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1. Considerations when harvesting drought-stressed corn for grain

Corn harvest has already begun in parts of Kansas. Dryland grain yields are below average so far, as expected. In addition to low grain yields, harvest may present some challenges when drought is a major factor in corn.

Aflatoxins

Drought-stressed corn may have high levels of aflatoxin (see article below). Aflatoxin levels may increase in storage if the corn is held very long at moisture levels above 14 percent. Growers intending storage for more than a week or two should have the corn tested for aflatoxin. Corn testing above 100 ppb should probably not be stored long-term.

One strategy to safely feed high aflatoxin corn is to ammoniate it with anhydrous. A publication from Texas A&M describing this process can be found at <http://agnewsarchive.tamu.edu/drought/drghtpak98/drght21.html>

Ammoniation is not a simple or foolproof process, so it might be preferable to blend corn that exceeds the 300 ppb threshold for finishing cattle. However, ammoniation might be an option for livestock producers. The publication suggests 0.5 to 1.5 percent anhydrous ammonia per dry weight of corn (48 lbs per bushel when not considering moisture). At 1 percent the producer would need 0.48 lbs of anhydrous ammonia. With an approximate anhydrous cost of \$700/ton, it would cost roughly \$0.17/bu to treat. See the publication for more specific rates based on different aflatoxin corn conditions.

Ear Drop

Ears may drop more easily in corn that has gone through a droughty growing season. Some causes of increased ear drop include:

- The ear shank may not develop normally in stressed conditions.
- Rapid drydown may result in brittle tissue where the ear attaches.
- A “pinched shank” or constriction on one side of the shank may occur. This is usually associated with missing kernels on the butt of the ear on the same side as the pinch.
- Hybrid differences. For example, some hybrids may have a smaller-diameter shank attachment
- Fusarium stalk rot (pink stalk rot) may infect the ear shank, causing deterioration of the tissues and greater numbers of dropped ears.

Stalk Lodging

Droughty conditions, especially during grain fill, can predispose corn to a number of stalk rots, which in turn may result in stalk lodging. Stalk lodging in corn occurs when the stalk weakens and breaks at some point below the ear. When this occurs, it results in harvest losses and slows down harvesting considerably. Grain moisture levels may also be unacceptably high in lodged corn.

We often find stalk rot disease organisms (charcoal rot, *Fusarium*, *Gibberella*, anthracnose, and others) on corn with stalk lodging. Although stalk rot is often the ultimate cause of lodging, in most cases, the stalk rot diseases were only able to infect the plants because certain other factors predisposed the plants to disease infection. Such factors include:

* *Hybrid differences in stalk strength or stalk rot susceptibility.* Some hybrids have genetically stronger stalks than others. This is often related to a hybrid’s yield potential and how it allocates carbohydrates during grain fill. But there are also genetic differences in stalk strength due to other reasons, including better resistance to stalk rot diseases. If a field of corn has stalk lodging problems, it could be due in part to hybrid selection.

* *Poor root growth and other stresses.* Cold, waterlogged soils early in the season; severe drought; and soil compaction all can result in small, inadequate root systems. Under these conditions, the roots may not be able to effectively extract enough water and nutrients from soil to support plant growth and carbohydrate production. When carbohydrate production is below normal during any part of the growing season, the ears will continue to take what they need during grain fill, which can leave the stalks depleted even under average yield conditions. The developing ear always has priority for carbohydrates within the plant.

* *Poor leaf health.* Any factor that results in poor leaf health will reduce carbohydrate production during the season. If overall carbohydrate reserves in the plants are low when grain fill begins, stalk integrity will often suffer as the available supply of carbohydrates moves into grain production. Maintaining good leaf health is important in minimizing stalk rots. The more photosynthesis, the less need for the plant to tap stalk reserves. Stay green characteristics in hybrids are highly correlated to stalk rot resistance and reduced lodging.

* *High populations.* Plants can become tall and thin when populations are too high, which can result in thin stalks with inadequate strength. In addition, plant-to-plant competition for light, nutrients, and

water enhances the competition for carbohydrates between the stalk and ear within the plant, thus reducing the vigor of the cells in the stalk and predisposing them to invasion by stalk rot.

* *Nutrient imbalances and/or deficiencies* predispose corn plants to stalk rot and stalk lodging. Both potassium and chloride deficiency have been shown to reduce stalk quality and strength, and stalk rot resistance. High nitrogen levels coupled with low potassium levels increase the amount of premature stalk death, and create an ideal situation for stalk rot and lodging. Soil chloride levels should be maintained above 20 lbs per acre.

* *Corn rootworm and corn borers*. Damage caused by corn rootworm and the European corn borer can predispose the corn plant to invasion by stalk rotting organisms, as well as lead to outright yield loss.

* *Mid-season hail damage*. Similar to the damage caused by insects, the physical damage caused by mid-season hail can set up the plant for invasion by stalk rotting organisms. Stalk bruising and the resulting internal damage may also physically weaken corn stalks, making them more likely to lodge later in the season.

Summary

Where corn has been under drought stress, there is increased likelihood for small kernels, dropped ears, stalk lodging, and grain toxins. In this situation, it is especially important that corn is harvested in a timely manner and with a well-adjusted combine after a dry growing season.

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2. Aflatoxin in corn: A potential concern in dry years

Aflatoxin is likely to be a problem again this year on drought-stressed corn in Kansas. Aflatoxin, produced by the fungus *Aspergillus flavus*, is a greenish-yellow, dime- to quarter-sized mold that grows on corn ears between the kernels. In severe cases, the mold may cover much larger portions of the ear (See photo). It tends to be favored by hot, humid, and droughty conditions and for that reason, is more often found in eastern Kansas rather than in the less-humid western counties.



Aspergillus is a yellowish-green mold. Photo by Doug Jardine, K-State Research and Extension.

Many elevators that have used the outdated “black light” test are now switching over to more sophisticated quantitative tests that can be performed in a very short period of time right at the point of delivery. Samples testing at less than 100 ppb are usually accepted without penalty. Levels over 100 ppb may be docked a percentage or not accepted at all.

The FDA has established 20 parts per billion [ppb] or higher as the level deemed unsafe for human consumption. However, buyers of corn for consumption by humans or pets typically have much more stringent standards and may require levels to be 10 ppb or less. Ethanol plants may also refuse aflatoxin contaminated grain since the toxin is heat stable and can concentrate as much as three- to four-fold in the distiller’s grains. Aflatoxin contaminated corn at any level should not be fed to lactating dairy cows because it can be passed through to the milk.

At 20 to 100 ppb, corn can still be fed to breeding cattle, swine, and mature poultry. Grain testing at 100 to 200 ppb can be used for finishing swine over 100 pounds and for beef cattle. For levels between 200 and 300 ppb, uses are limited to finishing beef cattle only.

Grain with aflatoxin levels higher than 300 ppb cannot be used as feed unless it has been cleaned or blended to safe levels. Blended corn can only be used for direct feeding on the farm where it is blended. It cannot be sold.

Drought stressed corn harvested for silage may also contain aflatoxin. Producers wishing to have silage tested for aflatoxin can do so through the Veterinary Medicine Diagnostic Lab at the University of Missouri. See their website at <http://www.vmdl.missouri.edu/services.html> for information on pricing and sample submission.

Once the fungus is detected in grain, the affected corn should be separated from “sound” corn and extra care used in cleaning bins that held contaminated corn.

Producers can reduce the incidence of aflatoxin and other mycotoxins after harvest by taking the following precautions:

- * Harvest when moisture content allows minimum kernel damage [24 to 26 percent].
- * Adjust equipment for minimum kernel damage and maximum cleaning.
- * Dry shelled grain to at least 15 percent moisture, 24 to 48 hours after harvest.
- * Dry grain to below 13 percent moisture for long-term storage.
- * Cool the grain as quickly as possible after drying to 35 to 40 F, realizing that with current weather conditions, this is not feasible.
- * Aerate and test for "hot spots" at one- to four-week intervals during the storage period.

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3. Irrigation capacity for extreme drought conditions

During a drought, irrigation can obviously help the crop avoid being stressed, but there are limits to how much irrigation can help. A portion of the crop water budget, even in irrigated fields in western Kansas, is expected to be met by precipitation or stored soil water accumulated from off-season precipitation or preirrigation. Irrigation systems are sized with this in mind. As a general rule, on soils with high water-holding capacity, such as silt loams, an irrigation capacity of about 0.25 inches/day is needed to have a reliable irrigation system. On soils with low water-holding capacity, 0.32 inches/day may be needed to achieve the same reliability.

Typical peak crop water use rates average about 0.35 inches/day, so drawdown of the soil water content in the root zone is expected if irrigation is the only water source available for extended periods during the growing season -- without being occasionally supplemented by rainfall. Single daily crop water use rates can approach and occasionally exceed 0.50 inches/day. During drought periods, crop water use rates would be higher than normal.

Many irrigated producers are experiencing the double jeopardy of decreased rainfall and higher-than-normal crop water use caused by high heat and dry winds. In some fields the crop may have already depleted the entire available root zone soil water reserve. What irrigation options are available in those situations to minimize crop yield loss? Increasing the flow rate (irrigation capacity) to a crop is generally not an option because the source of supply is a well with a fixed flow rate. The only practical but painful option is to abandon some acreage and concentrate the water on the remaining acreage.

The most likely scenario is that the soil water reserves are already depleted, so the area to try to salvage should allow an irrigation capacity of 0.32 in/day or greater.

Irrigation capacity (IC) is determined by dividing the system flow rate in gallons per minute (GPM) by 450 (450 GPM = 1 ac-in/hr), then multiplying that rate by the number of hours of daily pumping, and then dividing by the number of irrigated acres. This is the gross irrigation capacity. Multiply the gross irrigation capacity by the system efficiency to obtain the net IC.

The number of acres that can be irrigated for an irrigation capacity that will support crop growth can be calculated as follows:

$$\text{Irrigated acres} = \frac{\text{System GPM}/450 \times 24 \text{ hrs/day}}{\text{Gross IC} \times \text{Efficiency}}$$

Example: To determine how many acres can be irrigated for a target IC of 0.35 in/day, with a system flow rate of 600 GPM and an irrigation system efficiency of 90 percent:

$$\text{Irrigated acres} = \frac{600 \text{ GPM}/450 \times 24 \text{ hrs/day}}{0.35 \text{ in/day} \times 0.9} = 102 \text{ acres}$$

Approximately 102 acres of a crop currently experiencing water stress might be able to be salvaged in this scenario.

Three software tools may also be of help to decide the best course of action. These include:

1. KanSched: an ET-based irrigation scheduling tool
(see download link at <http://www.ksre.ksu.edu/mil>)
2. Crop Yield Prediction (<http://www.ksre.ksu.edu/mil/YieldEstimator.htm>)
3. Crop Water Allocator (<http://www.ksre.ksu.edu/mil/cwa>)

These tools were not designed specifically to look at the question of diverting water from one portion of the field to another, but could provide some insight about different scenarios by examining output for multiple runs with different assumptions. However, selecting the number of acres to water in salvage should be based on estimated crop water use and irrigation capacity as described above.

Before making any decisions about changing irrigation practices, please discuss this with your crop insurance representative (and see article on this topic in the July 20, 2012 edition of the Agronomy e-Update).

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4. Southern rust in corn

Of all the diseases on corn, southern rust is the one that typically occurs latest in the season. It occurs slightly less frequently in Kansas than common rust or gray leaf spot, but more frequently than anthracnose leaf blight, northern corn leaf blight, or Goss's wilt.

In terms of impact, only gray leaf spot has the potential to cause more yield loss under moderate to severe infections than southern rust.

Southern rust does not overwinter in Kansas. Spores blow up from southern production areas in mid- to late-July. Hot, humid weather favors infection.

Southern rust pustules look similar to common rust, but there are usually a lot more of them and they usually occur only on the upper leaf surfaces. This often gives the upper leaves a dusty appearance. Common rust on the other hand, has pustules that break through on both the upper and lower leaf surfaces with spores that are dark, cinnamon brown compared to the lighter colored southern rust spores (See photo below). K-State publication MF-3016, *Corn Rust Identification and Management in Kansas* has more information on the identification and management of these two diseases and can be found at: <http://www.ksre.ksu.edu/library/plant2/mf3016.pdf>.

Many hybrids have excellent resistance to southern rust and their use is the best choice for rust management. In Kansas, greatest yield losses to southern rust occur when susceptible hybrids are planted late or when the disease arrives earlier than normal. When either of these situations occurs and weather conditions are favorable, applications of a systemic foliar fungicide may be justified. Products containing a triazole mode of action fungicide are recommended.



Southern rust (left) and common rust on corn.

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5. Crop insurance considerations regarding summerfallow and cover crops

The following information on summerfallow and cover crops in Kansas is from the Topeka Regional Office of the USDA's Risk Management Agency.

Q: How is "summerfallow" defined?

A: Summerfallow -- A production practice utilized to allow soil moisture levels to increase by leaving acreage fallow for a full crop year. To qualify for this practice for the current crop year, the acreage must not have been planted to a crop the preceding crop year and lie fallow for a full crop year. In addition, any plant growth (e.g., weeds, volunteer crop, etc.) must be terminated no later than JUNE 1 and any later plant growth must be controlled by mechanical or chemical means. However, if a crop was planted on acreage qualifying as summerfallow the preceding crop year but was terminated by JUNE 1, and any later growth is controlled by mechanical or chemical means, the

acreage will qualify as summerfallow the next crop year. For example, if wheat planted in the fall of 2011 (2012 crop year) qualifies as summerfallow and the wheat is terminated by JUNE 1, 2012, and any later growth is controlled by mechanical or chemical means, wheat planted in the fall of 2012 (2013 crop year) will qualify as summerfallow.

Q: What is the purpose of the "summerfallow" practice?

A: The summerfallow (SF) practice is available for non-irrigated wheat in semi-arid parts of Kansas, Nebraska and Colorado. Its purpose is to support the insurability of non-irrigated wheat plantings by reducing crop production risks associated with soil moisture depletion during fallow periods. The fallow period is defined as the preceding crop year.

Q: What is RMA's definition of a cover crop?

A: A crop generally recognized by agricultural experts as agronomically sound for the area for erosion control or other purposes related to conservation or soil improvement.

Q: The summerfallow practice is applicable in my county. From a crop insurance perspective, what are the consequences if I planted a cover crop during the fallow period that precedes planting wheat?

A: Planting a cover crop during the fallow period affects the insurability of your next wheat crop. In the above scenario, your next wheat crop would not qualify for the SF practice. Therefore, if continuous cropping is an insurable practice in your county, then your planted wheat can be insured under a continuous crop practice. However, if continuous crop practice is not available, then your planted wheat will not be insurable.

Q: I harvested a wheat crop in July 2011. On the advice of an agricultural expert, I planted a cover crop the following October. I will terminate it by June 1, 2012, and then plant wheat in October, 2012. Will my October 2012 planted wheat qualify for the summerfallow practice?

A: No. To qualify for the SF practice, the acreage must not have been planted to a crop the preceding crop year and remain fallow for a full crop year. In this example, your acreage did not remain fallow for the preceding full crop year, and your next wheat crop will not meet the SF criteria.

RMA recommends that you discuss your plans related to cover crops with your crop insurance agent prior to planting the cover crop.

Q: My acreage is currently in a perennial crop under a Conservation Reserve Program (CRP) contract. The CRP contract will soon expire, and I plan to start cropping the acreage again. What do I need to do so the acreage will qualify for the summerfallow practice?

A: In cases of a previously existing perennial crop, including those on previous CRP ground, the perennial crop must be terminated by mechanical or chemical means a full crop year before planting of the crop qualifying for the SF practice. This means the land must have been broken out of CRP by fall and lie fallow for a full crop year. Anything broken out in the spring to be planted in the fall would be considered a continuous cropping practice.

For more information, contact the [Topeka Regional Office](#).

-- Rebecca Davis, Director, Topeka Regional Office, USDA Risk Management Agency
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6. East Central Experiment Field Crop Production Field Day, August 15

The East Central Experiment Field in Ottawa will host a crop production field day on Wednesday, August 15. The field day begins at 9 a.m. with registration, coffee and doughnuts, and the program starts at 9:30 a.m. A complimentary lunch will be served.

Field day topics and K-State presenters include:

- * Current Research at the Field – Eric Adee
- * Cost and Returns from Precision Equipment – Craig Smith (Ft. Hays State University)
- * Pushing Soybeans to Higher Yields – Doug Shoup and Bryson Haverkamp
- * Drought-Tolerant Corn Hybrids in Kansas – Kraig Roozeboom
- * Challenges Controlling Waterhemp – Dallas Peterson and Curtis Thompson

From I-35 at the Ottawa exit, the East Central Experiment Field is south 1.7 miles on Kansas Highway 59, then east 1 mile, and south 0.75 mile.

More information is available by contacting the East Central Experiment Field at 785-242-5616.

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7. Comparative Vegetation Condition Report: July 10 – 23

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>

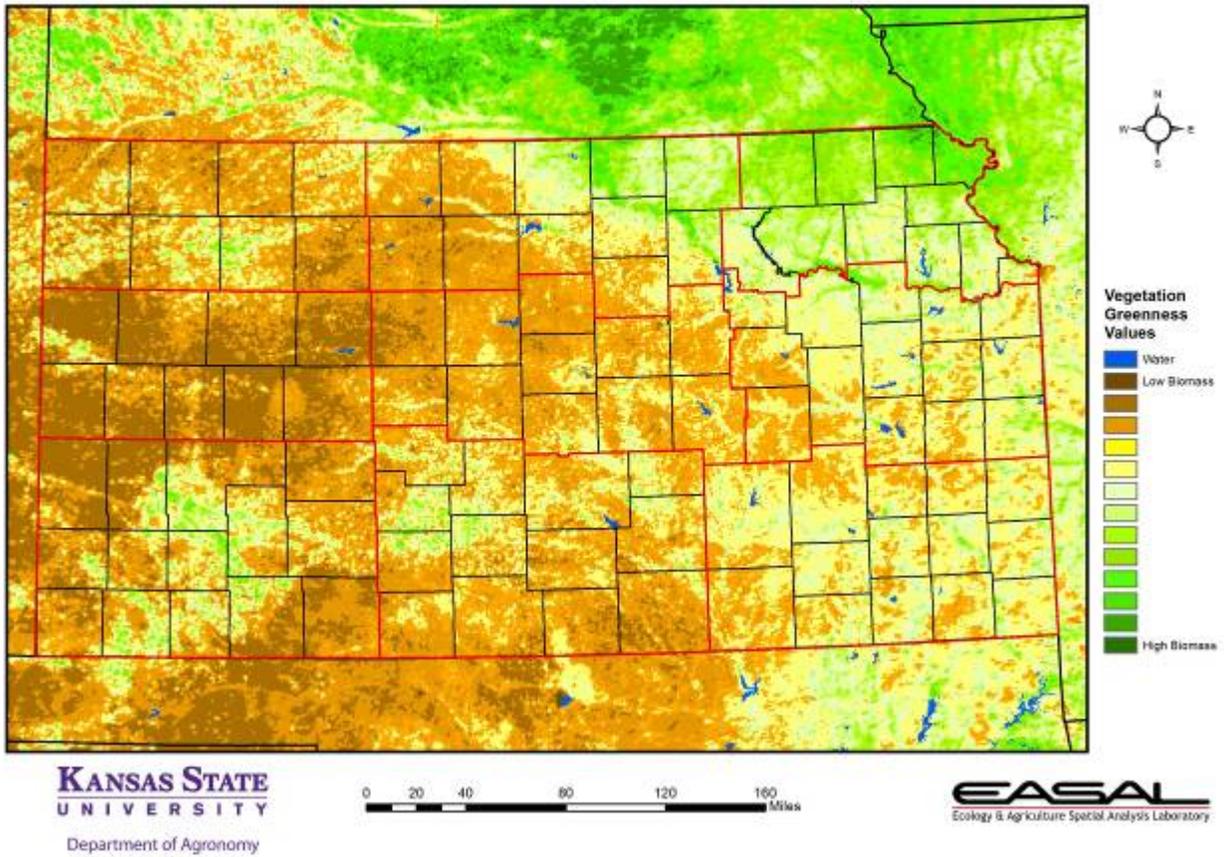
<http://www.youtube.com/watch?v=tUdOK94efxc>

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:

Kansas Vegetation Condition

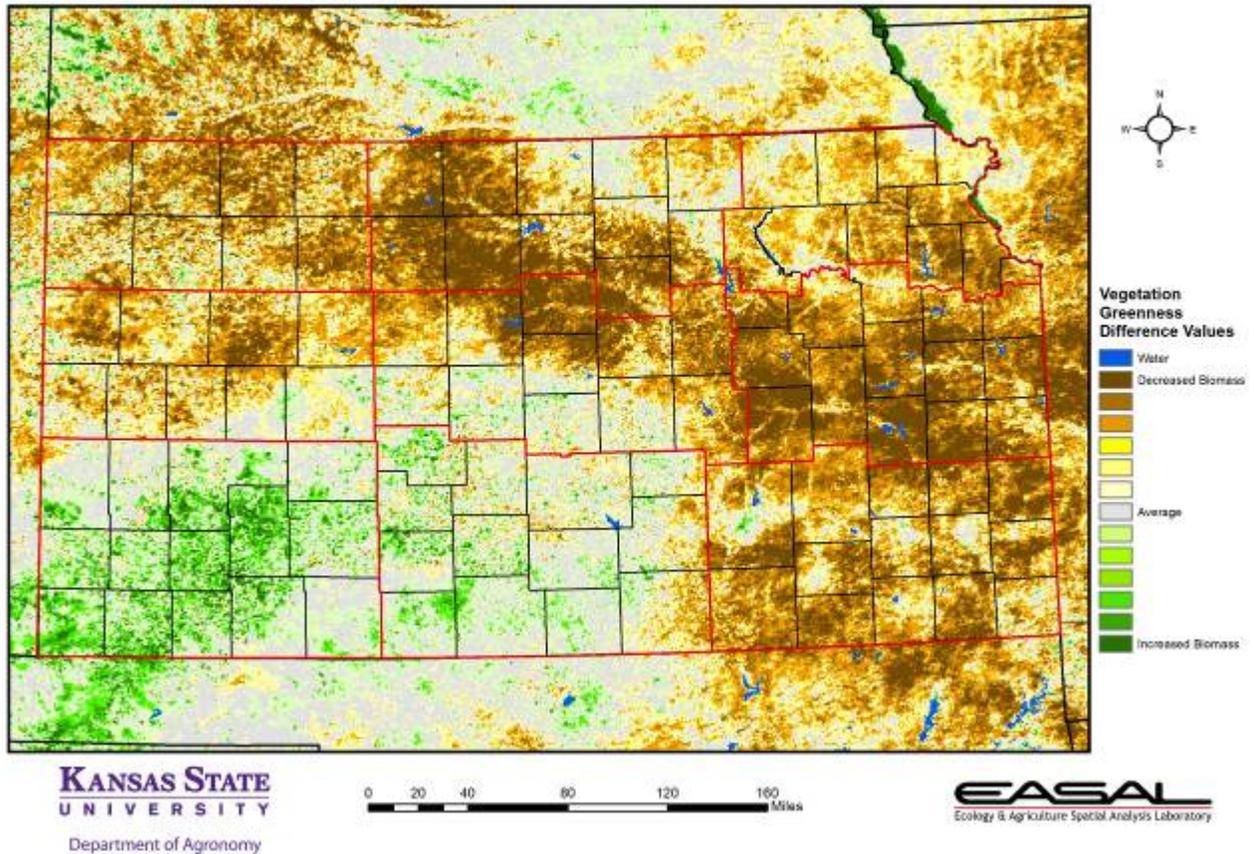
Period 29: 07/10/2012 - 07/23/2012



Map 1. The Vegetation Condition Report for Kansas for July 10 – 23 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that most photosynthetic activity is confined to northeast Kansas, north of the Kansas River Valley. In southwest Kansas, greatest signs of biomass production are in the irrigated areas.

Kansas Vegetation Condition Comparison

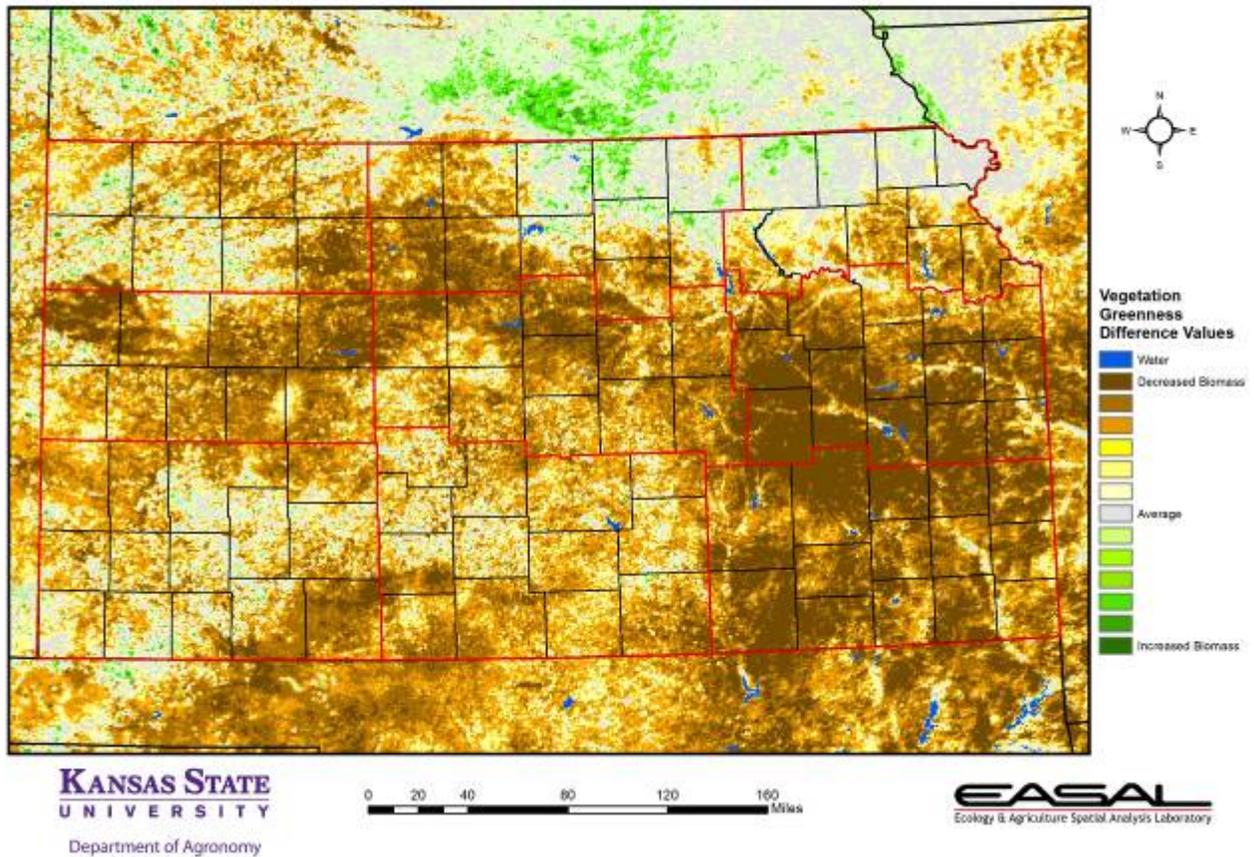
Mid-July 2012 compared to the Mid-July 2011



Map 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for July 10 – 23 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows what a difference a year can make. Much lower rainfall totals in the northern and eastern areas of the state have resulted in lower productivity. Meanwhile, in southwest and south central Kansas, current conditions are better than last year. This is due primarily to winter moisture, and is not indicative of good conditions. Last year’s conditions were extremely poor, so just a little productivity stands out.

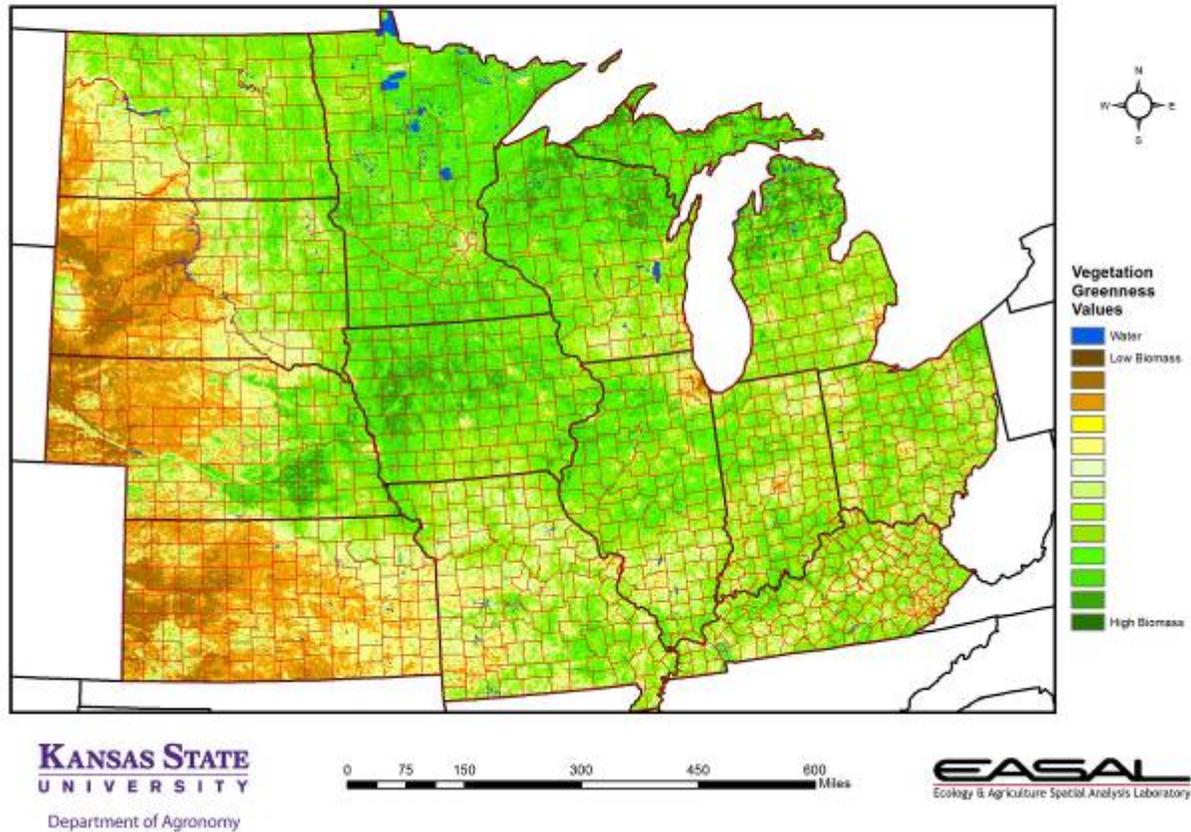
Kansas Vegetation Condition Comparison

Mid-July 2012 compared to the 23-Year Average for Mid-July



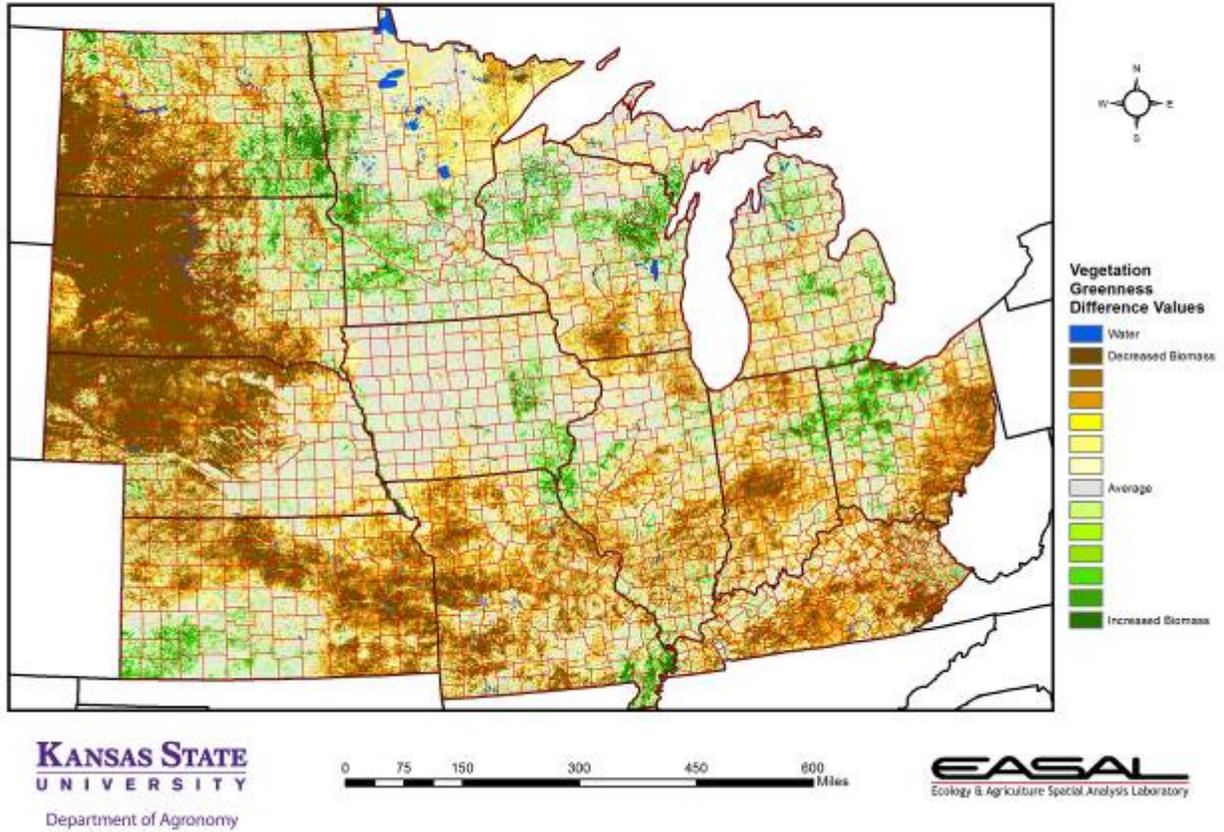
Map 3. Compared to the 23-year average at this time for Kansas, this year's Vegetation Condition Report for July 10 – 23 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that only a small area of north central Kansas is close to normal productivity. Jewell and Republic counties have had timely rains that have bypassed the rest of the state.

U.S. Corn Belt Vegetation Condition
Period 29: 07/10/2012 - 07/23/2012



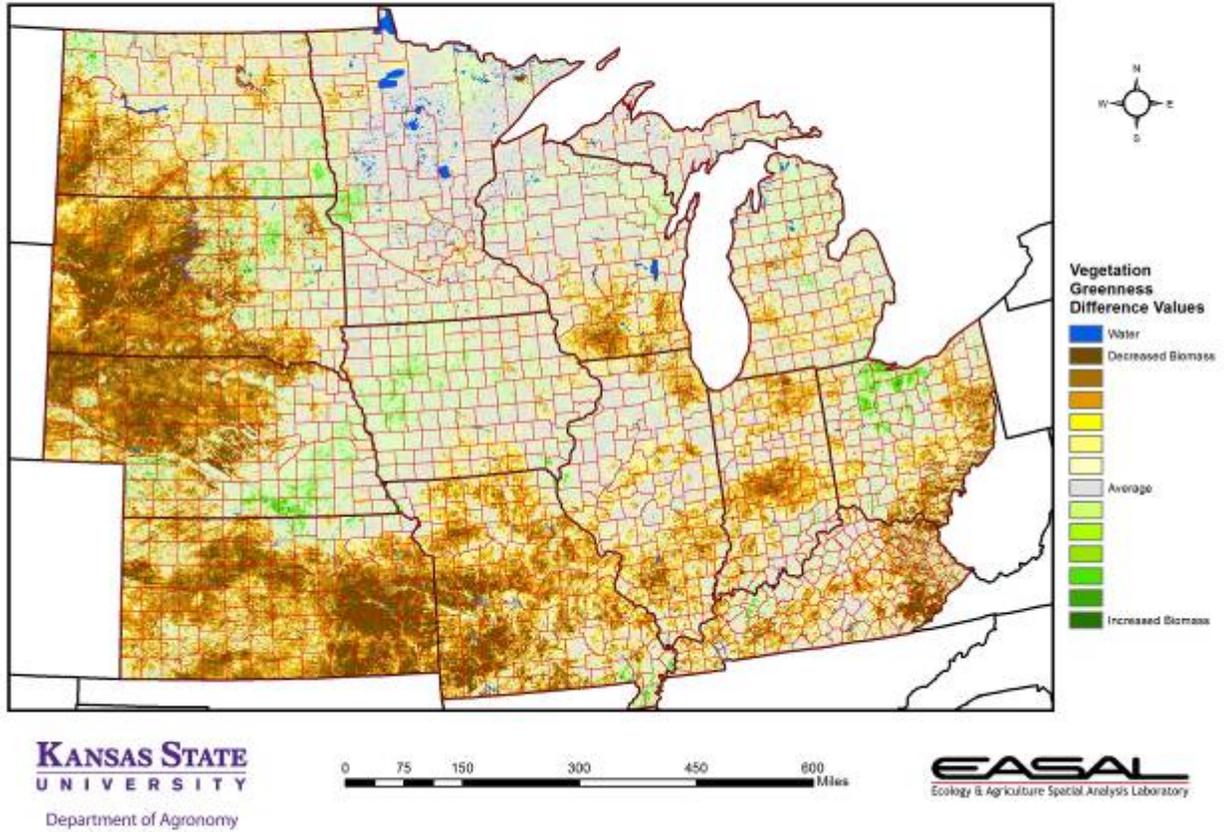
Map 4. The Vegetation Condition Report for the Corn Belt for July 10 – 23 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the greatest biomass production is confined to a narrow area from eastern Nebraska to Northern Michigan. The western portions of the Corn Belt are seeing little photosynthetic activity, which is in line with the low pasture and crop conditions being reported.

U.S. Corn Belt Vegetation Condition Comparison
Mid-July 2012 Compared to Mid-July 2011



Map 5. The comparison to last year in the Corn Belt for the period July 10 – 23 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows a few areas with apparently higher biomass production. In the northern and eastern areas, productivity had been limited by flooding last year. In southwest Kansas, the better conditions (compared to last year) are due mainly to the extremely poor conditions of last year, rather than any particularly good conditions this year.

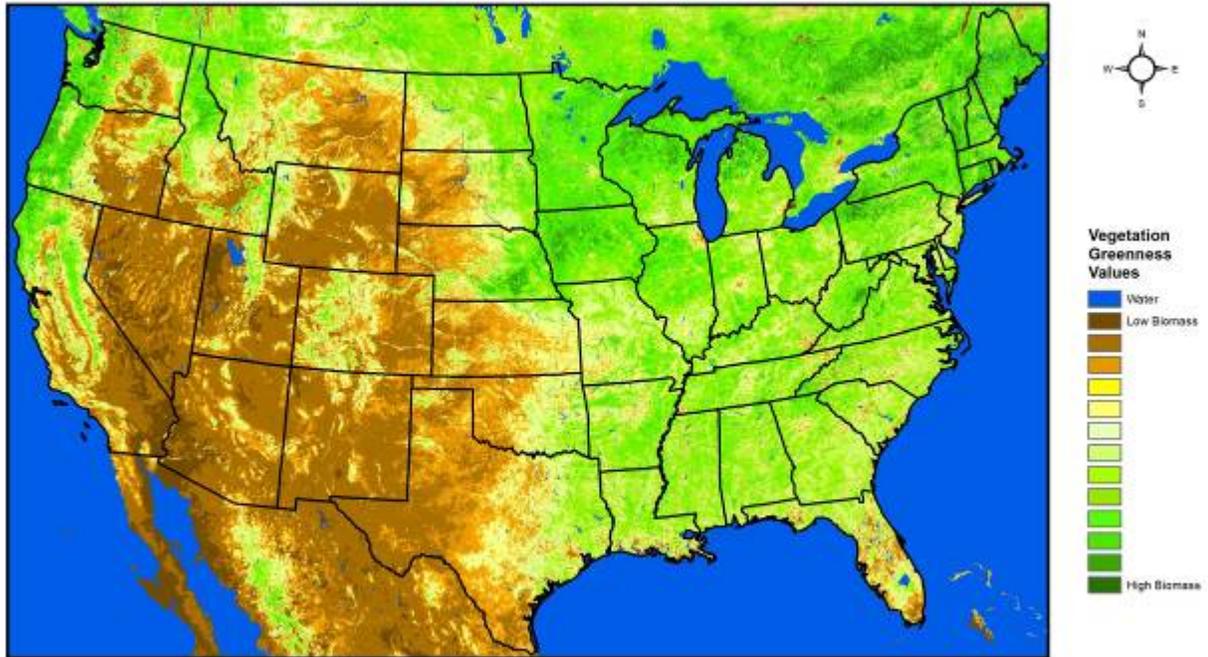
U.S. Corn Belt Vegetation Condition Comparison
Mid-July 2012 Compared to the 23-Year Average for Mid-July



Map 6. Compared to the 23-year average at this time for the Corn Belt, this year's Vegetation Condition Report for July 10 – 23 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows only a very small portion has above-normal photosynthetic activity. Almost a third of the region is in moderate to exceptional drought. Illinois has more than 70 percent of the state in extreme to exceptional drought.

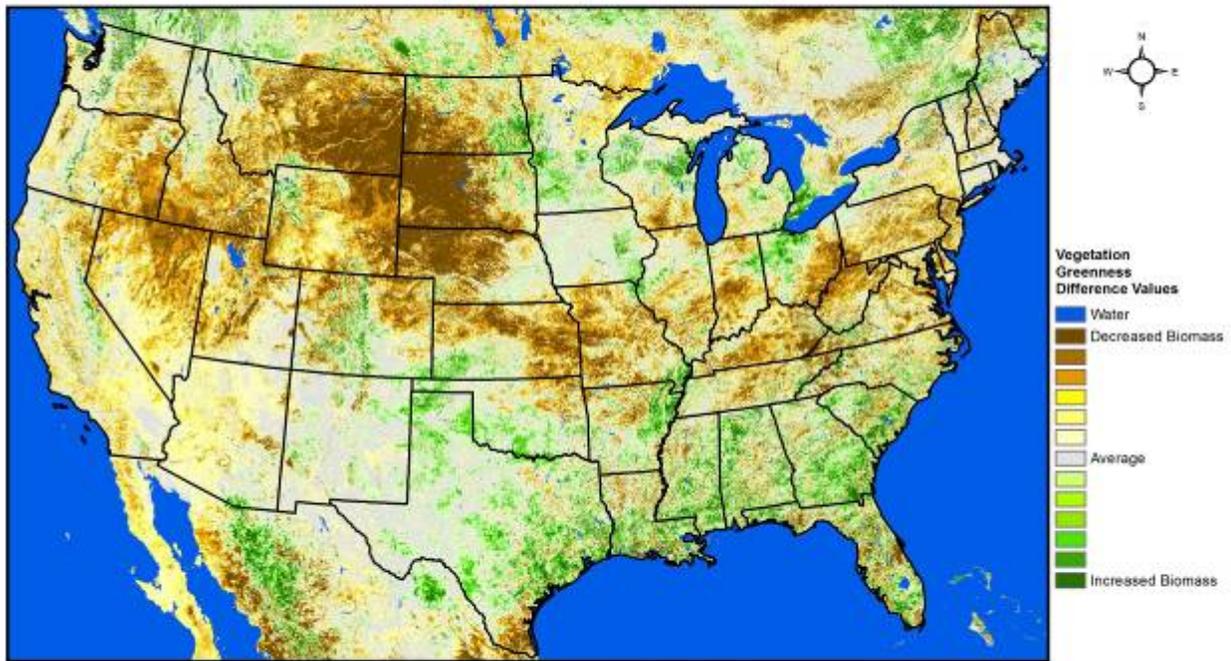
Continental U.S. Vegetation Condition

Period 29: 07/10/2012 - 07/23/2012



Map 7. The Vegetation Condition Report for the U.S. for July 10 – 23 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the area of high biomass production continues to shrink. Greatest photosynthetic activity can be seen in northern Maine, Vermont, and New Hampshire. Moderate activity is seen in the Pacific Northwest and in the Upper Midwest, where more favorable precipitation and temperatures have prevailed.

Continental U.S. Vegetation Condition Comparison
Mid-July 2012 Compared to Mid-July 2011



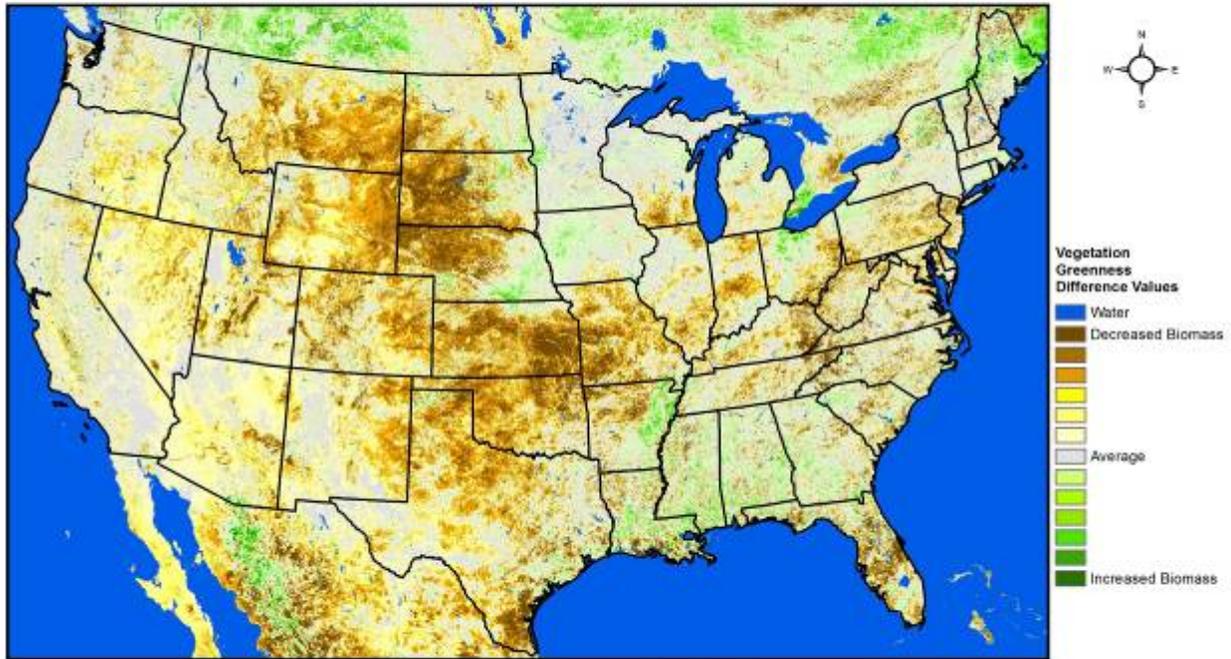
KANSAS STATE
UNIVERSITY
Department of Agronomy

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EASAL
Ecology & Agriculture Special Analysis Laboratory

Map 8. The U.S. comparison to last year at this time for the period July 10 – 23 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows the Northern Plains region has much lower biomass production. The wet conditions of last year have been replaced by much drier and hotter conditions this year. This decrease in favorable weather is also evident across the center of the U.S., into the Ohio River Valley. In the South, slightly more favorable growing conditions have resulted in higher biomass production this year.

Continental U.S. Vegetation Condition Comparison
Mid-July 2012 Compared to 23-year Average for Mid-July



Map 9. The U.S. comparison to the 23-year average for the period July 10 – 23 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that only a very small portion of the country has above-average productivity. While the areas of drought in the South are smaller than last year, biomass production has not yet returned to normal levels.

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.
If you have questions or suggestions for topics you'd like to have addressed in the weekly updates, contact Steve Watson, 785-532-7105 swatson@ksu.edu, or Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader 785-532-0397 jshroyer@ksu.edu