Resilient Analytics Project Summaries

The yield from agricultural crops is highly dependent on environmental factors. The length of a growing season, the amount of water available for irrigation, and the existence of extreme weather events all contribute to the success or failure of a crop. Historic changes in environmental factors leads to annual differences in crop production. In some case, such as the dust bowl era, these changes have led to fundamental changes in agricultural practices.

Climate change poses a historic impact on crop production. Resilient Analytics, Inc studied this potential impact focusing on corn production as an initial impact area. The study analyzed the effect of climate change on corn production in key growing regions across a number of global locations. Within the United States, corn production was analyzed based on the impacts of temperature change on growing season and the change in precipitation on the prevalence of drought.

Looking at a broad cross-section of climate scenarios, Resilient Analytics found that many areas will be impacted both by increases in temperature and reductions in precipitation which may lead to increased drought. In terms of growing degree days, the United States sees increases in growing degree days of 12%-28% in a lower-impact climate scenario by 2050. At the higher levels, these growing degree day increases rise to a 14%-37% increase.

In both scenarios, the larger of these numbers are found in the northern Midwest and plains. These increases reflect an increase in growing season length due to the underlying increases in temperature. In contrast to this consistent increase due to temperature increases, precipitation varies across the United States with values ranging from a decrease of 9% to an increase of 5% annually. Where reductions exist, and even in places where there are minimal increases, the advantage of the longer growing season will be offset by the reduction in available water.

Agricultural crops are sensitive to any changes in environmental conditions. The industry has optimized crop production through crop rotations, seed enhancement, irrigation technologies, and weather forecasting to name only a few. However, the decades of innovation that have improved crop yields are at risk from the projected climate changes.

As demonstrated in the study, corn crops will likely be negatively impacted by climate change due to a combination of rising temperatures and decreasing rainfall.

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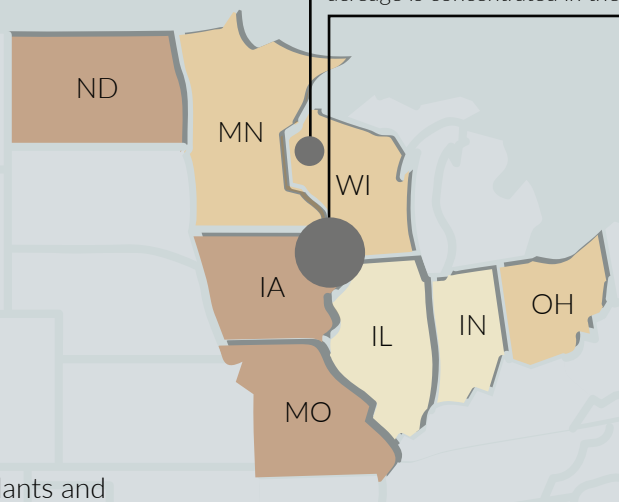
IMPACTS OF CLIMATE CHANGE ON THE AGRICULTURE SECTOR

Recent research has shown that for each day of delayed corn planting in Wisconsin, a yield decrease of 1.008 bushels per acre typically occurs.

Iowa and Illinois account for approximately one third of the U.S. corn crop, and more than 80% of soybean acreage is concentrated in the upper Midwest.



Growing Degree Days (GDD):

Used to **estimate the growth** and development of plants and insects during the growing season. The basic concept is that **development will only occur if the temperature exceeds some minimum development threshold, or base temperature.**

Climate Change During Growing Season (May-Sept.)

RCP 4.5 2050 vs. Historic Data

Location	Precip. % Change	GDD % Change
MO	-8%	14%
IN	3%	14%
IL	0%	18%
OH	-1%	19%
IA	-8%	17%
WI	-1%	24%
MN	-4%	20%
ND	-10%	20%

For corn, each degree of warming during June–Aug is capable of suppressing yields by as much as a 19% decrease compared to current. **It is a very sensitive crop to rising temperatures**

Winter warming may lead to **overwintering of pests**. Increase in **more frequent heavy rainfall** is the new normal, and farmers need to be prepared.

Yields from **major U.S. commodity crops are expected to decline** as a consequence of higher temperatures, especially when these higher temperatures **occur during critical periods of reproductive development.**

About Resilient Analytics

Resilient Analytics answers climate impact questions with the Infrastructure Planning Support System (IPSS). IPSS is a unique, first-of-its-kind system that performs engineering analysis within a broader resiliency perspective. IPSS models infrastructure vulnerability to future climate conditions, considers specific adaptation scenarios, and provides a cost benefit based risk analysis. IPSS draws its data from a range of climate science projections, engineering and materials studies, and environmental research to provide users with decision support that is based in real-world risk scenarios.