Issue 454

K-STATE Research and Extension

Extension Agronomy

eUpdate

05/02/2014

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. Effect of freezing temperatures on wheat in boot and early heading stages

Overnight temperatures dropped below freezing and into the upper 20's in parts of Kansas in the early morning of May 2. In low areas of the fields, temperatures will typically be lower than the officially recorded temperatures.

Here are the possibilities for freeze injury by the most common stages of growth in the areas of the latest freeze:

Jointing to pre-boot. Jointing wheat can usually tolerate temperatures in the mid to upper 20's with no significant injury. The lowest official readings were all in that range or above on May 2. But, if temperatures in some low-lying areas fell into the low 20's or even lower for several hours, the lower stems, leaves, or developing head may have sustained injury. If the tillers were in this stage or earlier at the time of the freeze and the tillers are green and growing actively now, then the heads should be fine. If the head had been killed, the tiller would not be green and actively growing. If the leaves coming out of the whorl are chlorotic, then the head on that tiller is dead.

Boot. In this stage, wheat can be injured if temperatures drop down into the mid to upper 20's for several hours. Injury is more likely if this occurs repeatedly and if it is windy at night.

To detect injury, producers should wait several days then split open some stems and look at the developing head. If the head is green or light greenish in color and seems firm, it is most likely going to be fine. If the head is yellowish and mushy, that's a sign of freeze injury.

Freeze injury at the boot stage causes a number of symptoms when the heads are enclosed in the sheaths of the flag leaves. Freezing may trap the spikes inside the boots so that they cannot emerge normally. When this happens, the spikes will remain in the boots, split out the sides of the boots, or emerge base-first from the boots.

Sometimes heads emerge normally from the boots after freezing, but remain yellow or even white instead of their usual green color. When this happens, all or part of the heads have been killed. Frequently, only the male parts (anthers) of the flowers die because they are more sensitive to low temperatures than the female parts. Since wheat is self-pollinated, sterility caused by freeze injury results in poor kernel set and low grain yield.

It's possible for some of the spikelets to be alive and a healthy dark green while other spikelets on the same head are damaged. If a spikelet flowers normally and the kernels on that spikelet develop normally, then the head is at least partially viable and will produce grain (unless it freezes again, of course).

Awns beginning to appear. If the awns have begun to appear, there can be significant injury to the heads if temperatures reach about 30 degrees or lower for several hours. The heads may fully exert from the boot, but few, if any, of the spikelets may pollinate normally and fill grain. Damaged heads from a freeze at this stage of growth may seem green and firm at first glance, but the floral parts will be yellowish and mushy.

Flowering. It's possible a few fields may be in the flowering stage where temperatures got below freezing on May 2. Wheat is particularly vulnerable to damage from freezing weather as the head starts to emerge through the flowering stage. Temperatures of 30 degrees or lower can damage anthers.

If the wheat was in the flowering stage at the time of the freeze, you can determine if the anthers are damaged by examining them with a magnifying lens. Healthy anthers will first be lime green, then yellow. If they are damaged by a freeze, they will begin twisting within 2 to 3 days. Shortly afterward, they will begin to turn whitish or brown. The stigma in the florets may or may not also be damaged by a freeze. If the anthers are damaged by freeze, the flowers may fail to develop a kernel.

Fortunately, wheat doesn't flower all at the same time on the head. Flowering proceeds from florets near the center of wheat spikes to florets at the top and bottom of the spikes over a 3- to 5-day period. This small difference in flowering stage when freezing occurs can produce some odd-looking heads. The center or one or both ends of the spikes might be void of grain because those florets were at a sensitive stage when they were frozen. Grain might develop in other parts of the spikes, however, because flowering had not started or was already completed in those florets when the freeze occurred.

Healthy wheat anthers are trilobed, light green and turgid before pollen is shed. Each wheat floret contains three anthers. Healthy stigmas are white and have a feathery appearance. Photos from Spring Freeze Injury to Kansas Wheat**, K-State Research and Extension publication C646.**

Anthers become twisted and shriveled, yet they are still their normal color within 24 to 48 hours after a freeze. A hand lens is necessary to detect these symptoms.

If damaged, anthers become white after 3 to 5 days and eventually turn whitish-brown. The anthers will not shed pollen or extrude from the florets.

Damage may occur in different areas of the spike because flowering, which is the most sensitive stage to freeze, does not occur at the same time in all florets.

If you are unsure whether there has been freeze damage to the anthers, wait several days and determine whether kernels are developing normally. A week after flowering, kernels should be well-formed up and down the head under normal conditions.

In addition to this, be watching for any freeze damage to lower stems. If the damage is severe enough, the plants will eventually lodge.

More information

The comments above are general guidelines. Actual damage, if any, will not become apparent until temperatures have warmed back up for several days and growth has resumed.

For more information on freeze damage to wheat, see *Spring Freeze Injury to Kansas Wheat*, K-State Research and Extension publication C646, at: http://www.ksre.ksu.edu/bookstore/pubs/c646.pdf

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2. Is there any value to starter fertilizer on soybeans?

Soybean is a crop that can remove significant amounts of nutrients per bushel of grain harvested. Because of this, soybeans can respond to starter fertilizer applications on low-testing soils, particularly phosphorus.

In many cases, corn shows a greater response to starter fertilizer than soybean. Part of the reason for that is that soils are generally warmer when soybeans are planted than when corn is planted. The typical response in early growth observed in corn is usually not observed in soybeans. However, yield response to direct soybean fertilization with phosphorus and other nutrients if needed in low-testing soils can be expected.

K-State guidelines for soybeans include taking a soil test for phosphorus (P), potassium (K), sulfur (S), zinc (Zn), and boron (B). If fertilizer is recommended by soil test results, then fertilizer should either be applied directly to the soybeans or indirectly by increasing fertilizer rates to another crop in the rotation by the amount needed for the soybeans.

The most consistent response to starter fertilizer with soybeans would be on soils very deficient in one of the nutrients listed above, or in very high-yield-potential situations where soils have low or medium fertility levels. Furthermore, starter fertilizer in soybeans can be a good way to complement nutrients that may have been removed by high-yielding crops in the rotation, such as corn and help maintain optimum soil test levels.

Banding fertilizer to the side and below the seed at planting is an efficient application method for soybeans. This method is especially useful in reduced-till or no-till soybeans because P and K have only limited mobility into the soil from surface broadcast applications.

However, with narrow row soybeans, it may not be possible to install fertilizer units for deep banding. In that situation, producers can surface-apply the fertilizer. Fertilizer should not be placed in-furrow in direct seed contact with soybeans because the seed is very sensitive to salt injury.

Soybean seldom responds to nitrogen (N) in the starter fertilizer. However, some research under irrigated, high-yield environments suggests a potential benefit of small amounts of N in starter fertilizer.

Figure 1. Visual differences with starter P fertilizer on low testing soils. Picture by Nathan Mueller, K-State Agronomy graduate student.

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3. Diagnosing corn early-season growth problems

Getting a good stand of corn, with vigorous early-season growth, is the first step in getting good yields. When adverse conditions, such as a hard rain or unusually cool weather, occur after planting and emergence, producers should get out in their fields and take a close look at how their corn is doing.

If the plants emerged in good fashion, but the seedlings then have problems maintaining adequate growth and development or leaf color, there may be several possible reasons. A few of the most likely causes include:

Freeze damage. Much of the corn that was emerged at the time of the freeze on April 15th is beginning to recover with minimal damage. However, some of the new growth is having a hard time emerging from the dead tissue. New growth may become trapped and start to split from the side of the leaf sheath. Generally warmer temperatures will increase growth rates and new leaves will eventually split the dead tissue, emerge, and continue to grow normally.

Unusually cool temperatures, compacted soil, or waterlogging. Wet soils and unusually cool temperatures can inhibit root growth especially, slowing plant development. This can cause yellowed, wilting plants due to poor root growth, drowning, or a seedling blight infection. Seedling blight is often characterized by stem tissue near ground level that is discolored or water-soaked in appearance. Also, planting in wet soil can compact the seed furrow, inhibiting root growth. A shallow compaction layer can slow early root growth, resulting in stunted, nutrient deficient plants.

Sidewall and seed zone compaction in heavy clay soil. Photo by Stu Duncan, K-State Research and Extension.

Early-season lodging ("floppy corn syndrome"). This is usually associated with hot, dry weather during V1 to V6, which prevents adequate development and penetration of nodal roots. Plants can survive for a time on just the seminal root system, but they will have little mechanical support. Reasons for poor nodal root development and an elevated crown include sidewall compaction, erosion after emergence but before nodal root development, and sinking of the seedbed due to pounding rains. Often a good soaking rain is enough to allow nodal roots to establish and plants to recover. Inter-row cultivation can be used to push soil against plants with exposed crowns.

“Floppy corn” syndrome. Corn seedling lodging caused by dry weather and warm soil stunting crown root development. Photo by Doug Shoup, K-State Research and Extension.

White grubs or wireworms. These soil insects may be eating the roots, which will cause the plants to wilt.

Black cutworms. These insects, which can be found in the soil or on the surface, cause “window paning” of the leaves on young plants. Cutworms may also cut off seedling plants at the soil surface.

Flea beetles. These tiny leaf-chewing insects can cause “scratches” on leaves. Eventually, the leaves may shrivel, turn gray, and die. Plants are more susceptible to flea beetle injury when temperatures are cold and seedling growth is slow. Seedling plants are often able to recover from flea beetle injury because the growing point remains below ground level until the fifth leaf emerges.

Poor growth that occurs as circular to oval patches in the field could be an indicator of nematode problems. Approximately 35 days after emergence is an ideal time to sample for nematodes, particularly the root lesion nematode that inhabits about 80 percent of Kansas corn fields. Take 20 cores at a depth of 12 inches from directly in or alongside the row from the outer edges of affected areas. Additionally, 2 to 3 root balls of affected plants should be submitted at the same time. Bag the root samples separately from the soil cores. Samples can be submitted through local Extension offices or sent directly to the Plant Disease Diagnostic Lab in Throckmorton Hall.

Free ammonia from an anhydrous ammonia application. This can injure roots and kill germinating seed if the ammonia was applied too shallowly (especially in coarser soils), too close to the time of planting, or if dry soil conditions slowed the conversion of ammonia to ammonium. One way to minimize damage is to apply the ammonia at a 10 to 15 degree angle from the direction of planting. If injury occurs then it is more randomly distributed, reducing the multi-plant skips, and allowing the unaffected plants to compensate.

Ammonia injury can also occur when sidedressing anhydrous ammonia under dry soil conditions. Root injury can occur if the plants get too big or the knives run too close to the row. Ammonia injury resulting from poor soil sealing can cause leaves to appear watersoaked or have dead margins. Roots may appear sheared off, or burned off. Plants will normally recover from this injury, but yields can be reduced.

Putting a urea-based N fertilizer in contact with the seed. Urea will hydrolyze into ammonia and injure the seedling.

Seedlings damaged after starter fertilizer containing urea-N was placed in direct seed contact. Photos by Dorivar Ruiz Diaz, K-State Research and Extension.

Nitrogen deficiency. This does not usually occur until a later stage of growth in conventional tillage systems. But in no-till corn, especially in high residue situations, N deficiency is common where producers haven't applied nitrogen as a starter, or broadcast a significant amount of N prior to or at planting. In early planting in very cold soils where no N was applied close to the seed as a starter, seedlings may be N deficient in conventional-till also. Nitrogen deficient corn seedlings will be spindly, with pale yellow-green foliage. As the plants grow, the lower leaves will "fire," with yellowing starting from the tip of the leaf and progressing back toward the stalk.

Phosphorus deficiency. This can result in stunted growth and purple leaves early in the growing season. Phosphorus deficiency is often enhanced by cool, wet growing conditions.

Iron deficiency. This can cause upper leaves to be pale green between the veins. Iron deficiency is more common on high pH and calcareous soils.

Sulfur deficiency. This can result in stunted plants having pale green leaves, with no distinct pattern on the leaves.

Herbicide injury. This is not as common now as in the past, but can still occur. Corn is very susceptible to injury from carryover sulfonylurea herbicides which may have been applied to a previous crop, such as wheat. Carryover depends on soil pH, soil texture, application rates, rainfall, and other factors listed on the herbicide labels. Symptoms include stunting, chlorosis, and an overall sickly appearance. Corn will not grow out of this type of injury.

ALS herbicide carryover injury to corn. Photo by Stu Duncan, K-State Research and Extension.

For more details, see "Diagnosing Corn Production Problems in Kansas," K-State publication S-54, at: http://www.ksre.ksu.edu/bookstore/pubs/S54.pdf

Also, see "Corn Production Handbook," K-State publication C-560, at: http://www.ksre.ksu.edu/bookstore/pubs/C560.pdf

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4. Considerations for corn planted under wet conditions

What should producers expect if they planted corn into soils that were too wet, and what can they do to minimize any problems?

It is best, of course, to allow time for the soil to dry adequately before tillage or planting operations if at all possible. Wet conditions will make the soil more susceptible to compaction. Tilling some soils when they are too wet can produce large, persistent clods, complicate planting, reduce herbicide effectiveness, and destroy the seedbed. Also, compaction can occur in the seed furrow itself, restricting proper root development (also diminishing nutrient accessibility) and early plant growth.

If soils remain or become unusually wet after the corn has emerged, corn may look sickly for a while. 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 (early during the growth period). 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 is inadequate to extract needed water from lower in the profile.

If weather conditions persist for more than a week, corn emergence will be delayed and seedling will be more vulnerable to the presence of insects and diseases. Uneven corn stands likely will be greater when planting in cold and wet soils. This situation will be directly affecting the plant-to-plant uniformity, which could have an impact on the potential yield.

Figure 1. Uneven corn stand due to cold, wet weather in late April. Photo by Ignacio Ciampitti, K-State Research and Extension.

Saturated soils can also cause loss of nitrogen fertilizer by either denitrification (loss of nitrogen to the atmosphere) or leaching (movement of nitrogen beyond the rooting zone). For denitrification to occur, the soil doesn't need to be completely saturated. Denitrification can also occur at 85-90% of the pore space filled with water. Nitrogen in the nitrate (NO3) form is needed for these losses to occur. Therefore a combination of fertilizer source, application time and the use of nitrification inhibitors can reduce leaching and denitrification.

Corn may respond to in-season nitrogen applications if a large portion of early-applied nitrogen is lost to these processes. Keep an eye out for nitrogen deficiency symptoms on fields that have been saturated for long periods. It may not be a bad idea to apply a strip or two of a high rate of nitrogen in those fields as soon as possible to serve as a fully-fertilized reference point.

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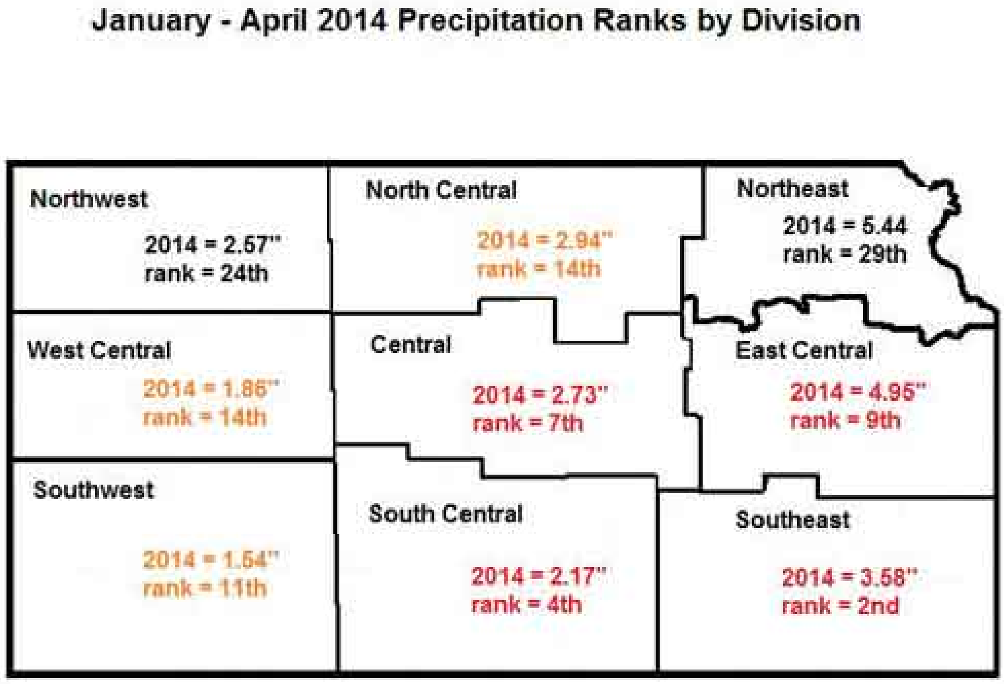
5. How dry and windy has it been so far this year in Kansas?

The dry weather that has persisted through April has raised concerns. In western Kansas, this has been the 11th driest start to the year since 1895. Below is a map showing the total rainfall for 2014 by division and the historical rank:



Note that the Southeast Division has had the second driest start to the year. Because southeast Kansas typically has more moisture during the winter months, there is a greater possibility of having a significantly dry start to the row crop season this year.

In addition to the dry conditions, strong winds have created increasing problems with blowing dust and dust storms. Below is a table comparing this year's average winds at the National Weather Service 1st Order stations to data at the same location from 1930-1996:

KANSAS		Jan	Feb	Mar	Apr
Concordia	Historical Wind Speed*	12	12	14	14
	2014	**12.7**	**10.9**	**14.2**	**14.9**
	Days avg >= 20 mph	**1**	**0**	**3**	**7**
	Peak Gust	60	52	54	64
	2014	**58**	**46**	**56**	**49**
Dodge City	Historical Wind Speed	11	11	12	12

	2014	**14**	**12.8**	**16**	**16.3**
	Days avg >= 20 mph	**2**	**2**	**5**	**7**
	Peak Gust	66	57	48	61
	2014	**56**	**60**	**59**	**58**
Goodland	Historical Wind Speed	13	13	14	14
	2014	**14**	**13.4**	**14.8**	**17**
	Days avg >= 20 mph	**2**	**1**	**5**	**9**
	Peak Gust	64	51	53	54
	2014	**64**	**58**	**58**	**64**
Topeka	Historical Wind Speed	10	10	12	12
	2014	**9.9**	**7.9**	**10.3**	**10.3**
	Days avg >= 20 mph	**0**	**0**	**1**	**0**
	Peak Gust	49	47	43	47
	2014	**41**	**48**	**49**	**55**
Wichita	Historical Wind Speed	10	10	11	11
	2014	**12.5**	**10.6**	**14.3**	**15**
	Days avg >= 20 mph	**0**	**1**	**7**	**8**
	Peak Gust	59	49	49	58
	2014	**53**	**43**	**43**	**59**

All speeds are in miles per hour (mph); Historical data is in *italic**

* from CLIMATIC WIND DATA FOR THE UNITED STATES; NCDC Nov 1998;
based on 1930-1996 data

Note that in April, only Topeka had winds that were less than the historical average. In Dodge City, the wind speed in April was more than 4 mph above the historical average; and in Goodland wind speeds were 3 mph above average for April. This is a considerable amount.

As a result of the drought and windy weather, dust storms have been common this year.

Figure 1. Dust storm in Wichita County, April 27, 2014. Photo by Allen Baker, Wichita County Research and Extension Agent.

Figure 2. Dust blowing across a highway in Wichita County on April 27, 2014. Photo by Allen Baker, Wichita County Research and Extension Agent.

Figure 3. Field on May 2, 2014 after repeated episodes of blowing soil. Photo by Kylee Harrison, Seward County Research and Extension Agent.

Figure 4. Wheat field on May 2, 2014 partially covered by soil from dust storms. Photo by Joe Liebbrandt, Grant County Research and Extension Agent.

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6. Wheat tour scheduled at North Central Experiment Field, June 4

The North Central Experiment Field Wheat Plot Tour is scheduled for Wednesday, June 4, starting at 7:30 a.m. The morning also features information about growing canola in north central Kansas.

The field is located about two miles west of Belleville on Kansas Highway 36. Juice and rolls will be served ahead of the tour. Tour topics include:

- Wheat Varieties and Diseases
- Canola Variety Selection for North Central Kansas.

The tour is free and open to the public. More information is available by calling the North Central Experiment Field at 785-335-2836 or contacting Dallas Peterson at 785-532-0405 or depterso@ksu.edu.

7. Comparative Vegetation Condition Report: April 15 - 28

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 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:

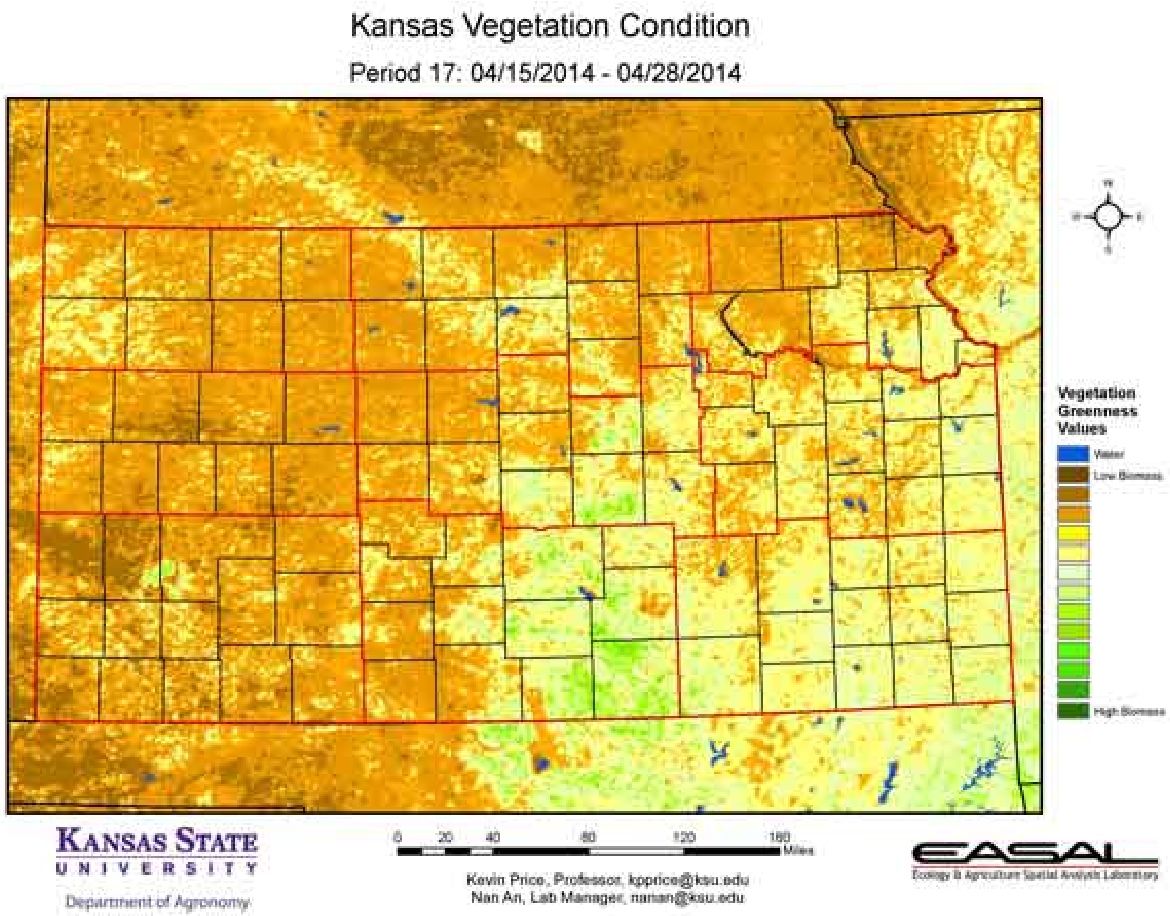

Figure 1. The Vegetation Condition Report for Kansas for April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that photosynthetic activity is greatest in south central Kansas, where temperatures have been warmer.

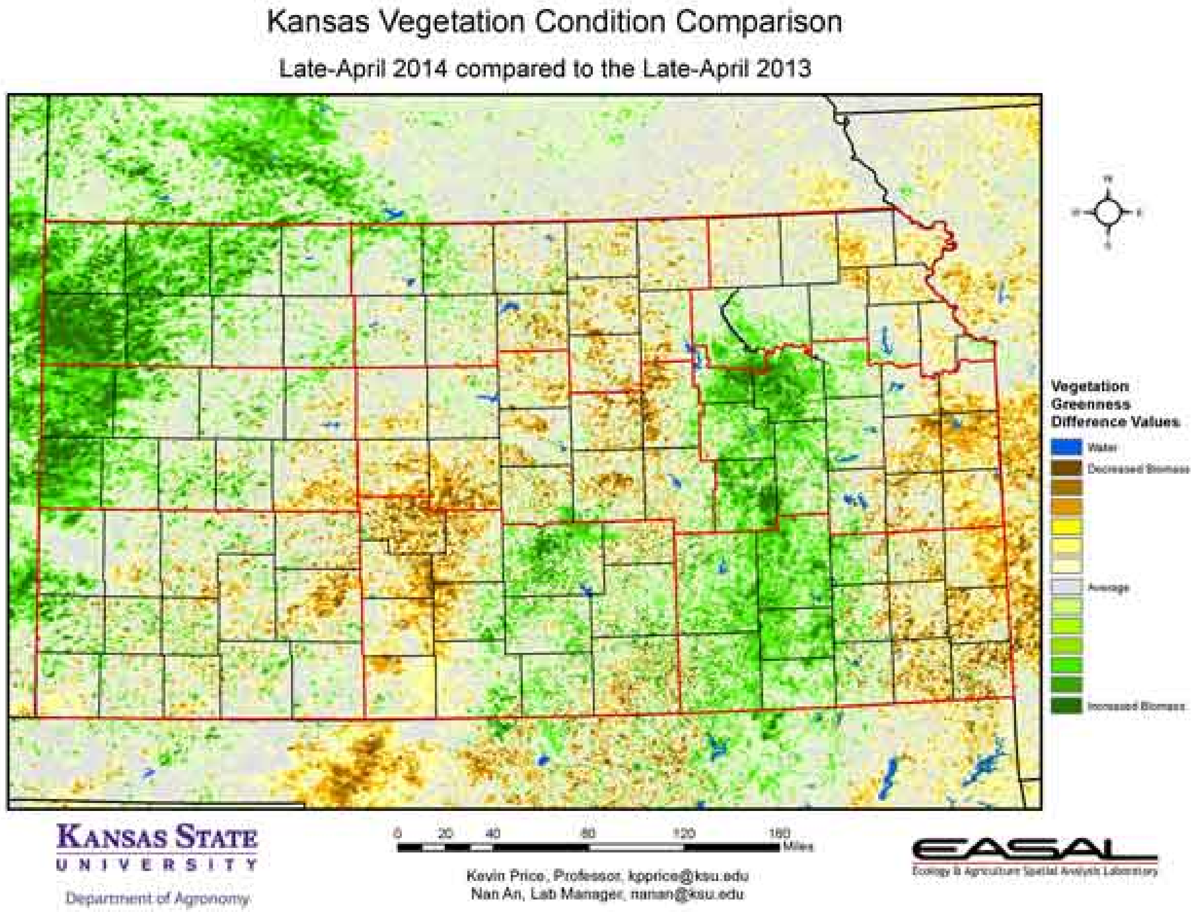

Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the Flint Hills and northwest Kansas have much higher NDVI values. In the Northwest, while drought continues, there was more fall moisture than in the previous year. In the Flint Hills region, temperatures are closer to normal this year.

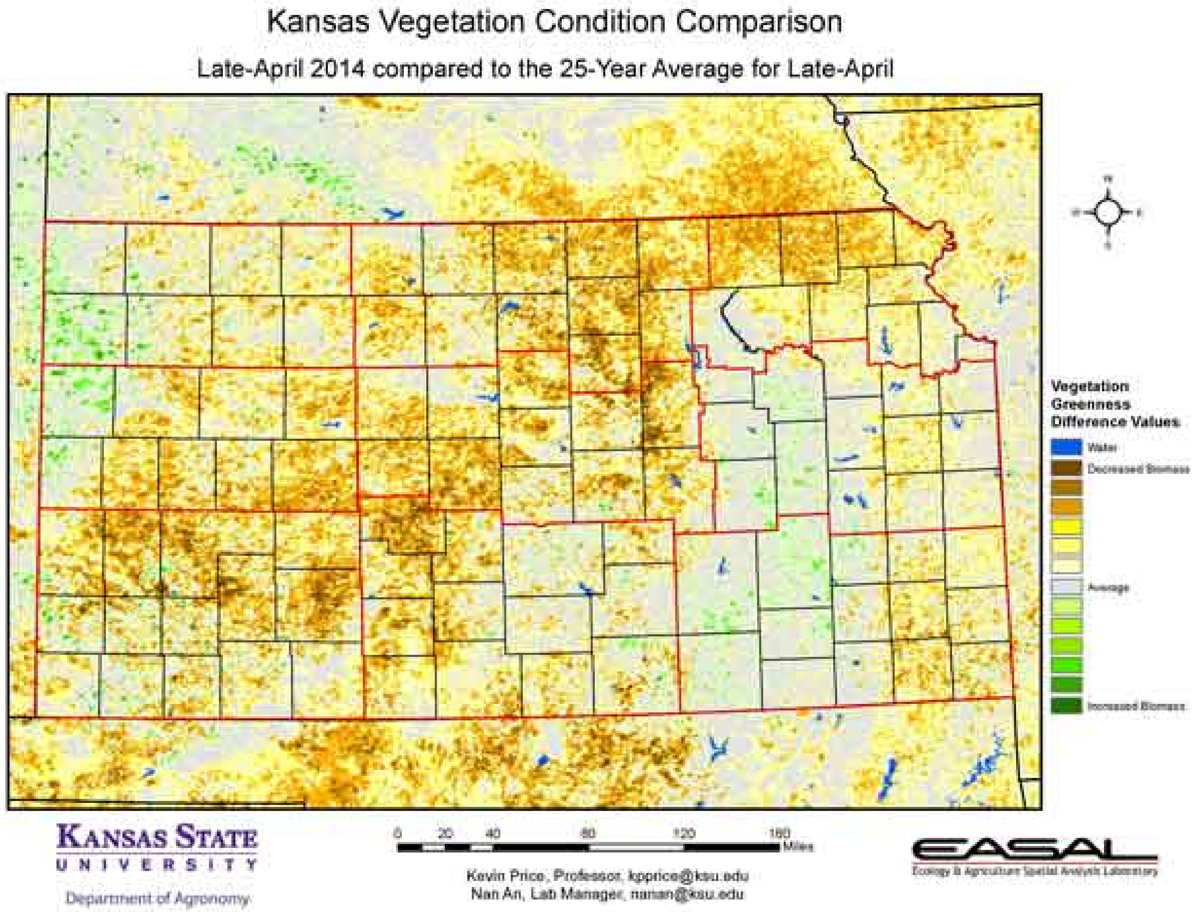

Figure 3. Compared to the 25-year average at this time for Kansas, this year's Vegetation Condition Report for April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows below average vegetative activity from the Southwest through the Central Divisions into the North Central and Northeastern Divisions. Reasons for this low level of activity vary. In the Southwest and Central Divisions, dry soils have limited vegetation. In the North Central and Northeast, cooler temperatures have been a major factor. Emerging drought in east central and southeast Kansas, coupled with cooler-than-average temperatures, is also impacting biomass production.

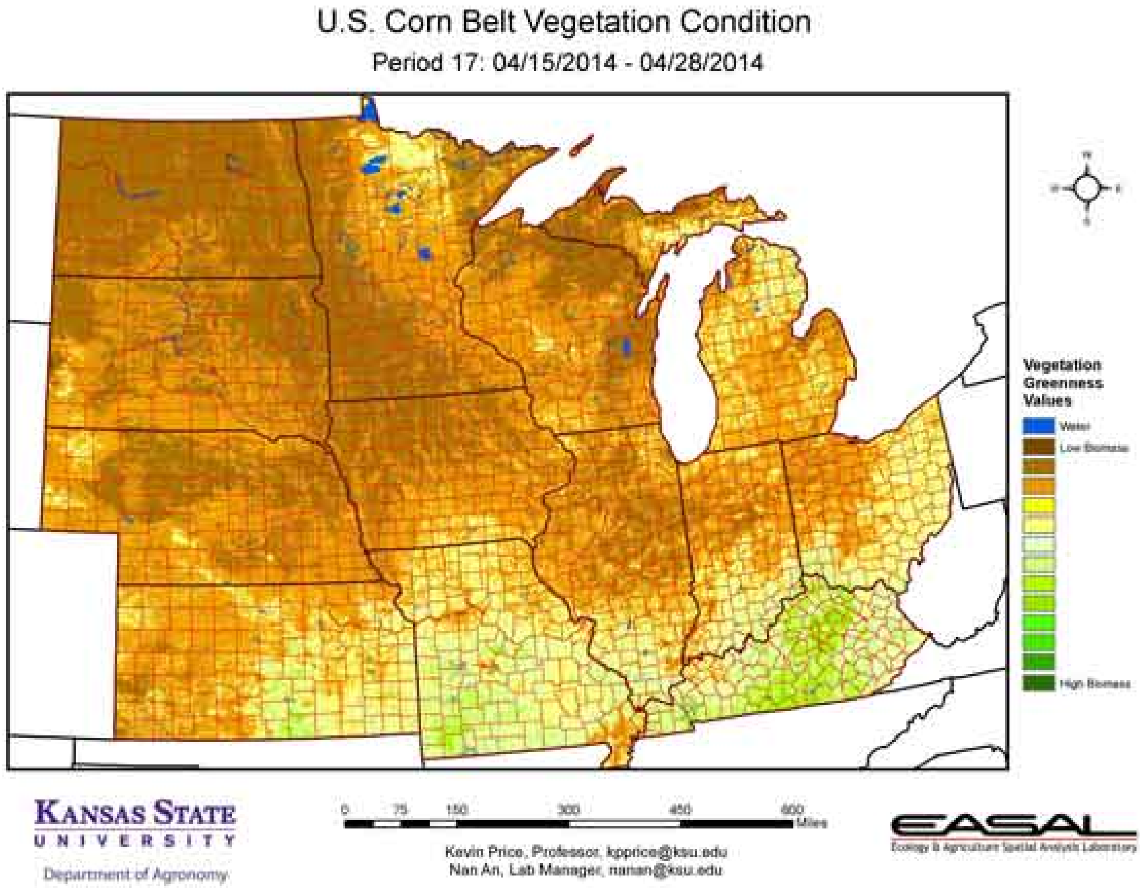

Figure 4. The Vegetation Condition Report for the Corn Belt for April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that vegetative activity has been slow to develop, particularly along the northern portions of the region. Cooler-than-average temperatures have had the biggest impact on the low NDVI values. In the southwestern part of the region, extremely cold temperatures at the beginning of the period further damaged vegetation already under drought stress.

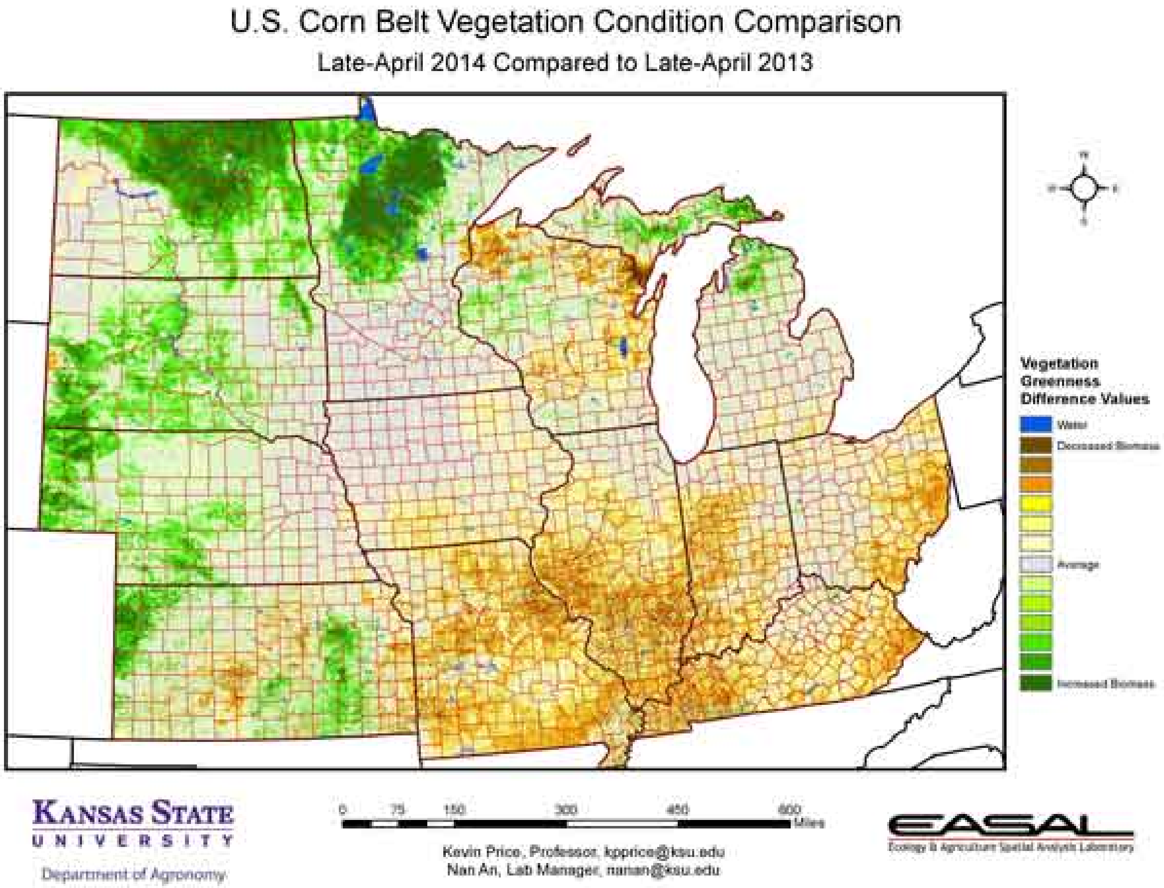

Figure 5. The comparison to last year in the Corn Belt for the period April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows patches of higher biomass production in North Dakota and Minnesota. These areas have a quicker melt of the snowpack than has been the case in Wisconsin, allowing for greater vegetative activity this year.

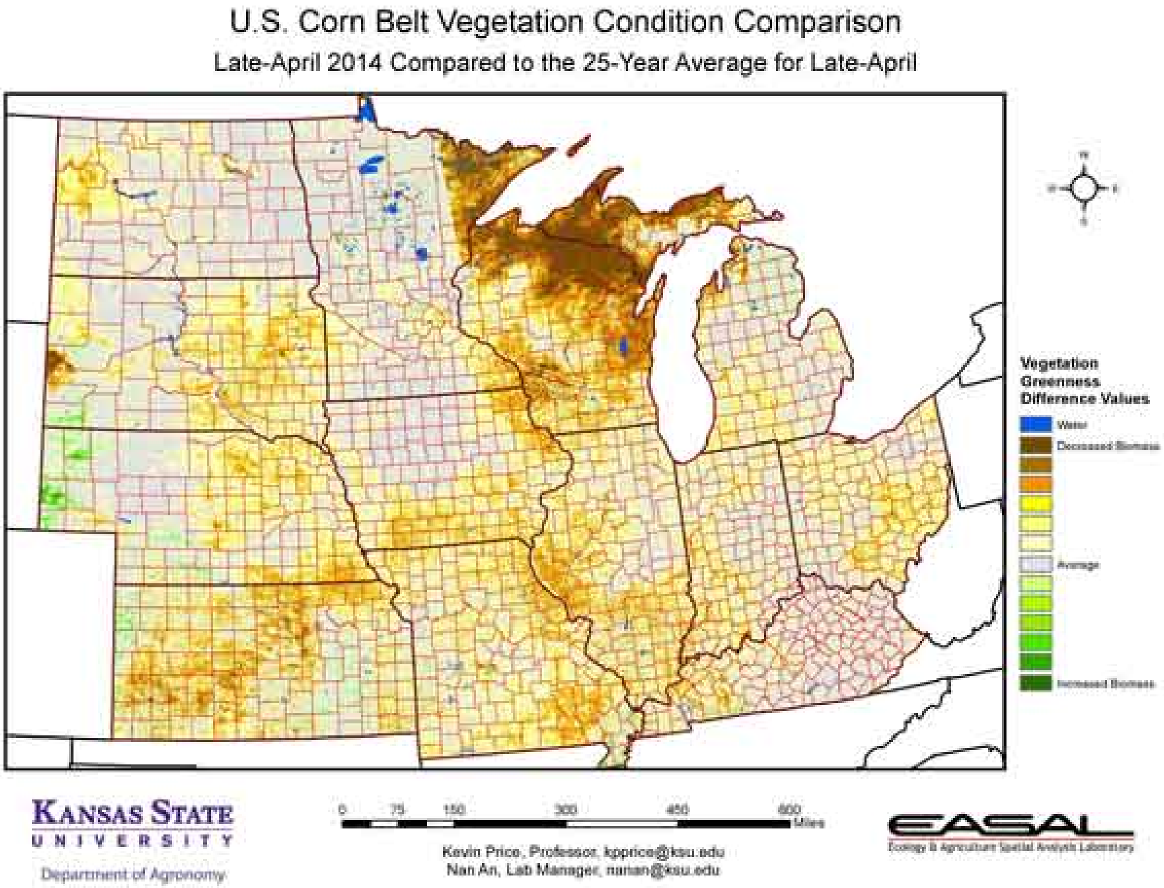

Figure 6. Compared to the 25-year average at this time for the Corn Belt, this year's Vegetation Condition Report for April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the upper Great Lakes continues to have the greatest lag in biomass production. Persistent cold and snow have delayed plant development in the region. A mix of colder weather and drought have reduced vegetative activity in Kansas.

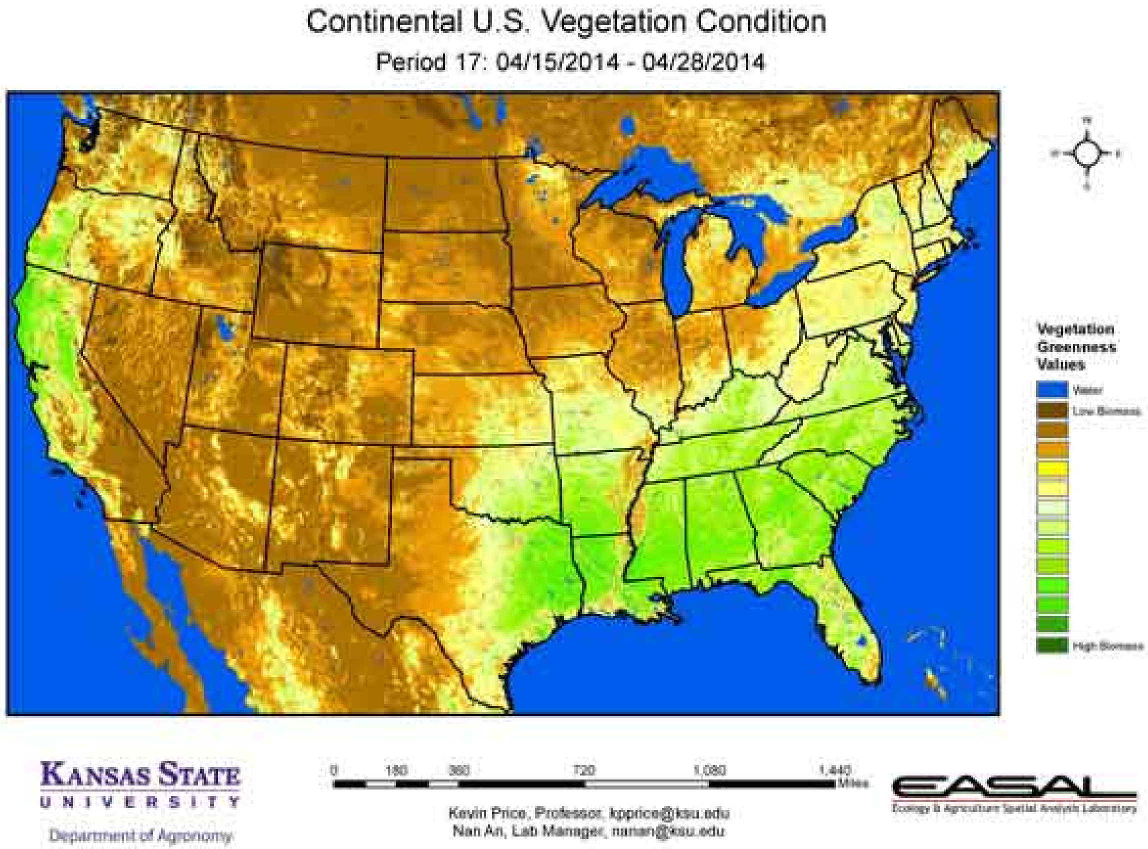

Figure 7. The Vegetation Condition Report for the U.S. for April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that greatest vegetative activity is in the Southeast. Heavy rains along the Gulf Coast have created problems in the region. In the Pacific Northwest, the amount of high biomass activity is decreasing.

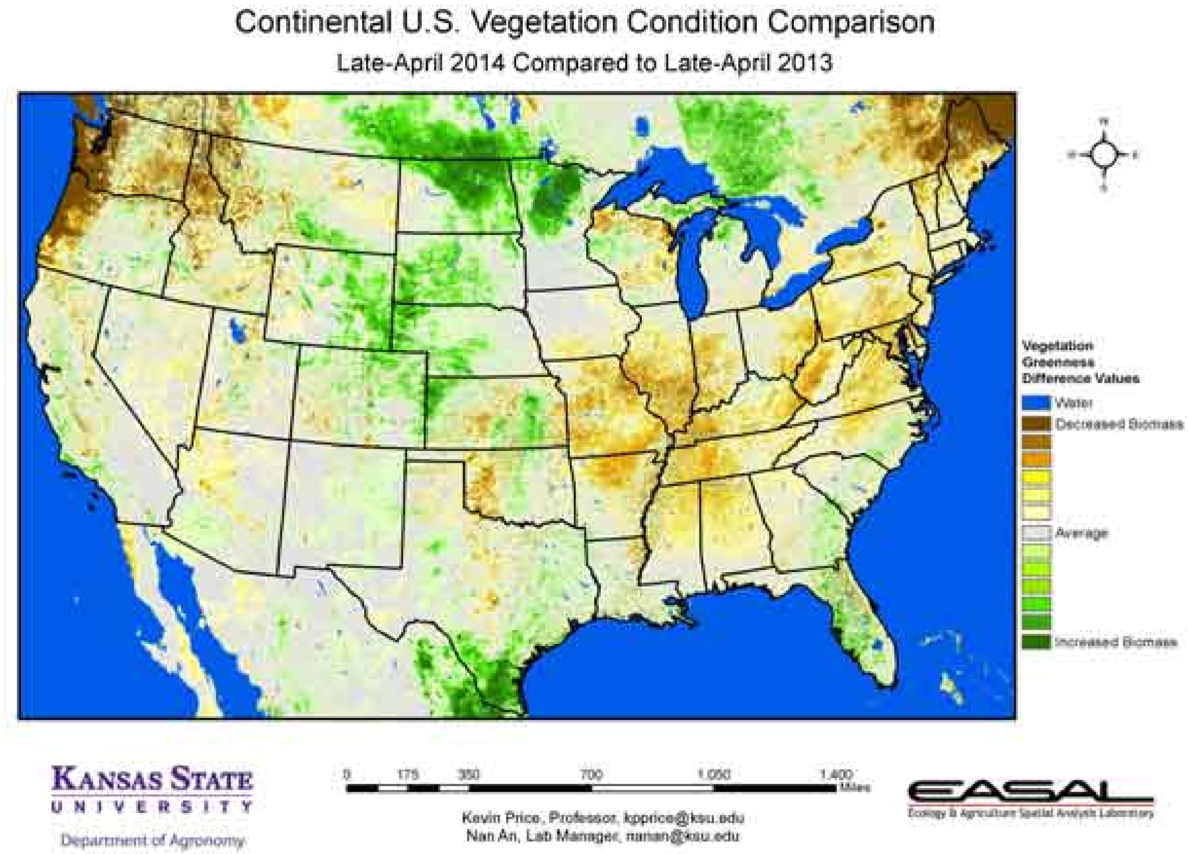

Figure 8. The U.S. comparison to last year at this time for the period April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the biggest differences are in the Northern Plains, where less snow remains this year than last year at this time.

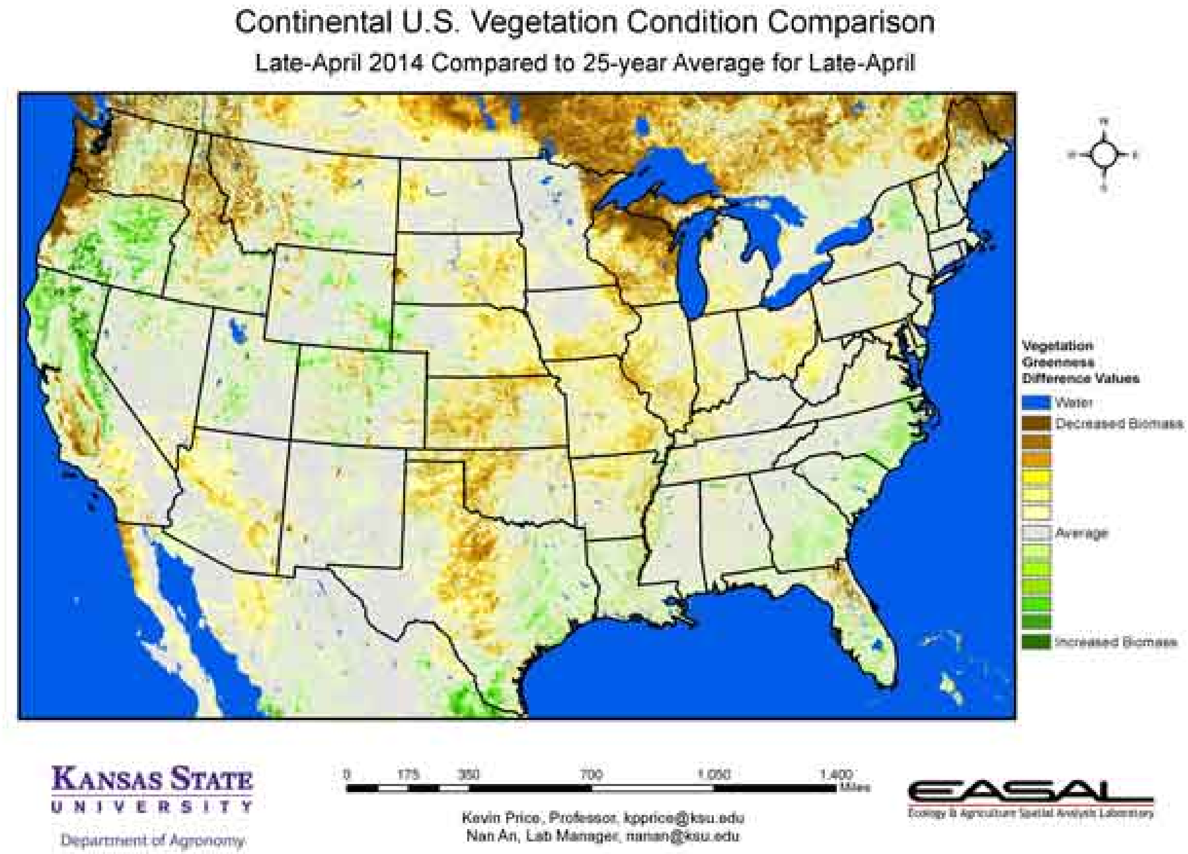

Figure 9. The U.S. comparison to the 25-year average for the period April 15 – 28 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the biggest departures are in the Pacific Northwest and the Upper Great Lakes. In the Upper Great Lakes, lingering cold temperatures and snow have delayed plant development. Impacts of dry conditions can be seen from central Texas into north central Kansas, as vegetation is slow to develop.

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