k-state extension
Agronomy e-Updates

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1. The value of soil organic matter

Soil organic matter (SOM) provides many benefits for crop production in Kansas. Higher SOM levels mean better soil aggregation, improved water infiltration, less compactability, less erodibility, and a generally higher level of productivity due to more available water and nutrients.

About how much of an increase in available water and nutrients can producers expect from each one percent increase in SOM?

Water: Numerous studies have shown that SOM increases soil water holding capacity. In one such study (Emerson, W.W. 1995. Water retention, organic carbon and soil texture. Australian J. Soil Res. 33: 241-251), the authors concluded that available soil water increased from 1-10 grams for every 1 gram increase in SOM. Stretching out the math from there, the end result is that each one percent increase in SOM results in about 20,000 to 25,000 more gallons of available soil water per acre, or about one acre-inch. Only a portion of the total water in a soil is available, so the increase in total water content for each percentage increase in SOM is even higher than that.

Nitrogen: A soil with 3% SOM contains about 3,000 pounds of total nitrogen per acre. Each percent increase in SOM adds about 1,000 pounds of nitrogen per acre. Most of this nitrogen is unavailable until it is mineralized by soil microbes. In Kansas, SOM mineralization rates range from 1 to 3% per year, depending on soil temperatures, soil moisture levels, soil pH, and tillage systems. With a mineralization rate of 2%, typical of central Kansas, this would mean that one acre with 3% SOM may provide about 60 of available nitrogen. Each percent increase in SOM would increase available nitrogen by about 20 pounds per acre. In eastern Kansas, the increase in available nitrogen would be higher because there is more soil moisture and the mineralization rate is higher.

Phosphorus: In general, the ratio of available nitrogen to available phosphorus in SOM is 10:1. Therefore, each percent increase in SOM would increase available phosphorus by about 2 pounds of elemental P, or 4.5 pounds P_2O_5 per acre in regions where the annual mineralization rate is about 2%. In eastern Kansas, the increase in available phosphorus would be higher.

Potassium: Potassium release by SOM is negligible.

Sulfur: In Kansas, sulfur release from organic matter is 2.5 pounds per 1 percent SOM.

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2. Plant analysis for soybeans

Now is the time to start planning for plant sampling and nutrient analysis for soybeans. There are two primary ways plant analysis can be used for soybeans: as a routine monitoring tool to ensure nutrient levels are adequate in the plant, and as a diagnostic tool to help explain some of the variability in soybean growth and appearance we see in fields. Keep in mind, however, that any plant stress (drought, soil compaction, cyst nematodes, etc.) can have a serious impact on nutrient uptake and the nutrient concentrations found in soybeans. Sampling under stress conditions for monitoring purposes can give misleading results, and is not recommended.

Monitoring to ensure adequate plant nutrition

For monitoring purposes, collect 20-30 sets of the three upper, fully developed trifoliate leaflets, less the petiole, at random from the field at flowering to initial pod set (growth stages R2-R3). The top, fully developed leaves are generally the dark green leaves visible at the top of the canopy, which are attached at the second or third node down from the top of the stem. Sampling later, once seed development begins, will give significantly lower nutrient contents as soybean plants begin to translocate nutrients from leaves to the developing seed very quickly.

The sampled leaves should be allowed to wilt over night to remove excess moisture, placed in a paper bag or mailing envelope, and shipped to a lab for analysis. Do not place the leaves in a plastic bag or other tightly sealed container, as they will begin to rot and decompose during transport, and the sample won’t be usable.

The data returned from the lab will be reported as the concentration of nutrient elements, or potentially toxic elements in the plants. Units reported will normally be in percent for the primary and secondary nutrients (N, P, K, Ca, Mg, and S) and ppm, or parts per million, for the micronutrients (Zn, Cu, Fe, Mn, B, Mo, and Al).

Most labs/agronomists compare plant nutrient concentrations to published sufficiency ranges. A sufficiency range is simply the range of concentrations normally found in healthy, productive plants during surveys. It can be thought of as the range of values optimum for plant growth. The sufficiency ranges change with plant age (generally being higher in young plants), vary between plant parts, and can differ between cultivars. So a value slightly below the sufficiency range does not always mean the plant is deficient in that nutrient, but it is an indication that the nutrient is relatively low. Values on the low end of the sufficient range are common in extremely high-yielding crops. However, if that nutrient is significantly below the sufficiency range, then one should ask some serious questions about the availability and supply of that nutrient.

Levels above the sufficiency range can also indicate problems. High values might indicate over fertilization and luxury consumption of nutrients. Plants will also sometimes try to compensate for a shortage of one nutrient by loading up on another. This occurs at times with nutrients such as iron, zinc and manganese. In some situations very high levels of a required nutrient can lead to toxicity. Manganese is an example of an essential nutrient which can be toxic when present in excess.

Diagnosing field problems

Plant analysis is an excellent diagnostic tool to help understand some of the variation seen in the field. When using plant analysis to diagnose field problems, try to take comparison samples from both good/normal areas of the field, and problem spots. Collect soil samples from the same good and bad areas, and don't wait for flowering to sample soybeans. If problems develop early in the season, collect whole plants from 15 to 20 different places in your sampling areas. Later in the season, collect 20 to 30 sets of top, fully developed leaves. Handle samples the same as those for monitoring, allowing them to wilt to remove excess moisture and avoiding mailing in plastic bags.

The following table gives the range of nutrient content considered to be "normal" or "sufficient" for top fully developed soybean leaves at flowering. Keep in mind that these are the ranges normally found in healthy, productive soybeans.

Nutrient Content Considered "Normal" or "Sufficient" for Soybeans		
		Growth Stage
Nutrient	Units	Top, fully developed leaves at flowering
Nitrogen	%	4.25-5.50
Phosphorus	%	0.25-0.50
Potassium	%	1.70-2.50
Calcium	%	0.35-2.00
Magnesium	%	0.26-1.00
Sulfur	%	0.15-0.50
Copper	ppm	10-30
Iron	ppm	50-350
Manganese	ppm	20-100
Zinc	ppm	20-50
Boron	ppm	20-55
Molybdenum	ppm	1.0-5.0
Aluminum	ppm	<200

In summary, plant analysis is a good tool to monitor the effectiveness of your fertilizer and lime program, and a very effective diagnostic tool. Consider adding this to your toolbox.

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3. Sorghum headworms: Potential yield loss and control

The sorghum headworm (*Helicoverpa zea*) is the same insect as the corn earworm. Although larvae of this moth prefer corn, they sometimes infest sorghum heads. The head capsule is light brown and the body color varies from pink to green to brown with light and dark stripes along the length of the body. Larvae can be 1½ inches long at maturity.

Sorghum headworm (corn earworm) larva. Photo by K-State Research and Extension, Department of Entomology.

Sorghum headworm (corn earworm) adult. Photo by K-State Research and Extension, Department of Entomology.

Infestations are more common in southern and central Kansas, and sorghum is vulnerable to infestation from bloom through milk stages. One to two larvae per head can result in approximately 5 to 10 percent yield loss. The average size of larvae at detection is a key consideration, because less will be gained by treating older, larger larvae. The decision to treat should balance the expected yield and crop value against treatment cost and the amount of damage that can be prevented.

Two tests were conducted in 2011 for sorghum headworm control. The results are in the table below. These tests show that sorghum headworm can be successfully controlled with insecticides to levels that should reduce yield losses to less than 5 percent. Yield losses can be prevented, but only if controlled when larvae are small.

Sorghum headworm control with insecticides: K-State tests, 2011		
	Dickinson County	Marion County
Treatment	Sorghum headworms per 10 heads	
Insecticide*	0.51	0.39
Untreated	4.50	5.30

* Average of 11 combinations of insecticides and rates
Dickinson County: Sprayed August 21, 2011. Plots sampled August 28 and Sept. 1.
Marion County: Sprayed September 3, 2011. Plots sampled Sept. 3 and Sept. 14.
At both locations, sorghum was between half-bloom and soft dough when treated.

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4. June 2012 weather in Kansas: The drought deepens

Continued heat has resulted in rapid deterioration of the drought situation in June. Only a small area of northeast Kansas had at or above normal moisture. Some counties in southwest and west central Kansas averaged less than half an inch of precipitation in June (Lane and Scott counties). In north central Kansas record heat was the story. Norton Dam recorded 118 ^{o}F on June 28$^{th.}$ This was an all-time record for the station, and appears to be an all-time record high for June in the state. Even with these records, June was only the 10th warmest on record. The average temperature was 77.2 °F, which was 4.0 degrees above normal. The warmest June was recorded in 1952, when the average temperature was 81.1 °F. The coldest June on record occurred in 1903, when the average temperature was 66.6 °F. Again, the highest reading was 118 °F at Norton Dam (Norton County) on the 28th. The coldest reading for the month was 38 °F at Burr Oak (Jewell County) on the 1st.

Preliminary statewide average precipitation was 2.28 inches, which was only 53% of normal. This makes it the 18th driest June since 1895. The Northeast Division was the wettest in overall precipitation with an average of 4.46 inches, or 86% of normal. The Northwest Division was the driest, with an average precipitation of 1.06 inches, or 33% of normal. Ten days saw no reports of precipitation, and on 3 days the state-wide average was zero, with only isolated reports of moisture. Only four days had an average precipitation greater than 0.10 inches. The heaviest rains occurred on June 15th. The western portions of northeastern Kansas had the heaviest amounts.

Drought conditions worsened across the state. A large area of extreme drought developed in western Kansas, with more expected as hot dry conditions continue. Currently, the entire state is reported in abnormally dry to extreme drought conditions, with 94% in moderate to severe drought. The latest Drought Outlook indicates drought conditions are expected to continue through September. The La Niña has ended. For July, the probability is equally likely for wetter- or drier-than-average conditions in the state, except drier-than-normal conditions in the northeastern parts of the state. Temperatures are expected to continue above average.

Table 1. June 2012 Kansas Climate Division Summary

	Precipitation (inches)						Temperature (°F)			
	June2012			2012: Jan. through June					Monthly Extremes	
Division	Total	Dep. [1]	% Normal	Total	Dep. [1]	% Normal	Ave	Dep. [1]	Max	Min
Northwest	1.06	-2.10	33	5.88	-4.88	54	77.1	6.3	118	43
West Central	1.25	-1.78	40	5.99	-4.14	58	77.7	5.9	115	42
Southwest	1.46	-1.60	46	7.36	-2.56	73	78.6	5.1	113	44
North Central	2.92	-0.99	71	9.84	-3.70	71	77.4	4.1	114	38
Central	2.69	-1.68	61	10.74	-3.71	74	77.8	3.7	115	40
South Central	2.63	-1.51	63	13.61	-0.59	95	77.4	2.3	110	44
Northeast	4.46	-0.76	86	13.48	-3.56	79	76.4	3.4	105	40
East Central	2.30	-3.27	41	13.12	-5.18	72	76.7	3.4	106	43
Southeast	2.30	-2.80	45	19.40	0.36	101	75.8	1.4	105	45
STATE	2.28	-1.86	53	11.17	-2.91	76	77.2	4.0	118	38

1. Departure from 1981-2010 normal value
2. State Highest temperature: 118 degrees F at Norton Dam (Norton County) on June 28th. All-time record high for location and state for June.
3. State Lowest temperature: 38 degrees F at Burr Oak (Jewell County) on June 1st.
4. Greatest 24hr rainfall: 3.24 at Belleville, Republic County on the 15th; 3.80 at Seneca, Nemaha County on the 15th.

Source: KSU Weather Data Library

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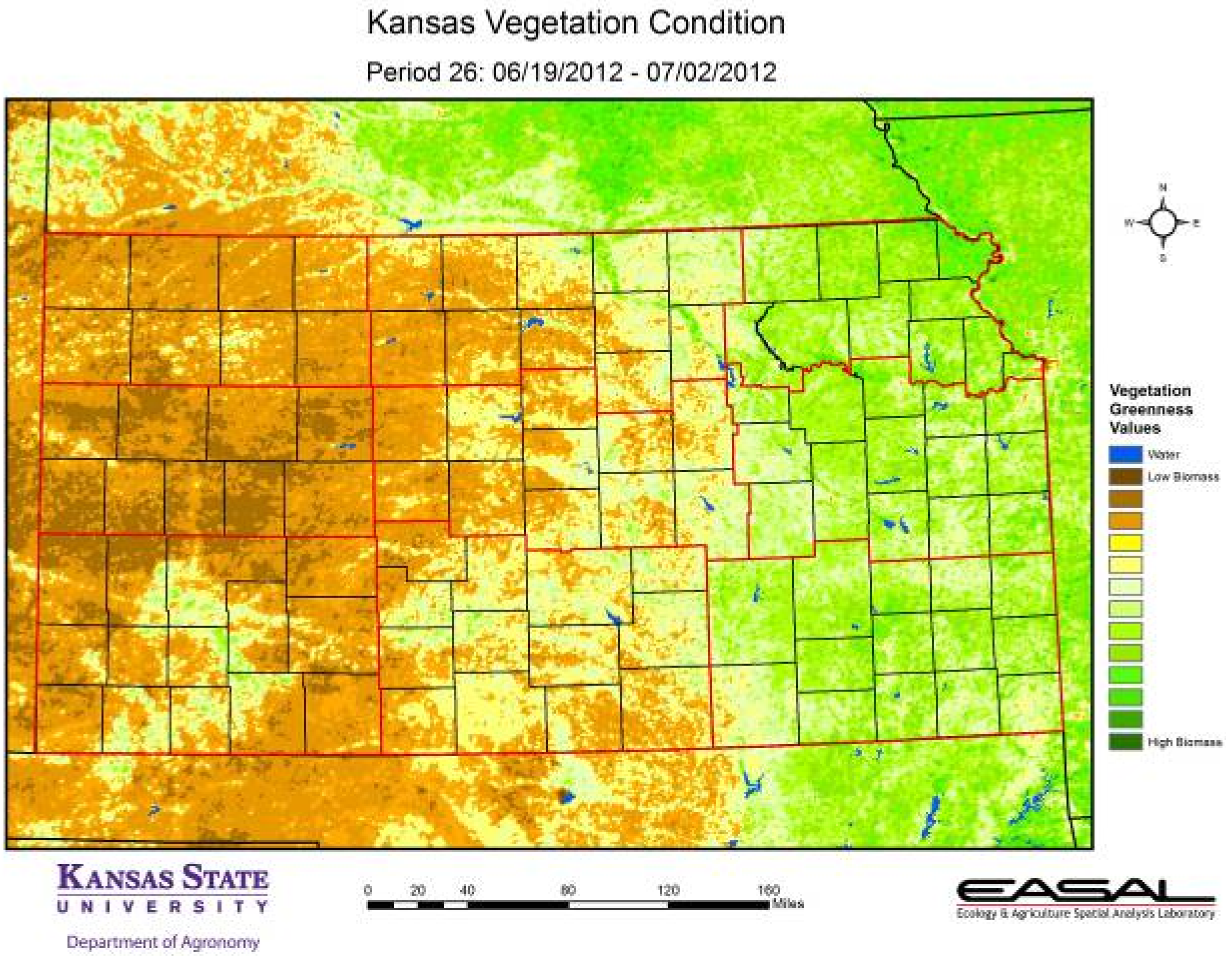
5. Comparative Vegetation Condition Report: June 19 – July 2

K-State's Ecology and Agriculture Spatial Analysis Laboratory (EASAL) produces weekly Vegetation Condition Report maps. These maps can be a valuable tool for making crop selection and marketing decisions.

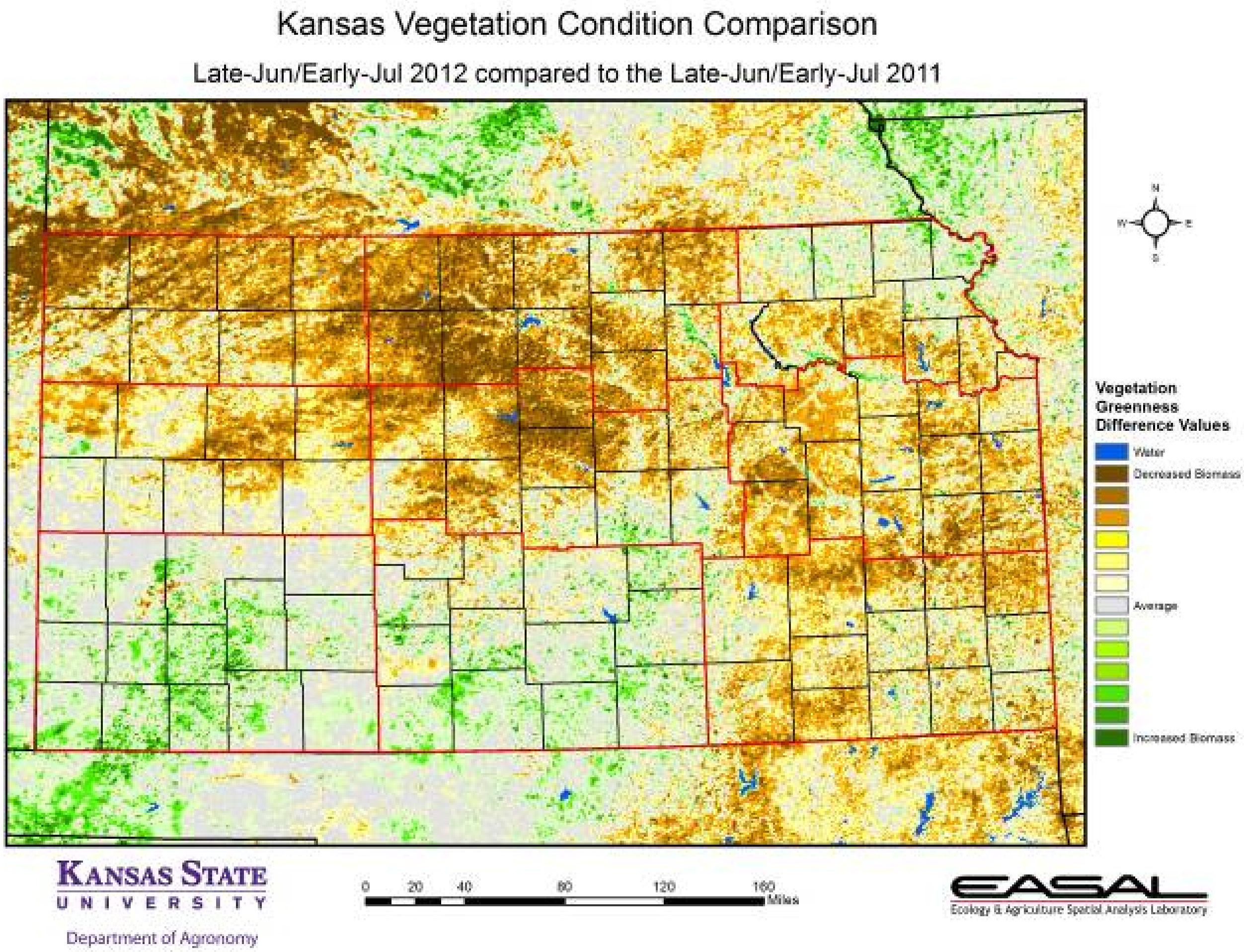
Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:
http://www.youtube.com/watch?v=CRP3Y5NIggw
http://www.youtube.com/watch?v=tUdOK94efxc

The objective of these reports is to provide users with a means of assessing the relative condition of crops and grassland. The maps can be used to assess current plant growth rates, as well as comparisons to the previous year and relative to the 21-year average. The report is used by individual farmers and ranchers, the commodities market, and political leaders for assessing factors such as production potential and drought impact across their state.

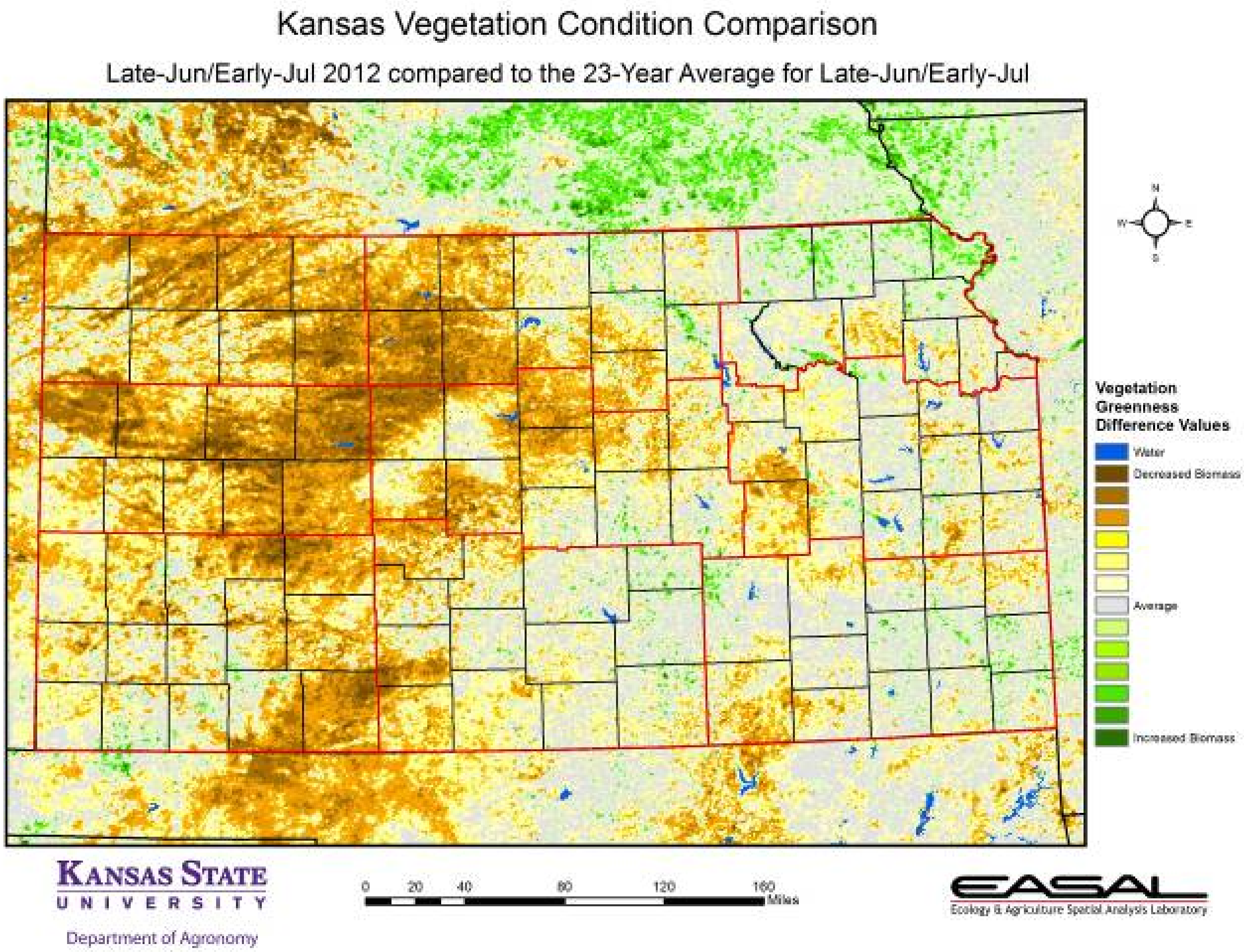
The maps below show the current vegetation conditions in Kansas, the Corn Belt, and the continental U.S, with comments from Mary Knapp, state climatologist:



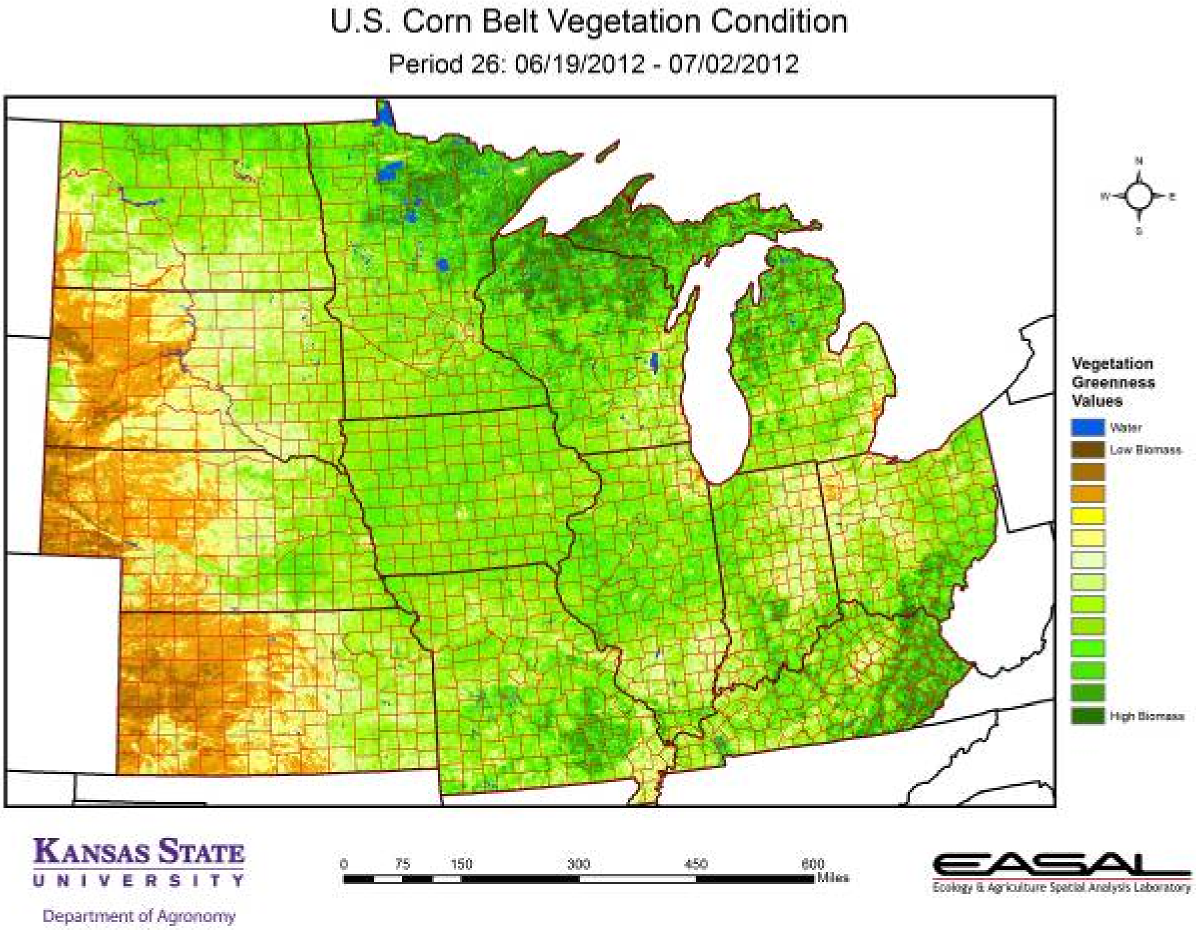
Map 1. The Vegetation Condition Report for Kansas for June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the low NDVI values continue to expand eastward. There is a small area of southwest Kansas where rains have been closer to average which has resulted in moderate photosynthetic activity.



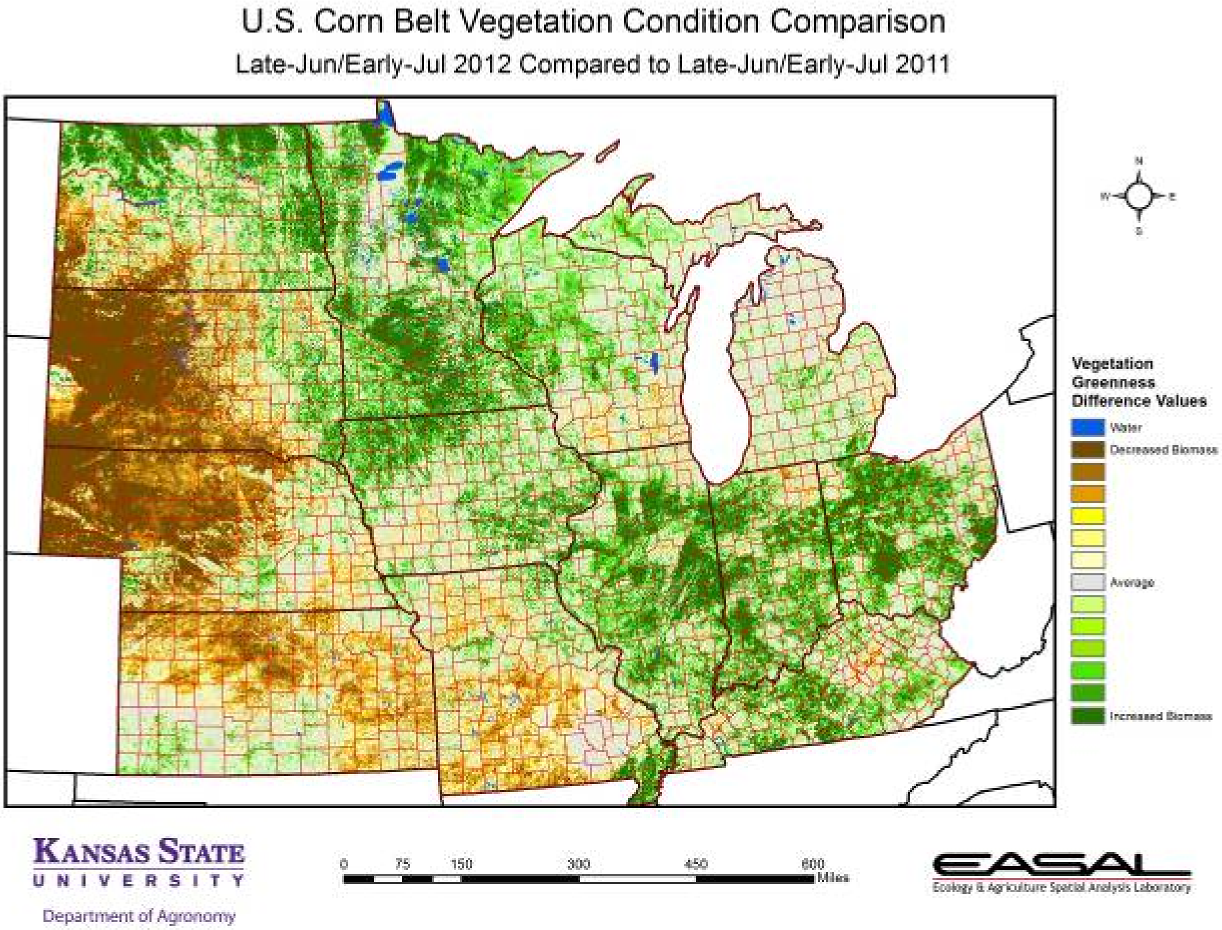
Map 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the Southwest and South Central Divisions have greater biomass production. Much of this is due to the extremely poor conditions in these areas last year. In contrast, last year the Northwest and North Central Divisions had above-normal precipitation and corresponding biomass productivity, resulting in a larger negative comparison to this year.



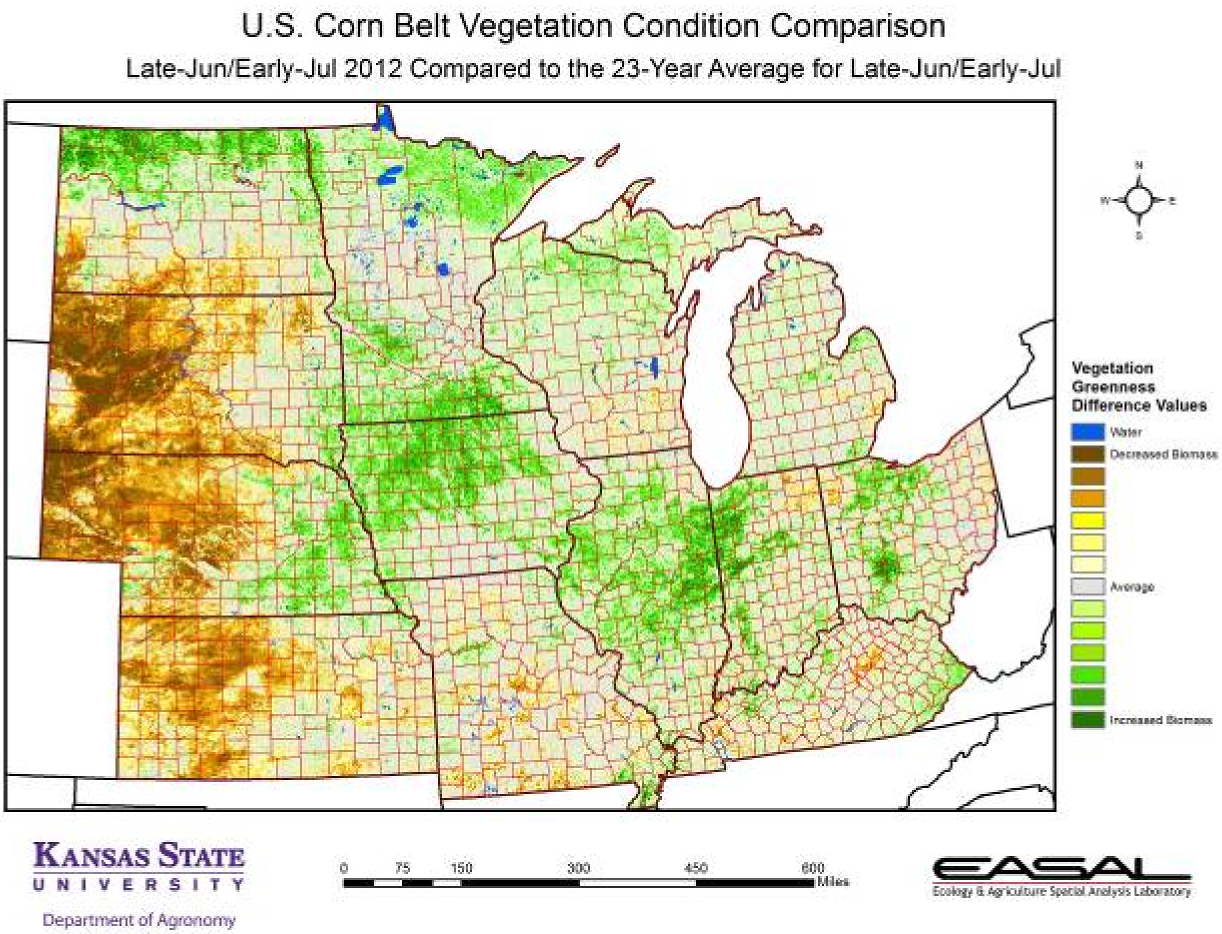
Map 3. Compared to the 23-year average at this time for Kansas, this year's Vegetation Condition Report for June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that only a few areas in northeast Kansas have slightly above-normal productivity. In Nemaha County, several locations had almost an inch above-normal rainfall for June this year.



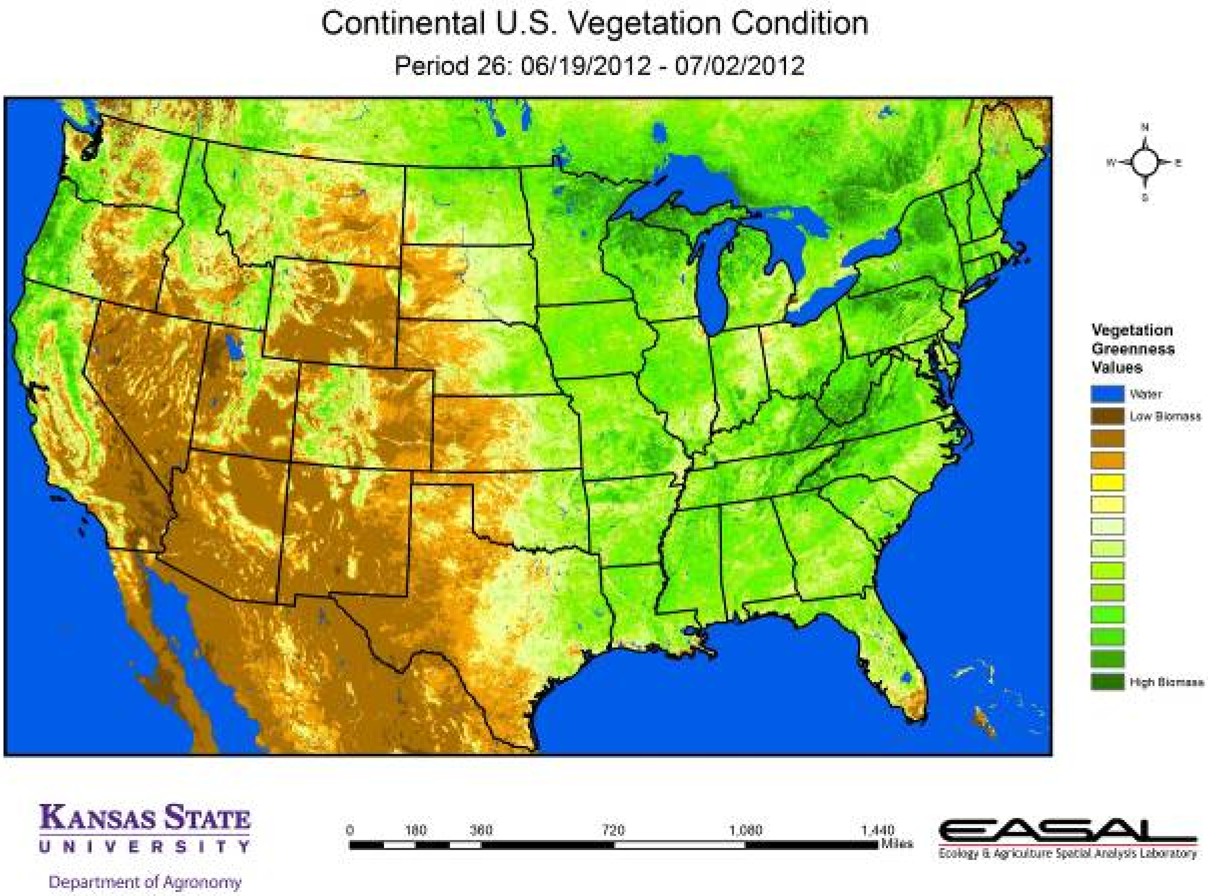
Map 4. The Vegetation Condition Report for the Corn Belt for June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that high biomass productivity is confined to northern Minnesota, Wisconsin, and Michigan. Another band of high photosynthetic activity can be seen in eastern Kentucky. Plant productivity is decreasing in the western portions of the region as heat and lack of moisture continue.



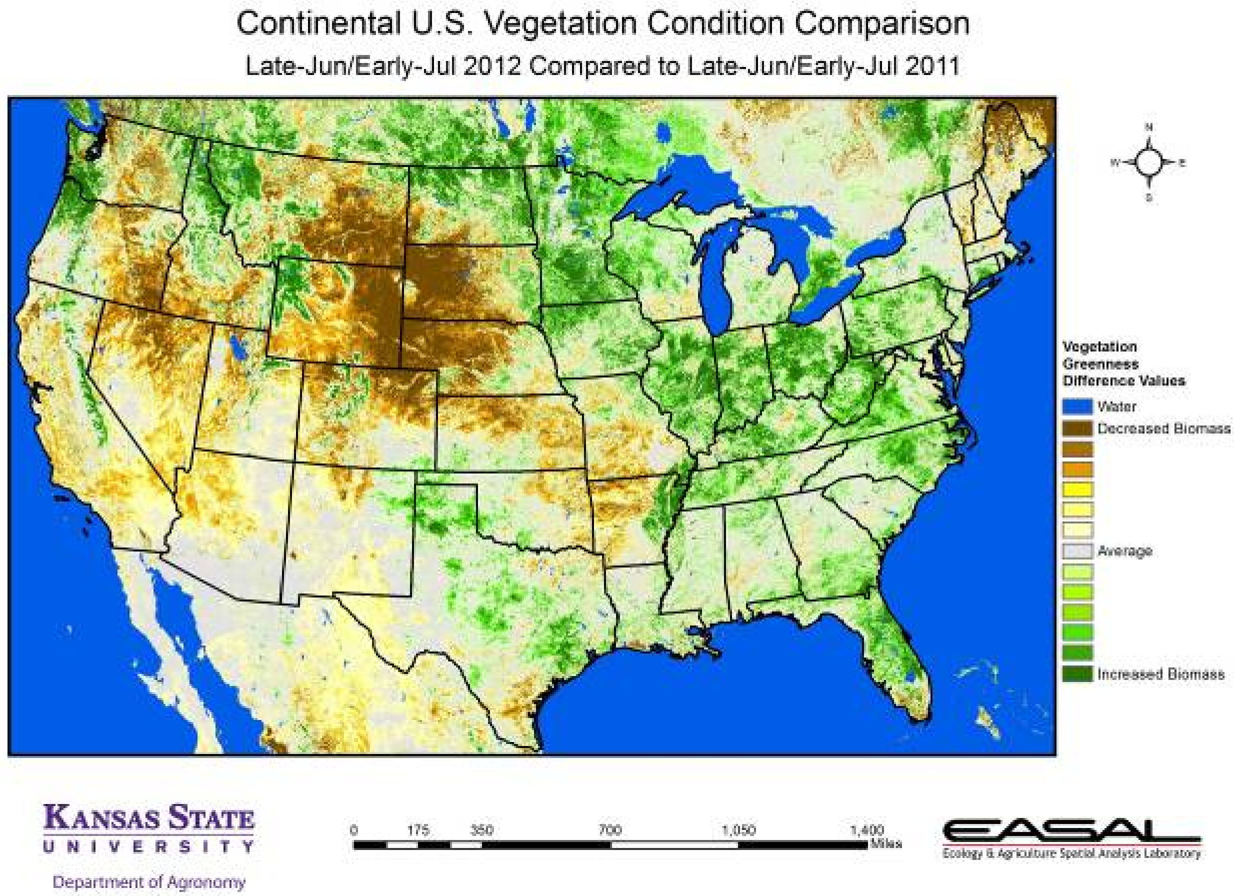
Map 5. The comparison to last year in the Corn Belt for the period June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that low biomass productivity is particularly notable in western South Dakota and western Nebraska, where spring greenup was limited. Last year, these areas enjoyed much more favorable moisture and temperatures. In contrast, the Northern Plains has experienced less flooding this year, and thus more favorable conditions for plant development. The decrease in photosynthetic activity compared to last year is also pronounced in northern and eastern Kansas and western Missouri. The increased productivity seen in Illinois, Indiana, and Ohio reflects the poor conditions present last year due to flooding, and not necessarily favorable conditions this year.



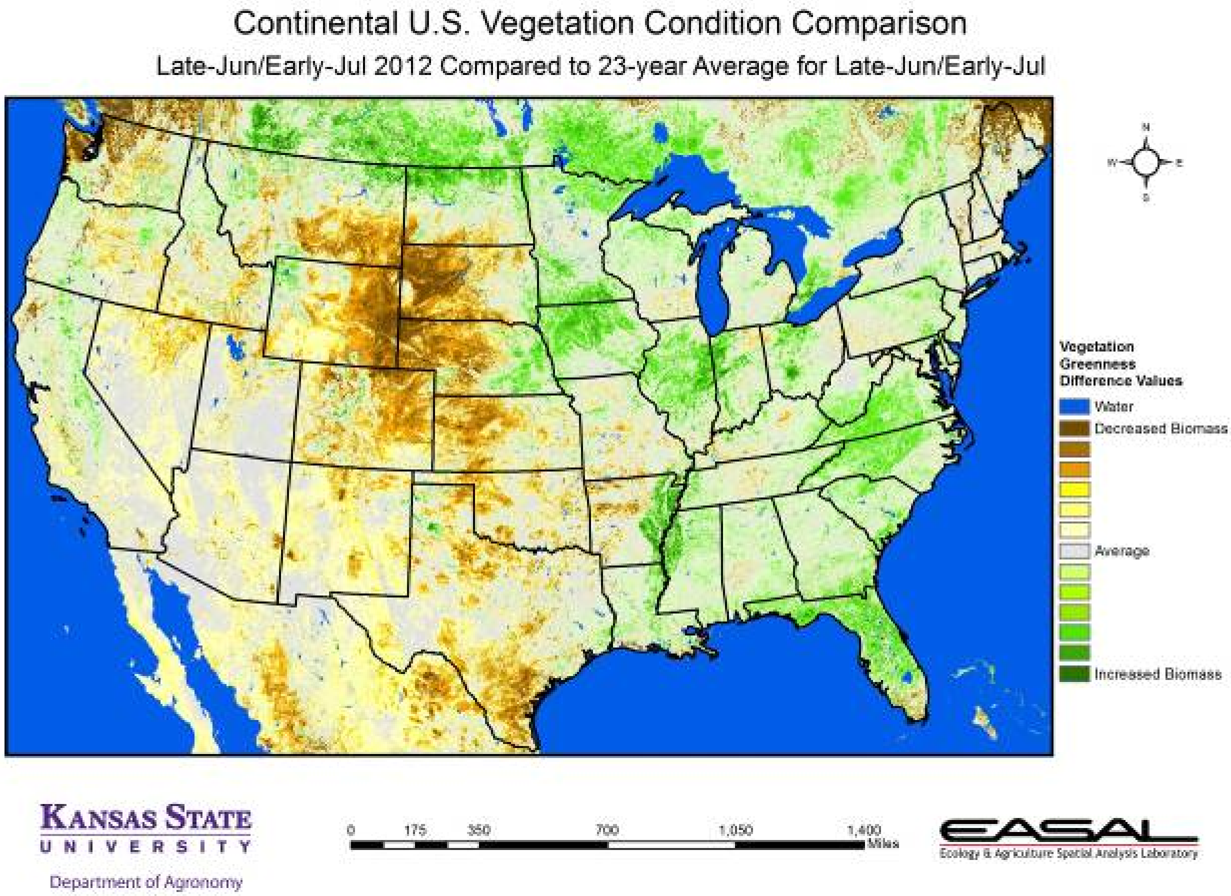
Map 6. Compared to the 23-year average at this time for the Corn Belt, this year's Vegetation Condition Report for June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows decreased biomass production in the western portions of the region. The area of below-average photosynthetic activity is also expanding in Missouri, Kentucky, and Indiana as drought conditions expand in these regions.



Map 7. The Vegetation Condition Report for the U.S. for June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that highest NDVI values are limited to the Upper Midwest and the higher elevations of the Appalachians. In the Southeast, the lowest NDVI values are confined to the southern tip of Florida, which didn't see as much moisture from the tropical systems in June as did the middle and northern portions of the state.



Map 8. The U.S. comparison to last year at this time for the period June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the Ohio River Valley and portions of Texas have the greatest increase in photosynthetic activity. Last year, much of the Upper Midwest was suffering from the impacts of flooding, while Texas was in exceptional drought. In contrast, last year Wyoming, South Dakota, Nebraska, and northern Kansas enjoyed favorable moisture and temperature that is not present this year.



Map 9. The U.S. comparison to the 23-year average for the period June 19 – July 2 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the biggest area of below-average photosynthetic activity is concentrated in the central High Plains, particularly in areas of Wyoming, southern Montana, and western South Dakota, Nebraska, and Kansas. The extremely high temperatures and low humidity have had large negative impacts on the vegetation.

Note to readers: The maps above represent a subset of the maps available from the EASAL group. If you'd like digital copies of the entire map series please contact us at kpprice@ksu.edu and we can place you on our email list to receive the entire dataset each week as they are produced. The maps are normally first available on Wednesday of each week, unless there is a delay in the posting of the data by EROS Data Center where we obtain the raw data used to make the maps. These maps are provided for free as a service of the Department of Agronomy and K-State Research and Extension.

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These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time.
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