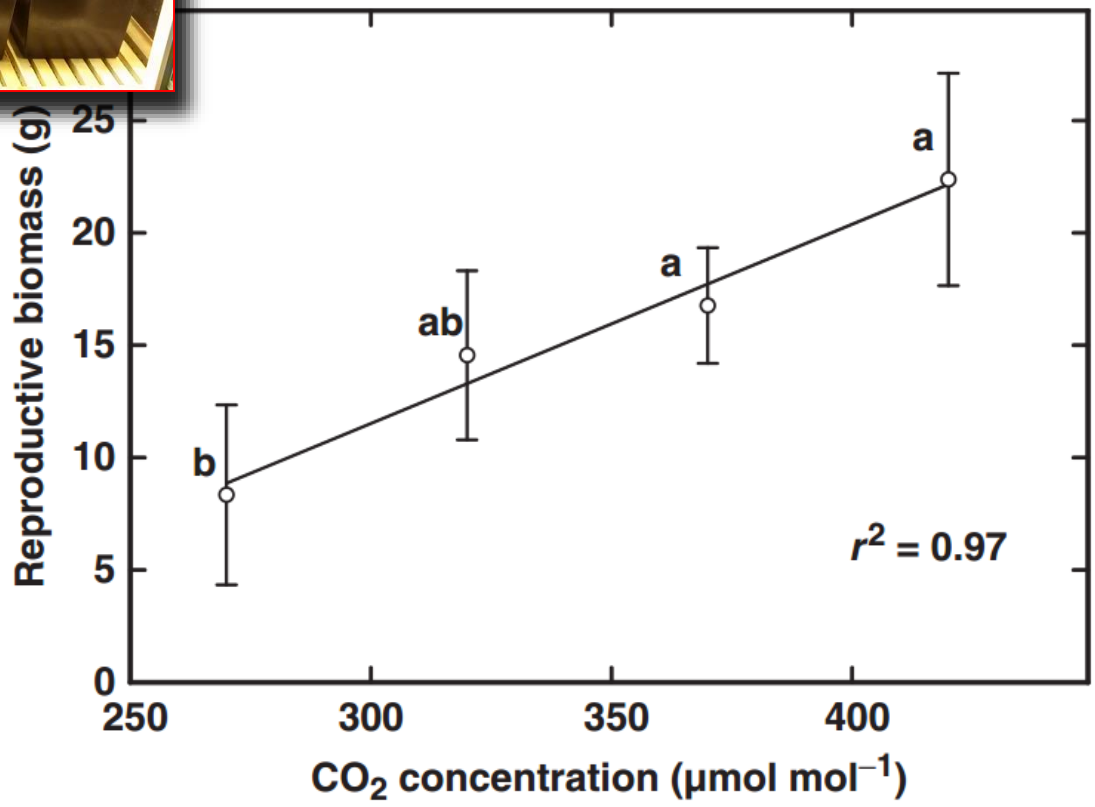
Biomass





Cheatgrass and CO_2

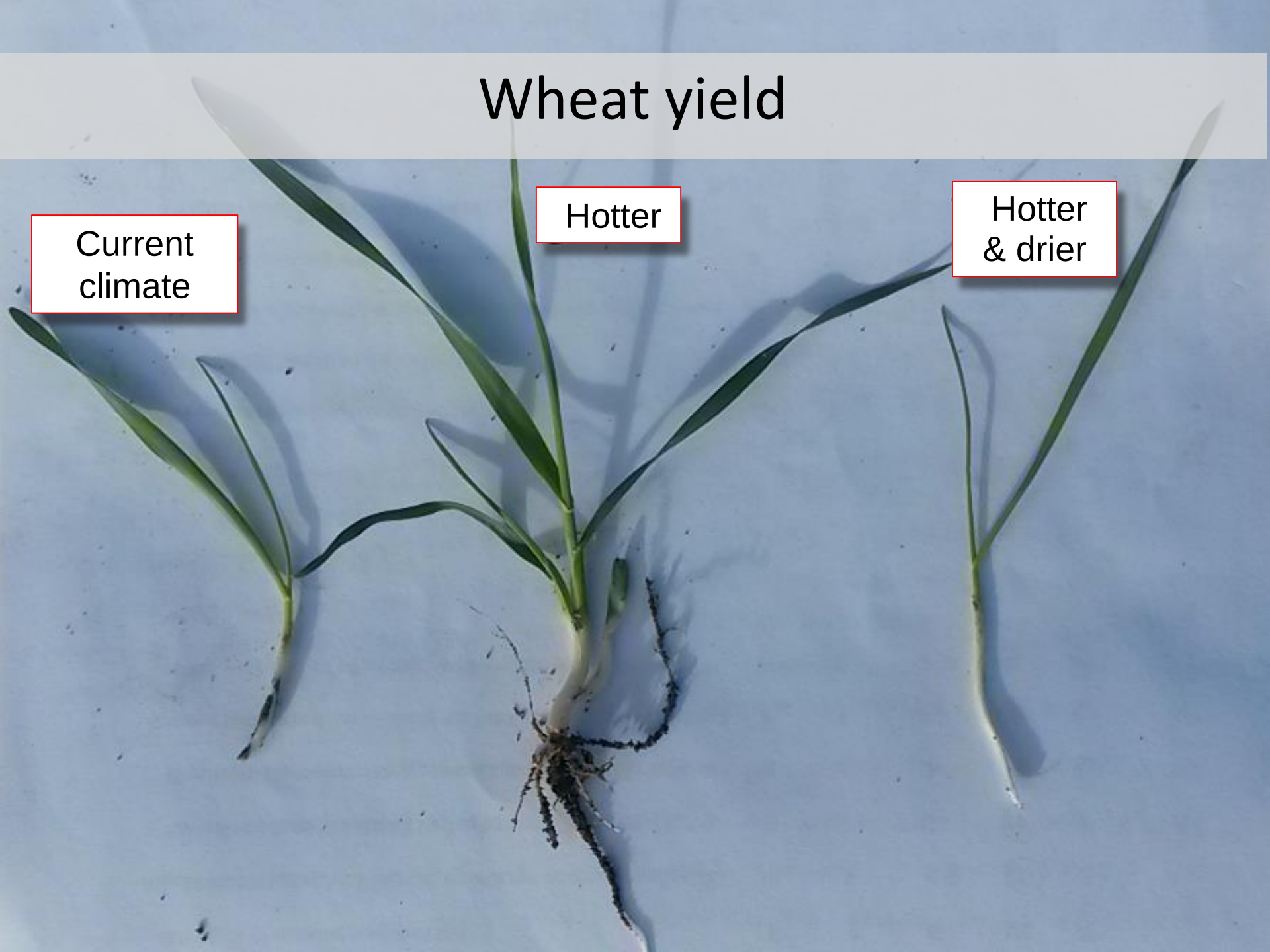
Seed production



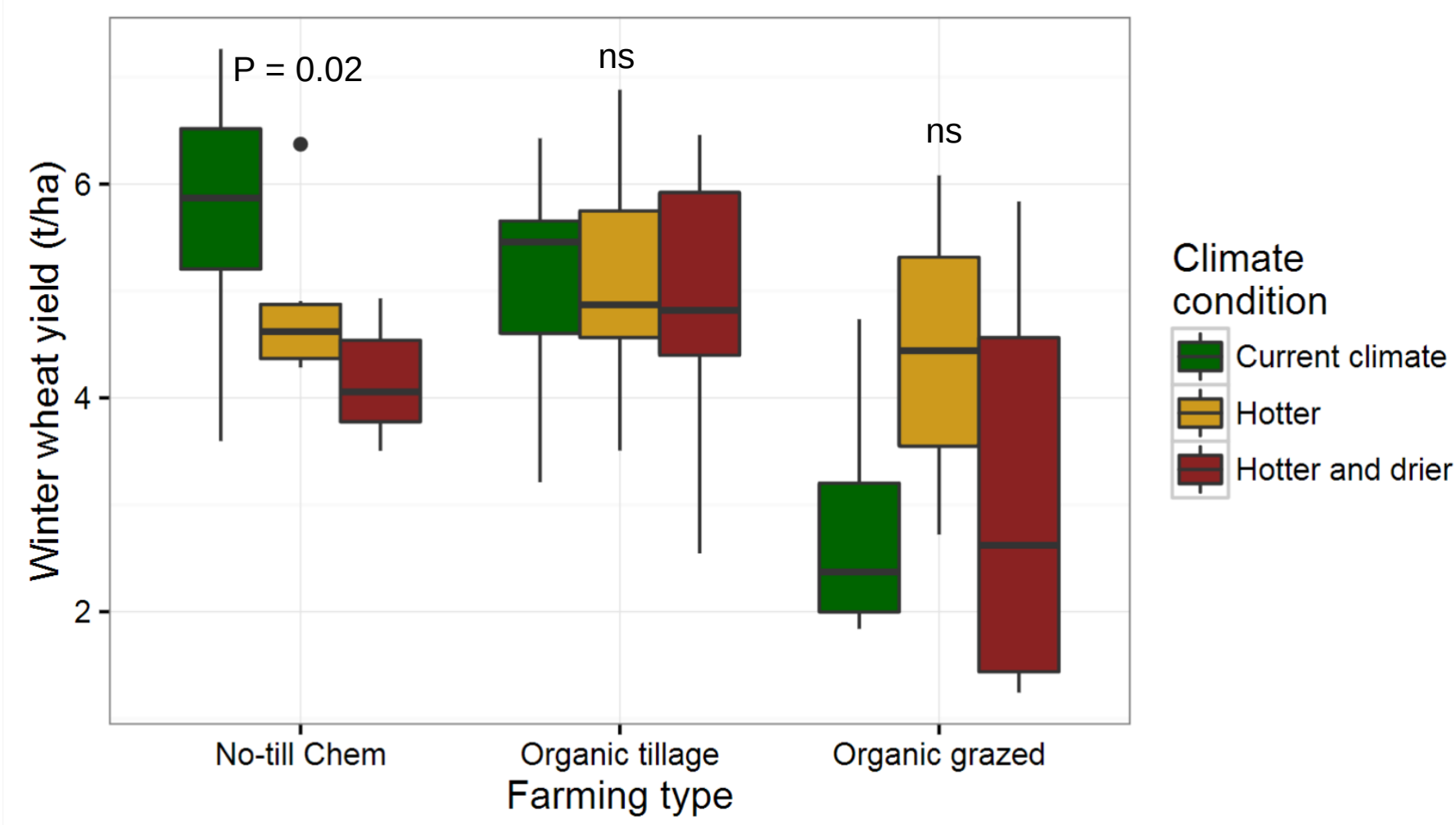
After Ziska et al. 2005. Global Change Biology 11: 1325-1332

Mid- to long-term shift in weed communities?

Wheat yield



Wheat yield


P = 0.02
ns
ns
Winter wheat yield (t/ha)
6
4
2
No-till Chem
Organic tillage
Organic grazed
Farming type
Climate condition
Current climate
Hotter
Hotter and drier

What does this mean for Montana ag?

- How will climate change impact crop and weeds?
  - *Reduced yield, increased weed growth*
- Does climate change impact conventional and organic systems equally?
  - *Evidences suggest that organic systems are more resilient*
- Opportunities?

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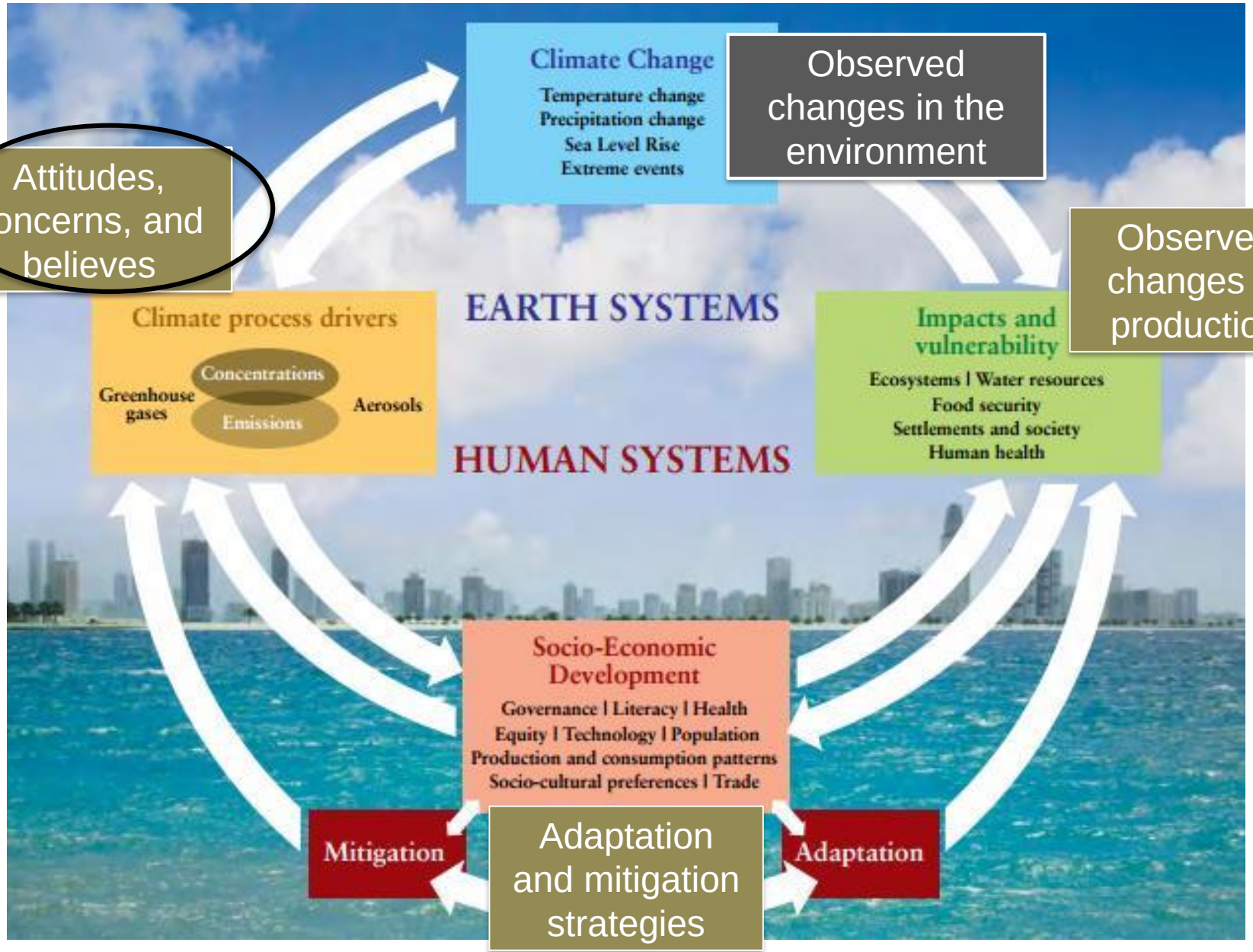
Montana's citizens



IPCC, 2007: Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts, and Response Strategies. Expert Meeting Report.

Montana agricultural stakeholders perceptions

- Do stakeholders acknowledge climate change?
- Is climate change perceived as an imminent problem?
- Are humans capable to mitigate the impacts of climate change?
- What are the causes of climate change?

Attitude: What best describes your attitude towards climate change? 1. The climate has not changed; 2. Not alarmed; 3. Somehow alarmed; 4. Very alarmed.

Seriousness: Do you think that changes in climate will be a serious issue? 1. Never; 2. Only in the present; 3. In the near future; 4. Always.

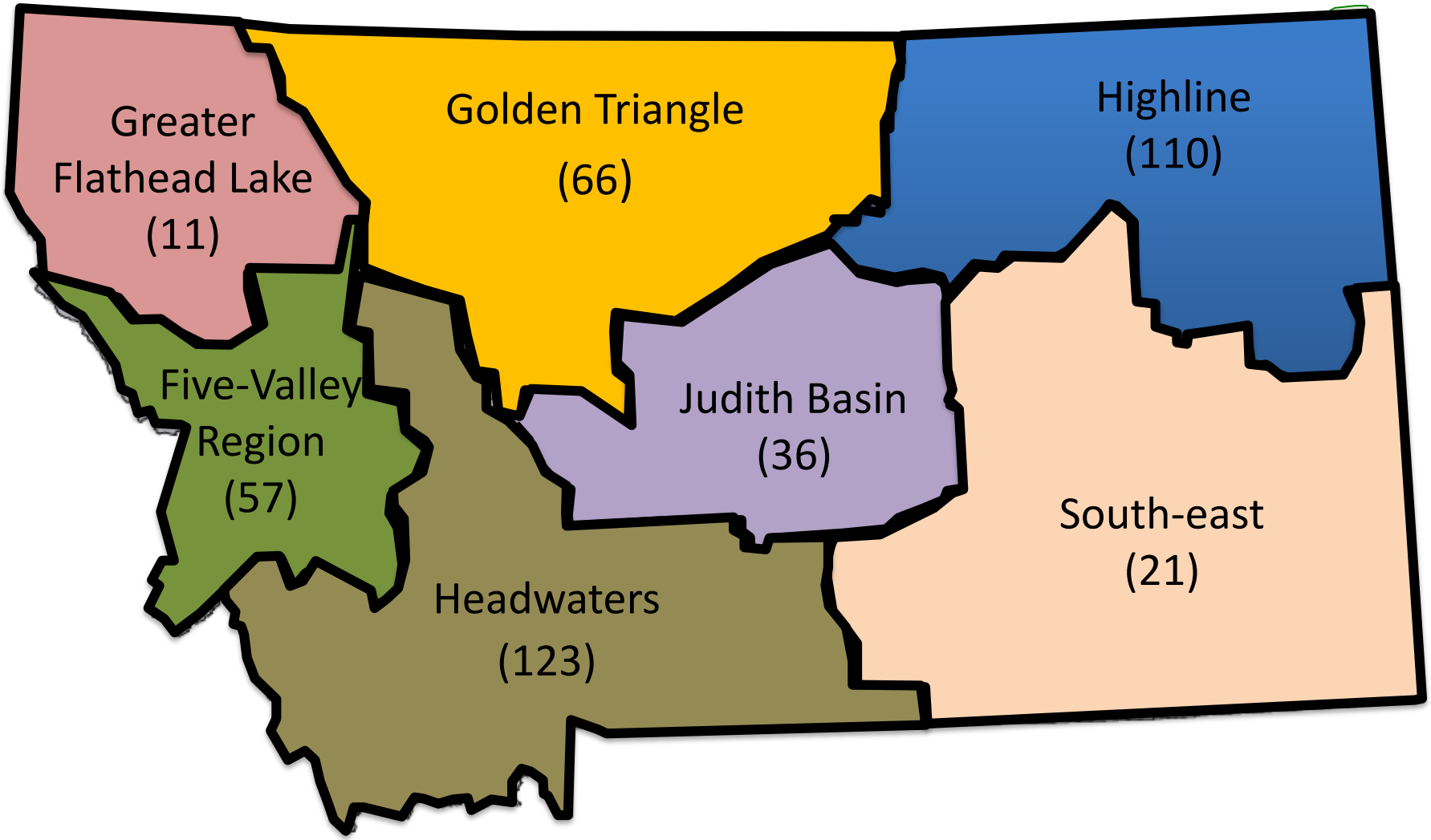
Capability: Do you think people have the capability to reduce the impacts of change in climate? 1. The climate has not changed; 2. No; 3. Not sure; 4. Yes.

Cause: What is the main cause of climate change? 1. The climate has not changed; 2. Man-made activities; 3. Natural terrestrial cycles and catastrophes (e.g., the seasons, volcanic eruptions); 4. Extraterrestrial natural phenomena (e.g., Sun's spots, meteorites); 5. Non-physical causes (e.g. God); 6. Other.

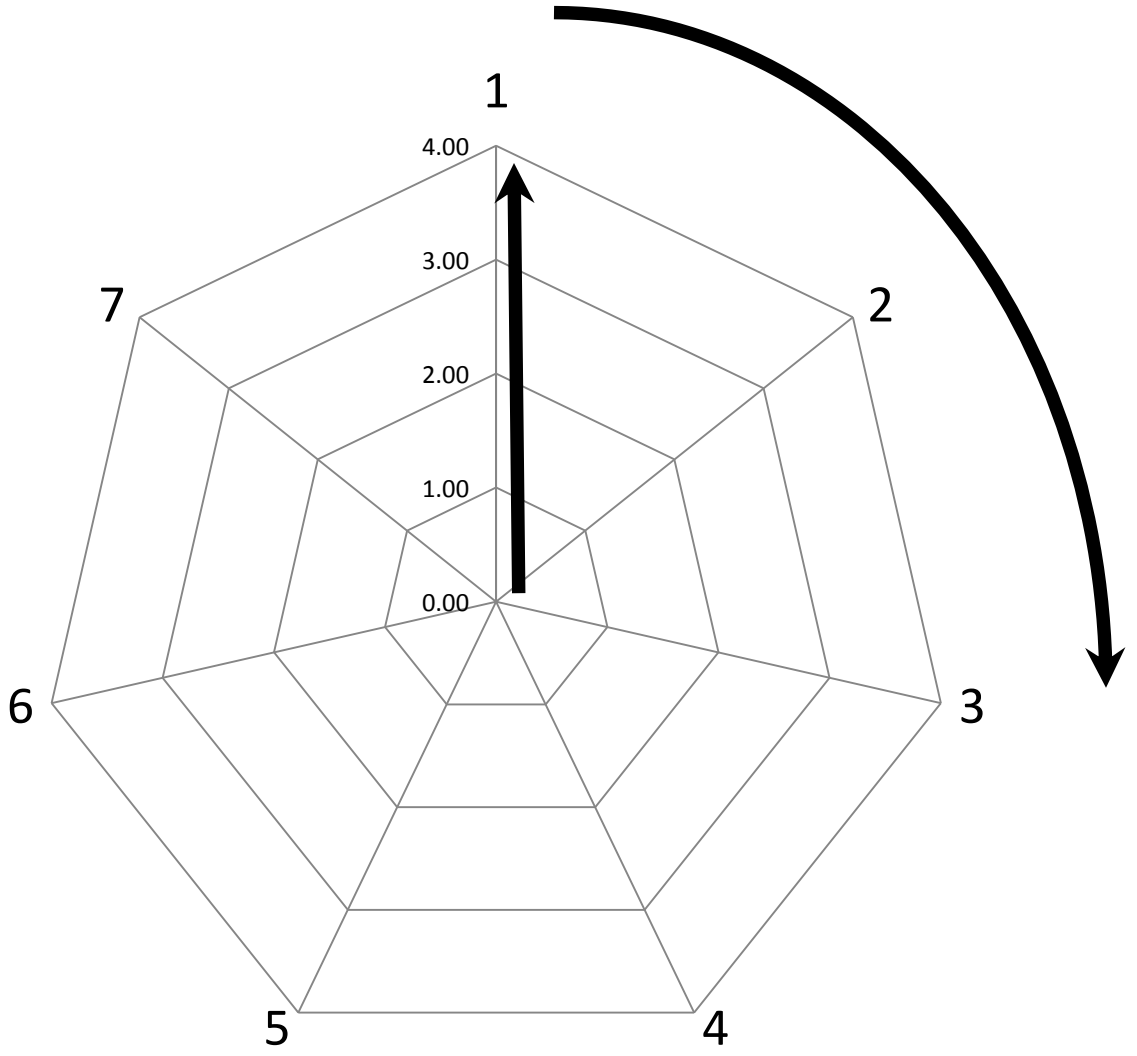
Demographic

- Location
- Affiliation
- Age
- Income
- Political view
- Gender
- Race/ethnicity

Montana's citizens

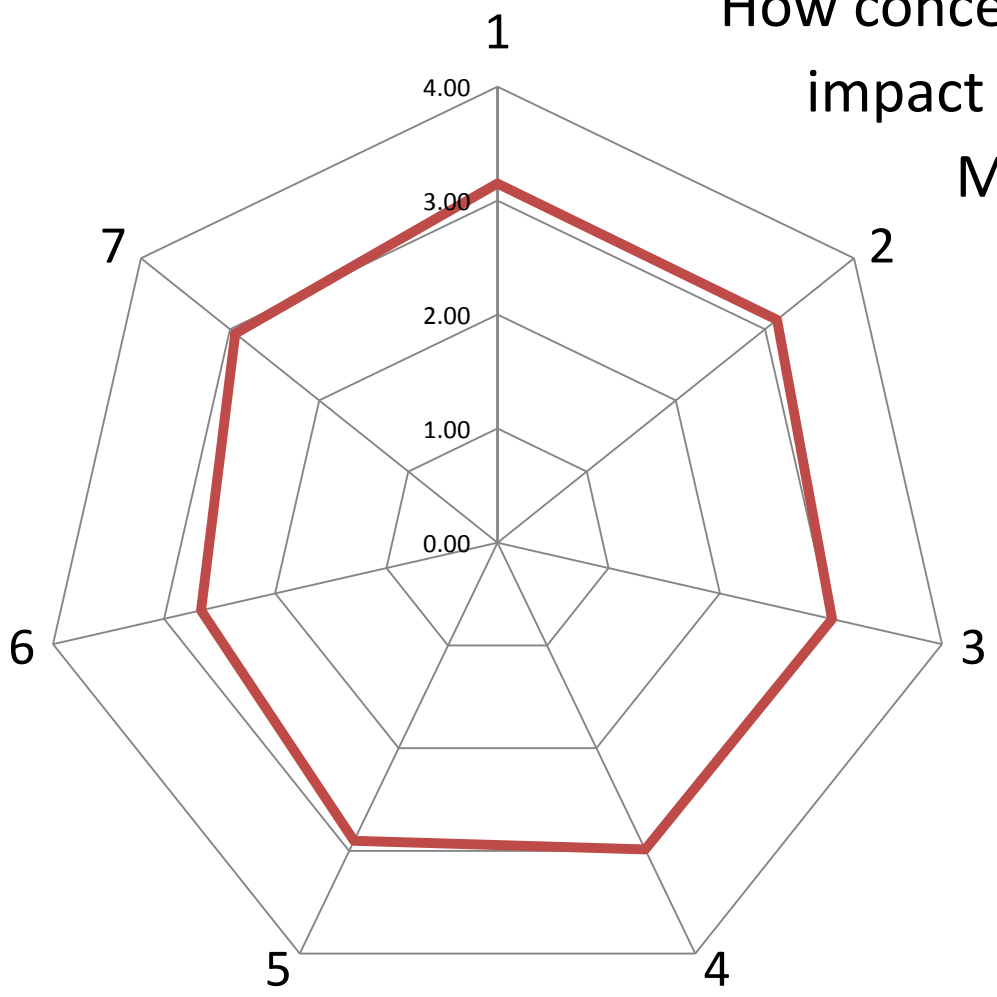


Political view vs. perceptions



1. Liberal
7. Conservative

Political view vs. perceptions



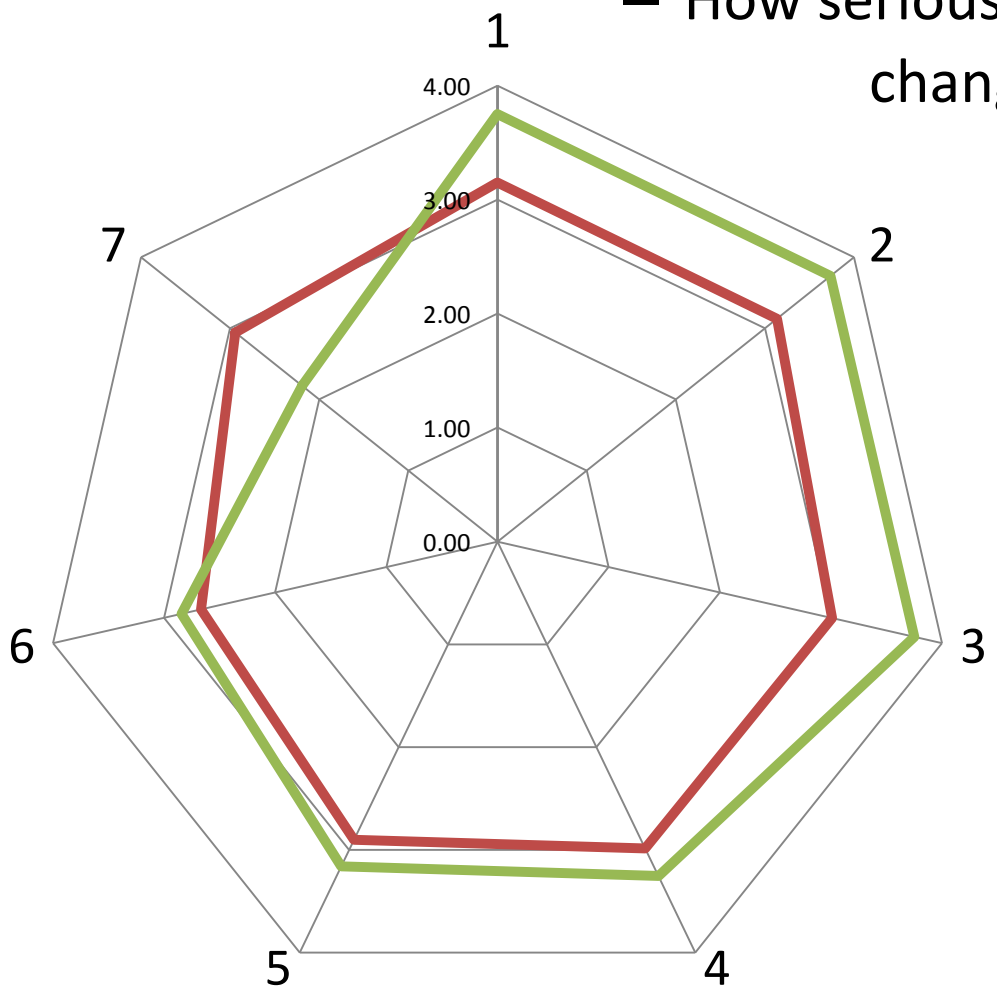
How concern are you about the impact of climate change on Montana's agricultural production?

Concern

1. Liberal
7. Conservative

Political view vs. perceptions

– How serious do you think climate change will become in the future?



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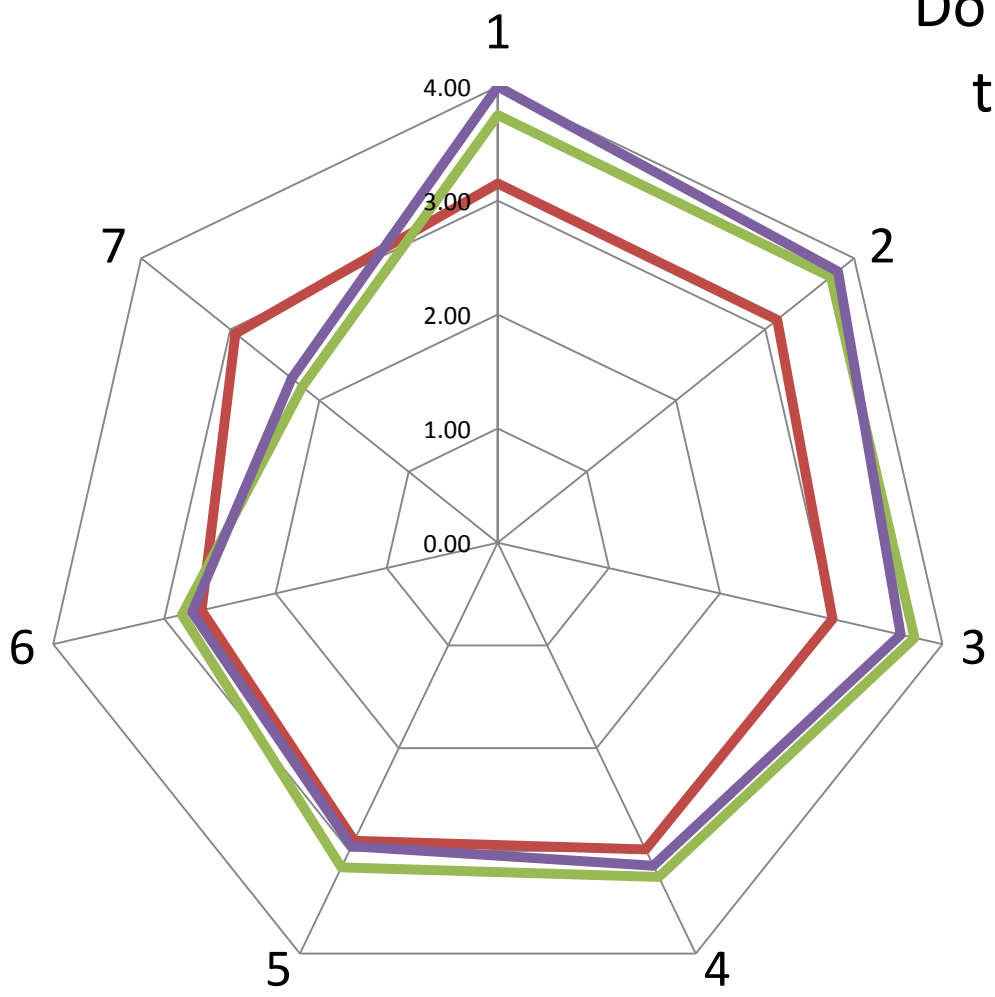
Political view vs. perceptions

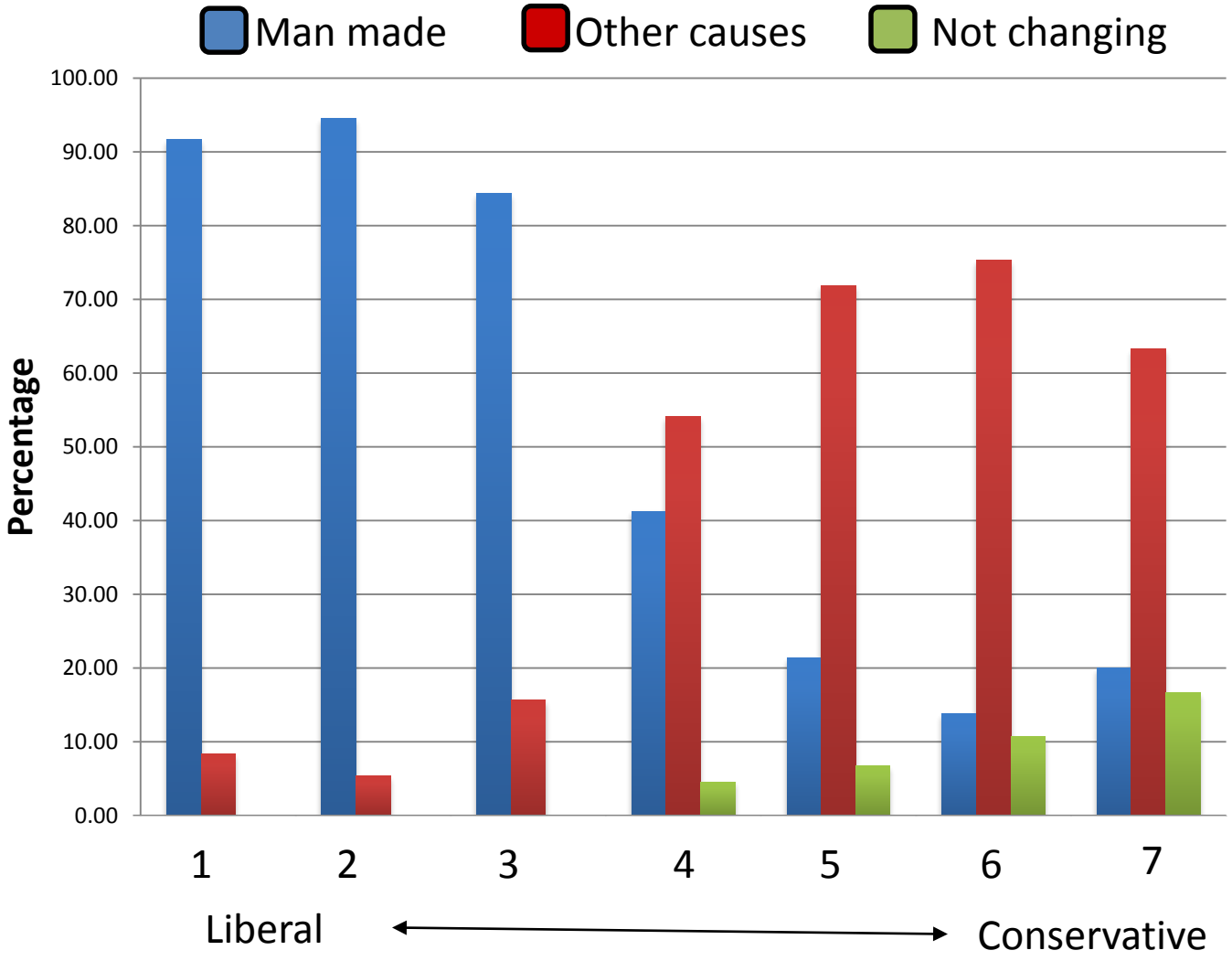


Do you think people have the ability of mitigating climate change?

- Concern
- Seriousness
- Capability

1. Liberal
7. Conservative

Political view & causes of climate change



Do Montana agricultural stakeholders acknowledge climate change?

Yes, between 89-95% of Montana agricultural stakeholders acknowledge climate change.

Is climate change perceived as an imminent problem?

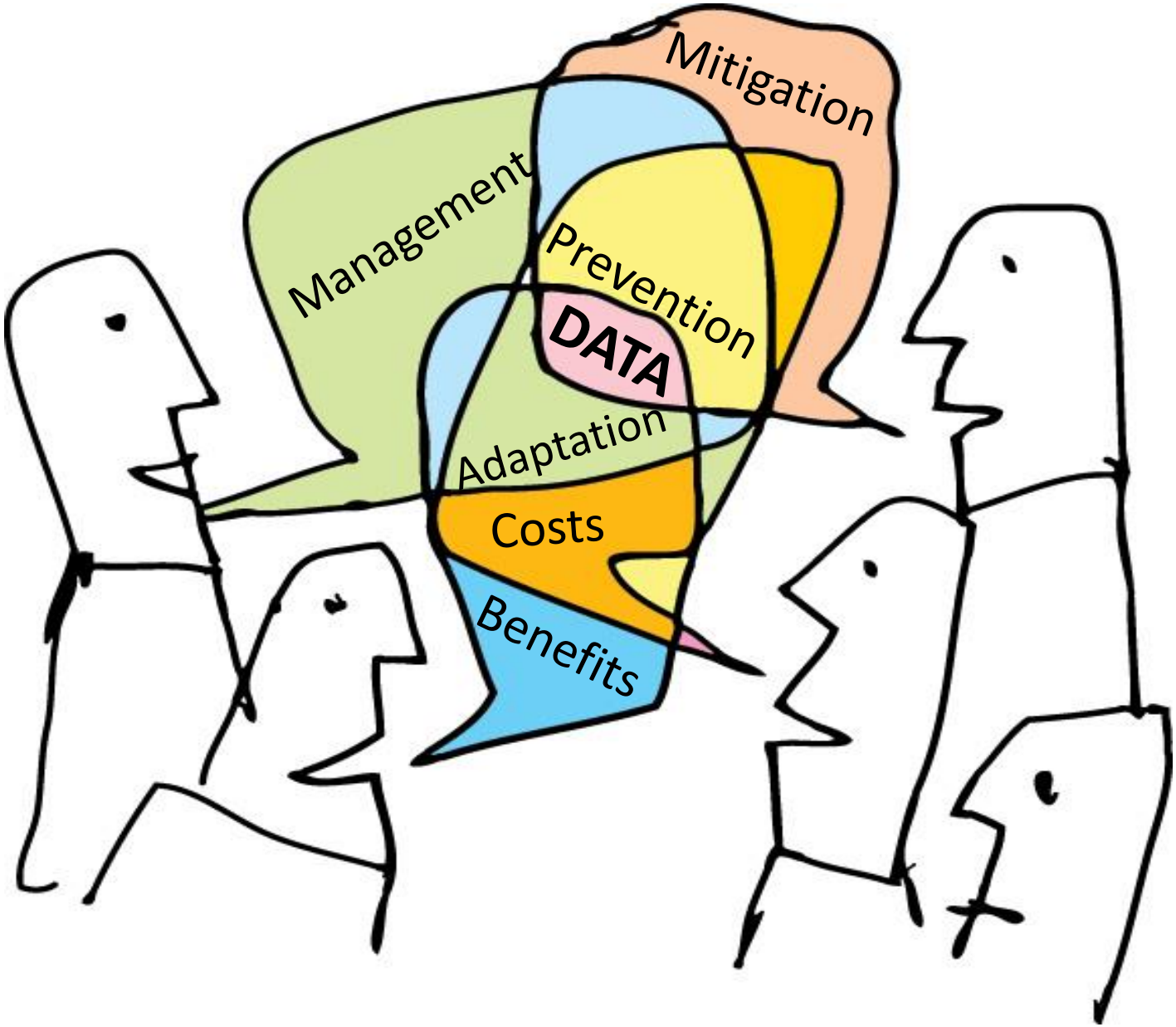
Yes, 83.5% of Montana agricultural stakeholders think climate change is a serious problem now, near- or in the long-term future.

Are humans capable to mitigate the impacts of climate change?

46% of Montana agricultural stakeholders think humans can mitigate the effects of climate change

What are the causes climate change?

About 36% of Montana agricultural stakeholders attribute climate change to human activities and 43% to natural causes.



De-politicize the causes of climate change

"The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is new, so we must think anew, and act anew."

Abraham Lincoln, 1862

Montana State

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