



K-STATE
Research and Extension

Extension Agronomy

eUpdate

06/13/2014

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 any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, Jim Shroyer, Crop Production Specialist 785-532-0397 jshroyer@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. Wheat conditions in north central Kansas

In north central Kansas, wheat has been helped somewhat by the rainfall in June. Overall, the yield potential of wheat in this area is as good as or better than in most other regions of the state.

However, wheat planted late or doublecropped after soybeans in this area is generally thinner and has less yield potential than full-season wheat.

Some wheat leaf diseases and problems were found in Clay and Republic counties this week; primarily tan spot, physiological leaf spotting, and Cephalosporium stripe. Of those problems, tan spot is the most widespread and the most likely to affect yield potential on several fields.



Figure 1. Tan spot in Clay County. Photo by Jim Shroyer, K-State Research and Extension.



Figure 2. Physiological leaf spotting on the flag leaf of wheat in Clay County. This problem, which is not a true disease, was isolated to just a few scattered plants. Photo by Jim Shroyer, K-State Research and Extension.



Figure 3. Cephalosporium stripe on wheat in Clay County. This is a soil-borne fungal disease and cannot be controlled with fungicides. Varietal resistance and crop rotation are the most effective means of control. It is most commonly found in the Pacific Northwest. Photo by Jim Shroyer, K-State Research and Extension.

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2. Effect of water-logged soils on corn growth and yield

Heavy rains in some parts of Kansas over the past week or two have subjected some fields of corn to saturated soils or even flooding for a day or two, or even more. Producers should know what might happen to their corn as a result of early-season wet conditions so they can correctly diagnose any future problems that may occur as the season progresses.



Figure 1. Corn under water June 11, 2014 at K-State's Ashland Bottoms experiment field near Manhattan. Photo by Ignacio Ciampitti, K-State Research and Extension.



Figure 2. Flooded corn at Ashland Bottoms near Manhattan, June 11, 2014. Photo by Ignacio Ciampitti, K-State Research and Extension.

Saturated soils inhibit root growth, leaf area expansion, and photosynthesis because of the lack of oxygen and cooler soil temperatures. Yellow leaves indicate a slowing of photosynthesis and plant growth. Leaves and sheaths may turn purple from accumulation of sugars if photosynthesis continues but growth is slowed.

Corn plants can recover with minimal impact on yield if the plants stay alive and conditions return to normal fairly quickly. Although root growth can compensate to some extent later in the season, a saturated profile early in the season can confine the root system to the top several inches of soil, setting up problems later in the season if the root system remains shallow. Corn plants in this situation tend to be prone to late-season root rot if wetness continues throughout the summer, and stalk rots if the plants undergo mid- to late-season drought stress. Plants with shallow root systems also become more susceptible to standability problems during periods of high winds. Overall, shallow root systems are more prone to drought and nutrient stresses, due to the diminished capacity of the plant to explore the entire soil profile.

Young corn plants typically can tolerate full submersion for up to 48 hours with minimal impact on yield. If flooding occurs before V6, when the growing point is at or below the soil surface, flooding that lasts more than 2 to 4 days can impact season-long plant growth and grain yield or cause significant plant mortality. Chances of plant survival increase dramatically if the growing point was not completely submerged or if it was submerged for less than 48 hours. Research has demonstrated

yield reductions from early-season flooding ranging from 5 to 32 percent, depending on soil nitrogen status and duration of flooding.

Temperatures can influence the extent of damage from flooding or saturated soils. Cool, cloudy weather limits damage from flooding because growth is slowed and because cool water contains more oxygen than does warm water. Warm temperatures, on the other hand, can increase the chances of long-term damage.

Silt deposition in the whorls of vegetative corn plants can inhibit recovery of flooded corn plants. Enough soil can be deposited in the whorl that emergence of later leaves is inhibited. A heavy layer of silt on leaf surfaces can potentially inhibit photosynthesis or damage the waxy surface layer of the leaf (cuticle), making the leaves subject to drying out. New leaves should not be affected if they can emerge normally. In some instances, the soil in the whorl may contain certain soft-rotting bacteria. These bacteria can cause the top of the plant to rot. The whorl can easily be pulled out of a plant infected with these soft-rotting bacteria. In addition, a rather putrid odor will be present. These plants will not recover.

Flooding can increase the incidence of moisture-loving diseases like crazy top downy mildew. Saturation for 24 to 48 hours allows the crazy top fungus spores found in the soil to germinate and infect flooded plants. The fungus grows systemically in the plant, but visual symptoms will not appear for some time. Symptom expression depends on the timing of infection and amount of fungal growth in the plant. Symptoms include excessive tillering, rolling and twisting of upper leaves, and proliferation of the tassel. Eventually the tassel can resemble a disorganized mass of small leaves, hence the name "crazy top."

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3. Saturated soybean fields

How do soybeans respond to prolonged saturated soil conditions? When soils are saturated for a prolonged period of time, a lack of oxygen in the roots can lead to the accumulation of lactic acid and other products of anaerobic respiration. This is the underlying cause of damage to plants in waterlogged soils where only the roots are flooded.

Injury can depend on variety, growth stage, duration of waterlogging, soil texture, fertility levels, and diseases present. Interactions of these factors make it hard to predict how a given soybean field will react to waterlogged soils.

Growth stage factors

Research examining the influence of growth stage on the degree of injury from waterlogged soils has provided mixed results.

- Germination. Saturated conditions during germination can reduce successful germination by up to 40 percent and can inhibit seedling growth. Seeds that are further in the germination process at the time of saturation sustain more injury.
- Vegetative growth stages. Excess water during vegetative stages usually causes less injury than waterlogging during the reproductive and grain filling stages. Short-term waterlogging (2 to 3 days) at V2 to V4 can cause yield reductions of 0 to 50 percent, depending on soil texture, variety, and subsequent weather. Yield reductions from waterlogging during the early vegetative stages have been attributed to reduced plant population and shorter plants with reduced branching and fewer pods per plant.

Duration of soil saturation

The longer the soil is saturated, the greater the injury, mortality, and consequent yield reductions. During germination, saturated conditions for 48 hours can decrease germination by 30 to 70 percent depending on the timing of the saturation -- nearly twice the yield decrease resulting from durations of 24 hours or less. For plants that have emerged, a waterlogged condition that lasts for less than two days often causes little or no noticeable yield reduction. Intolerant varieties begin to show yield reductions after 2 days of saturation, but tolerant varieties can withstand up to 4 days of waterlogging with little reduction in yield. As the duration of soil saturation increases, researchers have documented greater reductions in population, biomass, height, pods per plant, leaf tissue nitrogen (nodulation), and yield.

Other factors

Soil conditions play a role in the severity of injury from waterlogging as well. Coarser textured soils will drain more quickly, minimizing the duration of oxygen deprivation to the roots. Fine-textured soils maintain saturation longer, increasing the chances of injury.

Higher levels of soil nitrates can minimize injury from flooding, but fertilizing after the soil has dried is generally not helpful. Most Kansas soils mineralize enough nitrogen during the season to maintain the young soybean plants until nitrogen fixation becomes well established. Fertilizer nitrogen will ultimately inhibit nodule nitrogen fixation.

Fields that are flooded, or are at or above the water-holding capacity of the soil, will be more likely to develop root rot problems. Flooding accompanied by cooler temperatures would be favorable to *Pythium* root rot whereas as warmer temperatures would favor *Phytophthora* and *Rhizoctonia* root rots. Whether *Phytophthora* root rot develops often depends on the tolerance or resistance of the variety used. If the flooding occurs beyond the first week or two after emergence, any seed treatment fungicides that may have been used will no longer be effective.

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4. Nitrogen loss potential in wet soils

Many parts of eastern and central Kansas are faced with the potential for leaching or denitrification loss of nitrogen from fields planted or intended for corn and sorghum due to recent heavy rains. The warmer the weather, the greater the potential for loss.

The leaching and denitrification processes are quite different, and normally occur on different types of soils and under different situations. But both involve the nitrate form of nitrogen. The nitrate-N present in fertilizers such as ammonium nitrate (50% nitrate) or UAN solution (25% nitrate), is immediately susceptible to leaching or denitrification loss. Other forms of nitrogen have to be converted in the soil to nitrate-N before leaching or denitrification would become a problem. Before estimating how much N may have been lost in wet soils from leaching or denitrification, producers should first try to get some idea of how much of the N they applied may have undergone nitrification into nitrate-N at this point in the season.

Factors affecting nitrification

How quickly ammonium-N in soil converts to nitrate-N is a function of soil oxygen content, soil temperature, pH, how the N is applied, and some characteristics of the fertilizer. Nitrification is an aerobic process and requires high levels of soil oxygen. Conditions that reduce oxygen supplies, such as wet soils, will inhibit nitrification and keep N in the ammonium form. Optimum soil temperatures for nitrification are in the range of 75-80 degrees. When urea or UAN are broadcast, nitrification will occur more rapidly than when those materials are banded. The nitrification rate of anhydrous ammonia is even slower, due to the impact of the ammonia on the organisms in the application band. The use of a nitrification inhibitor, especially with banded ammonia, will slow the process of nitrification even further.

Leaching

Leaching involves the movement of nitrate-N below the root zone with water. Leaching losses are primarily a concern on coarse-textured, sandy soils, where water moves quickly through the soil profile. Ammonium-N is not readily lost to leaching, even on coarse-textured soils. Ammonium-N has a positive charge, and is retained on the cation exchange capacity (CEC) sites of soils, while nitrate-N has a negative charge and is repelled by the soil and remains in the soil water.

Denitrification

Denitrification is the conversion of nitrate-N to gaseous N by soil microbes in anaerobic (low-oxygen, waterlogged) soils. Denitrification loss is a problem normally associated with medium- to fine-textured soils under wet weather conditions. There are several conditions that must be met for denitrification to occur. These include:

- Lack of soil oxygen. The specific soil microbes responsible for denitrification only function under anaerobic soil conditions. Poorly drained, compacted, and/or waterlogged soils have the highest potential for denitrification loss. Poorly drained soils in central and eastern Kansas, and the claypan soils of southeast Kansas, are normally the soils in the state with the most significant potential for denitrification. Well-drained soils normally pose little risk of significant denitrification loss.
- Nitrate-nitrogen. Denitrification only affects nitrate-N; it has no impact on ammonium-N.

Maintaining N in an ammonium form is an effective strategy to avoid denitrification losses, and is the reason there are differences among N sources in denitrification potential.

- Warm soil temperatures with organic residue and/or organic matter. Denitrification is a microbial process, and ample food (organic materials) and warm soil temperatures are required for microbial activity. Like nitrification, the optimum temperatures for denitrification are in the 75-80 degree range.

Summary

It has been warm enough this spring that at least some of the N applied early, especially the fall-applied N, has likely been nitrified. Where heavy rainfall in early June resulted in several days of saturation, some denitrification loss likely has or will occur. Not all of the N will have been lost, but producers who applied all their N in the fall or very early spring should be in position to apply additional N if needed.

All corn that appears yellow at this time won't be seriously N deficient. In fields where N application was delayed until late April or early May, especially where ammonia was applied, the majority of the N is likely still present. In this case, the corn is likely yellow due to the effect of soil saturation and will green up when things dry out and oxygen gets back into the soil. No additional N may be needed at all.

Trying to sort out exactly how much N loss has occurred in a specific field is difficult, if not impossible. One thing producers can do is to establish some reference strips in the field to serve as a base for comparison. Apply the equivalent of an additional 50 to 75 pounds of N per acre to 3 to 5 areas in a field. (Note: If your crop is in 30-inch rows, then applying 1.8 pounds of urea to 6 rows in a 40-foot-long section = 60 lbs N/acre.) These areas can serve as a point of reference for evaluating your crop.

If you have access to a chlorophyll meter or active crop sensor, you can use these instruments to make measurements of greenness and growth, and make some fairly good estimates of the amount of N needed. But, even without these tools, the reference strips can help you visually evaluate whether the crop will respond to additional N. At the very least, it will allow you to make an "educated guess."

Recent work at K-State has shown that N applied at the 16-leaf stage can be used effectively by dryland corn. That will require dribbling the N on between the rows to minimize leaf damage with high-clearance application equipment. But if your corn "runs out of gas" in a few weeks, it gives you an option to correct the problem.

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5. Comparative Vegetation Condition Report: May 27 - June 9

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=CRP3Y5Nlggw>

<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 25-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.

NOTE TO READERS: The maps below represent a subset of the maps available from the EASAL group. If you'd like digital copies of the entire map series please contact Nan An at nanan@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.

The maps in this issue of the newsletter show the current state of photosynthetic activity in Kansas, the Corn Belt, and the continental U.S., with comments from Mary Knapp, service climatologist:

Kansas Vegetation Condition

Period 23: 05/27/2014 - 06/09/2014

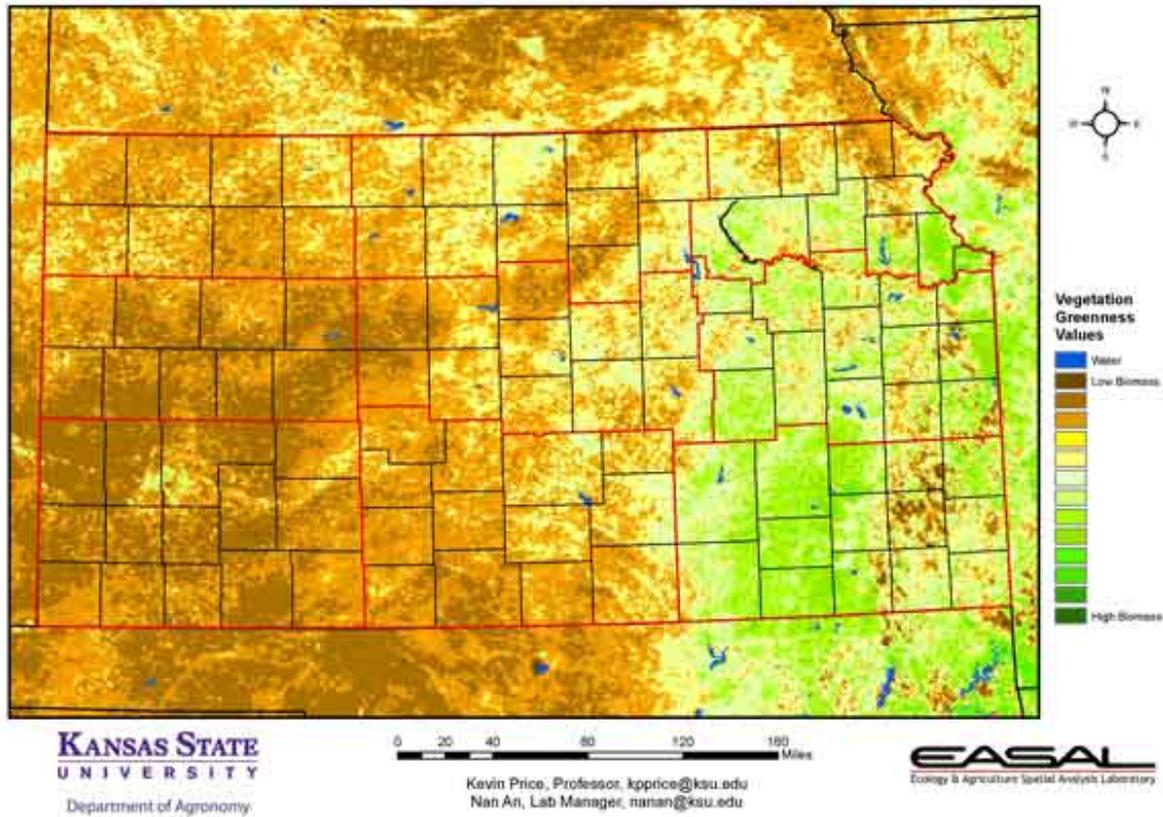


Figure 1. The Vegetation Condition Report for Kansas for May 27 – June 9 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the most active vegetation is in the eastern third of the state. There are areas of decreased activity even in that region, however, particularly in Neosho and Allen counties, where saturated soils have been a problem.

Kansas Vegetation Condition Comparison
Late-May/Early-Jun 2014 compared to the Late-May/Early-Jun 2013

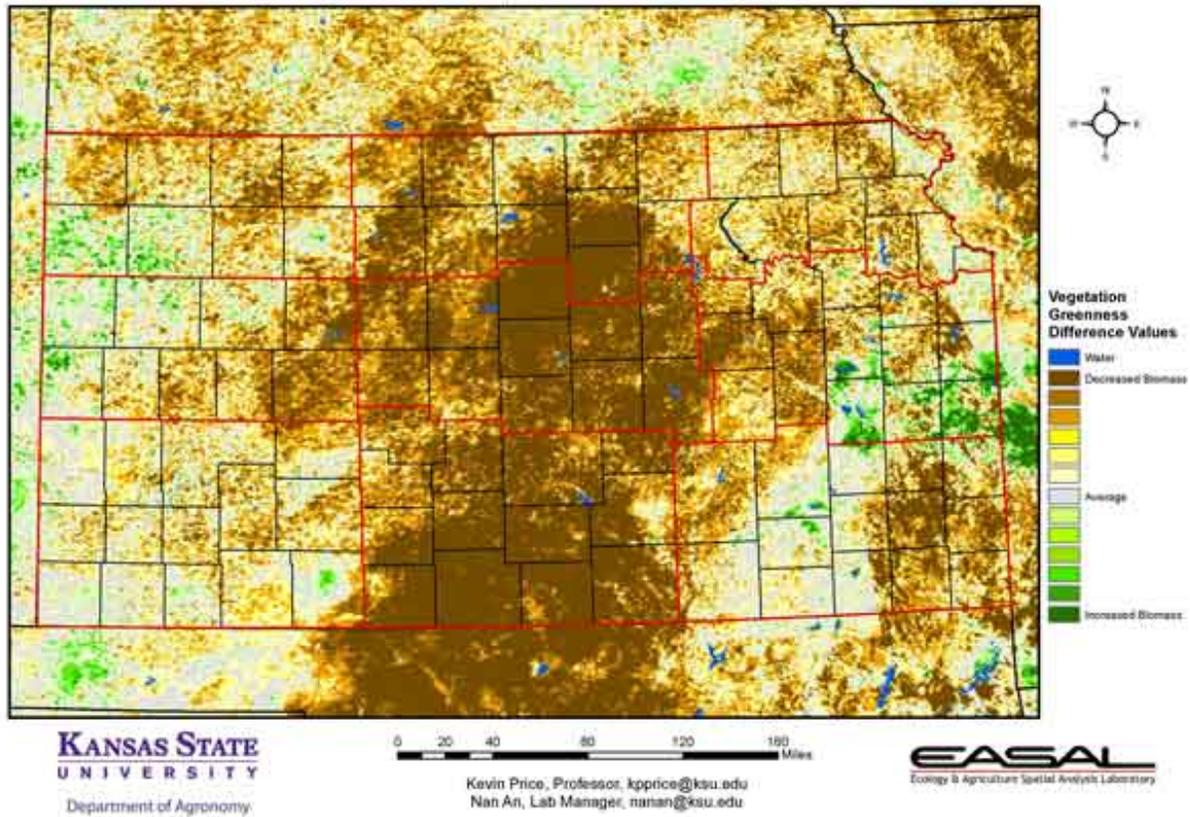


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for May 27 – June 9 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that east central Kansas has had more favorable conditions. In contrast, most of central Kansas has much lower vegetative activity. This is due to a combination of freeze injury and drought damage.

Kansas Vegetation Condition Comparison

Late-May/Early-Jun 2014 compared to the 25-Year Average for Late-May/Early-Jun

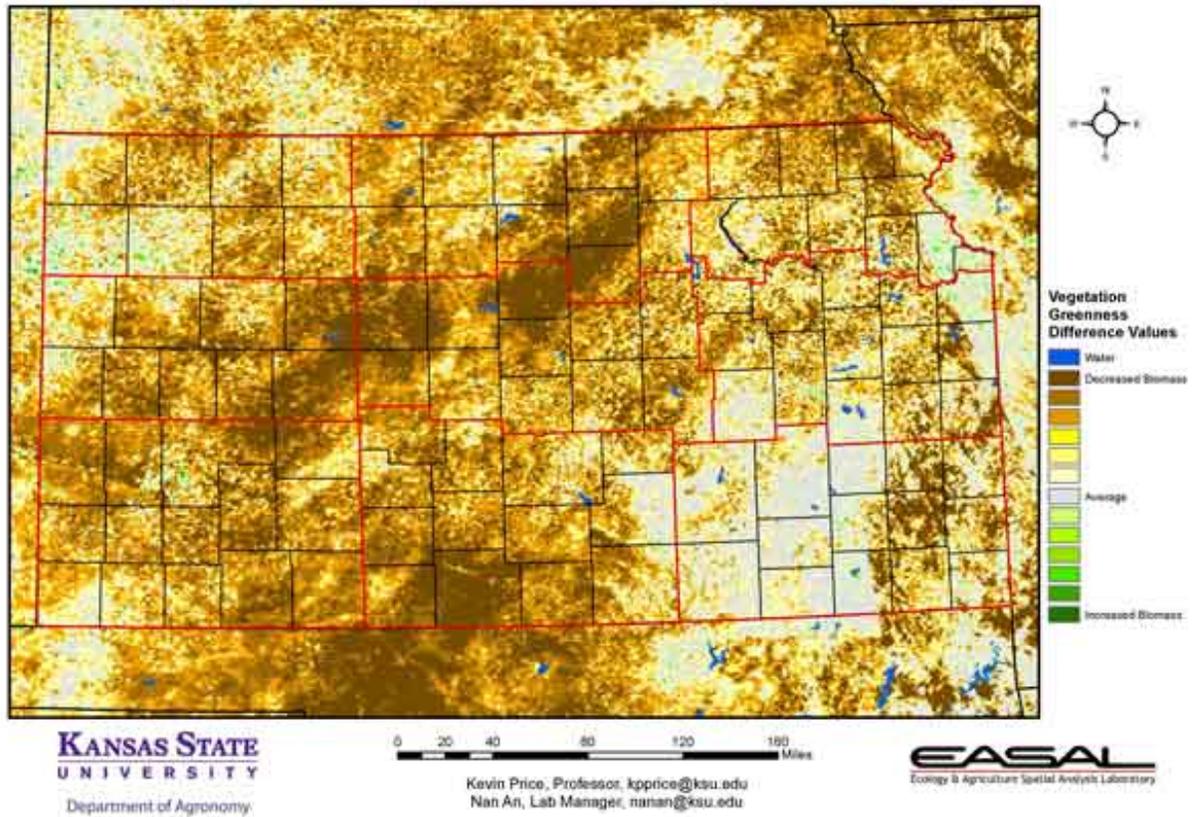


Figure 3. Compared to the 25-year average at this time for Kansas, this year's Vegetation Condition Report for May 27 – June 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows most of the state with much-below-average vegetative activity. In general, the vegetation hasn't had time to respond positively to the recent rains, and in some locations excessive moisture has created additional problems.

U.S. Corn Belt Vegetation Condition

Period 23: 05/27/2014 - 06/09/2014

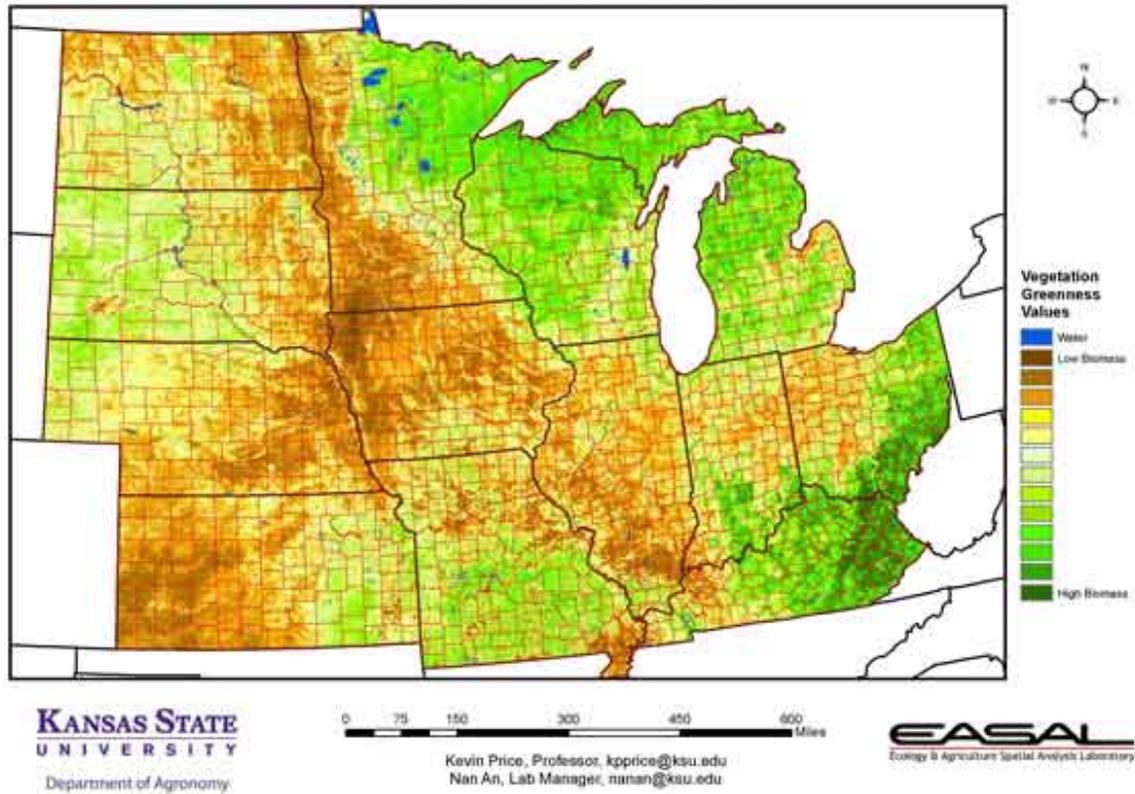


Figure 4. The Vegetation Condition Report for the Corn Belt for May 27 – June 9 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that vegetative activity continues to increase. The greatest level of activity is in the eastern portions of the region, where favorable moisture and temperatures have been the rule. The northern Great Lakes region has also seen an increase in vegetative activity as temperatures warm.

U.S. Corn Belt Vegetation Condition Comparison
Late-May/Early-Jun 2014 Compared to Late-May/Early-Jun 2013

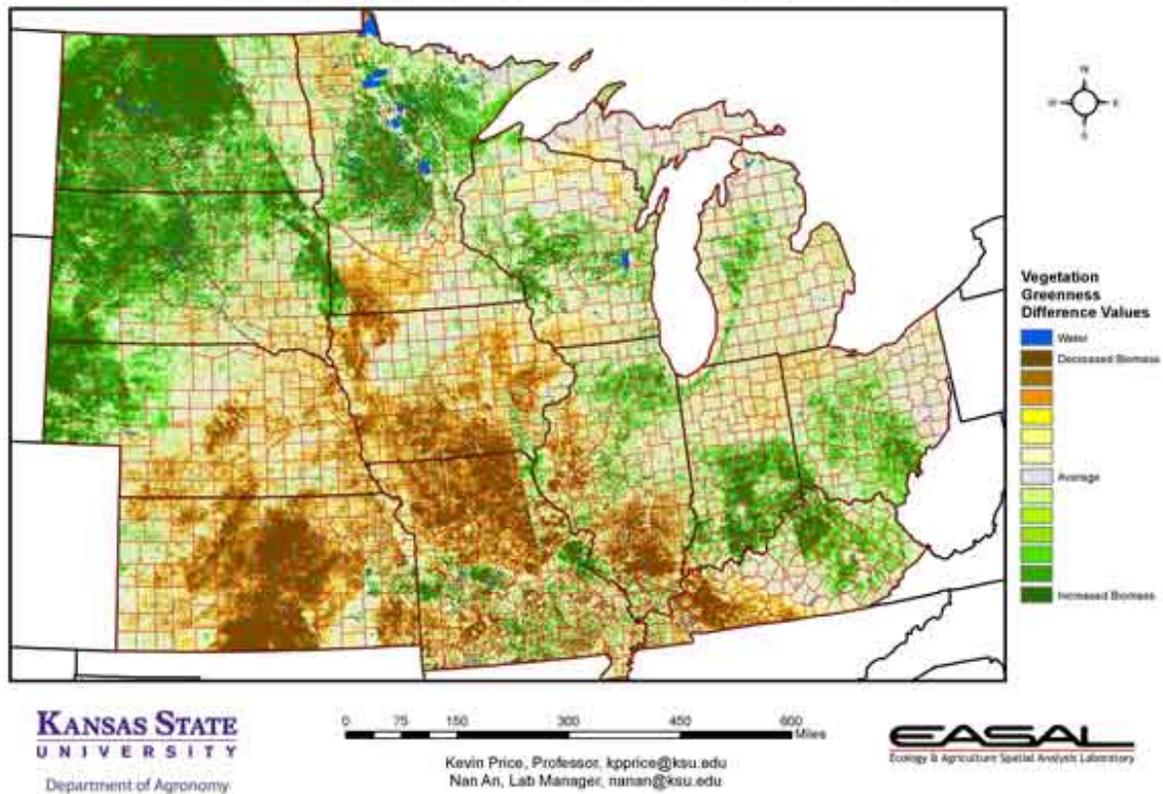


Figure 5. The comparison to last year in the Corn Belt for the period May 27 – June 9 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the greatest increase in vegetative activity has been in the northwestern portions of the region. Favorable temperatures and moisture have greatly benefited the vegetation in those areas. In North Dakota, 81 percent of the range and pasture is reported to be in good to excellent condition. In Kansas, however, only 22 percent of the range and pasture is reported in good to excellent condition.

U.S. Corn Belt Vegetation Condition Comparison
Late-May/Early-Jun 2014 Compared to the 25-Year Average for Late-May/Early-Jun

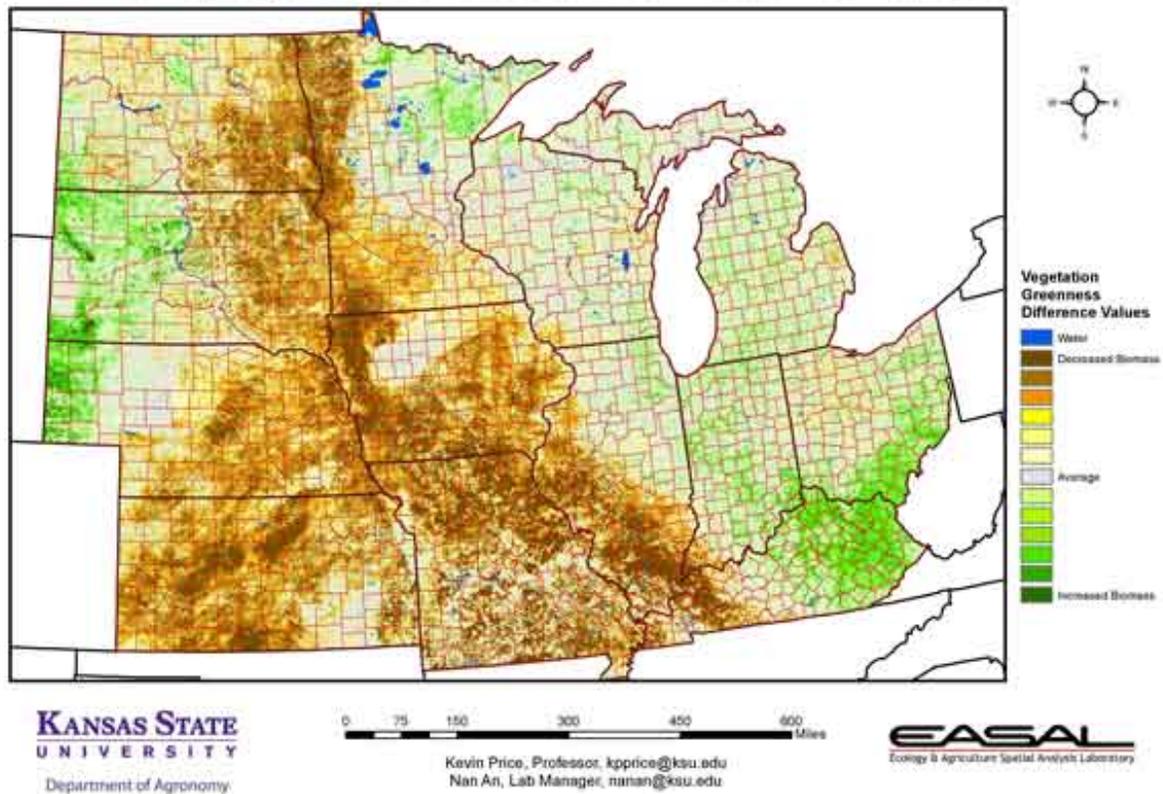


Figure 6. Compared to the 25-year average at this time for the Corn Belt, this year's Vegetation Condition Report for May 27 – June 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the center of the region has much-below-average vegetative production. This is due to a combination of drought and freeze to the south and cold, wet conditions to the north.

Continental U.S. Vegetation Condition

Period 23: 05/27/2014 - 06/09/2014

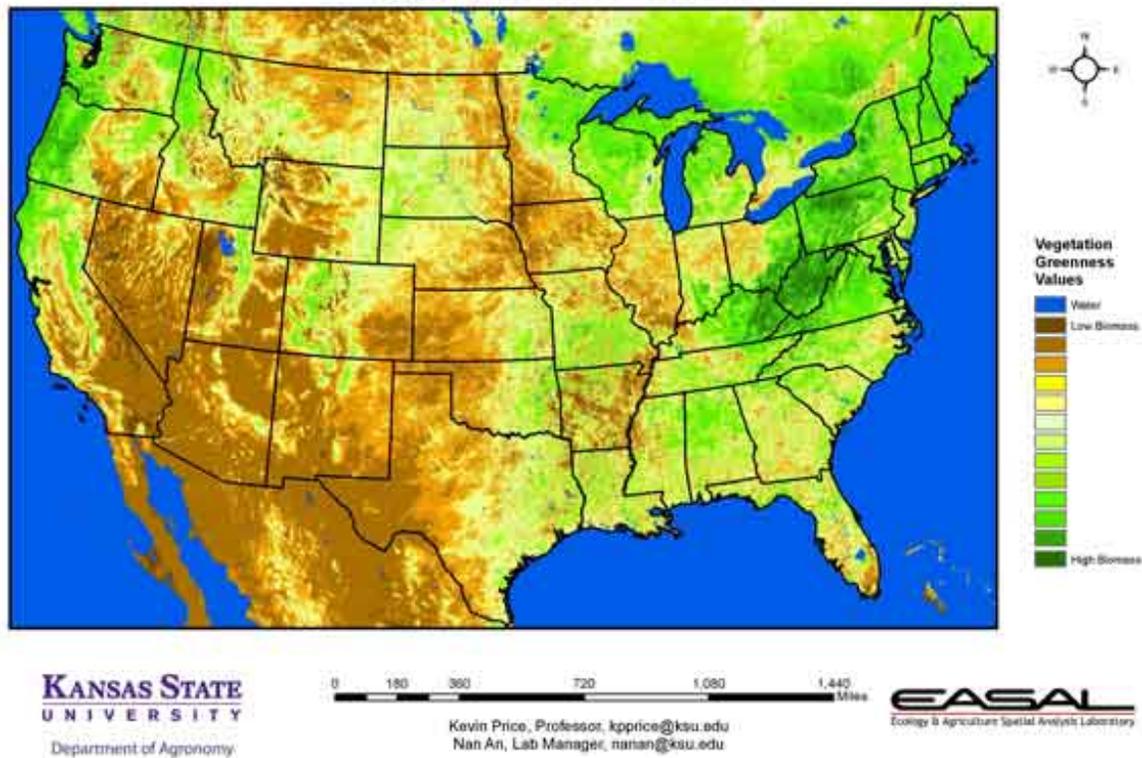


Figure 7. The Vegetation Condition Report for the U.S. for May 27 – June 9 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that Arkansas stands out with lower vegetative activity than most of the South. Extended rainfall has created problems in the state, delaying field work and planting. For the state, topsoil moisture is reported to be 54 percent surplus and subsoil moisture is reported at 34 percent surplus.

Continental U.S. Vegetation Condition Comparison
Late-May/Early-Jun 2014 Compared to Late-May/Early-Jun 2013

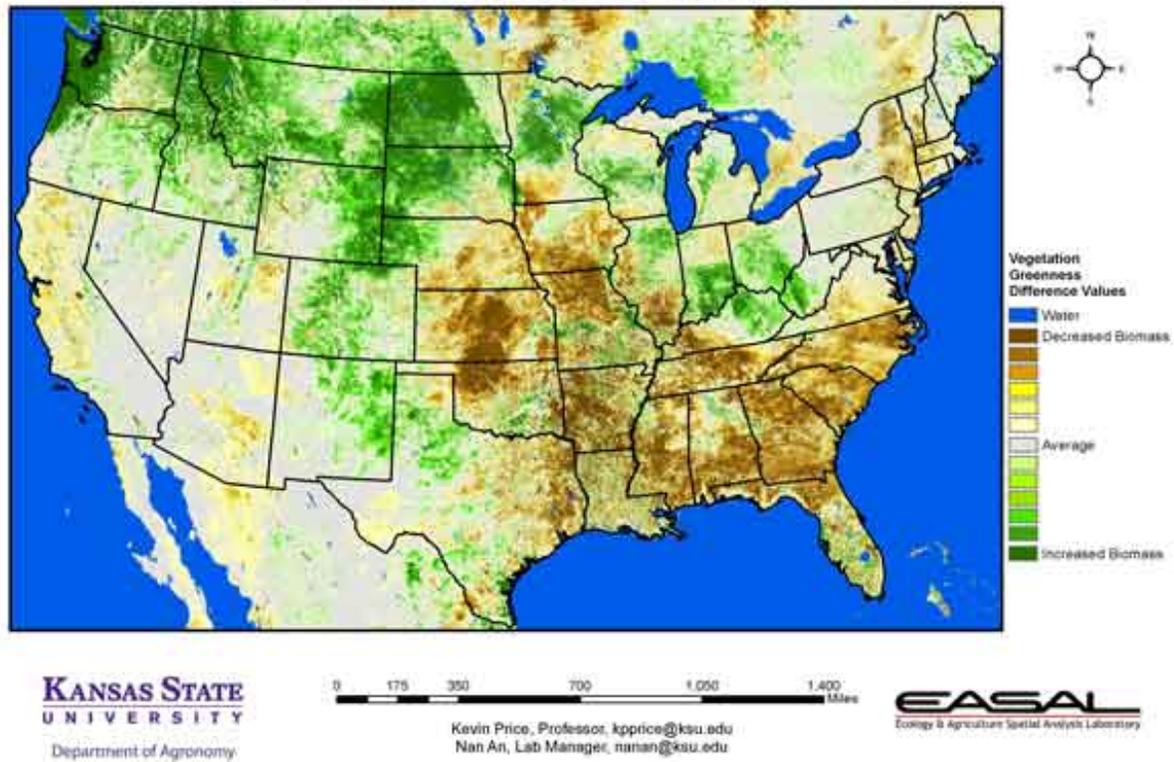


Figure 8. The U.S. comparison to last year at this time for the period May 27 – June 9 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that much of the Northwest has higher NDVI values, while the South has much lower NDVI values. The increased vegetative activity is also noteworthy in eastern New Mexico and the Texas Panhandle. Some stations in these areas reported more rain in the last month than in the previous twelve months combined. This has allowed for improvement from exceptional drought to severe drought in the area.

Continental U.S. Vegetation Condition Comparison
Late-May/Early-Jun 2014 Compared to 25-year Average for Late-May/Early-Jun

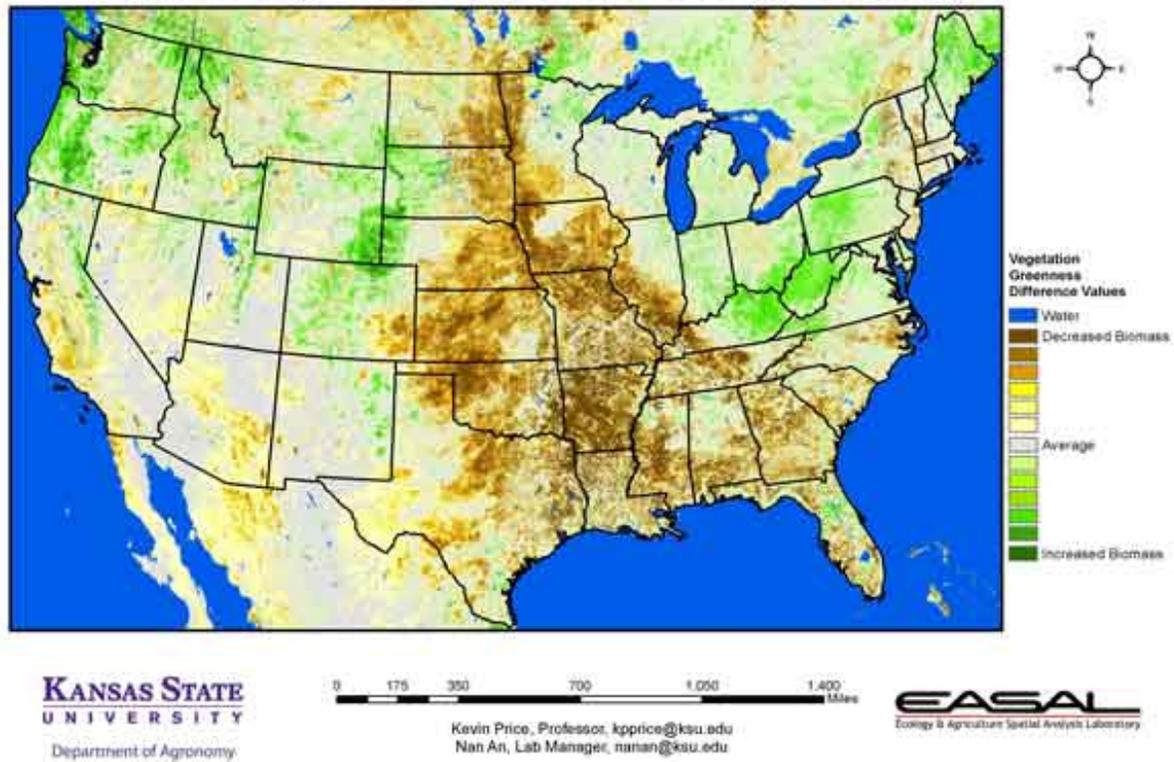


Figure 9. The U.S. comparison to the 25-year average for the period May 27 – June 9 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the main area of below-average vegetative activity is concentrated in the center and south of the country. This is a result of a complex combination of excessive moisture to the southeast, drought to the west, and cold to the north.

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