Kansas Wheat Yield Outlook for 2024 (Week 16) using Drought Monitor Data

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Week 16 prediction[1]

Kansas wheat estimate for 4/19/24 Using Drought Monitor Data
Yield range from 39.1 to 46.2
Predicted yield of 42.6

Abstract

This paper uses data from the U.S. drought monitor website (https://droughtmonitor.unl.edu[2]) to predict yields on a crop reporting district (CRD) level for Kansas. These CRD level numbers are aggregated upward to get a state average yield. Although this estimate is very preliminary with wide confidence intervals, there are clear indications that production may be diminished in some areas of the state (Central and South Central Kansas). The preliminary analysis developed here estimates a state average wheat yield of 42.6 bu/ac (confidence interval from 39.1 to 46.2 bu/ac). The individual CRD estimates are shown in Figure 1. This estimate should be compared with Ibendahl's 4/14/2024 estimate Kansas Wheat Yield Outlook for 2024 - Week #15 using NASS crop condition report. The NASS estimate was 1.1 bu higher than the soil moisture estimate in this paper.

Introduction

Kansas once again has wide areas of the state in some level of drought. In particular the central and south central regions are very dry. As shown in Figure 2, 2024 is not that unusual as there have been many dry springs. The key to final yields will be the how much additional rain the state receives.

Most farmers would agree that wheat prospects this year are less than ideal based on the current soil moisture conditions. The question that farmers, lenders, and others in agriculture are asking

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https://www.youtube.com/@little_pond_farm
[2]U.S. Drought Monitor. (https://droughtmonitor.unl.edu).

though is what can Kansas expect for wheat production this year. Last year, Ibendahl estimated wheat yields and production on a regular basis throughout the growing season using the USDA estimates of crop conditions. The USDA-NASS data is only available at the state level. This paper estimates wheat yields on a CRD level basis and then on a state level using drought data from the U.S. Drought Monitor site. This data is available since 2000 on a consistent weekly basis. The drought monitor data is also more finely grained with county level and crop reporting level data available in addition to the state report. The consistent weekly data allows a yield prediction model to be developed much sooner than using the USDA crop condition indexes as the wheat crop condition reports from NASS do not start on a regular basis until April.

Data

The model developed here follows a similar procedure that Ibendahl used to estimate wheat yields based on the USDA crop conditions report. Instead of the growing conditions report, the Drought Severity and Coverage Index (DSCI) is used to estimate wheat yields. The DSCI (Akyuz[3]) shares many similarities to the Crop Condition Index (CCI) (Bain and Fortenbery[4]). Where the CCIndex weights the best condition with the most points, the DSCI weights the worst condition with the most points.

The U.S. Drought Monitor labels droughts by the level of severity. There are 5 levels of drought ranging from D0 (least severe) to D4 (most severe). The DSCI is a computed by the formula:

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DSCI = (% acreage in D0) * 1    +
       (% acreage in D1) * 2    +
       (% acreage in D2) * 3    +
       (% acreage in D3) * 4    +
       (% acreage in D4) * 5
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The index ranges from [0, 500]. An index value of 500 corresponds to 100 percent of the crop acreage in the most extreme drought (D4), and a value of 0 indicates 100 percent of the crop acreage is not in any drought state. The U.S. Drought Monitor computes these values for various sized areas including at the county level. The site has weekly data back to the year 2000.

Model

The model used in this paper first computes the trend line yield on a crop reporting district basis from 2000 to 2023. Most CRDs have a small positive trend line increase in yields. Next, the deviation from trend line is calculated for each year. This deviation from trend is what the DSCI is used to estimate. Because NASS no longer reports CRD yields, Ibendahl generated the CRD yields by aggregating individual counties within a CRD.

[3]Akyuz, F. A. 2017. Drought Severity and Cover- age Index. United States Drought Monitor. droughtmonitor.unl.edu/About/AbouttheData/ DSCI.aspx

[4]Bain, R. and T. R. Fortenbery. 2013. "Impacts of Crop Conditions Reports on National and Local Wheat Markets." Proceedings of the NCCC-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. St. Louis, MO. (http://www.farmdoc.illinois.edu/nccc134)

A linear regression model is used to estimate the deviation from trend for a specific week using the data from 2000 to 2023. There is a separate regression model for each CRD. The regression model is unique to a specific week. For this paper, the lastest DSCI report for 2024 is week 16. To estimate the linear model, the DSCI data is filtered to provide only the historical week 16 DSCI numbers and these are used as the independent variable to predict the final yield. Once the linear model is developed at the CRD level, the DSCI reading for 2023 and week 16 is plugged into the equation to estimate the deviation from trend for this year's CRD yield.

To generate the state yield estimate, Ibendahl weighted each of the individual CRD yields by the number of planted acres last year. NASS has not yet reported planted acres on a county level for 2024. Because NASS is not able to report on all counties, aggregating upward to a state yield is not fully complete. However as long as the missing county data is representative of the reported county data, results should not change very much.

Results

The CRD level results are shown in Figure 2. The second column in each of the tables is the trend line yield. This is the expected yield for a CRD in a "normal" year. The next three columns are the predicted yields based on the linear model using the DSCI to predict the yield deviation for this year. The yield deviation from the linear model is subtracted from the trend yield to get the predicted yields shown. While the most likely yield column is the point estimate of the model, the upper and lower range values should not be ignored. At this point, there is a wide range of yields that could occur and the confidence interval reflects this uncertainty.

The final column is the r-squared value and it tells how well the linear regression model fits the yield data. Values can range from -1 to 1 with a 0 value indicating the model doesn't predict yields at all. As Figure 2 shows, there is a wide variation in how well CRD level data works. While some CRDs show the model has no explanatory power, there are other CRDs with a strong fit. Those CRDs with an r-squared value close to zero will show a predicted yield close to trend line in most cases. In these CRDs more attention should be focused on the possible yield range.

Discussion

These are very preliminary results. However future weeks should show an improvement in the model. Once the USDA starts producing crop condition reports on a regular basis in April, this crop condition reports will also be used to forecast yields. Be sure to check AgManager.info for the latest yield forecasts. The intention is to produce an estimate of wheat yields using both crop conditions and the drought index. While the drought index has an advantage of more detailed data down to the county level, it also has no way to indicate when there is excess moisture available. In other words, the drought index only shows moisture deficit levels and not excess moisture levels.

While this report currently indicates a below average wheat year, the wide confidence intervals indicate these predictions could improve with timely rains. It is still early spring after all. The poorest quality wheat is more likely to be abandoned which would help improve the state average wheat yield but at the expense of lowering harvested acres.

Predicted CRD Yields

week - 16

CRD	Trend Yield	Predicted Yields			R squared
		Lower Bounds	Most Likely Yield	Upper Bounds	
NORTHWEST	50.2	49.6	52.5	55.5	0.62
NORTH CENTRAL	43.8	39.1	42.7	46.3	0.03
NORTHEAST	51.1	48.9	55.5	62.1	0.07
WEST CENTRAL	44.9	44.2	47.2	50.3	0.51
CENTRAL	44.3	38.0	42.1	46.1	0.11
EAST CENTRAL	47.2	44.6	49.2	53.7	0.03
SOUTHWEST	42.7	41.6	44.2	46.9	0.59
SOUTH CENTRAL	38.9	32.2	35.9	39.5	0.26
SOUTHEAST	50.5	47.3	50.9	54.5	−0.02

Figure 1: Kansas Crop Reporting Districts - Estimated Yields

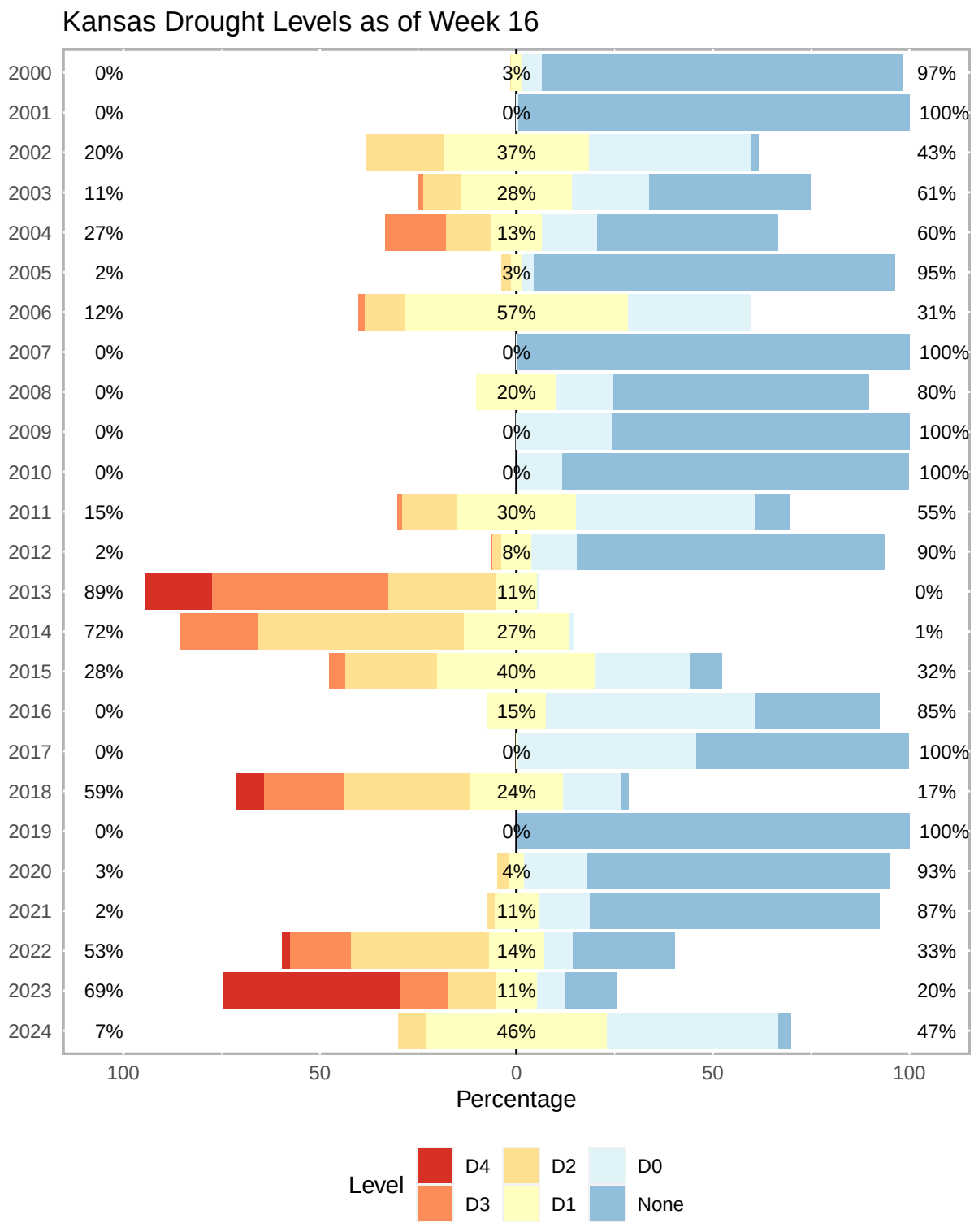

Figure 2: Historical Drought Conditions in Kansas