# Questions & Answers about Climate Change

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**Q: Who says climate change is real?**

A: The basic findings of human-induced climate change have been reviewed and confirmed by the leading professional scientific societies[1] and national academies of science[2], both in the United States and around the world. Surveys and reviews of the scientific literature have repeatedly found that approximately 97 percent of actively publishing climate scientists adhere to the basic premise that human activities are responsible for most of the observed global warming since the middle of the 20th century.

[Oreskes 2004; Doran and Zimmerman 2009; Anderegg et al 2010]

[1] http://www.aaas.org/news/releases/2009/media/1021climate_letter.pdf

[2] http://www.nationalacademies.org/includes/G8+5energy-climate09.pdf

**Q: What are the likely effects of climate change on our region?**

A: The historical trend in average annual temperature for the High Plains region shows a warming of 1.7°F over a 115 year period. Temperatures were cooler than normal early in the record, followed by significant warmth during the 1930's dust bowl era, and warmer than normal conditions since the 1970's, especially over the last 10 years. Precipitation shows a much weaker trend than temperature with essentially no change for the annual average in the High Plains Region. There is high year-to-year variability throughout the century long dataset, which is typical for the continental type climate of the region. Projections of future climate conditions based on a composite of the various climate models show a warming in the High Plains region of about 4°F by 2050 and 8°F or higher by 2090. While the individual models show a range of temperature increases, they all project a warming. Model projections of changes in precipitation vary by season, showing a general drying in summer and autumn with wetter conditions in winter. Spring is projected to be wetter in the northern part of the region and drier in the south. The summer drying trend is compounded by increased evaporation rates due to the projected warming.

[http://www.hprcc.unl.edu/publications/files/HighPlainsClimateChangeGuide.pdf]

**Q: What does it mean for agriculture in the state?**

A: Scientists for the National Oceanic and Atmospheric Administration (NOAA) have said that the 2012 drought falls within the context of natural climate variability and it is hard to link one extreme event to climate change. However, with the high temperatures that occurred in combination with the dryness in 2012, this year does give a potential glimpse of what future climate extremes might look like for Nebraska--with virtually all climate models indicating increased temperatures in the future.[3]

[Hayes, testimony to Nebraska Legislature Agricultural Committee, 2/26/2013]

[3] http://www.climatecentral.org/news/record-setting-hot-2012-will-be-average-year-in-future-years-15756

**Q: How much did the 2012 drought cost?**

A: Based on data back to 1895, 2012 was both the warmest and the driest year on record for the state of Nebraska. While the costs of last year's drought are still being tallied, estimates range as high as $35-77 billion. Crop indemnity payments for 2012 (through 2/19/2013) have reached $15.9 billion for the country, and $1.5 billion for Nebraska, not including livestock. Fire was another major impact in our state last year with a record 500,000 acres burned, which was double the previous high. In fact, three of the five highest acres burned years have occurred since the year 2000 based on data going back to 1964.

[Hayes, testimony to Nebraska Legislature Agricultural Committee, 2/26/13; Svoboda, testimony to Nebraska Legislature Natural Resources Committee, 3/1/13; updated 3/26/13]

**Q: Isn't it all just a result of urbanization?**

A: Urban and rural areas generally show the same trends.

**Q: Water vapor is a more important greenhouse gas than carbon dioxide, but the models don't include water vapor.**

A: They do include water vapor – as a feedback, not as a forcing. Unlike the increases in CO2 caused primarily by the combustion of fossil fuels, water vapor in the atmosphere is increasing as a result of the temperature increase due to the enhanced greenhouse effect. Because water vapor is a powerful greenhouse gas, this increase in atmospheric water vapor further enhances the greenhouse effect.

**Q: Isn't it all just because of changes in the sun?**

A: Satellite measurements of solar radiation since the late 1970s show the well-documented 11-year cycle in solar activity but little trend. Over this time period, global temperature has increased substantially, so changes in solar radiation cannot be the underlying cause. Moreover, increased solar radiation would cause temperature increases throughout the atmosphere while observations show warming in the lowest layer of the atmosphere (troposphere) and cooling in the layer above (stratosphere), consistent with warming caused by an enhanced greenhouse effect.

# Questions & Answers about Climate Change, conclusion

[http://earthobservatory.nasa.gov/Features/ACRIMIII/; Rowe, testimony to Nebraska Legislature Agricultural Committee, 2/26/2013; Rowe, testimony to Nebraska Legislature Natural Resources Committee, 3/1/2013]

**Q: Didn't the warming stop in 1998?**

A: Scientists at NASA's Goddard Institute for Space Studies (GISS) say 2012 was the ninth warmest year since 1880, continuing a long-term trend of rising global temperatures. The ten warmest years in the 132-year record have all occurred since 1998. The last year that was cooler than average was 1976.

[http://earthobservatory.nasa.gov/IOTD/view.php?id=80167]

**Q: Just why is it that changes in snowpack in the Rockies are so important for water resources in Nebraska? Isn't local precipitation more important?**

A: Climate model projections are for a large reduction in snow pack in the central and northern Rocky Mountains. This is due to both a reduction in overall snowfall, and warmer conditions, meaning more rain and less snow, even in winter. Flow in the Platte and Missouri Rivers during summer critically depends on the slow release of water as the snow pack melts. Such flow could be greatly reduced in coming years.

[Oglesby, testimony to Nebraska Legislature Natural Resources Committee, 3/1/2013]

**Q: I'm not sure I understand why in a warmer world conditions for agriculture will be drier, if precipitation doesn't change. Can you clarify?**

A: As temperature increases, so does evaporation. If precipitation remains the same, there is not enough moisture to meet the increased demand and soil moisture will decrease.

[Oglesby, testimony to Nebraska Legislature Natural Resources Committee, 3/1/2013]

**Q: I've heard increased carbon dioxide can be beneficial for plant growth. How does that counter any climate change impacts?**

A: While some studies have shown increased plant growth in CO2-enriched environments, the effect may be short lived as other nutrients become limiting. Moreover, the impact of higher CO2 levels on weeds may be as large or larger.

**Q: Are we likely to have more severe storms in summer and more severe droughts?**

A: Extreme events are likely to be more common in summer, and, well, more extreme. That is, longer and harsher droughts, and more summertime flooding rains can both be expected. In winter, blizzards are expected to occur less often, but be worse when they do happen.

[Oglesby, testimony to Nebraska Legislature Natural Resources Committee, 3/1/2013]

**Q: We can't even forecast the weather a couple weeks in advance. How can we predict the climate decades in the future?**

A: While weather is inherently not predictable beyond about 2 weeks, climate is a statistical construct that is inherently more predictable – like being able to predict with high accuracy the results of 900 rolls of a pair of dice (25 twos, 50 threes, 75 fours, 100 fives, 125 sixes, 150 sevens, 125 eights, 100 nines, 75 tens, 50 elevens and 25 twelves), while not being able to predict the result of the next roll with the same accuracy.

**Q: Don't ice core records show that temperature increased before increases in carbon dioxide at the end of past ice ages?**

A: Increasing CO2 was not the cause of the temperature increase marking the end of past ice ages. Well known changes in the Earth's orbit cause changes in the amount and distribution of solar energy over the Earth, leading to the onset and end of ice ages over geologic time spans. However, warming causes the oceans to release CO2 into the atmosphere, which amplifies the warming caused by orbital variations.

**Q: Wasn't the big concern back in the 1970s about global cooling?**

A: This was predominantly a media bias, a review of peer-reviewed scientific papers published in the late 1960s and 1970s showed that warming was of more concern than cooling by a ratio of 6 to 1.

[Peterson et al. 2008]

**Q: Didn't the global temperature go down from the 1940s to the 1970s while carbon dioxide was increasing?**

A: Climate scientists attribute the primary cause of the observed cooling in the middle of the 20th century to an increase in atmospheric aerosols primarily from the burning of fossil fuels. Aerosols have a complex effect on the climate, but their overall effect is thought to increase reflection of solar radiation, cooling the Earth. Increased pollution controls beginning in the 1970s have decreased the amount of these aerosols, reducing their effect.

**Q: Can you explain more about what happened with 'Climategate'?**

A: In November 2009, around 1000 email messages were stolen from the Climatic Research Unit (CRU) of the University of East Anglia (UEA). Though some of the emails may show the scientists in a bad light, several inquiries have cleared the scientists of any fraud or deception. The emails do not negate the preponderance of evidence for anthropogenic climate change. Investigations in the United States and United Kingdom have reached the same conclusion.

[http://www.factcheck.org/2009/12/climategate/]