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11/13/2015

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. Applications of Small Unmanned Aerial Systems (sUAS)

(Note: The following article in an excerpt from the new K-State Research and Extension publication *SUAS What You Should Know About Small Unmanned Aerial Systems*, MF3245, by Brian McCornack, field crop entomologist, and Kurt Carraway, UAS program manager, K-State Polytechnic Campus, Salina. The full publication is available online at:
http://www.bookstore.ksre.ksu.edu/pubs/MF3245.pdf
-- Steve Watson, Agronomy eUpdate Editor)

Small unmanned aerial systems (SUAS), also known as drones, are fixed- or rotary-winged vehicles that do not carry humans. The lighter-than-air units were developed for the military, but advances in computer technology and enthusiastic aerial radio-controlled vehicle hobbyists provided the incentive for the syndicated technologies and UAS systems that have made their way into commercial industry and the federal airspace.

The smallest unmanned aerial systems weight less than a pound and fit into the palm of a hand. They are typically powered by electricity and fly for about 10 minutes. The largest vehicles in this category weight up to 55 pounds, are gasoline-powered, and fly for almost 24 hours. An unmanned aircraft system is comprised of one or more ground control stations, a data link, a payload (e.g., camera, sensor), a human operator, and the unmanned aircraft.

Small unmanned aerial systems offer a broad range of capabilities. A few practical applications include:

- Food production: Sensor technology allows farmers and ranchers to monitor plant health at critical growth stages and detect problems with livestock (e.g., thermal sensing, left) and rangelands long before they become visible to the unaided eye. Other uses include monitoring crop status, growing stage, yield estimates; collecting precision agriculture prescription data; and tracking livestock migration.
- Crop protection and plant biosecurity: Remote-sensing technologies enable early detection of pests and invasive species and implementation of sophisticated pest management strategies. For example, with UAS-generated vegetation maps, researchers can chart distinct field patterns that allow them to quickly identify and manage damaging infestations of crop pests such as Russian wheat aphid.
- Infrastructure inspection: Small unmanned aerial systems can capture and relay information about the condition of structures such as wind turbines, power lines and smokestacks in real time and at relatively low cost compared to manual inspections. Using unmanned vehicles to inspect hard-to-reach structures reduces risks to inspectors and increases the economic efficiency of the power system.
- Transportation: The ability to capture images tagged with technical details such as time and location increases the utility of small UAS for road and bridge inspection, pothole detection, accident reporting, environmental assessment, and post-disaster surveys.
- Public safety: In firefighting search and rescue efforts in wilderness or large urban areas, the aerial view enables responders to cover large areas and to locate victims quickly. Detailed site data helps responders make better decisions, which saves lives and protects property.
- Water quality: Small UAS offer rapid response to changing environmental conditions. They can be used to monitor swimming beaches or shorelines for toxic algal scum that threatens humans, or to detect algal blooms that can be deadly to livestock.

Source: *SUAS What You Should Know About Small Unmanned Aerial Systems*, MF3245: http://www.bookstore.ksre.ksu.edu/pubs/MF3245.pdf

2. Small Unmanned Aerial Systems: Regulations and safety

(Note: The following article in an excerpt from the new K-State Research and Extension publication *SUAS What You Should Know About Small Unmanned Aerial Systems*, MF3245, by Brian McCornack, field crop entomologist, and Kurt Carraway, UAS program manager, K-State Polytechnic Campus, Salina. The full publication is available online at:
http://www.bookstore.ksre.ksu.edu/pubs/MF3245.pdf
-- Steve Watson, Agronomy eUpdate Editor)

Know the rules for operating a small, unmanned aircraft (sUAS) in federal airspace before you fly. The rules can be found at http://knowbeforeyoufly.org/ Obtain a certificate of authorization (COA), which is required for both public and commercial entities. See table below for details. To learn how to apply, visit the Federal Aviation Administration (FAA) web site at http://www.faa.gov/uas.

Guidelines for use of small UAS in federal airspace			
Restrictions / Requirements	Hobbyist	Public entity	Commercial user
Section 333 Exemption	No	No	Yes
Certificate of Authorization	No	Yes	Yes
Visual Line of Sight	Yes	Yes	Yes
Pilots License	No	COA*	Yes, COA*
Altitude Limitation	400 feet above ground level	COA*	COA*
Distance from Airport	5 nautical miles unless authorized	COA*	COA*

* Flight restrictions are specified in the Certificate of Authorization (COA)8 y terms

miles unless authorized federal airspacelinaanned aircraft.one or more ground control stations, a data link, a payloa

Key terms

Section 333 Exemption – A Section 333 exemption is required for commercial use. It allows an sUAS operator with an FAA airworthiness certificate and COA to fly in approved airspace. Other operators may be granted an exemption for commercial use. For application procedures, visit the FAA's "Section 333" page.

Certificate of authorization (COA) – waiver that allows an operator of a small unmanned aerial system to fly within federal airspace. Altitude limitations and distance from nearest airport are specific to the **authorization certificate.**

Visual line of sight – The operator must keep the vehicle in eyesight at all times and use an observer to assist, if needed.

Altitude limitation – the maximum height (in feet or meters) above ground level that an operator can fly a small unmanned aerial system in federal airspace.

Hobbyist or recreational user – operation of a system for personal interest and enjoyment but without compensation. Selling images or videos taken from an unmanned aerial system, is considered commercial use.

Public entity – an institution or publicly funded organization (university, fire department, law enforcement) must apply for a certificate of authorization (COA) from the FAA for use in public aircraft operations or for research.

Commercial user – any person using a small unmanned aerial system for compensation or hire, for example, to capture and sell images or videos, or to provide industrial inspection, security, or telecommunication services.

The average time to process a COA is less than 60 days, but an application can be expedited in an emergency situation. Laws and regulations pertaining to public aircraft operations are referenced in 49 U.S.C. §§ 40102(a)(41), 40125, and FAA Advisory Circular 00-1.1A, Public Aircraft Operations (Feb. 12, 2014).

Source: *SUAS What You Should Know About Small Unmanned Aerial Systems*, MF3245: http://www.bookstore.ksre.ksu.edu/pubs/MF3245.pdf

3. Weather, climate, and the determination of climate normals

(Note: The following article in an excerpt from the K-State Research and Extension and Oklahoma State University publication *What Is The Difference Between Weather and Climate?*, MF3197, by Peter Tomlinson, K-State environmental quality specialist; Mary Knapp, K-State assistant state climatologist; Albert Sutherland, OSU assistant Extension specialist; and Amber Campbell, K-State adjunct assistant professor and project manager. The full publication is available online at: http://www.bookstore.ksre.ksu.edu/pubs/MF3197.pdf

-- Steve Watson, Agronomy eUpdate Editor)

Weather and climate are not independent. The confusion comes from weather and climate being intimately connected to each other, and this confusion is often highlighted in discussions about our changing climate. The averages of daily weather are used to monitor climate. Changes in climate lead to changes in weather patterns including extremes. An easy way to remember the difference is that climate is what you expect, like a hot summer, and weather is what you get, like a cool day in August.

Our communities and farms are affected by short-term weather events. Their long-term sustainability is affected by climate and climate variability attributed to natural processes and human activities. Figure 1 depicts how weather and climate are intertwined. Over time, the weather forms the climate and influences the environment (soil, hydrology, plants, and animals), and economic viability of our human systems.

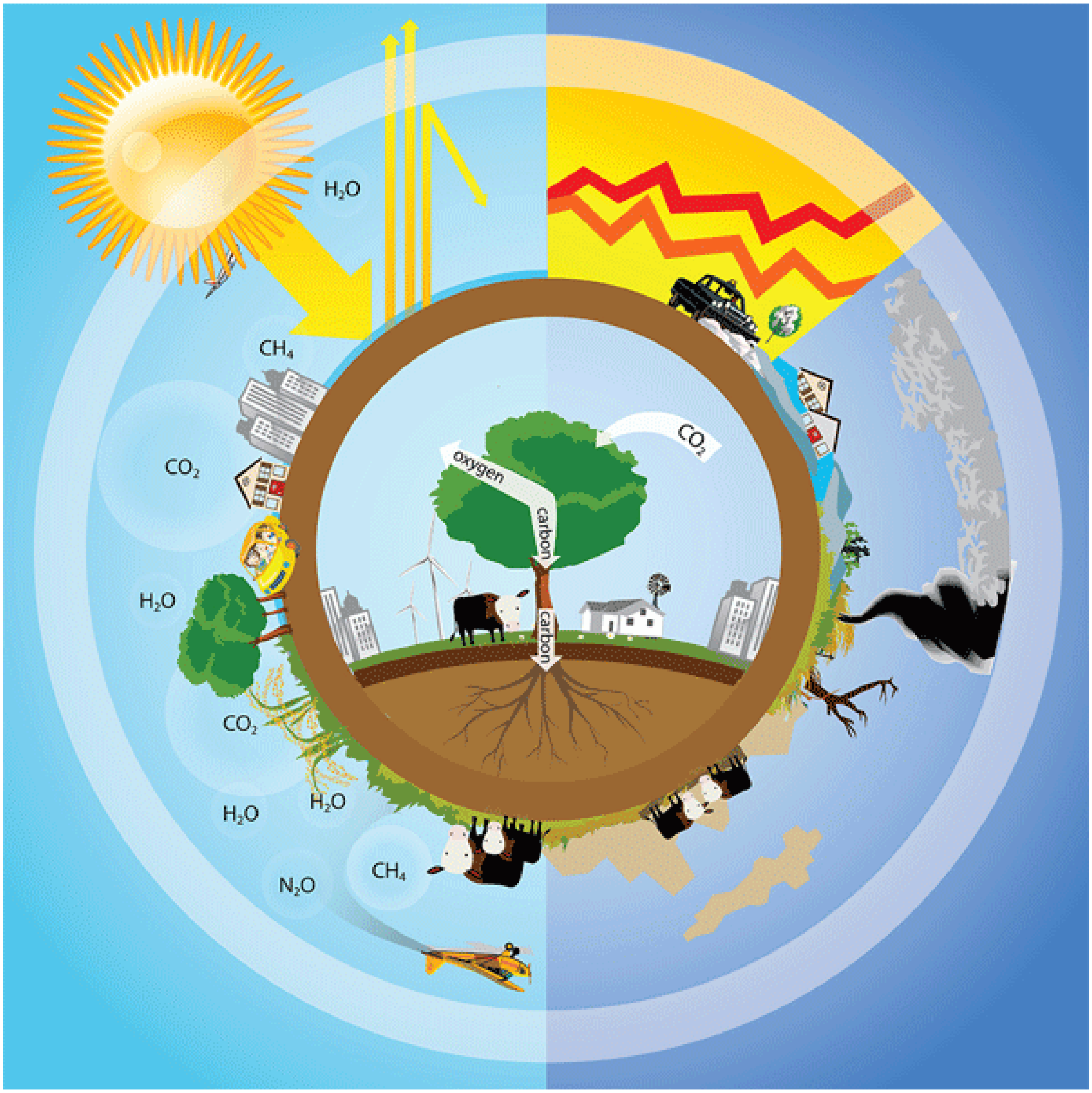

Figure 1. Communities and farms are affected by short-term weather events. Their long-term sustainability is affected by climate (long-term weather variation or expected weather) and climate variability driven by natural and human processes.

Weather:

Weather is the behavior of atmosphere at any given moment. It is what we observe on a daily or weekly basis and includes, but is not limited to, sunshine, rain, cloud cover, wind, hail, snow, sleet, freezing rain, blizzards, ice storms, and thunderstorms. We generally think about weather and how it affects our lives and activities. Weather can change from minute-to-minute, hour-to-hour, day-to-day, and season-to-season.

Climate:

Climate is the long-term aggregation of weather that occurs in an area and the extent to which those conditions vary over long time intervals. When scientists talk about climate, they are looking at patterns of precipitation, temperature, humidity, sunshine, wind speed, fog, frost, and other variables, such as soil temperature and moisture, that occur over a long period in a particular place. The concept of climate has broadened and evolved in recent decades in response to the increased understanding of the underlying processes that determine climate and its variability. Earth's climate starts with the sun, the sole energy source for our planet. Climate is influenced by interactions involving the sun, ocean, atmosphere, clouds, ice, land, and living organisms (Figure 1).

Often, this is thought of as the "climate system." Climate varies by region as a result of local differences in these interactions. The Great Plains has a continental climate. This features wide variability from season to season and year to year, with little moderating effect from large water bodies.

Climate normals:

Meteorologists and climatologists regularly use "normal" for placing recent climate conditions into a historical context. Climate "normals" are three-decade averages of climatological variables, including temperature (Figure 2) and precipitation. A "normal" of a particular variable (e.g., temperature) is defined as the 30-year average. The current normal period in the United States is based on 1981 through 2010 data.

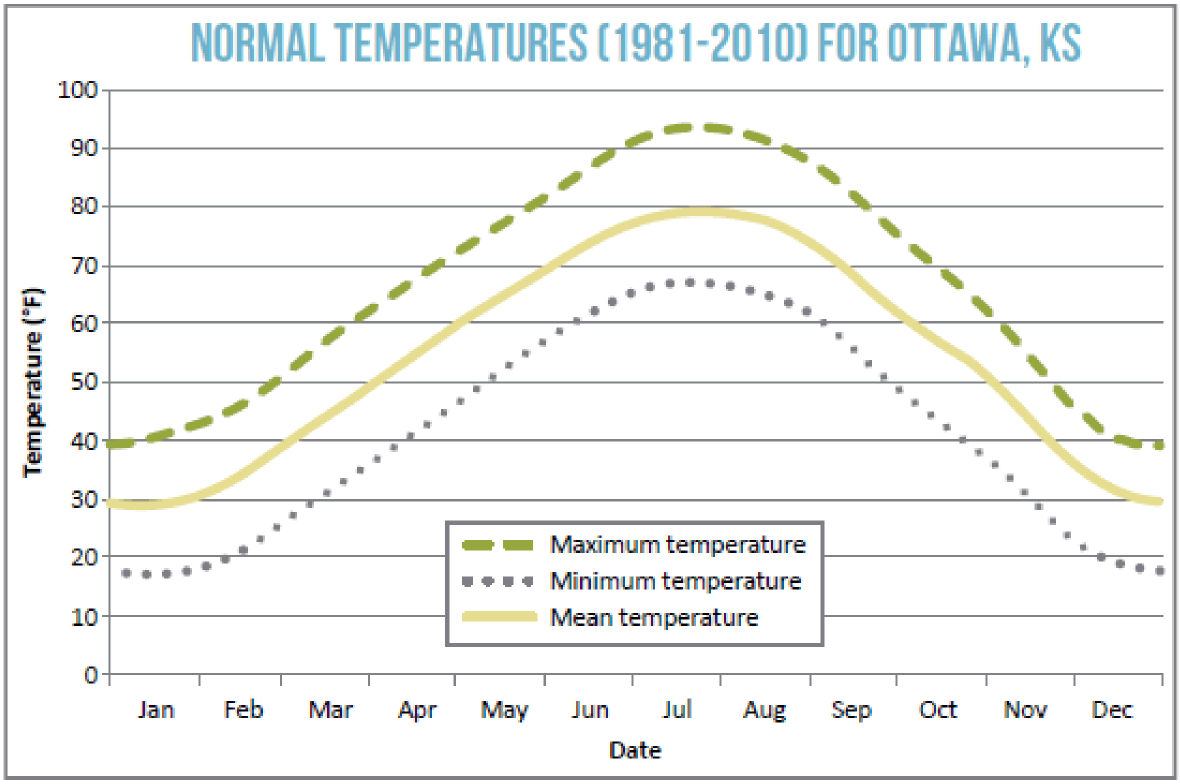

Figure 2. Ottawa, Kansas daily temperature normals for the 1981-2010 period.

For example, the January minimum temperature normal for Ottawa, Kansas (19.3 degrees Fahrenheit) is computed by calculating the average minimum daily temperature in January for each year from 1981 to 2010 and then averaging those values. NOAA's National Climatic Data Center (NCDC) released the 1981 through 2010 Normals on July 1, 2011.

Because climate normals provide a historical perspective and help us understand the unusualness of current weather, they are commonly seen on local weather news segments for comparisons with the day's weather conditions. Graphing the high, low, and mean temperature for a single year over the normal for that location can help you visualize how well conditions fit into the typical pattern (Figure 3).

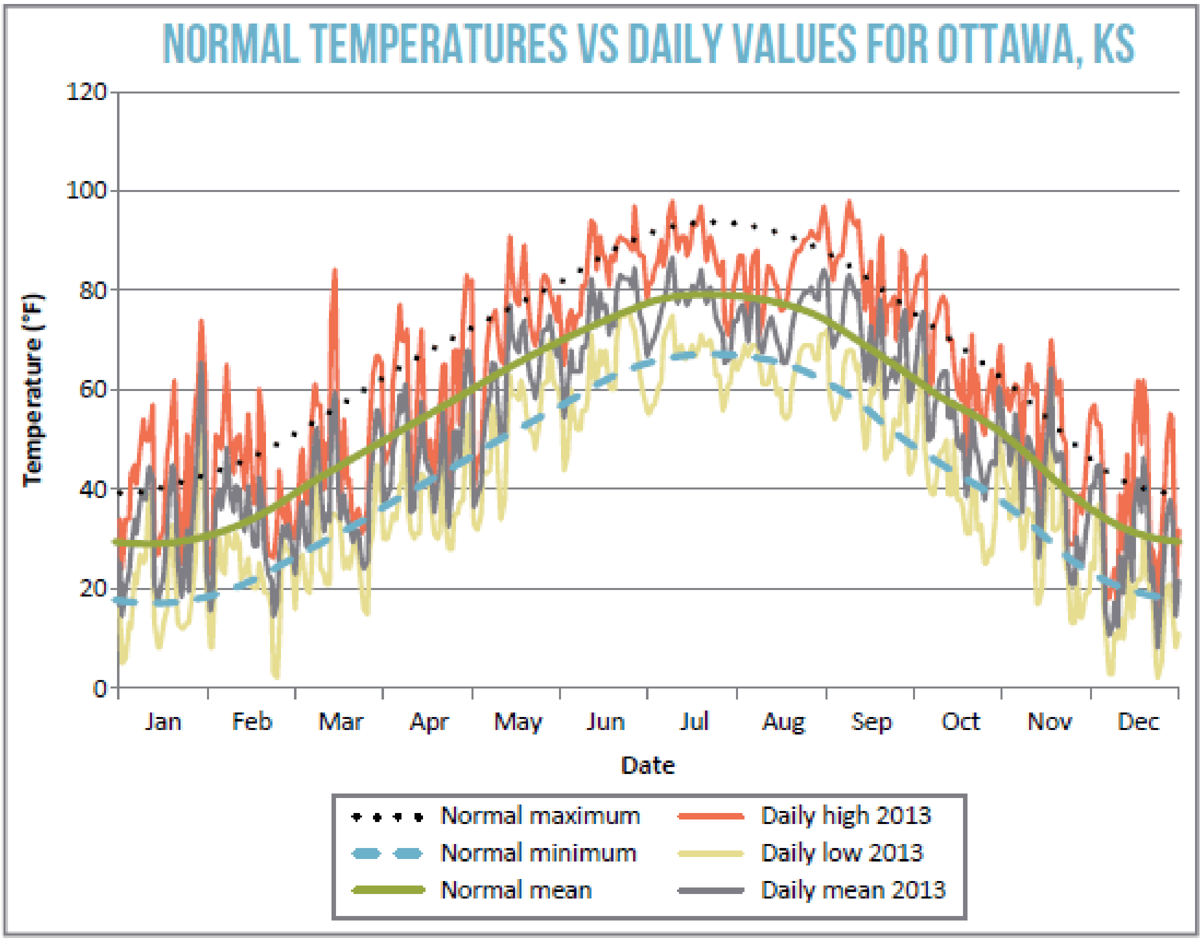

Figure 3. Ottawa, Kansas daily temperatures for 2013 compared to 1981-2010 normals.

Source: *What Is The Difference Between Weather and Climate?* MF3197:
http://www.bookstore.ksre.ksu.edu/pubs/MF3197.pdf

4. Winter grain mites

(Note: The following article is from K-State Research and Extension's Kansas Insect Newsletter, November 13, 2015, No. 26. – Steve Watson, Agronomy eUpdate Editor)

This time of year there is usually considerable interest in winter grain mites, and this year is no exception. Below is a refresher on winter grain mites:

- Adults can be seen by the naked eye, but they are tiny.

- They have dark colored bodies with distinctive red legs and a red spot at the rear of their back, which is an anal pore.

- There are 2 generations per year.
- Adults will be actively feeding in the fall and spring and overwinter and oversummer as eggs.
- Feeding will continue as long as temperatures are cool (not cold), i.e. they are most active from 40°F to 70°F.

Feeding activities usually peak about this time of year and will cease during winter, when temperatures usually are too cold. The first generation deposits eggs in November and December and these eggs will hatch in late February to March. This is about the time wheat is breaking dormancy, thus another time for grower concern. Under dry conditions winter grain mite feeding may cause plants to take on a silvery appearance because mites penetrate individual plant cells and remove the plant juice. Serious feeding, again in dry conditions, may result in yellowing of plants but, more commonly, just on the tips. Under good growing conditions this feeding will not even be noticed. Hot weather causes adult populations to quickly decrease.

In summary, mite feeding activity will be terminated by cold weather in winter and hot weather in the spring, both of which cause eggs to be deposited into the soil to withstand the unfavorable conditions. Winter grain mite feeding is only noticeable when wheat is under moisture stress, is reversed by adequate moisture, and rarely, if ever, results in any impact on yield.

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5. The economic return to soil test information

Fall after harvest is an excellent time for soil sampling and testing. This year, with low grain prices, many producers may be looking for places to cut costs. However, cutting back on soil testing could result in lowering profits.

Having accurate soil test information is critical to making the right decisions regarding fertilizer input. Fertilizer cost has remained steady while grain prices have dropped this fall. Therefore, making good use of fertilizer input becomes critical to maximize profits.

Previous research by former K-State agricultural economists Terry Kastens and Kevin Dhuyvetter simulated 10,000 observations from farm production fields to evaluate the economic value of accurate soil test information. Each field was assigned a random value for soil test P (STP) and soil test N (STN), and different scenarios for expected yields and prices for grain and fertilizer. The random values represent what a producer might guess the soil N or soil P level is without having results of a soil test for confirmation.

The resulting yields from nutrient rates applied based on the guesses made without accurate soil test information were compared with the yields obtained when applied nutrient rates were based on actual soil test levels of N and P. Results from this study show that when the guess on soil N and P levels turned out to be exactly correct, and equal to the actual levels, there was no effect on profit from having the actual soil test information – except for the cost of taking and analyzing the soil tests.

However, if the guess is not correct, and the actual soil N or P level is much lower or much higher than the initial guess, the producer would have lost a significant amount of money per acre. In other words, the overall return to accurate information on soil nutrient levels can be significant.

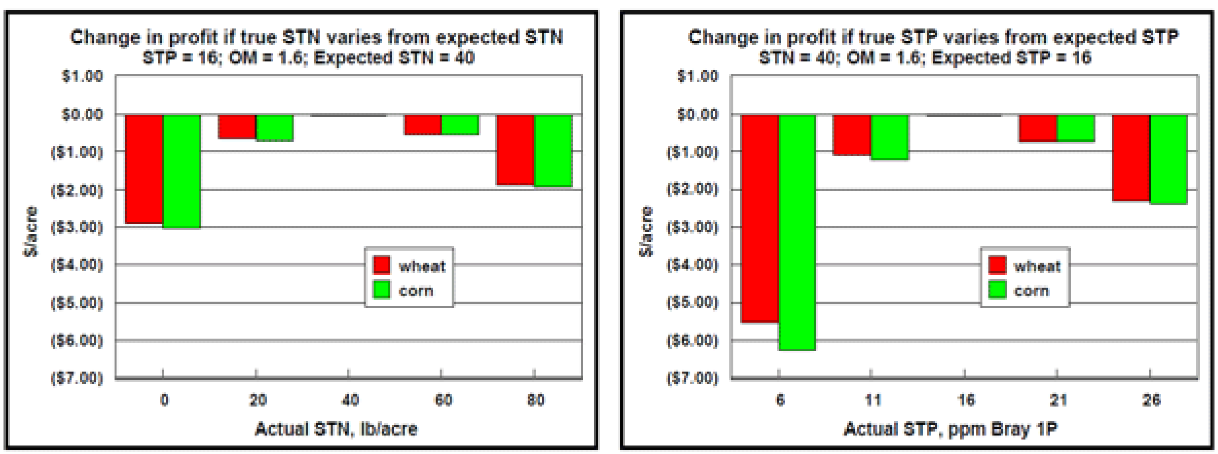

Figure 1. Losses can be expected if nutrient levels (N or P) in the field are significantly lower or higher than what a producer thinks the levels would be without having the benefit of accurate soil test information. Actual nutrient levels in the field can only be assessed with soil sampling. Source: Kastens and Dhuyvetter, KSU, available at:
http://www.agmanager.info/crops/prodecon/precision/Soiltest(revJan2005).pdf

Considering other variables such as fertilizer and grain price, results show that returns to soil sampling are generally greater when grain prices are lower. This is because potential returns to inputs are tighter at lower crop prices.

If actual soil test levels of N or P are higher than what you expect, producers can realize a significant savings by reducing or eliminating unnecessary nutrient applications. This situation is not uncommon for N, where some fields may have high levels of residual N from previous crops.

On the other hand, if producers overestimate how much N or P is in the soil and actual soil test levels are much lower than expected, yields and income could be increased by applying the higher, correct amount of nutrients needed. In this case, the difference in final income per acre will depends on the cost of the needed nutrients, the yield response from applying the needed nutrients, and crop prices.

If producers are applying a "farm-wide" uniform rate, they may be missing the opportunity to maximize profits for each field. Furthermore, by sampling and fertilizing based on management zones within a field, or based on historical yield map data, producers can further increase the return per area.

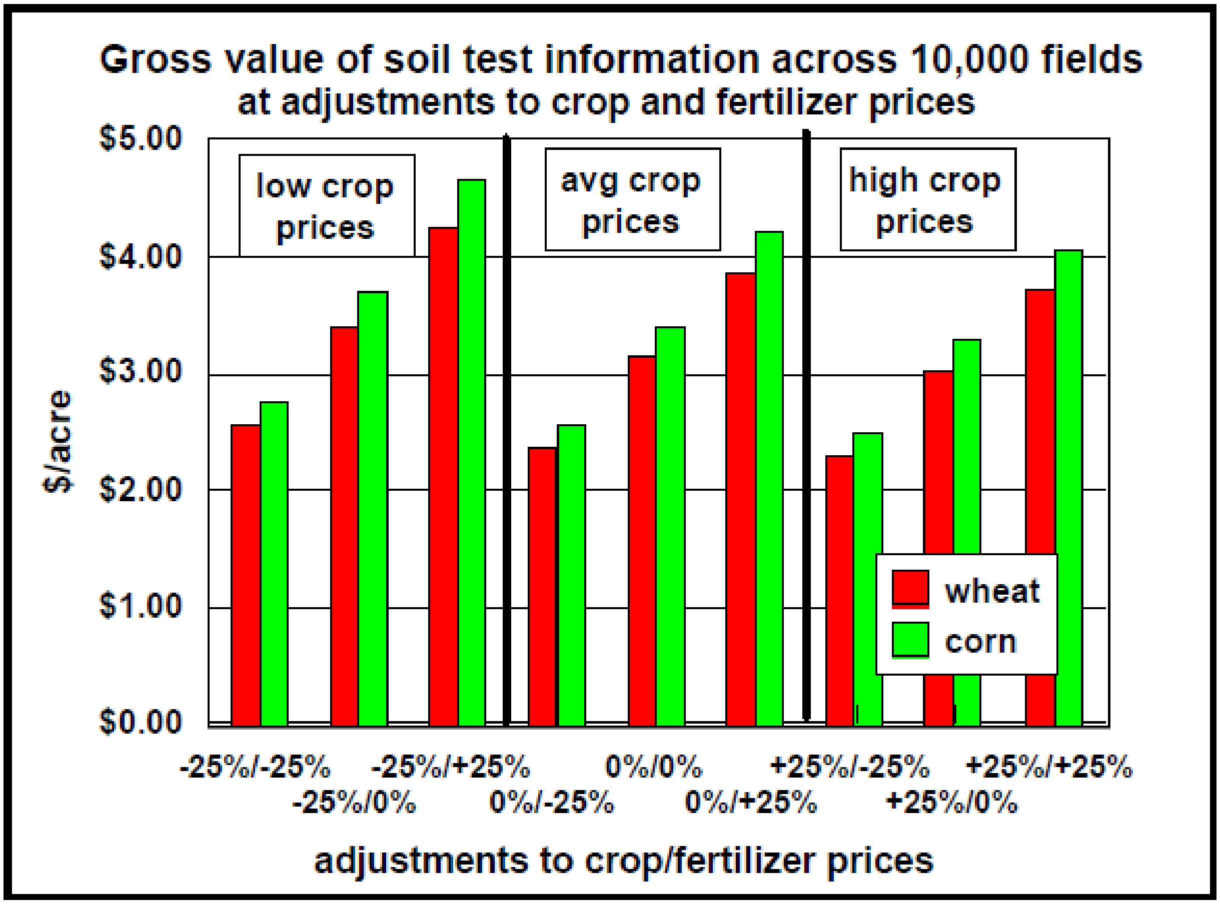

Figure 2. Returns to soil sampling are greater when crop prices are lower. This is because only fields with a greater potential yield increase per unit of N or P would be fertilized when crop prices are low and fertilizer prices are stable.

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6. Comparative Vegetation Condition Report: October 27 - November 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=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 26-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 an_198317@hotmail.com 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, assistant state climatologist:

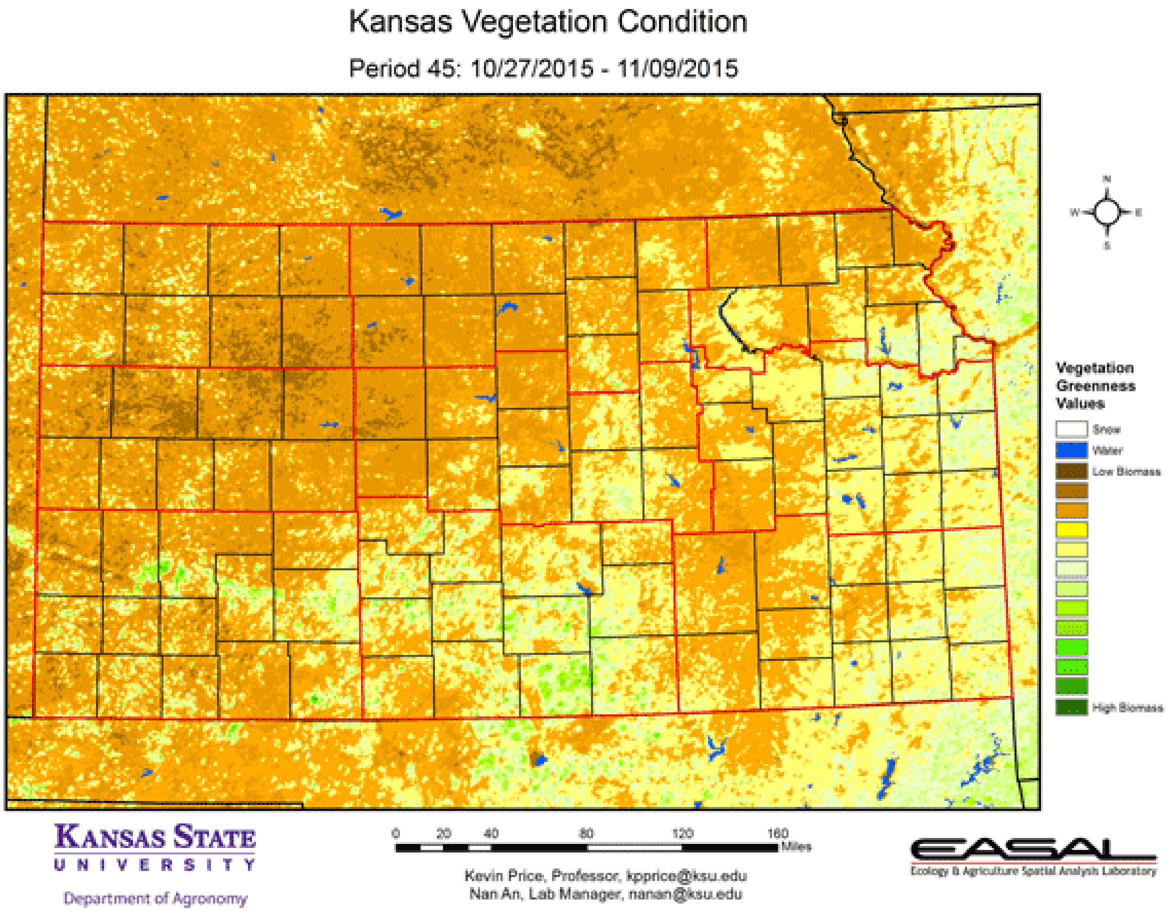


Figure 1. The Vegetation Condition Report for Kansas for October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the area of highest biomass production continues to be in a small pocket of activity along the Arkansas River in southwest Kansas and into the South Central Division. Very low NDVI values are visible in Trego, Ellis, Rush, and Ness counties where moderate drought conditions persist. The recent snow won't show until the next interval, as it fell after the 9th.

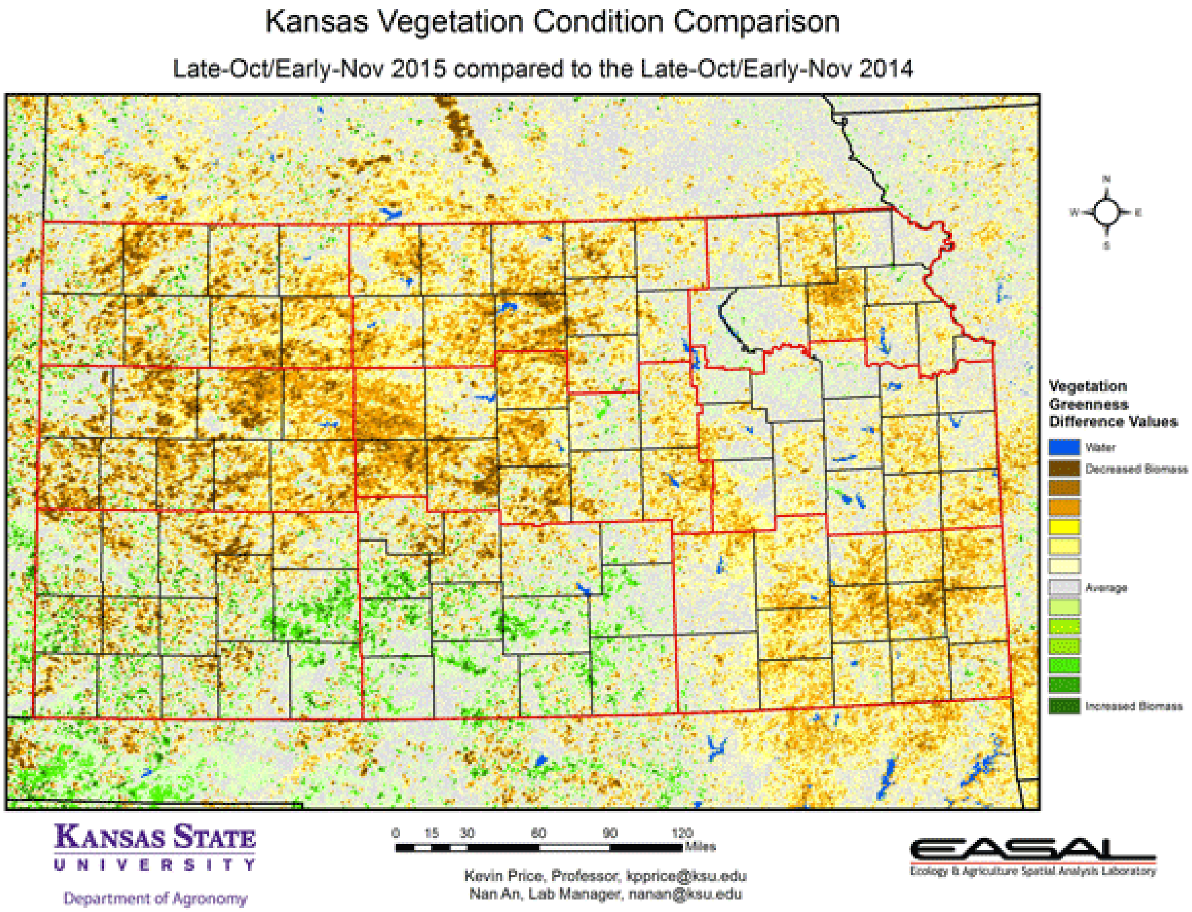
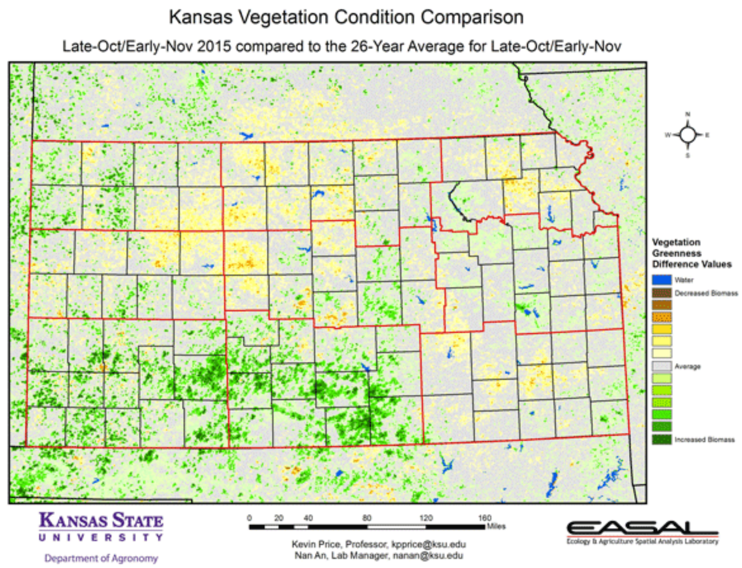


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows much of the state has lower photosynthetic activity. Only the Southwest and South Central Divisions have higher photosynthetic activity. These areas continue to have beneficial moisture, while the rest of the state has been dry. Moderate drought conditions have extended into more areas of the state, while abnormally dry



conditions cover over half the state.

Figure 3. Compared to the 26-year average at this time for Kansas, this year's Vegetation Condition Report for October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that most of the state continues to have near-average photosynthetic activity. The Southwest and South Central Divisions have the largest areas of above-average photosynthetic activity as moisture continues to be above average and temperatures remain favorable in those areas. Recent moisture in the Northwest Division has also favored higher photosynthetic activity. Below-average photosynthetic activity is most prevalent in the Graham/Trego county area, as moderate drought persists there.

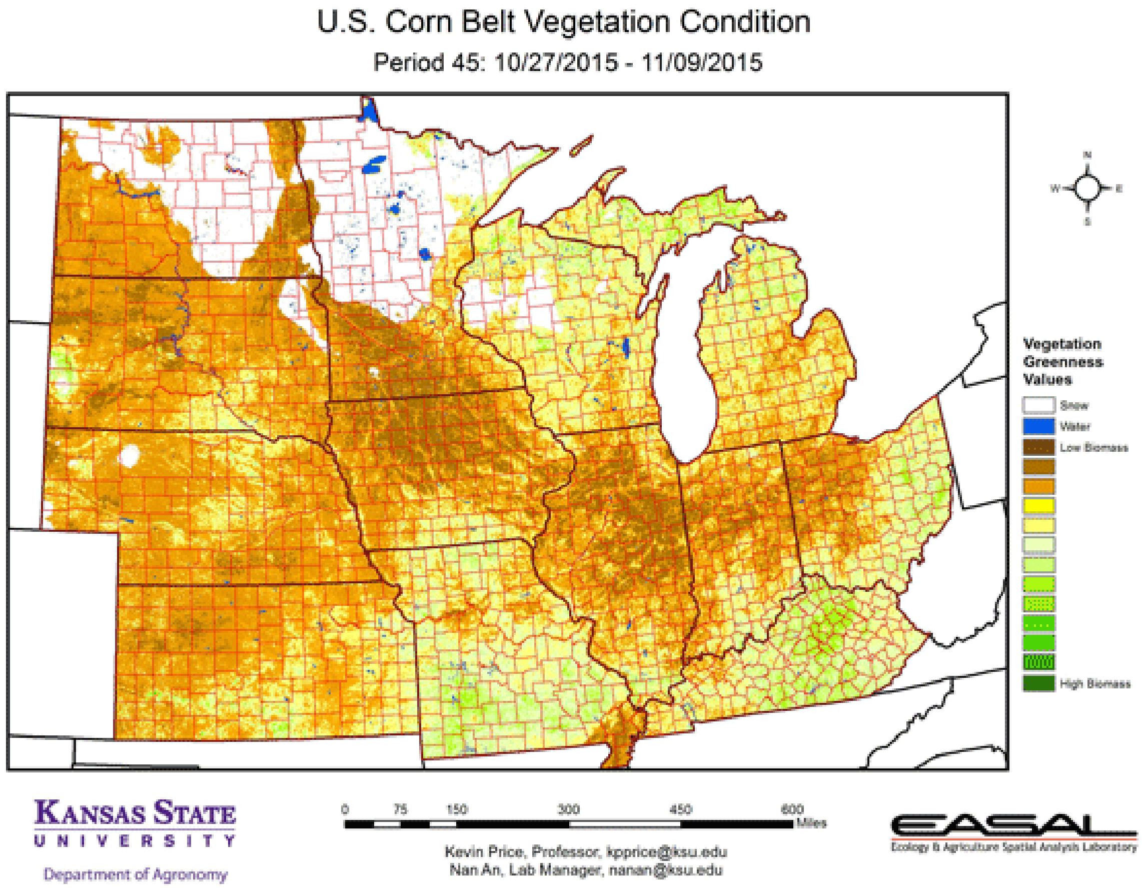


Figure 4. The Vegetation Condition Report for the Corn Belt for October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the greatest photosynthetic activity is concentrated in the southern parts of the region, although there is a band of higher activity in the Upper Peninsula of Michigan. Favorable moisture conditions in these areas have resulted in high photosynthetic activity. Snow has begun to show in the northern parts of the region, although amounts have been light.

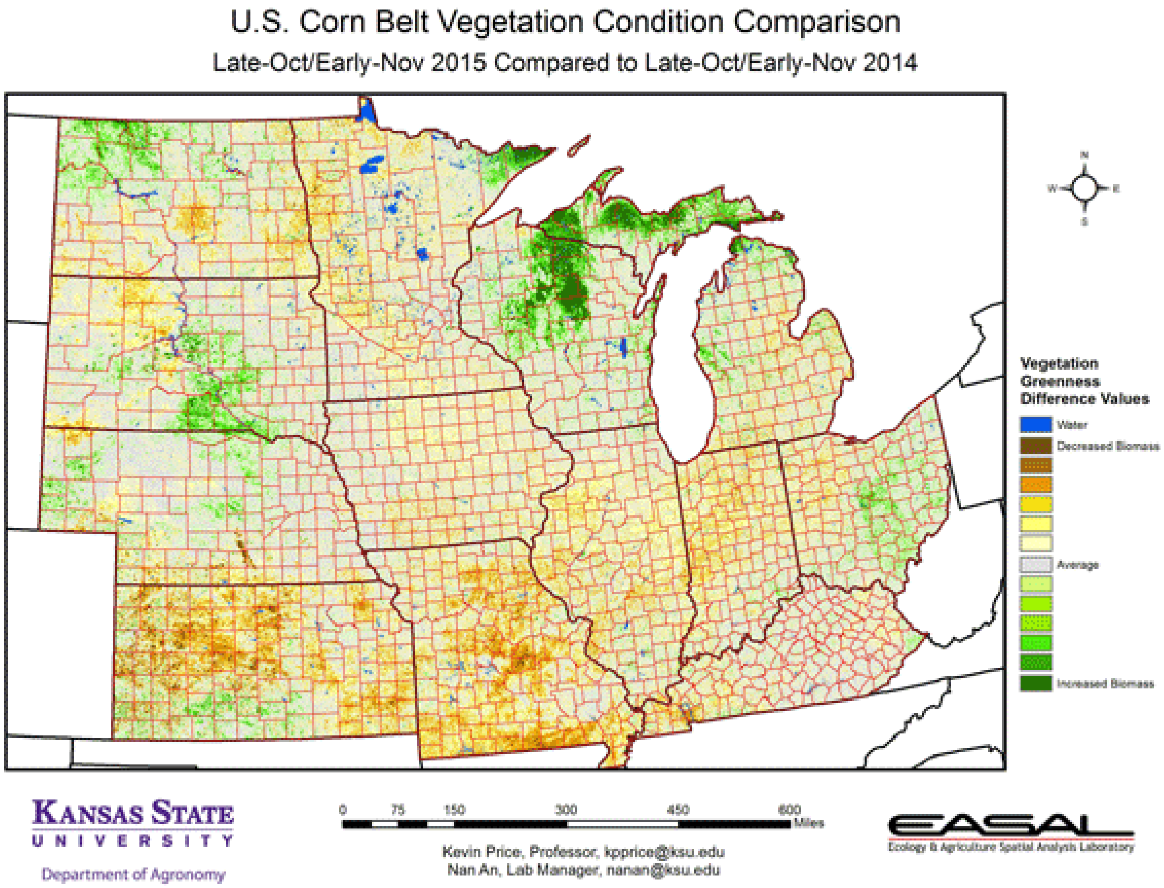


Figure 5. The comparison to last year in the Corn Belt for the period for October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows lower photosynthetic activity centered in the Central Plains, as an extended dry period has increased drought impacts, particularly with winter grains. Drought conditions continue to expand in this area. There is a small area of higher NDVI values in northern Wisconsin and the Upper Peninsula of Michigan, where moisture has been more favorable this year.

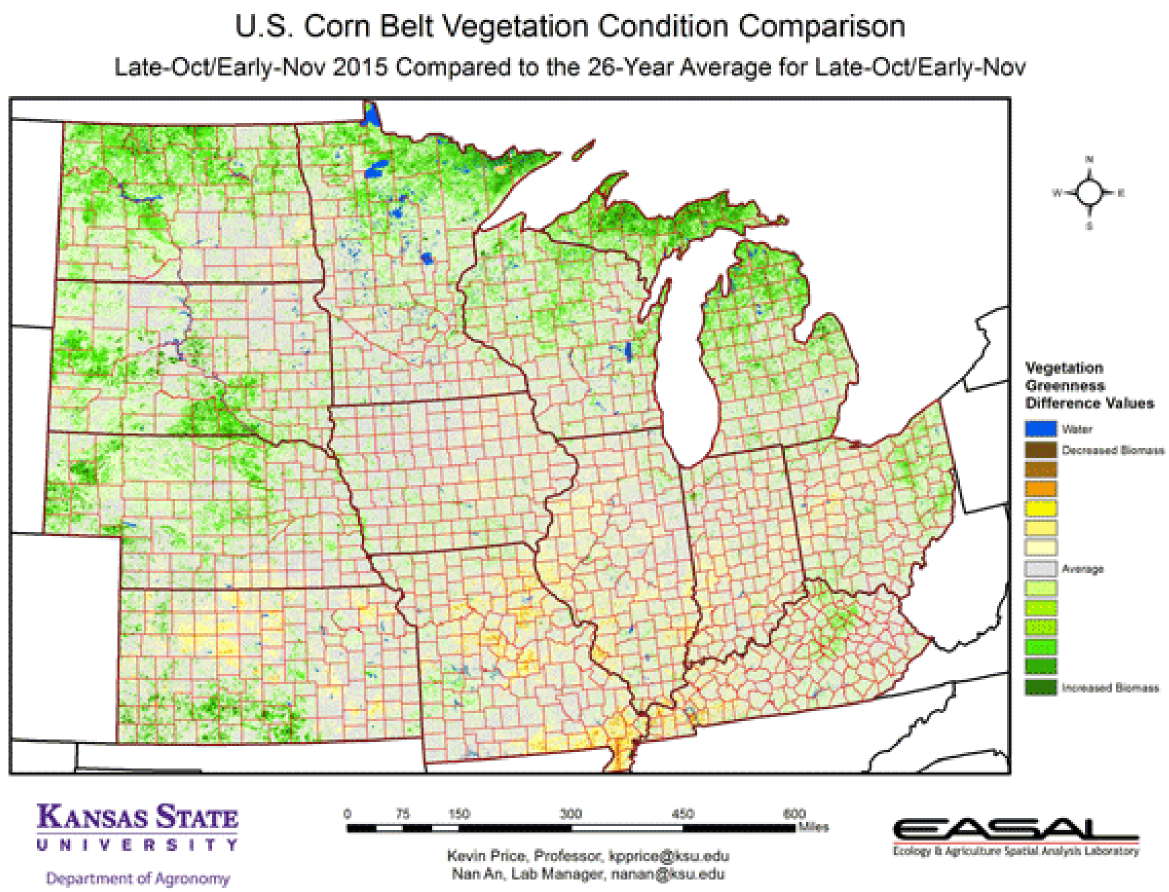


Figure 6. Compared to the 26-year average at this time for the Corn Belt, this year's Vegetation Condition Report for October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows most of the region has average biomass production. Above-average photosynthetic activity can be seen in the northern and western areas of the region, where temperatures have continued mild and moisture has been favorable. Parts of Kansas and Missouri stand out with lower NDVI values as warmer-than-average temperatures and low precipitation stress vegetation.

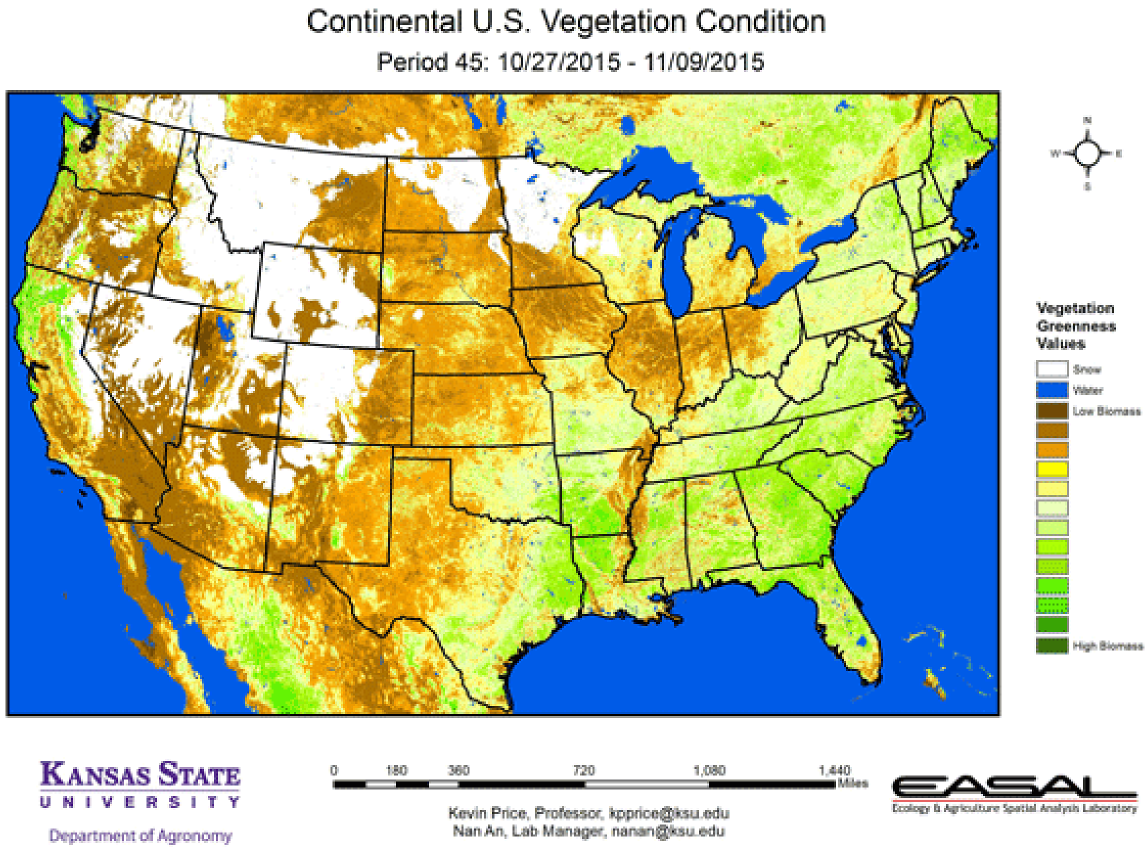


Figure 7. The Vegetation Condition Report for the U.S for October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the highest photosynthetic activity is east of the Mississippi River, where favorable temperatures have extended the growing season. An early storm system has brought some snow to the Mountain West, although much more is needed to address the long-term deficits. Low NDVI values are noticeable the Ohio River Valley and along the Mississippi River, where crops have matured early. Low NDVI values are notable along the lower Mississippi River and into east Texas. Heavy rains have caused flooding issues in these areas.

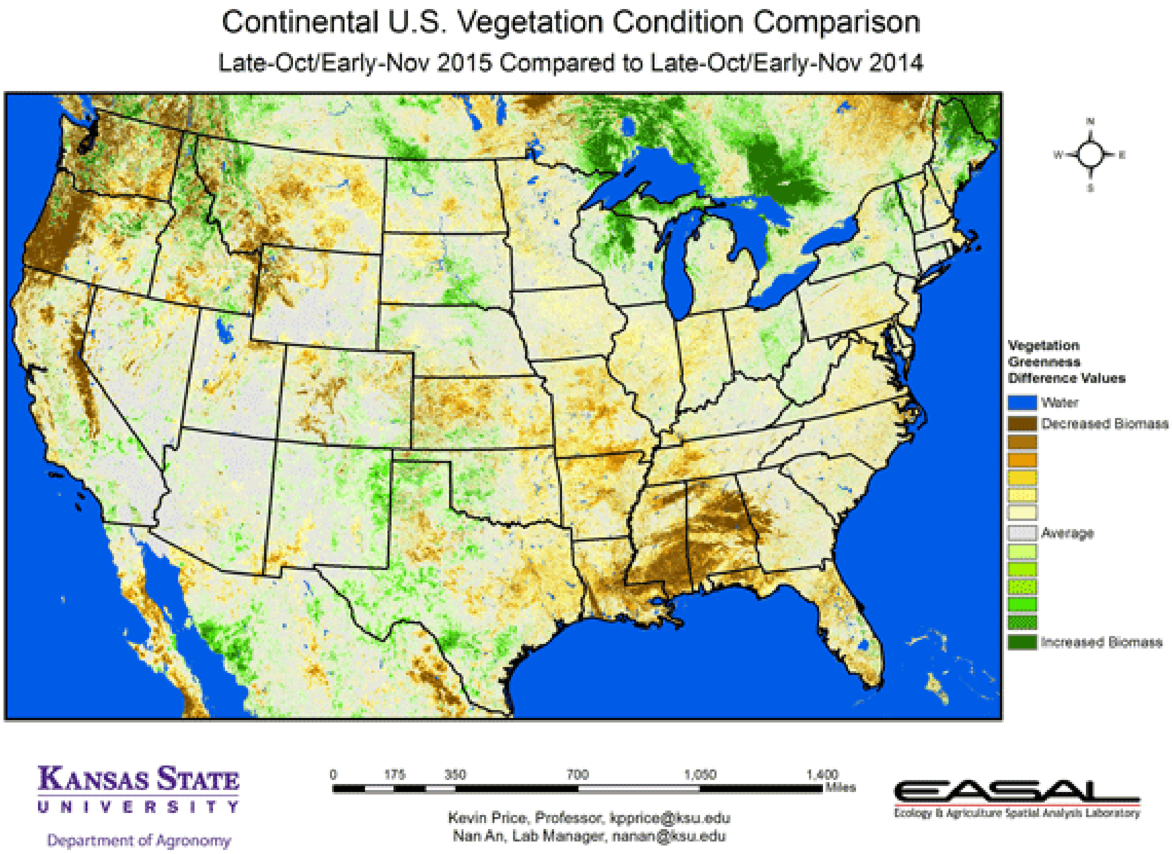


Figure 8. The U.S. comparison to last year at this time for the period October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that lower NDVI values are most evident along the Gulf Coast and in the Pacific Northwest. Heavy rains have had a negative impact on vegetation in these regions. Transition of this rainy pattern into a snowy pattern will be essential for significant drought relief. Across the Central Plains, the more moderate reduction in photosynthetic activity is due to continued drought pressure.

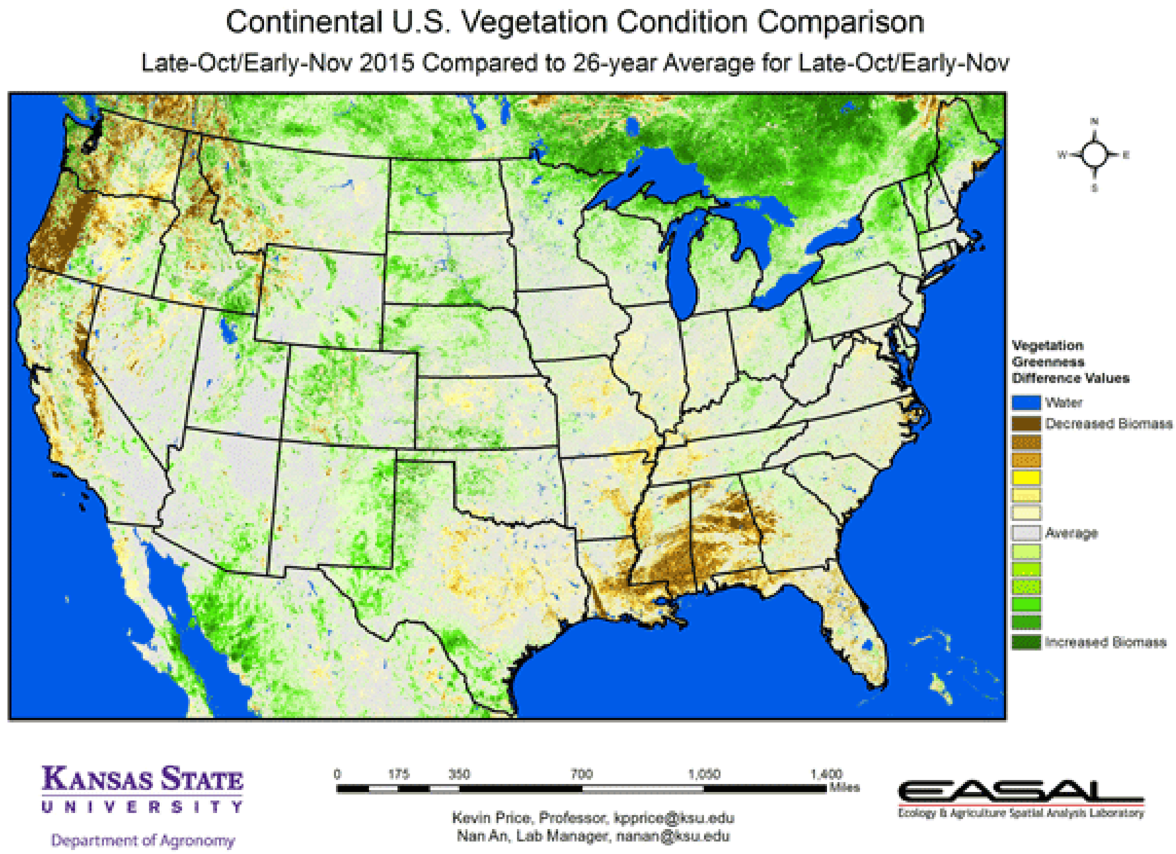


Figure 9. The U.S. comparison to the 26-year average for the period October 27 – November 9 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows below-average photosynthetic activity in east Texas and western Washington. Decreases in both of these areas are due largely to a very wet pattern over the last two weeks. Mild temperatures in the New England region have extended the growing season there. Meanwhile wetter-than-normal conditions continue to favor increased photosynthetic activity in the western High Plains, from Texas to North Dakota.

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