SELECTED RESEARCH HIGHLIGHTS

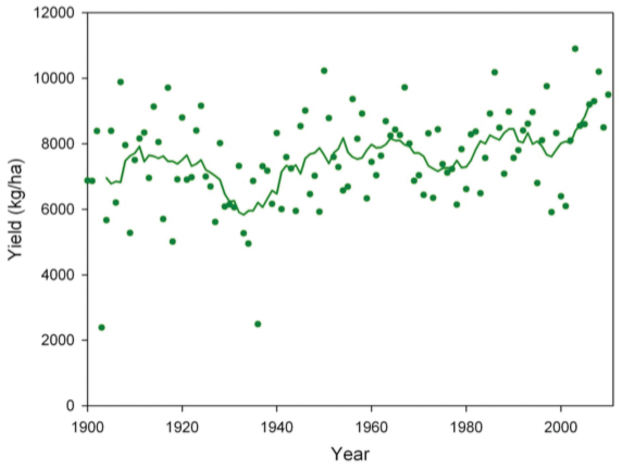
Modeling Spatial and Temporal Climate-Yield Interactions

Efforts are underway to simulate regional crop productivity as a function of past and projected climate and farm management practices. Different crop yield models of simple (HM[1]), intermediate (DSSAT[2]), and enhanced (ISAM[3]) biophysical complexity and process scale representations are being tested and applied. This work will help us understand the contributions of anomalous weather to crop productivity and implications for future management options.

PRELIMINARY FINDINGS:

- DSSAT simulations from 1900-2010 indicate an increase in average temperatures (approx. 0.3°-0.8°C) and annual precipitation (approx. 75-150mm per year) across the North Central US. The warming has mostly occurred in the winter and spring seasons since 1980. Increases in precipitation were found in all seasons since 1940 as a result of more frequent wet days and a greater number of heavy precipitation events.
- DSSAT simulated corn and soybean yields increased from 1900-2010 due to the wetter growing season conditions. The frequency and severity of moisture stress shortages have decreased with time across much of the region. The greatest yield increases (20-30 kg/ha/year for corn and 8-15 kg/ha/year for soybean) occurred after 1950.
- Results from ISAM simulations show that increased atmospheric CO_2 concentrations enhance soybean yield but has no effect on corn production.

Corn Yield vs. Year for La Porte, IN 1901-2010



[1]Hybrid Maize (HM)
[2]Decision Support System for Agrotechnology transfer (DSSAT)
[3]Integrated Science Assessment Model (ISAM)

Impact of ENSO on Climate and Crops in the Midwest

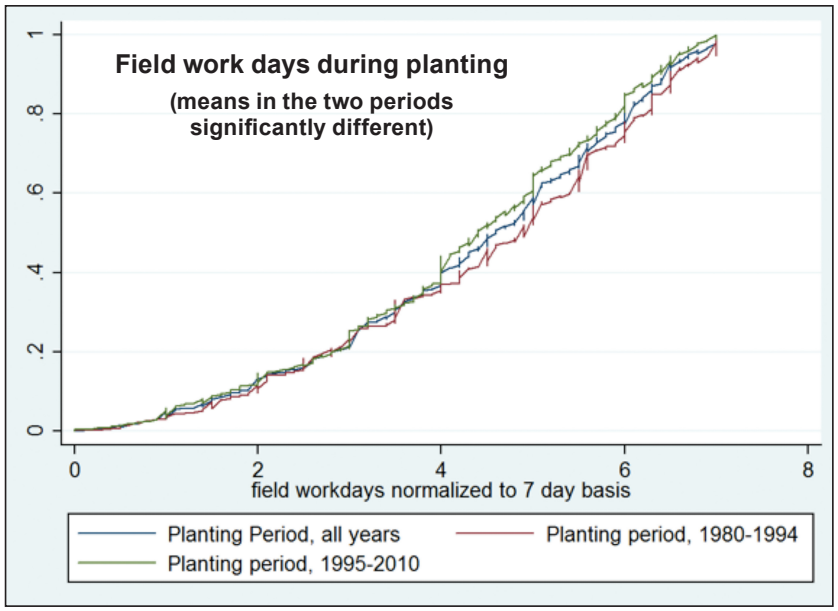
Understanding monthly and seasonal weather patterns associated with various ENSO phases (El Niño, neutral, and La Niña) can help the agricultural community assess their climate-related risks and potential crop production impacts. We are developing an ENSO Climatology Atlas for the North Central U.S. based on observed data from 1980-2012. The results of this analysis will show monthly and seasonal average temperature and precipitation by ENSO phase.

PRELIMINARY RESULTS FOR INDIANA:

- La Niña conditions are associated with warmer, drier spring and summer months, which agrees with observations for the 2012 growing season.
- Monthly average temperatures tend to be coldest during the neutral phase of ENSO.

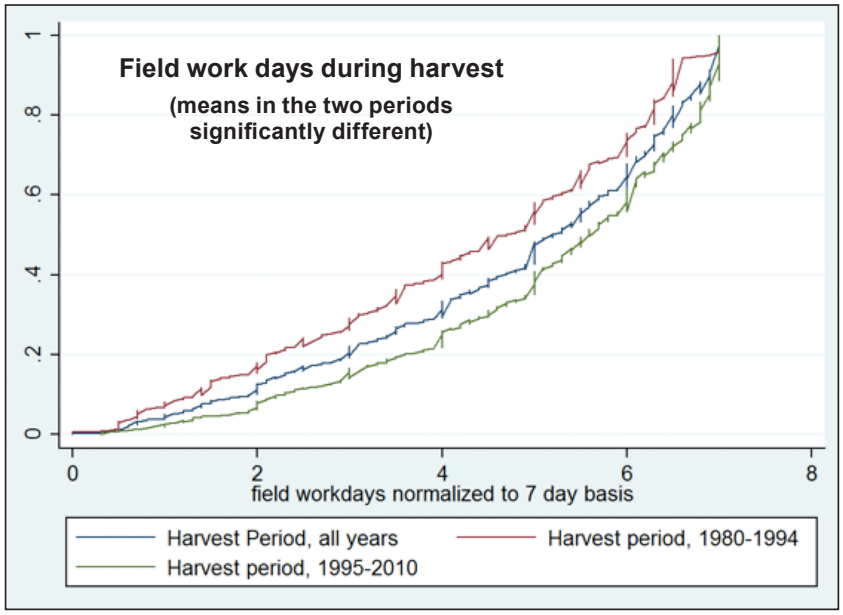
Predicting Days Available to Perform Field Operations

The number and timing of days available to perform on-farm field operations during planting and harvesting periods has a direct effect on crop productivity and is largely influenced by antecedent weather and soil conditions. Understanding the potential effects of climate change on field conditions has implications for intra-seasonal management options (i.e. tillage, fertilizer application) and long-term investment decisions (i.e. equipment purchases, tile drainage). We are developing a statistical model capable of predicting field work days (FWD) under future climate conditions based on historical FWD observations and accompanying weather data from 1980-2010.



PRELIMINARY FINDINGS:

- Comparing the periods 1980-1994 and 1995-2010 reveals a statistically significant increase in the average days available for field work in a given week across IA, IL, IN, KS, and MO. Results show a one-half day decrease over the planting period and eight-tenths of a day increase during the harvest period.
- The first reported FWD of the season was found to be occurring, on average, five days sooner during the most recent 15 years in the data set.



Farmer and Advisor Climate Needs Assessments

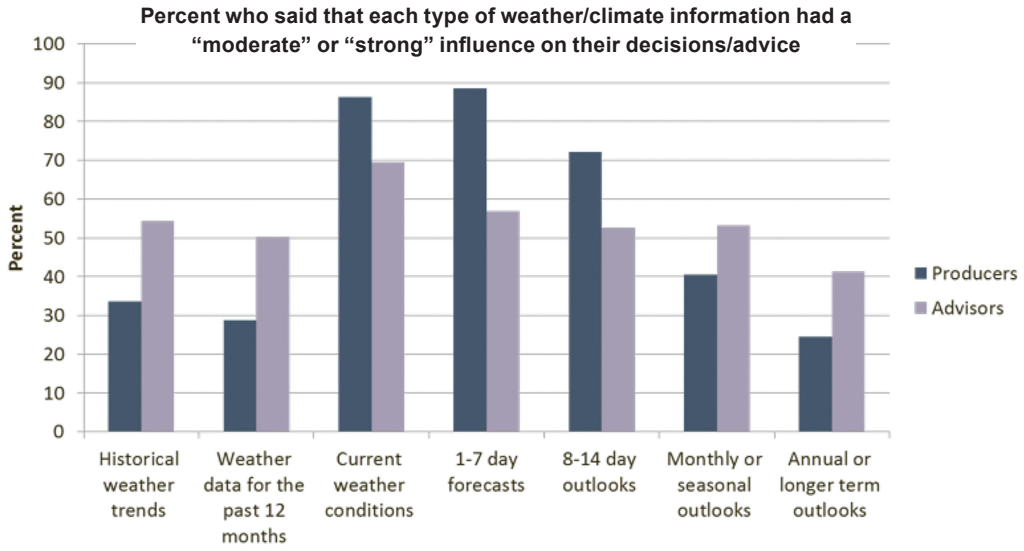
When used by farmers and their advisors, climate-based decision support tools can reduce uncertainty and risks in the planning, operation, and management decisions of the farm enterprise. However, little is known about whether the agricultural community is willing to use such tools, their information needs, or their ability to incorporate this knowledge into existing decision processes. Furthermore, it is unclear how climate change risks and impacts are perceived and if farmers have the ability to adapt to more variable conditions. In Feb-Mar 2012 we surveyed farmers and their advisors in the Midwest to better understand their information needs and concerns.

	Producers*	Advisors**
Climate change is occurring, and it is caused mostly by human activities	8%	13%
Climate change is occurring, and it is caused equally by natural changes in the environment and human activities	33%	37%
Climate change is occurring, and it is caused mostly by natural changes in the environment	25%	25%
There is not sufficient evidence to know with certainty whether climate change is occurring or not	31%	23%
Climate change is not occurring	4%	2%

*Responses from 4,778 Midwestern corn farmers collected Feb-Mar 2012
**Responses from 2,087 Midwestern agricultural advisors collected Mar 2012

PRELIMINARY FINDINGS:

- The agricultural community is concerned about numerous climate-related impacts and they are potentially willing to use climate information in their decision making.
- Most feel adaptation to climate change is important to the long-term success of U.S. agriculture, but there is too much uncertainty about the impacts of climate change to justify changing their practices at this time.
- There are significant relationships between farmers' and advisors' climate change beliefs and how climate risks are perceived, their willingness to use climate information, their beliefs about risk management practices and responsibilities, and who they trust for farm management and climate change information.



For more information please visit www.AgClimate4U.org

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