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Research and Extension

## Extension Agronomy

# eUpdate

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*12/02/2016*

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](mailto:swatson@ksu.edu), or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 [cthompso@ksu.edu](mailto:cthompso@ksu.edu).

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## 1. Deep tillage considerations

Now that row crop harvest is over in most areas, producers might be considering deep tillage for the purpose of alleviating compaction. Here are a few things to consider.

How deep should the tillage operation occur? That is best answered by taking a spade or soil probe out in your field and digging a few holes. Ideally, you should dig down to about 18 inches. You are looking for dense layers that are restricting plant roots. If you see “platy” soil structure, which looks like many horizontal layers of soil about ¼ to ½ thick in diameter, look to see if the roots have penetrated through this zone in the soil. If the roots have predominantly penetrated this zone, the layer probably isn’t really root-limiting. If you see a lot of roots that are growing horizontally, or if they appear stubby and gnarled, lacking many root hairs, that can also be a sign that the roots are having trouble making it through this layer.

If you see a dense zone that ends, at say, 8 inches, you’d only want to go about 9 inches deep with the tillage operation. As you double the depth of the tillage operation, you quadruple the power requirement, so going too deep is a waste of time and energy. Also, there is no point in going deeper and potentially damaging the soil profile even further (risks are explained below).

Is deep tillage going to be of benefit to future crop yields? In research studies, it is commonly concluded that deep tillage is only beneficial if the zone of compaction is truly root limiting. If it isn’t, deep tillage probably won’t be of much benefit. The only way to really know is to leave about 3-5 untilled strips through your field and then compare the yields in those areas to the tilled parts of the field next year — easy enough to do if you have a yield monitor and you mark the locations of those untilled strips.

How long does the effect produced by deep tillage last? Tillage can temporarily loosen soil, but because it breaks natural soil structure into smaller pieces, eventually tilled soils re-compact and become denser with time. If the field is subsequently conventionally tilled, and particularly if the traffic is not controlled or limited to certain tire track paths, the benefit will probably only last a few years, due to the many trips made across the field with various tillage and other implements. If the field is subsequently no-tilled and traffic is controlled, the effect of a single deep tillage operation might last longer.

Are there any negative side effects of deep tillage? If tillage is performed when the soil is too wet, the zone of compaction could be moved even deeper. To know if the soil is too wet for tillage, try to make a ribbon out of the soil without wetting it. If you can make a texture ribbon, it is too wet. Alternatively, if you can roll out a “snake” of soil by rubbing it between your palms, it’s too wet. This is called “plasticity” and if the soil is plastic (bendable) it can smear and compact easily. You’ll need your shovel or soil probe to test this to the entire depth that you want to till.

Your goal is to create fracture, so the soil has to be dry enough to shatter, not smear. To see if you’re achieving this, dig between the shanks with a spade and see if the soil is loosened. If you bring up huge clods, the soil isn’t shattering and it would be better to wait until it is drier. Straight shanks are going to cause the least amount of soil disturbance, as shown in the photos below.



**Figure 1. This image was taken 6 weeks after tillage with a ripper designed for minimum surface disturbance as it has straight shanks. The spade could be easily pushed all the way into**

**the soil. The area between the shanks was easy to dig, except in the end rows where there was a lot of traffic from heavily loaded grain carts. The implement used in this field is shown below. Photos by DeAnn Presley, K-State Research and Extension.**



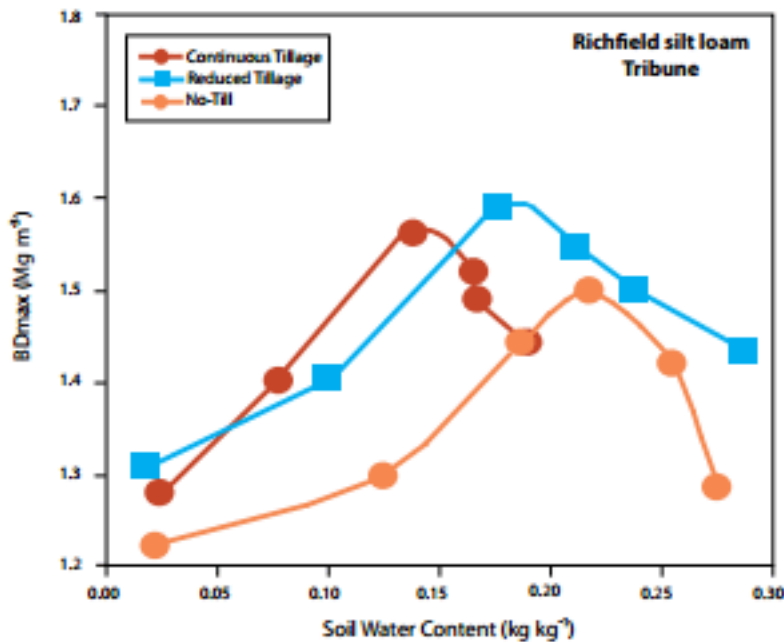
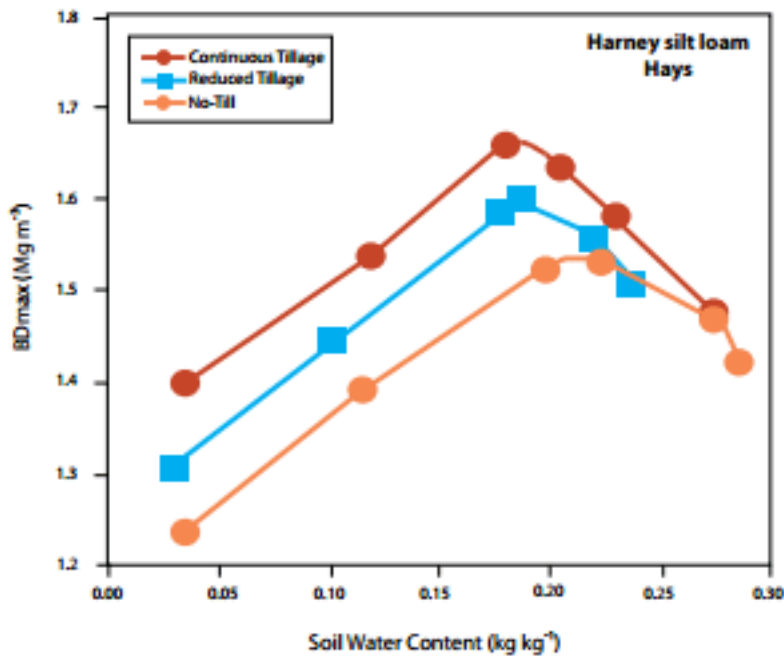
Also, keep in mind that certain areas of the field are probably more compacted than others. Compacted areas might not be ready for deep tillage at the same time as the rest of the field because compacted areas tend to stay wetter, longer. A case in point is a trip that I made to an Ellis County producer's farm. I observed soil shattering from deep tillage across the entire 30 inches between the shanks in the "average" part of the field, but in the end rows where the grain cart was driven, I dug up clods that were about one cubic foot in size, most likely because those more compacted areas were wetter.

Is deep tillage economical? Only if a root-limiting layer is really present, and even then it's not an easy decision because this is a costly operation. Deep tillage requires a lot of power. Deep tillage is slow-going and the implements are not very wide. As a result, deep tillage requires a lot of time, diesel fuel, and usually a few shear bolts! The table below shows the most recent information from the Kansas State University Agricultural Economics Department's Kansas Custom Rates Comparison for 2016 document.

2016 Custom Rates for Land Tillage											
Type of Operation	Average \$/Acre										
	Range	State	Northwest	West Central	Southwest	North Central	Central	South Central	Northeast	East Central	Southeast
Disking	8.00-18.00	12.20	∕	12.00	∕	∕	∕	11.44	∕	14.62	∕
Offset Disk	10.00-15.00	12.60	∕	∕	∕	∕	∕	∕	∕	∕	∕
Chisel (4-12")	10.00-23.00	13.95	∕	12.88	∕	∕	∕	17.00	∕	∕	∕
Undercutter	1.50-15.10	11.13	∕	9.70	12.49	∕	11.63	12.67	∕	∕	∕
Field Cultivator	7.00-17.00	11.78	∕	10.80	13.73	∕	∕	∕	∕	12.73	11.44
Subsoiler/In-line ripper	15.00-20.00	18.24									
Strip Tillage	9.20-20.00	17.07	∕	16.88	17.91	∕	∕	16.06	∕	16.21	∕
Vertical Tillage	9.00-22.00	13.33	∕	13.33	15.27	∕	∕	11.78	∕	15.00	∕

**Source: 2016 Kansas Custom Rates survey conducted by the Agricultural Land Use Survey Center in conjunction with the Kansas Department of Agriculture. Publication available after December 15<sup>th</sup> at <https://www.agmanager.info/>**

How can you prevent compaction? Deep compaction is caused by heavy axle loads. Research indicates that axle loads greater than 10 tons can cause compaction as deep as 12 to 18 inches, and many modern implements weigh well over 10 tons per axle. The only way to reduce axle weight is to decrease the load weight or add axles — axle load cannot be reduced by adding more or larger tires, unfortunately. Shifting to continuous no-till can help soils become more resistant to subsequent compaction, and long-term research conducted in the Great Plains shows that no-till is more resistant to compaction at wetter soil moisture levels.



From: MF3066 Efficient Crop Water Use in Kansas

<https://www.bookstore.ksre.ksu.edu/pubs/MF3066.pdf> (Source of original data: Blanco-Canqui, et al., 2009. No-till induced increase in organic carbon reduces maximum bulk density of soils. Soil Science Society of America Journal 73:1871-1879).

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## 2. Examine soils and look for signs of compaction

There have been many questions recently about soil compaction. This a good time to get out and investigate soil profiles for signs of compaction. There is much you can learn by pushing a tile or soil probe into the ground. First, if you have never done so, you can learn something about the soil profile. How many inches of topsoil do you have? At what depth do you encounter changes in soil textures? Topsoil thickness and soil texture are two properties you can't really control, at least not in the short term. One thing you can certainly look for and work on improving, however, is whether there are any layers of compaction.

Using a spade, soil probe, or tile probe is a good way to learn something about your soil profile and whether there may be a compaction layer. One approach is to dig a small hole about a foot deep, as if you were digging a post hole. You can take a knife and poke into the side of the hole, feeling for layers that seem denser, or that visually have a platy, compressed soil structure. Use a tape measure to determine the depth at which the dense layers occur. Then walk to a nearby fence row or waterway and do the same thing. Does this soil look and feel different? How does this compare to the endrows?

Once you determine the depth at which the compaction occurs, you can work on solutions for improving (decreasing) the density of the compacted layer, or the soil in general. If compaction seems limited to the upper 3 inches of the soil profile, then the most likely culprit is traffic. Running properly inflated tires, using floatation tires, and having more tires in general helps to decrease surface compaction. Of course it will also help to keep traffic off the soil as much as possible when the soil is wet.

A tougher problem to solve is subsurface compaction. If you can feel a layer that is compacted at depths greater than 6 inches, you may be dealing with subsurface compaction.

Subsurface compaction should not be confused with a change in the soil texture. It is common to observe changes in the soil texture as you go deeper in the soil profile. Many soils have an increase in clay content in the upper part of the subsoil, which is natural and took thousands of years to form. Some soils, such as those in floodplains, might have sandy layers present beneath the surface. This is the reason why the spade/post hole method is really the best, because it allows a person to discover so much more about the soil profile than using a tile probe alone.



**Figure 1. Digging a small hole with a spade is the best way to learn about the soil's natural and unnatural layers, such as compacted layers. Use a knife to feel for any unusually dense layers, and a tape measure to determine the depth of the layer. Photos courtesy of DeAnn Presley, K-State Research and Extension.**



**Figure 2. Large pieces of soil that are horizontally oriented, or “platy,” are a sign of compaction.**

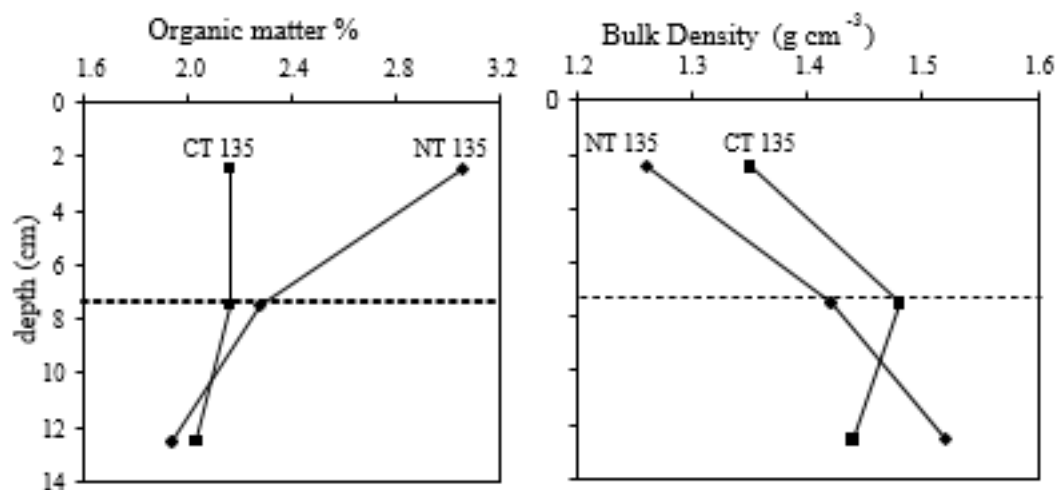
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### 3. Measuring the bulk density of soil

Density refers to the mass of a substance divided by its volume. In soil, we measure density (which we call bulk density) by pounding a cylinder of a known volume into the soil, and then drying the soil for two days in an oven. This gives us the oven dry mass, which we divide by the volume, and thus have the bulk density. There are detailed instructions available for this procedure online at [http://soils.usda.gov/sqi/assessment/test\\_kit.html](http://soils.usda.gov/sqi/assessment/test_kit.html)

In scientific research, this method is used to analyze the effects of different management practices on soil quality, the differences between soil types, and other factors. It can also be used to quantify the differences in soil density at various depths within the soil, which helps in research on soil compaction.

For example, in the graphs shown below, organic matter and bulk density were measured for three depths near the soil surface in a study involving continuous grain sorghum, long-term tillage, and nitrogen rates. In the charts below, CT stands for conventional tillage and NT is no-till; 135 is the amount of N fertilizer applied each year to the grain sorghum, which equates to 120 lbs per acre of actual N. This study ran from 1982 to 2009 with grain sorghum planted every year. It turned out that continuous grain sorghum was not sustainable. Weed pressure eventually caused the end of the study. But the results are still interesting to note. The top 7.5 cm (3 inches) had greater organic matter and was less dense in no-till than in the cultivated soil.



**Presley, D.R., A.J. Sindelar, M.E. Buckley, and D. Mengel. 2012. Long-term nitrogen and tillage effects on soil physical properties under continuous grain sorghum. *Agron. J.* 104:749-755.**

**Table 1. Average minimum bulk densities that restrict root penetration in soils of various textures.**

Texture	Bulk Density g/cc
Coarse, medium, and fine sand	1.80
Loamy sand and sandy loam	1.75
Loam and sandy clay loam	1.70
Clay loam	1.65
Sandy clay	1.60
Silt and silt loam	1.55
Silty clay loam	1.50
Clay	1.40

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#### 4. Considerations when applying anhydrous ammonia for corn in the fall

Soils in parts of Kansas are now cool enough to allow producers to apply anhydrous ammonia for their 2017 corn crop, and have been for the past couple weeks in northern Kansas.

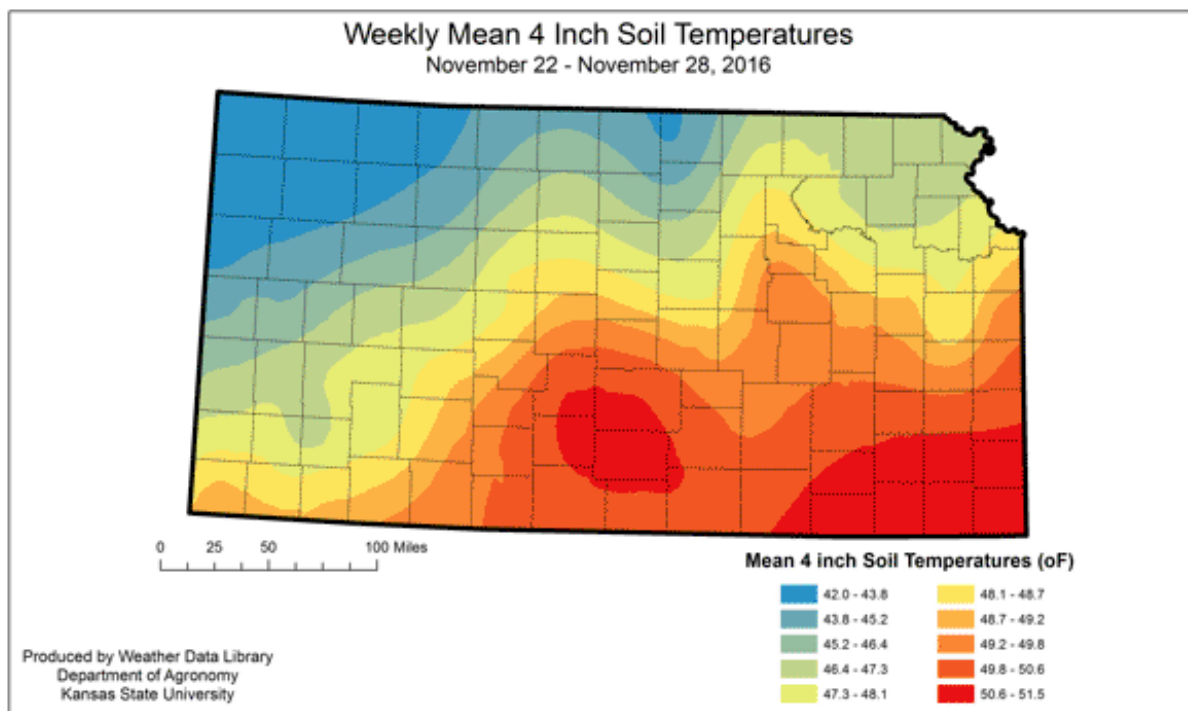


Figure 1 Weekly mean 4-inch soil temperatures for the period of Nov. 22-28. Soil temperatures in individual fields in any given area will vary with differences in vegetative cover, soil texture, soil moisture, and other factors. Source: K-State Weather Data Library.

This practice has some appeal. For one thing, fall fertilizer application spreads out the workload so that there's more time to focus on corn planting in the spring. Secondly, wet spring weather sometimes prevents producers from applying lower-cost anhydrous ammonia in the spring ahead of corn planting, and forces them to apply more expensive sources after planting. Equally important for many producers have been issues with ammonia availability at times in the spring.

Despite those advantages, producers should be aware that there is potential for higher nitrogen (N) loss in the spring following a fall application, as a result of nitrification of the ammonium during late winter and very early spring and subsequent leaching, or denitrification. If anhydrous ammonia has already been applied this fall for the 2017 corn crop, this article will discuss what to expect if soil temperatures have not been cold enough until now.

#### Reactions of anhydrous ammonia in the soil

When anhydrous ammonia is applied to the soil, a large portion of the ammonia is converted to ammonium ( $\text{NH}_4^+$ ), and can be bound to clay and organic matter particles within the soil. As long as the nitrogen remains in the ammonium form, it can be retained on the clay and organic matter, and

does not readily move in most soils except sandy soils with very low CED, so leaching is not an issue.

At soil temperatures above freezing, ammonium is converted by specific soil microbes into nitrate-N. Since it is a microbial reaction, it is very strongly influenced by soil temperatures. The higher the temperature, the quicker the conversion will occur. Depending on soil temperature, pH and moisture content, it can take 2-3 months or more to convert all the ammonia applied in late summer/early fall to nitrate.

By delaying application until cold weather, most of the applied N can enter the winter as ammonium, and over winter losses of the applied N will be minimal

Traditionally, producers should wait until soil temperatures are less than 50°F at a depth of 4 inches before applying ammonia in the fall or early winter. It's not that nitrification stops below 50 degrees, but rather that soils will likely become cold enough soon to limit the nitrification process. In many areas in Kansas, soils may stay warmer than 50 degrees well into late fall, and only freeze for short periods during the winter.

The use of a nitrification inhibitor such as N-Serve can help reduce N losses from fall N applications under specific conditions, particularly during periods when soil temperatures warm back up for a period after application.

One should also consider soils when considering fall application. Fall applications of N for corn should not be made on sandy soils prone to leaching, particularly those over shallow, unprotected aquifers. Rather, fall N applications should focus on deep, medium to heavy textured soils where water movement is slower.

### **When is N lost?**

When considering fall application of N, keep in mind that loss of N during the fall and winter is not normally our problem in Kansas. The conversion of "protected" ammonium to "loss prone" nitrate during the fall and winter can be minimized by waiting to make applications until soils have cooled, and by using products such as nitrification inhibitors. The fact that essentially all the N may remain in the soil as ammonium all winter, coupled with our dry winters, means minimal N is likely to be lost over winter.

However, soils often warm up early in the spring and allow nitrification to get started well before corn planting. Generally, if the wheat is greening up, nitrification has begun! Thus one of the potential downsides of fall application is that nitrification can begin in late February and March, and essentially be complete before the corn crop takes up much N in late May and June.

### **Summary**

The bottom line is this: If anhydrous ammonia is to be applied in the fall, there are a number of factors that must be considered, including soils, temperature and soil moisture. Consider the following guidelines:

- Do not apply anhydrous ammonia in the fall on sandy soils.

- On silt loam or heavier soils, wait to apply anhydrous ammonia until soil temperatures at 4 inch depth are below 50 degrees (records indicate in most years this will be in November).
- Use a nitrification inhibitor such as N-Serve with anhydrous ammonia to help reduce fall nitrification rates.
- To check the soil temperature in your area visit the K-State Research and Extension Weather Data Library at: <http://climate.ksu.edu>

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## 5. Evaluating wheat crop conditions going into winter

(Note: The following article is a slightly edited transcript of a short K-State Research and Extension YouTube video produced by Dan Donnert, KSRE videographer. The link to this video is: <https://youtu.be/7zL0BQUXLas> – Steve Watson, Agronomy eUpdate Editor, and Danielle Comstock, Agronomy Communications Student Intern)

What is the likelihood that the wheat crop in Kansas going to have successful winter survival? What are some of the things that we need to be looking for?

First we need the crown to be well protected. The wheat in Figure 1 below was planted in mid-October. The crown is about one inch below the surface in mid-November, and this is about right. We want the crown very well insulated by the soil. So as long as that crown is insulated, the soil is going to protect it from the winter temperatures and it's going to increase the likelihood that the crop is going to make it through the winter.



**Figure 1. Wheat with crown about one inch below the soil surface, well insulated for winter.**

Source of all photos: <https://youtu.be/7zL0BQUXLas>

Some of the problems we might face is with late-planted wheat, for example in south central and southeast Kansas, where planting was delayed in some cases due to too much moisture. Late-planted wheat crop is not going to be as well developed as we'd like. We'd like to see wheat with anywhere from three to five tillers (Figure 2) going into the winter. That is enough development to allow the crop to produce all the antifreeze substances it needs to make it through the winter.



Figure 2. It's best for wheat to have 3 to 5 tillers going into winter.

A crop that was planted late, for any of several reasons, either due to double cropping after soybeans or because planting was delayed due to moisture -- or as in southwest Kansas this year the wheat was mostly planted in time but didn't come up until mid-November because of lack of moisture -- that wheat will be more exposed to the dangers of freezing temperatures.

The wheat in Figure 3 was planted late as a double crop after soybeans. As if mid-November, some of this wheat had not emerged or was just starting to emerge. This is going to delay the whole development of the crop. The wheat in Figure 3 has just put its first leaf out and has not started to tiller yet. This wheat is definitely not as cold hardy as the wheat in Figure 2.



Figure 3. Poorly developed wheat is not yet well prepared to survive the winter.

Another main difference that we have between these two fields (wheat planted on time and wheat planted late) is in root development. The late-planted wheat doesn't have its secondary root system developed yet. It's going to take another couple weeks before it even starts to develop secondary roots. So these factors are going to affect its winter survival as well. Where I would be concerned is in southwest Kansas because in many fields, although they were planted in time, the crop has not emerged up to this point and those situations are where we can really see the crop having some problems making it through the winter.

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## 6. Kansas Forage and Grasslands Council annual meeting, December 13, Wichita

The Kansas Forage and Grassland Council will hold its Winter Conference and Annual Meeting on Tuesday, December 13, 2016, at the Sedgwick County Extension Education Center, 7001 West 21st Street, Wichita.

Registration begins at 8:30 a.m. and the conference kicks off at 9:00 a.m. A grower panel will be part of this year's program along with breakout sessions led by Kansas State University and industry experts covering topics including:

- Forage/Pasture Insect Control
- Late Season Burning and Sericea Lespedeza Control
- Range Beef Cattle Nutrition and Management
- Forage/Pasture Fertility Management
- Mineral Supplementation in Grazing Cattle
- Wheat Grazing Management.

"Forage Profit Strategies" will be the keynote address by Dr. Don Ball, Professor Emeritus Auburn University and author of the books *Southern Forages* and *Practical Forage Concepts*. The full agenda is available on the KSFGC website, <https://ksfgc.org/annual-meeting/>

Individual Conference Registration is \$65 in advance (\$85 at the door) and includes lunch and both KSFGC and AFGC membership for 2017. Additional registration information for businesses, vendors, and forage industry boosters can be found on the KSFGC website.

To register go to <https://ksfgc.org/annual-meeting/> and complete and send the registration form, along with the appropriate fee payable to KSFGC, 1228 Westloop Place, PMB #144, Manhattan, KS 66502-2840; Or simply register online. Direct any questions to Mark Nelson at [info@ksfgc.org](mailto:info@ksfgc.org).

## 7. K-State Corn Management Schools scheduled for January 2017

A series of three K-State Corn Production Management Schools will be offered in early January of 2017 to provide in-depth training targeted for corn producers. The schools are primarily sponsored by Kansas Corn Commission and Pioneer.

The one-day schools will cover up-to-date and specific corn topics: on-farm research, high-yielding corn production practices, weed control, soil fertility, and price and market perspectives. The focus of the Corn Production Schools will be in northwest, central, and eastern Kansas. Schools will be followed by a tour.

**Jan. 9 – Wichita** – Drury Plaza Hotel Broadview Wichita, 400 West Douglas Ave.

**Jan. 11 – Oakley** – Buffalo Bill Cultural Center, 3083 US 83

**Jan. 13 – Olathe** – John Deere Ag Marketing Center, 10789 South Ridgeview Rd.

### **Jan. 9 – Wichita**

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### **Jan. 11 – Oakley**

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### **Jan 13 – Olathe (John Deere facility) – Registration is needed**

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Lunch will be provided courtesy of the sponsors. There is no cost to attend, but participants are asked to pre-register before or by January 6.

Online registration is available at K-State Corn Schools: <http://bit.ly/KSCORNSchools>

You can also preregister by emailing or calling the nearest local Research and Extension office for the location you plan to attend.

For more information, contact:

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**Primarily supported by:**





## 8. K-State Soybean Schools scheduled for late January



A series of three K-State Soybean Production Schools will be offered in late January 2017 to provide in-depth training targeted for soybean producers and key stakeholders. The schools will be held at three locations around the state.

The one-day schools will cover a number of issues facing soybean growers: weed control strategies; production practices; nutrient fertility; and insect and disease management.

The dates and locations of the K-State Soybean Production Schools are:

**Jan. 24<sup>th</sup> – Parsons,** 25092 Ness Road

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Jeri Sigle, Wildcat Extension District, [jlsigle@ksu.edu](mailto:jlsigle@ksu.edu), 620-331-2690

**Jan. 26<sup>th</sup> – Hesston,** AGCO building, 420 W. Lincoln Blvd

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**Jan. 27<sup>th</sup> – Highland,** Highland Community Building, 501 West Av

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More information on the final program for each Soybean School will be provided in future issues of the Agronomy eUpdate.

Lunch will be provided courtesy of Kansas Soybean Commission. There is no cost to attend, but participants are asked to pre-register by Jan. 19.

Online registration is available at: [K-State Soybean Schools](#)

You can also preregister by emailing or calling the nearest local Research and Extension office for the

Kansas State University Department of Agronomy

2004 Throckmorton Plant Sciences Center | Manhattan, KS 66506

[www.agronomy.ksu.edu](http://www.agronomy.ksu.edu) | [www.facebook.com/KState.Agron](https://www.facebook.com/KState.Agron) | [www.twitter.com/KStateAgron](https://www.twitter.com/KStateAgron)



location you plan to attend.

Ignacio Ciampitti, Crop Production and Cropping Systems Specialist  
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Doug Shoup, Southeast Area Crops and Soils Specialist  
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## 9. Comparative Vegetation Condition Report: November 22 - 28

The weekly Vegetation Condition Report maps below can be a valuable tool for making crop selection and marketing decisions.

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 27-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 Vegetation Condition Report (VCR) maps were originally developed by Dr. Kevin Price, K-State professor emeritus of agronomy and geography. His pioneering work in this area is gratefully acknowledged.

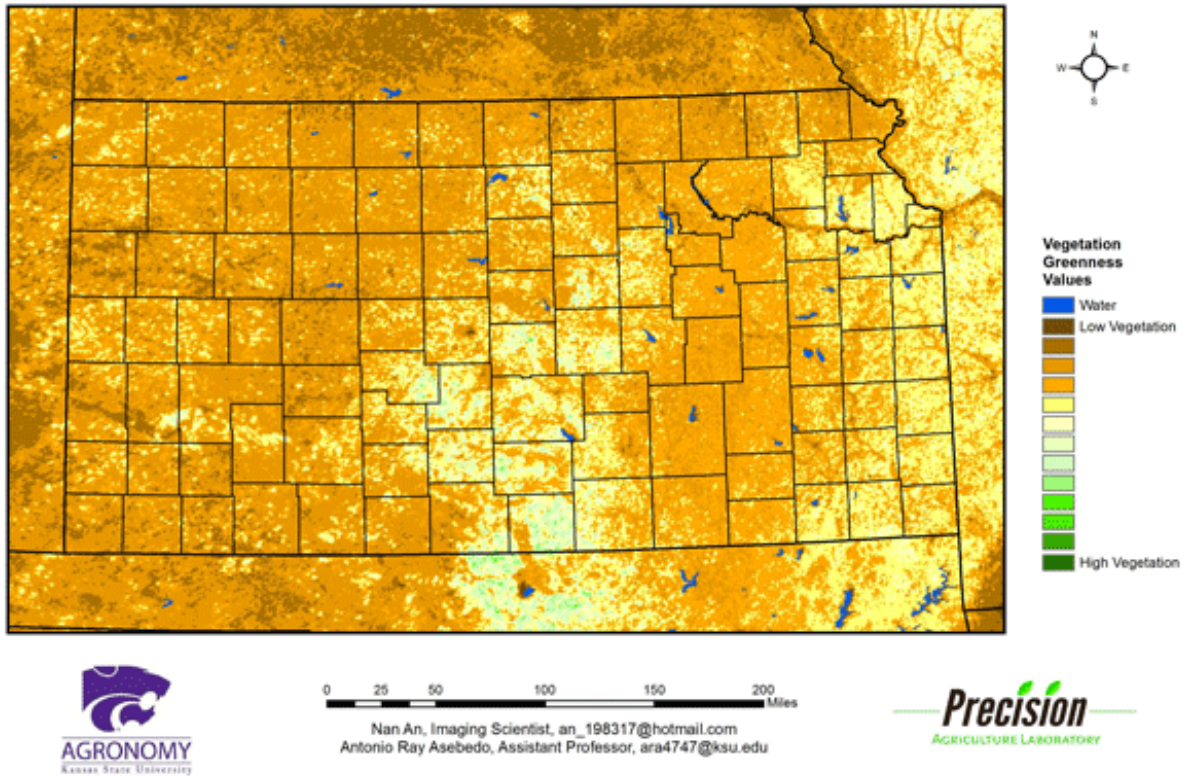
The maps have recently been revised, using newer technology and enhanced sources of data. Dr. Nan An, Imaging Scientist, collaborated with Dr. Antonio Ray Asebedo, assistant professor and lab director of the Precision Agriculture Lab in the Department of Agronomy at Kansas State University, on the new VCR development. Multiple improvements have been made, such as new image processing algorithms with new remotely sensed data from EROS Data Center.

These improvements increase sensitivity for capturing more variability in plant biomass and photosynthetic capacity. However, the same format as the previous versions of the VCR maps was retained, thus allowing the transition to be as seamless as possible for the end user. For this spring, it was decided not to incorporate the snow cover data, which had been used in past years. However, this feature will be added back at a later date. In addition, production of the Corn Belt maps has been stopped, as the continental U.S. maps will provide the same data for these areas. Dr. Asebedo and Dr. An will continue development and improvement of the VCRs and other advanced maps.

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

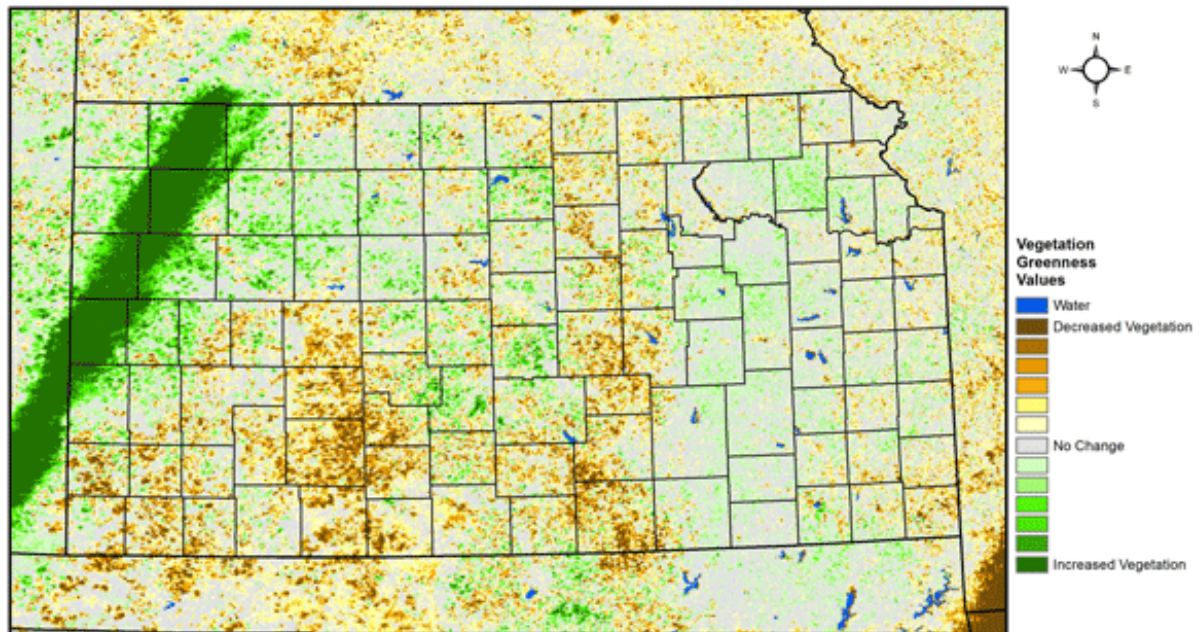
# Kansas Vegetation Condition

Period 48: 11/22/2016 - 11/28/2016



**Figure 1. The Vegetation Condition Report for Kansas for November 22 – November 28, 2016 from K-State’s Precision Agriculture Laboratory shows only light photosynthetic activity mainly in south central Kansas. All parts of the state have now had the first frost of the season.**

Kansas Vegetation Condition Comparison  
Late-November 2016 compared to the Late-November 2015



0 25 50 100 150 200 Miles

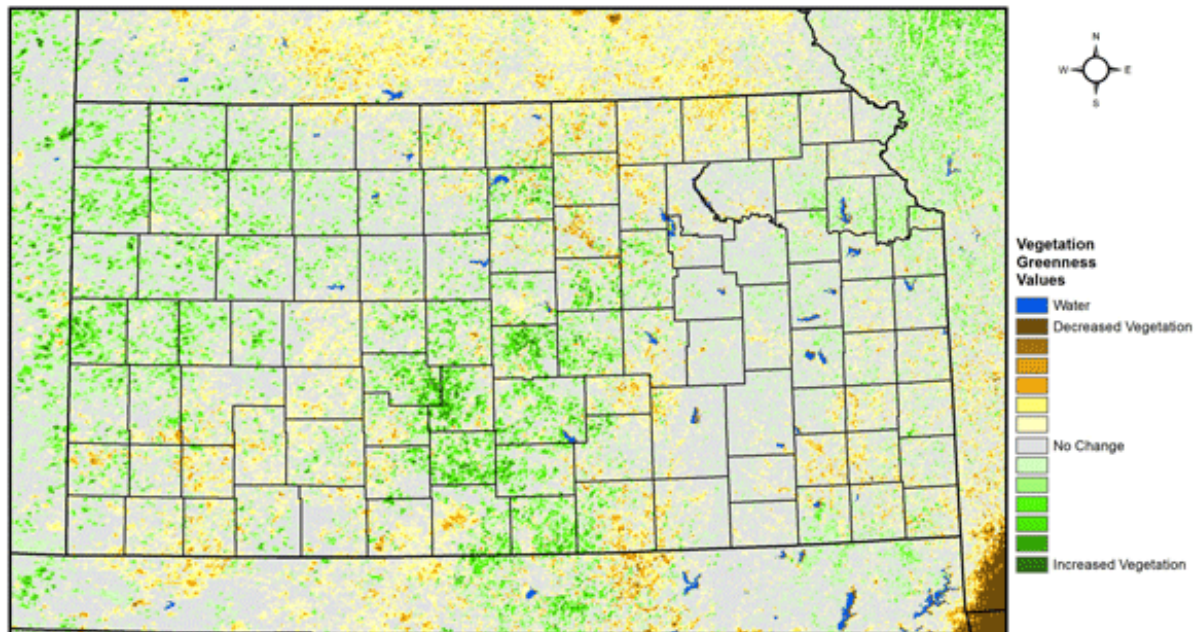
Nan An, Imaging Scientist, an\_198317@hotmail.com  
Antonio Ray Asebedo, Assistant Professor, ara4747@ksu.edu



**Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for November 22 – November 28, 2016 from K-State’s Precision Agriculture Laboratory shows a band of higher NDVI values across parts of northwest Kansas. This area has had more precipitation than last year. Expanding drought conditions and the slow establishment of winter wheat in the Southwest into the South Central Divisions is visible as reduced NDVI values there.**

## Kansas Vegetation Condition Comparison

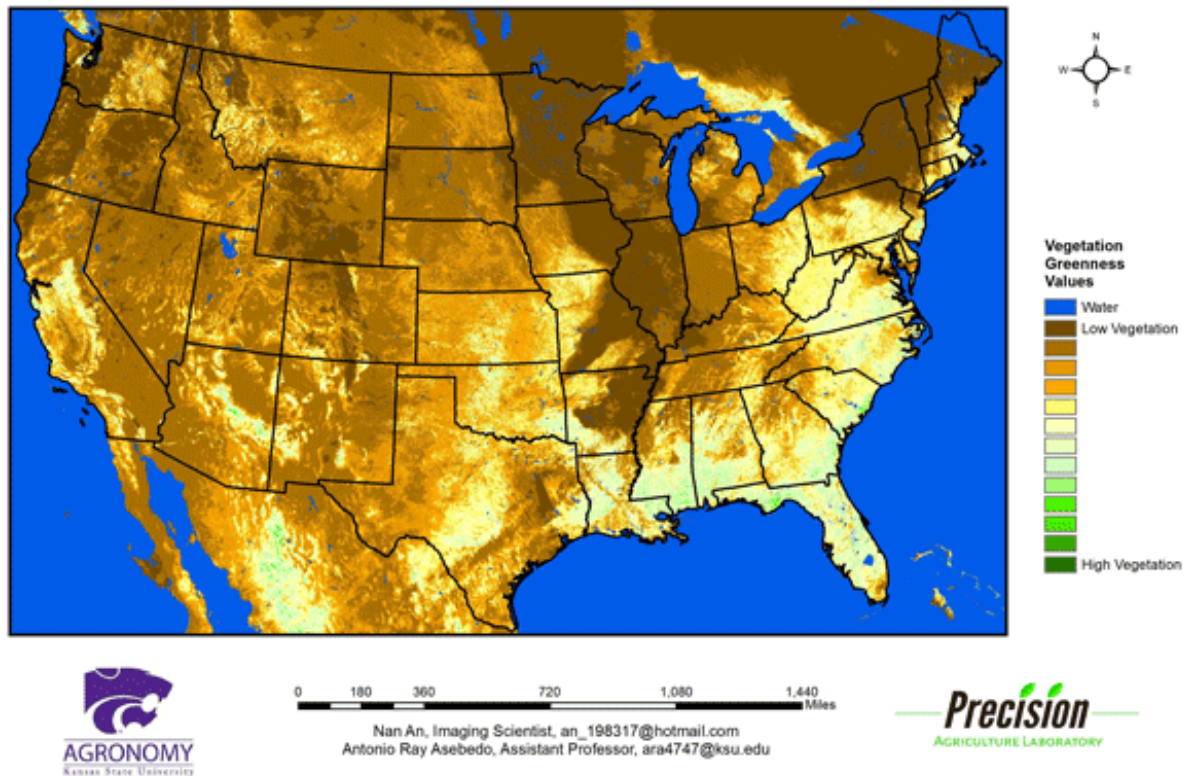
Late-November 2016 compared to the 27-Year Average for Late-November



**Figure 3. Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for November 22 – November 28, 2016 from K-State's Precision Agriculture Laboratory shows much of the state has close-to-average vegetative activity. Cold weather has finally arrived and vegetative activity has slowed.**

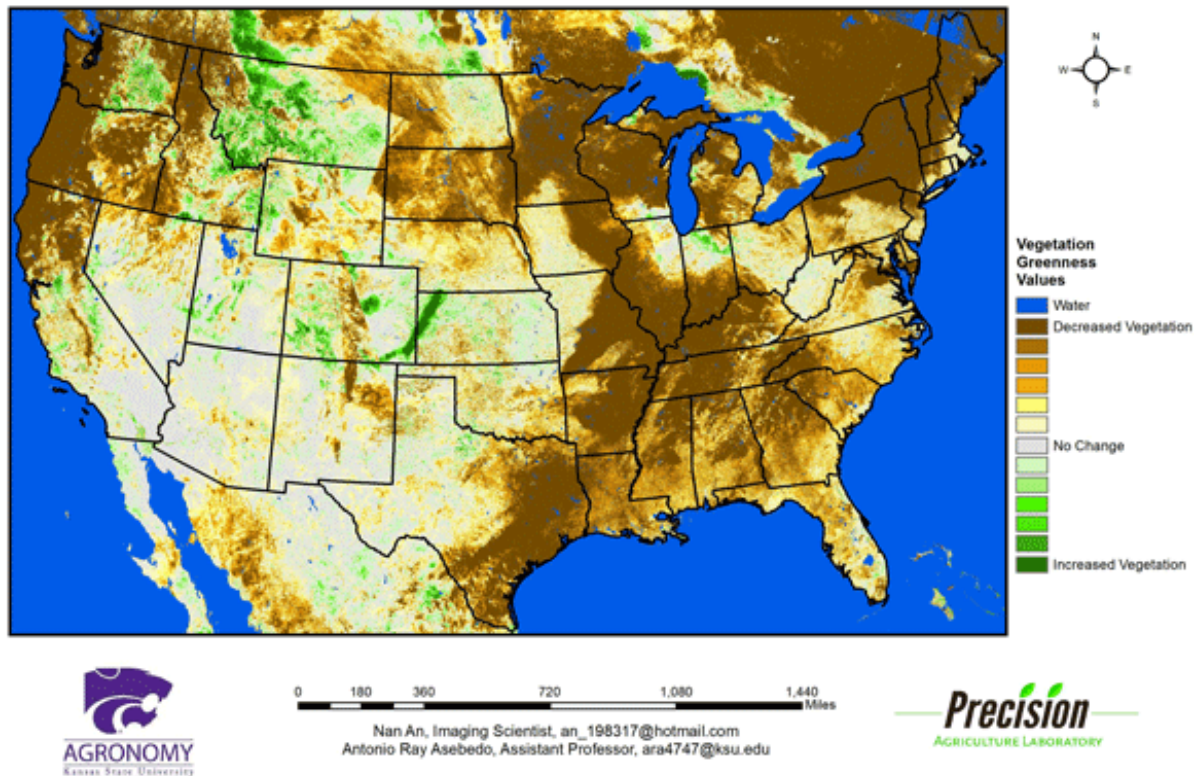
## Continental U.S. Vegetation Condition

Period 48: 11/22/2016 - 11/28/2016



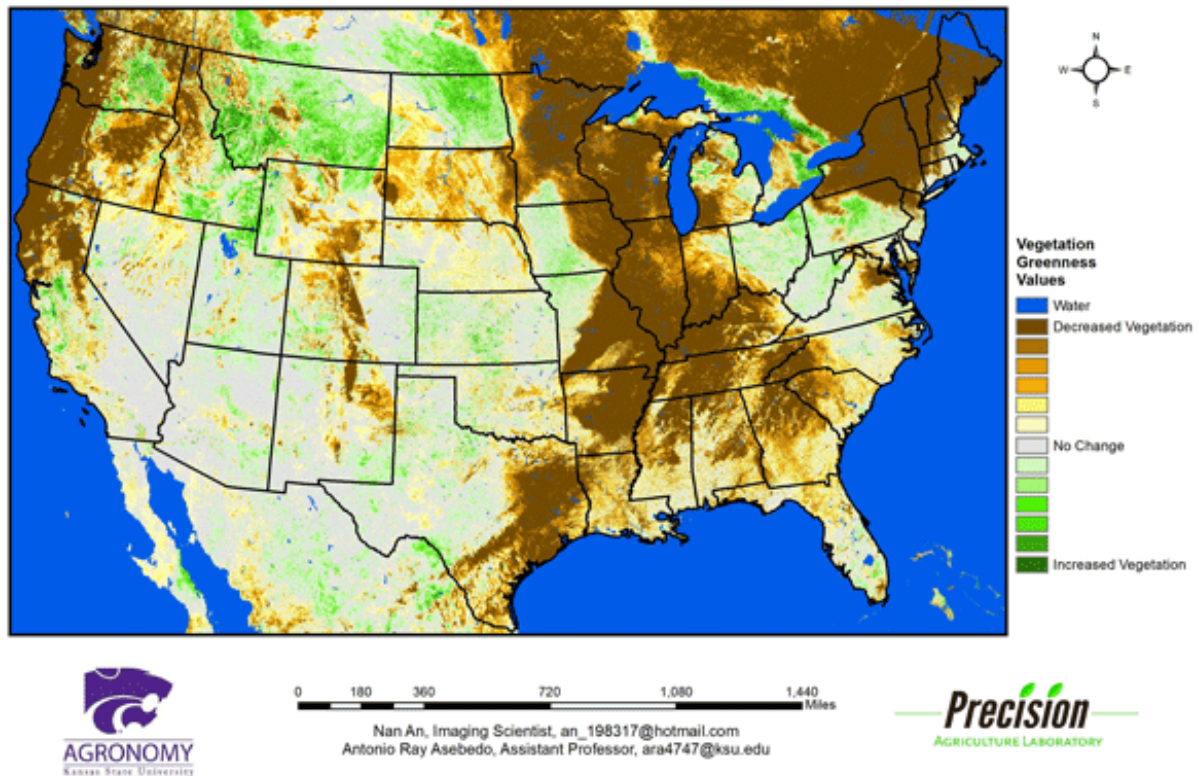
**Figure 4. The Vegetation Condition Report for the U.S for November 22 – November 28, 2016 from K-State’s Precision Agriculture Laboratory shows an area of high NDVI values along the Pacific Northwest where wet conditions continue to fuel photosynthetic activity. In the Southeast mild temperatures have extended the growing season, creating problems as drought intensifies in the area. Low NDVI values are visible in the Corn Belt and along the Mississippi River Valley, where crops are mostly mature, and harvest is ending.**

Continental U.S. Vegetation Condition Comparison  
Late-November 2016 Compared to Late-November 2015



**Figure 5. The U.S. comparison to last year at this time for November 22 – November 28, 2016 from K-State’s Precision Agriculture Laboratory shows higher NDVI values in the Pacific Northwest. Rainfall has been much more plentiful this year, and snowfall has been limited. Along the Gulf Coast, clouds have been more prevalent than last year. In the Southeast, the worsening drought conditions are visible, particularly in northern Georgia.**

Continental U.S. Vegetation Condition Comparison  
Late-November 2016 Compared to 27-year Average for Late-November



**Figure 6. The U.S. comparison to the 27-year average for the period November 22 – November 28, 2016 from K-State’s Precision Agriculture Laboratory shows below-average photosynthetic activity along the Gulf Coast. Warm temperatures and lack of rains are issues in this area. The South continues to have persistent drought conditions. There are much higher-than-normal NDVI values across the Northern Plains. This is due to persistent warmer-than-normal temperatures and lack of snow cover during this period. North Dakota is set to have one of the warmest Novembers on record.**

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