Issue 480

K-STATE
Research and Extension

Extension Agronomy

eUpdate

10/24/2014

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. The challenge of collecting a representative soil sample

At first glance, soil sampling would seem to be a relatively easy task. However, when you consider the variability that likely exists within a field because of inherent soil formation factors and past production practices, the collection of a representative soil sample becomes more of a challenge.

Before heading to the field to take the sample, be sure to have your objective clearly in mind. For example, if all you want to learn is the average fertility level of a field to make a uniform maintenance application of P or K, then the sampling approach would be different than sampling for pH when establishing a new alfalfa seeding or sampling to develop a variable rate P application map.

In some cases, sampling procedures are predetermined and simply must be followed. For example, soil tests may be required for compliance with a nutrient management plan or environmental regulations associated with confined animal feeding operations. Sampling procedures for regulatory compliance are set by the regulatory agency and their sampling instructions must be followed exactly. Likewise, when collecting grid samples to use with a spatial statistics package for drawing nutrient maps, sampling procedures specific to that program should be followed.

Regardless of the sampling objectives or requirements, there are some sampling practices that should be followed:

- A soil sample should be a composite of many cores to minimize the effects of soil variability. A minimum of 10 to 15 cores should be taken from a relatively small area (two to four acres). Taking 20-30 cores will provide more accurate results. A greater number of cores should be taken on larger fields than smaller fields, but not necessarily in direct proportion to the greater acreage. A single core is not an acceptable sample.

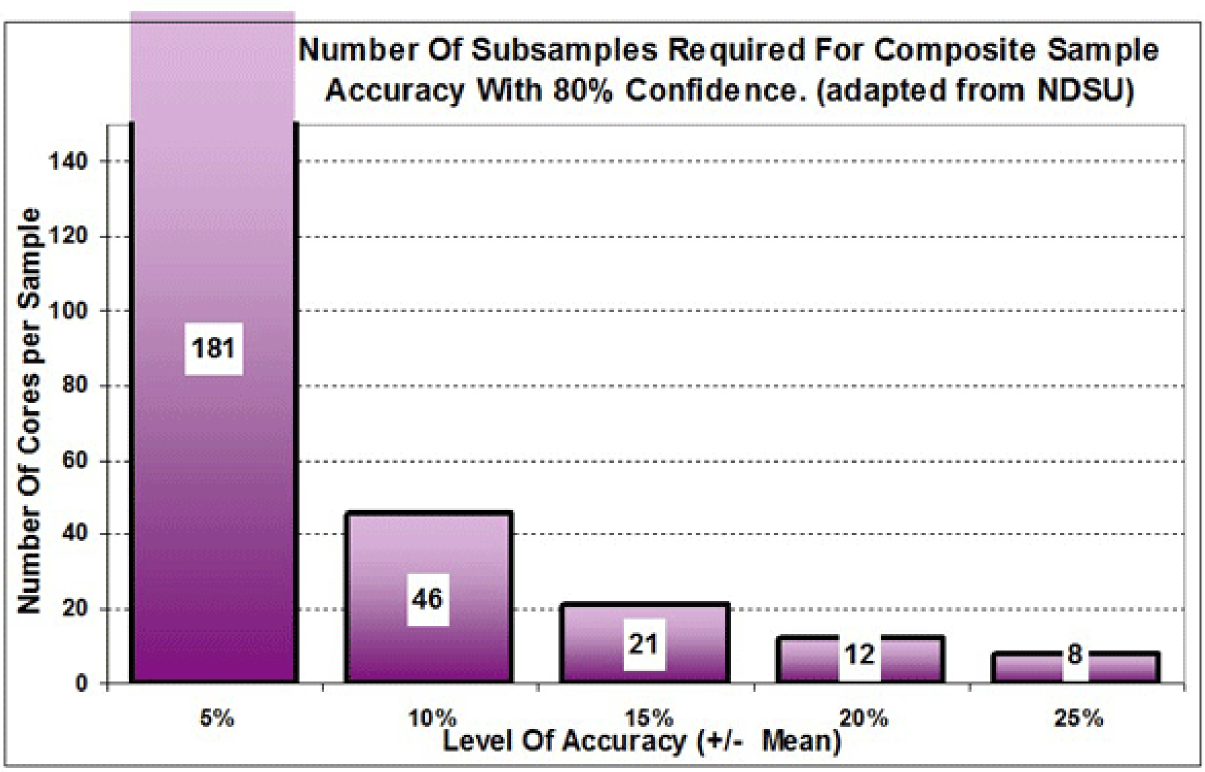

Figure 1 The level of accuracy of the results of a soil test will depend, in part, on how many subsamples were taken to create the composite sample. In general, a composite sample should consist of at least 10-15 subsamples. For better accuracy, 20-30 cores, or subsamples, should be taken and combined into a representative sample. This chart shows that if 21 cores per sample are taken, the results will be within 15% either way of the actual mean value.

- A consistent sampling depth for all cores should be used because pH, organic matter, and nutrient levels often change with depth. Sampling depth should be matched to sampling objectives. For example, K-State recommendations call for a sampling depth of two feet for the mobile nutrients – nitrogen, sulfur, and chloride. A six-inch depth is suggested for routine tests for pH, organic matter, phosphorus (P), potassium (K), and zinc (Zn).

- When sampling a specific area, a zigzag pattern across the field is better than following planting/tillage pattern to minimize any past non-uniform fertilizer application/tillage effects. With GPS system available, georeferencing of core locations is possible. This allows future samples to be taken from the same locations in the field.

- When sampling grid points for making variable rate nutrient application maps, collecting cores in a 5-10 foot radius around the center point of the grid is preferred for many spatial statistical software packages.

- Unusual spots obvious by plant growth or visual soil color/texture differences should be avoided. If information on these unusual areas is wanted, then a separate composite sample should be taken from these spots.

- If banded fertilizer has been used on the previous crop (such as strip till), then is suggested that the number of cores taken should be increased to minimize the effect of an individual core on the composite sample results, and obtain a better estimate of the average fertility for the field.

- For permanent sod or long-term no-till fields where nitrogen fertilizer has been broadcast on the surface, a three- or four-inch sampling depth would be advisable to monitor surface soil pH.

Soil test results for organic matter, pH, and non-mobile nutrients (P, K, and Zn) change relatively slowly over time, making it possible to monitor changes if soil samples are collected from the same field following the same sampling procedures. There can be some seasonal variability and previous crop effects, however. Therefore, soil samples should be collected at the same time of year and after the same crop. For example, in a corn-soybean rotation, sampling after soybean harvest in the fall would be an excellent sampling system

Soil sampling has much to offer if done properly, but it all starts with the proper soil sample collection procedure, fall after harvest is an excellent time for soil sampling.

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2. Instructions for soil sample collection and mailing to K-State lab

If you plan to do your own soil sampling and use the K-State Soil Testing Laboratory, the following provides specific information on soil sample collection methods and mailing instructions.

- To take a sample, you will need a sampling tube, auger or spade, and a clean pail. (If you're also having the soil analyzed for zinc, be sure to use a plastic container to avoid contamination from galvanized buckets or material made of rubber.) You will also need soil sample containers and field information forms from your local Extension office or fertilizer dealer.

- Draw a map of the sample area on the information sheet and divide your fields into uniform areas. Each area should have the same soil texture, color, slope, and fertilization and cropping history.

- From each area, take a sample of 20-30 cores or slices for best results. At the very minimum, 10-15 cores should be taken per sample. Mix the cores thoroughly in a clean container and fill your soil sample container from this mixture. For available nitrogen, chloride, or sulfur tests, a subsoil sample to 24 inches is necessary.

- Avoid sampling in old fencerows, dead furrows, low spots, feeding areas, or other areas that might give unusual results. If information is desired on these unusual areas, obtain a separate sample from the area.

- Be sure to label the soil container clearly and record the numbers on the soil container and the information sheet.

- Air dry the samples as soon as possible for the available nitrogen test. (Air drying before shipment is recommended, but not essential, for all other tests.) Do not use heat for drying.

- Fill out the information sheet obtained from your Extension office, or download a sheet from www.ksre.ksu.edu/agronomy/soiltesting

- Take the samples to your local Research and Extension office for shipping. Samples may also be sent directly to the lab by placing them in a shipping container or wrapping in heavy paper. Information sheets should be included with the package. Label the shipping container and tie securely. Mail the package to:

Soil Testing Laboratory
2308 Throckmorton Hall
Kansas State University
Manhattan, KS 66506-5504

A listing of the types of soil analysis offered, and the costs, are available on the web site mentioned above. For more information on the proper procedures for the Soil Testing Laboratory, see K-State publication MF-734 at: http://www.ksre.ksu.edu/library/crpsl2/MF734.pdf

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3. Gardening on lead-contaminated soils

(Note: The following article is based on the new K-State Research and Extension publication MF3166, *Gardening on Lead-Contaminated Soils.* See the full publication at: www.ksre.ksu.edu/bookstore/pubs/MF3166.pdf)

Urban soils are often used for gardening and food production. It may be a good idea to have these soils tested for contaminants, such as lead.

Lead affects everyone. Lead accumulates in humans, and the body releases that lead slowly. Children between the ages of 6 months and 5 years have been found to be the most vulnerable to lead toxicity. The Centers for Disease Control and Prevention (CDC) currently considers 5 μg dL^{-1} as the threshold for "elevated" blood lead, while pointing out that no safe blood lead level in children has been identified.

Mean lead concentrations in uncontaminated surface 6 inches of soils in the U.S. are 22 parts per million (ppm). Where lead levels are unusually high in urban soils, human activities are the main cause (Figure 1).

Soil dusts from former mining sites and airborne particles from smelting metals may have deposited lead on surface soils. Before being outlawed in the United States in 1986, automobile emissions from gasoline-powered engines led to significant deposition of the organic compound tetraethyl lead on the surrounding soils. Urban soils in city centers exposed to heavy automobile traffic have higher lead concentrations than suburban or rural areas with reduced traffic volumes.

Another potential source of contamination is paint. Most houses built before 1978 were painted with lead-based paint. The deterioration of these homes over several decades due to poor maintenance or harsh environmental conditions can result in paint chips or deposits near the sides of these homes.

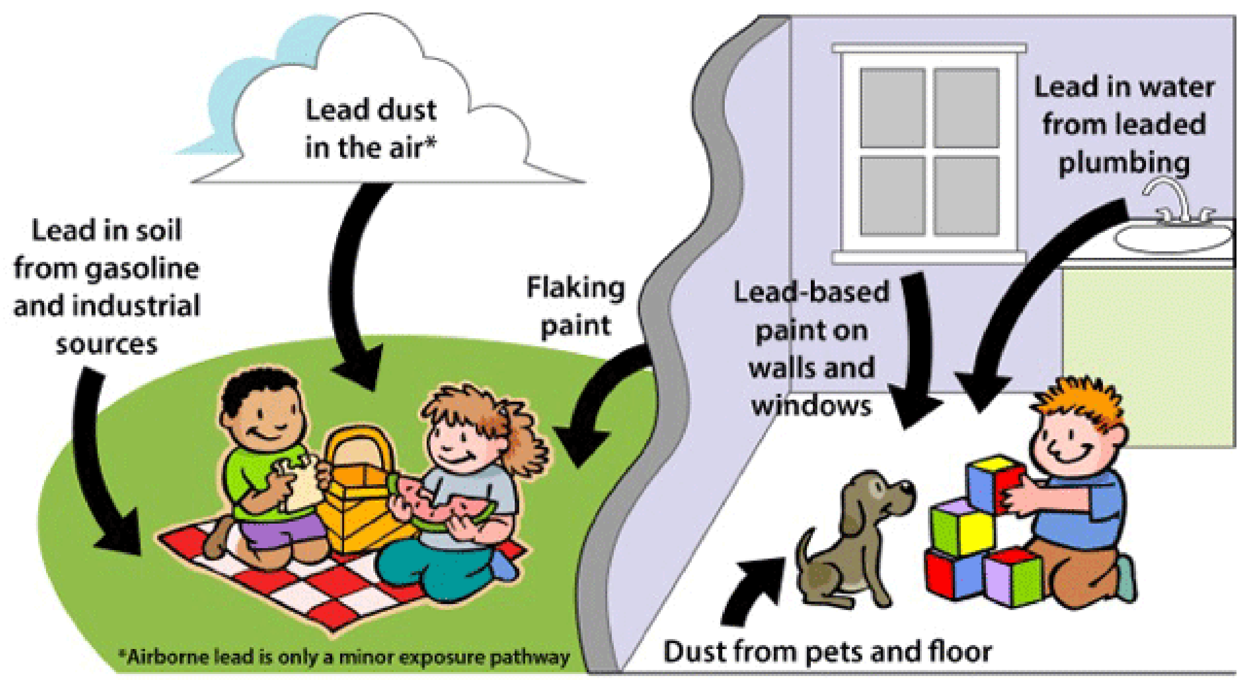

Figure 1. Lead exposure in the home environment.

Studies show lead levels in urban soils may range from 50 to about 3,000 ppm. The demolition of old homes; wastes generated from former paint factories; and shops that either fabricated or recycled metals, often within a small geographic area, account for the wide variation in soil lead distribution in urban environments.

Some residential properties now are sited on land previously used for industrial activities that contributed to high levels of lead in the soil. Preventing housing growth on contaminated soils could be assisted by soil testing before construction. However, soil tests are often overlooked or even ignored due to the pressure for housing. Moreover, movement of lead through soil is slow; hence, even though the use of these lead contaminants was banned over many decades, they can still pose health problems to residents.

Currently, there are no set regulations for gardening on urban soils. The Office of Solid Waste and Emergency Response residential soil screening level for lead, also used as the upper limit for child play areas by the U.S. Environmental Protection Agency (EPA), is 400 ppm. However, scientific studies have also expressed some concerns about gardening on soils with lower lead concentrations. Figure 2 summarizes suggested actions that should be followed if soil test results report lead concentrations in the specified range provided.

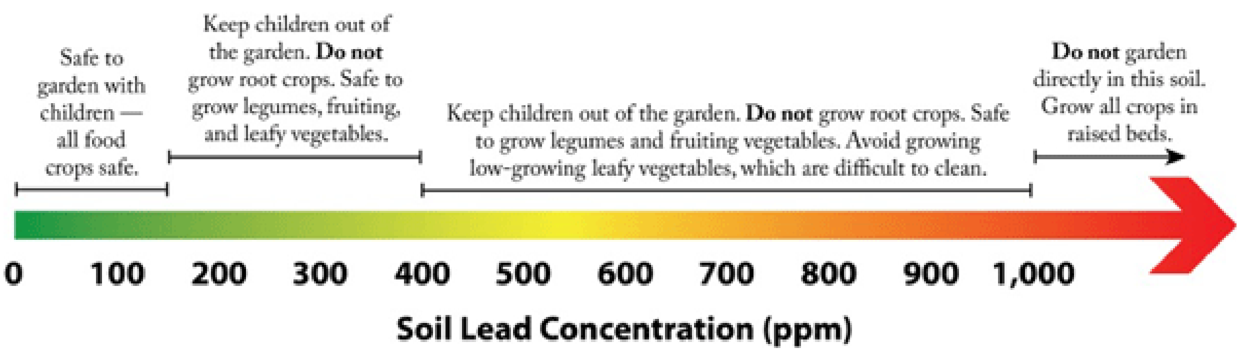

Figure 2. Soil lead level limits for growing food in garden.

Exposure pathways

Exposure to lead in soils primarily happens in two ways: direct exposure to lead-contaminated soil or exposure to plants that grew in lead-contaminated soil.

Soil-to-human exposure

This mainly involves direct exposure either by ingesting the soil or breathing contaminated dust. Incidences include:

- Children playing in the garden may ingest the soil accidentally.
- Eating root crops without proper washing to remove soil or dust particles.
- Children with an unusually strong desire to eat substances not normally eaten may ingest soil present under their fingernails or around their hands.

Soil-to-plant/plant-to-human exposure

Plants grown on contaminated soils may accumulate lead in their root and shoot systems; however, research has shown that most plants do not absorb high amounts of lead into their systems. Some crops absorb more lead than others. Root crops such as carrots and beets are more prone to lead absorption than leafy vegetables. If grown in highly contaminated soils (lead concentrations greater than 1,000 ppm) and poor soil conditions (low pH and organic matter), eating the edible portions of leafy vegetables may become a concern. If in doubt, take a soil sample to your local K-State Research and Extension office.

Factors to consider when growing on urban soils

Nutrient level and soil pH

Urban soils often have low levels of soil nutrients. They suffer from heavy compaction and erosion losses. The alteration of the natural soil profile has been chiefly responsible for the degradation in soil structure and texture (major factors affecting the movement of water in soils). Hence, fertilizer and/or organic manure additions are required to improve soil fertility levels and improve the soil structure. Recent studies have shown that organic matter inputs on moderately (100 – 400 ppm) contaminated lead soils reduce lead uptake in vegetables.

Sources of this organic matter include kitchen/local composts, animal manure, and treated biosolids. Suitable recommended mix ratios of the manures can vary between 30 to 50 percent. Compost addition helps dilute the total lead concentration in soils, making it less bioavailable (the extent to which it can be used by the body). If soil pH tests are low (less than 6.5), levels can be increased with lime applications. Lime additions are usually done to the soil to achieve a desired soil pH in the range of 6.8 to 7.5.

Choosing your crop

If you have tested your soil and found the lead levels to be greater than 400 ppm, then you should mainly grow leafy and fruiting vegetables. Fruiting vegetables such as eggplant, tomatoes, and peppers are recommended on mildly elevated soils. The outer leaves of the vegetables should be discarded and the vegetable should be thoroughly washed in prepared solutions (1 tablespoon of vinegar or liquid detergent dissolved in about a gallon of water).

With root crops (e.g., carrots, beets, radishes, or potatoes) grown on soils where lead concentrations are below 400 ppm, it is advisable that the washing procedure be conducted before peeling. Soil particles bound tightly to the root surfaces may be accidentally ingested when eating raw carrots. Research has shown that more than 80 percent of lead in the soil is bound to fine clay particles. Additionally, it is well established that surface contamination can cause much more damage than what is absorbed by plants.

Other practices to follow when gardening in lead-contaminated soil

- Keep a watchful eye on children when they are in the garden to monitor their activities.
- Always wear gloves when gardening. Immediately after gardening wash your hands thoroughly with soap, and shower.
- Keep garden attire separate and wash it in a different load than your other clothes. Clean

garden tools and shoes thoroughly and keep tools and garden attire away from toddlers.

- In a moderately contaminated soil, raised beds are encouraged, but they should be tested annually for soil lead. Composted manure should be added to the top 3 to 4 inches, and mixed thoroughly.
- Avoid heavy tilling of the soil, particularly if the soil is sandy, because this could stir up dust particulates, increasing aerial deposition on nearby crops/vegetables. The use of a dust mask is strongly encouraged when weeding or during tillage.
- Ground covering should be used and garden pathways should not be left bare. The use of cover crops is recommended after fall harvesting. It helps provide nutrients to the soil when incorporated the following year and serves as a protection from wind.
- Avoid smoking when gardening because of the contact between your hands and mouth.
- Fencing may help prevent stray animals from burrowing through the garden.

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4. Comparative Vegetation Condition Report: October 7 - 20

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:

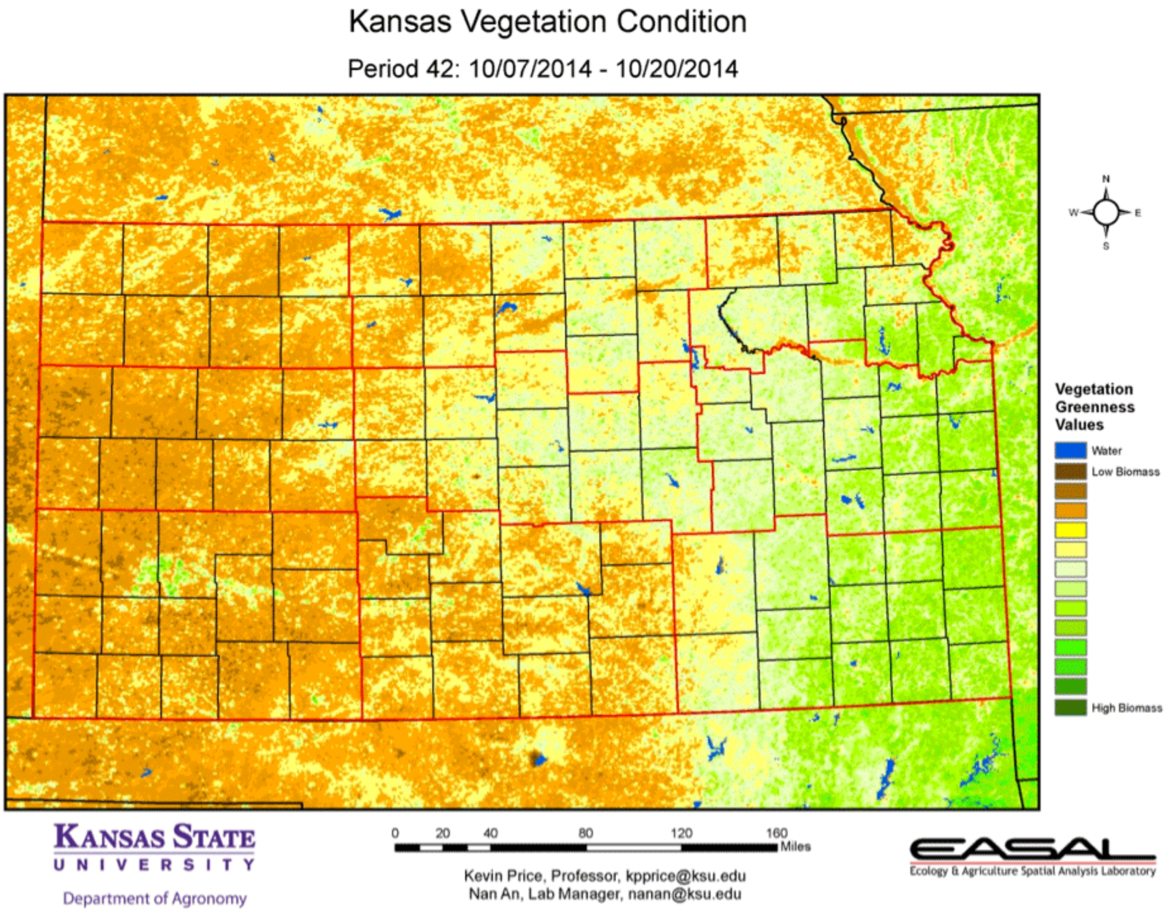

Figure 1. The Vegetation Condition Report for Kansas for October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the most photosynthetically active region continues to be in the eastern third of the state. Higher values can also be seen on the border of Finney and Kearny counties, where irrigated alfalfa is still active. Low NDVI values are seen in Brown and Doniphan counties, where the excess moisture from previous weeks continues to have an impact.

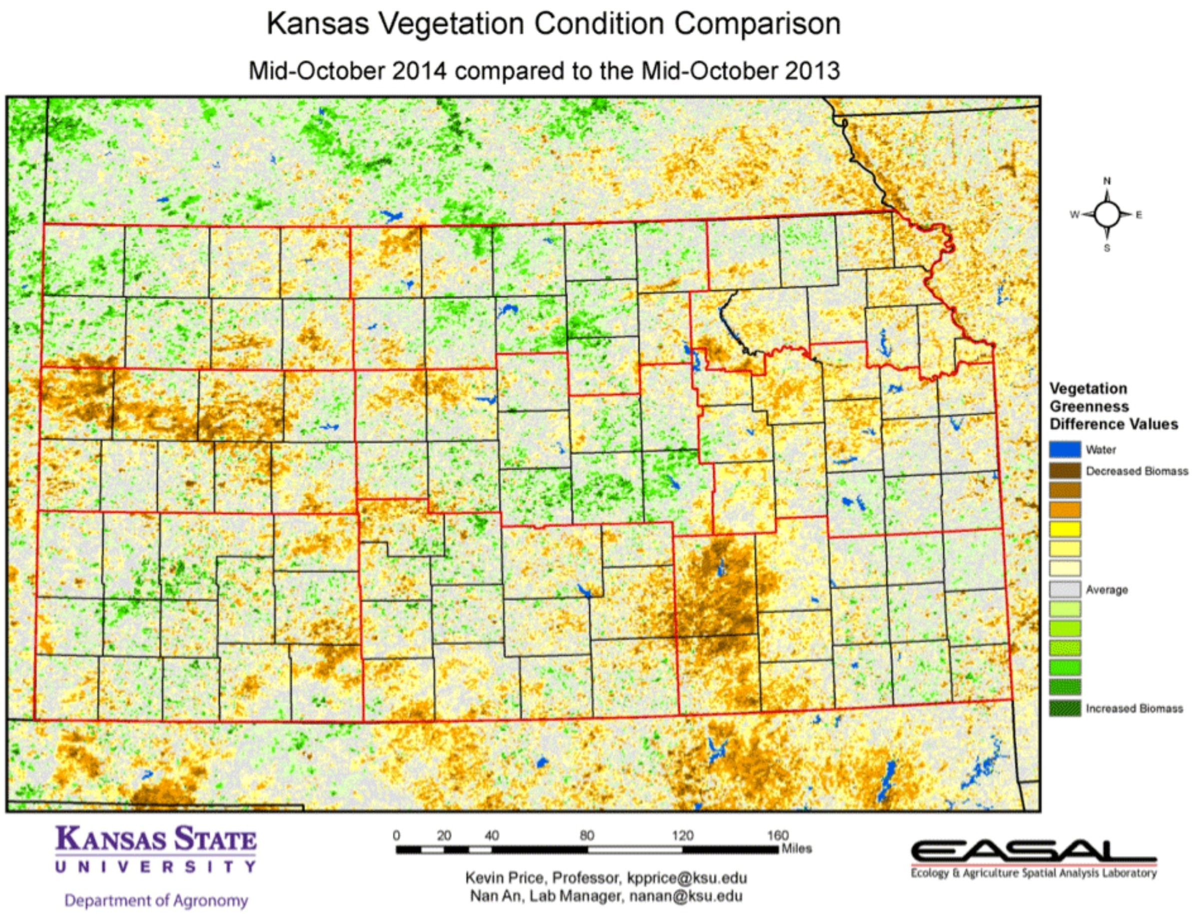

Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that there is a mix of higher and lower photosynthetic activity. There is a prominent area of lower NDVI values from Wallace to Gove counties, where preparation for wheat planting is in progress, but wheat has yet to emerge. Similar conditions prevail in Butler County as well.

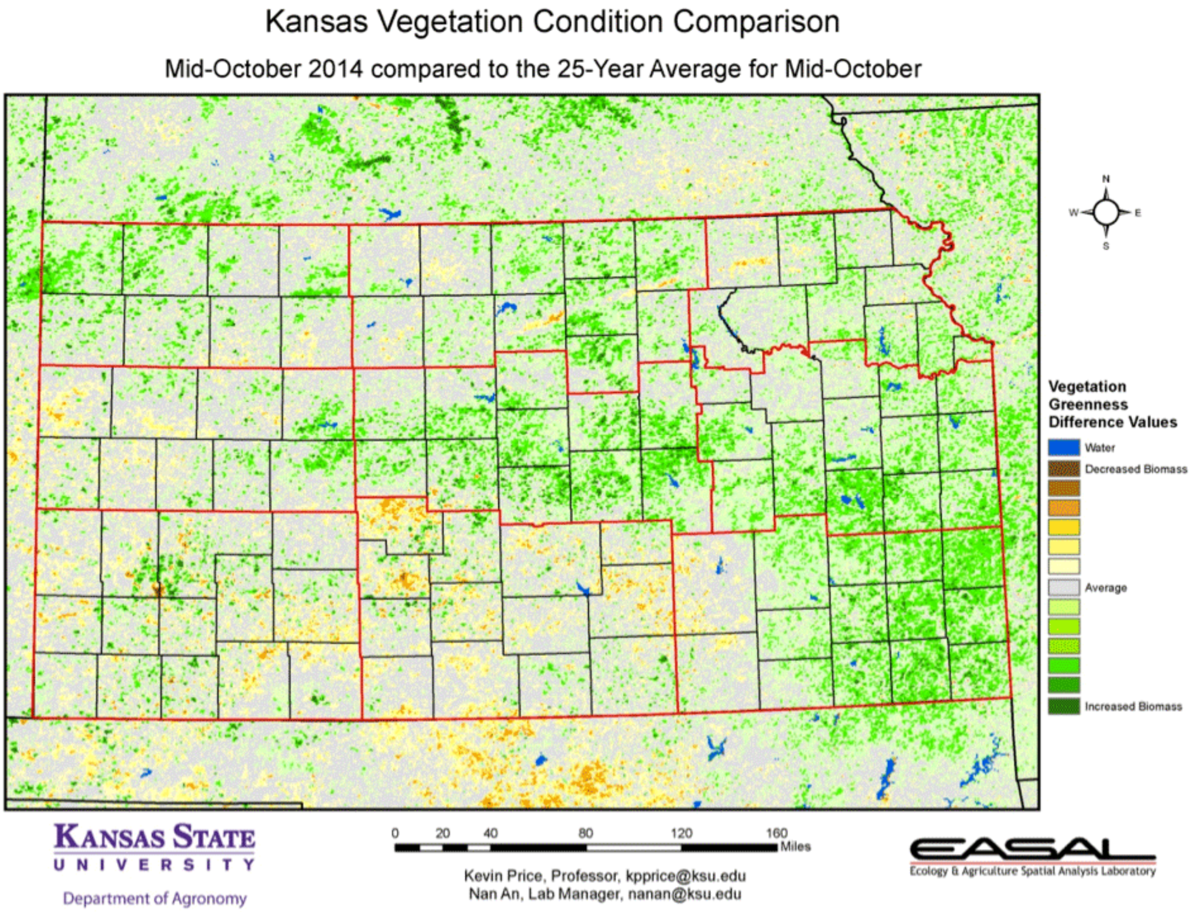

Figure 3. Compared to the 25-year average at this time for Kansas, this year's Vegetation Condition Report for October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows the Southeast and East Central Divisions have the greatest increase in biomass production, but above-average values also prevail in the Central Division. Mild temperatures and ample moisture continue to favor development in these areas.

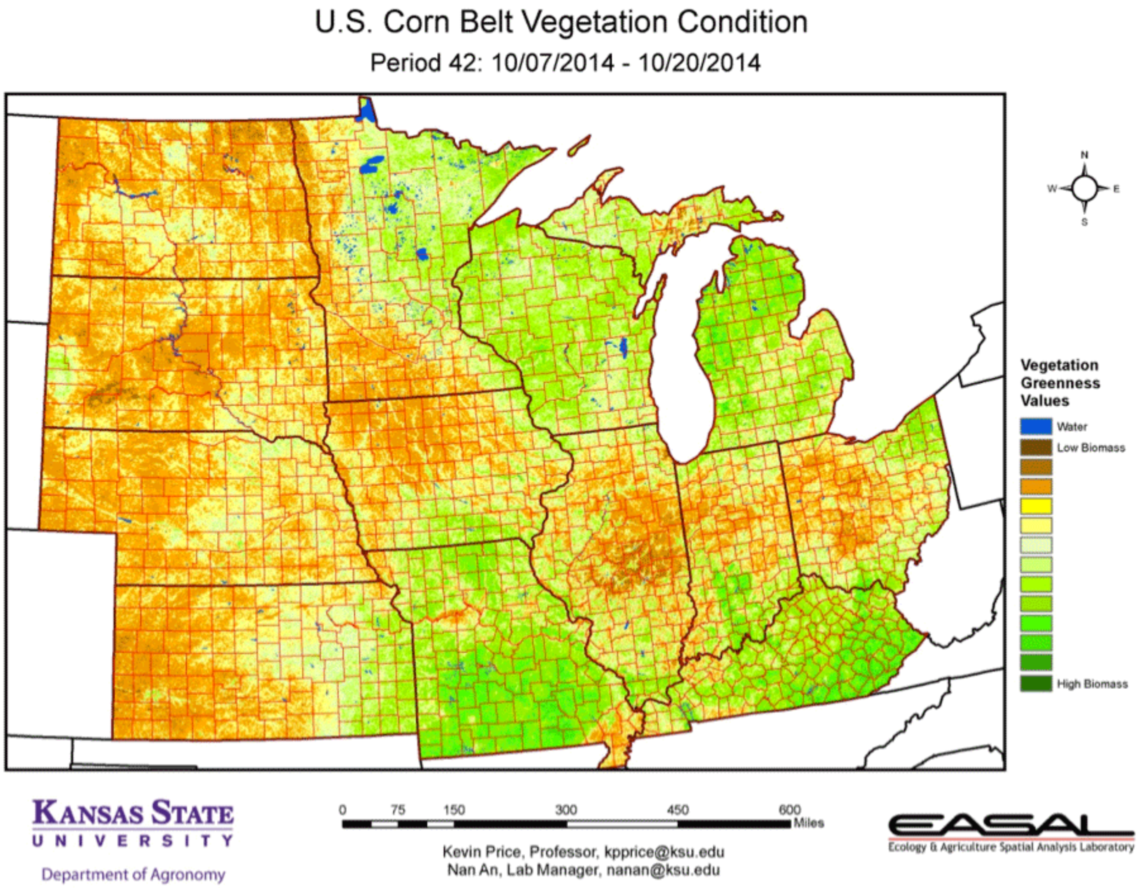

Figure 4. The Vegetation Condition Report for the Corn Belt for October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that high levels of biomass productivity is confined to the northern and southern fringes of the region. In the Great Lakes region, plant development into senescence continues to be delayed. In the southern portions, favorable moisture and mild temperatures have continued to aid photosynthetic activity.

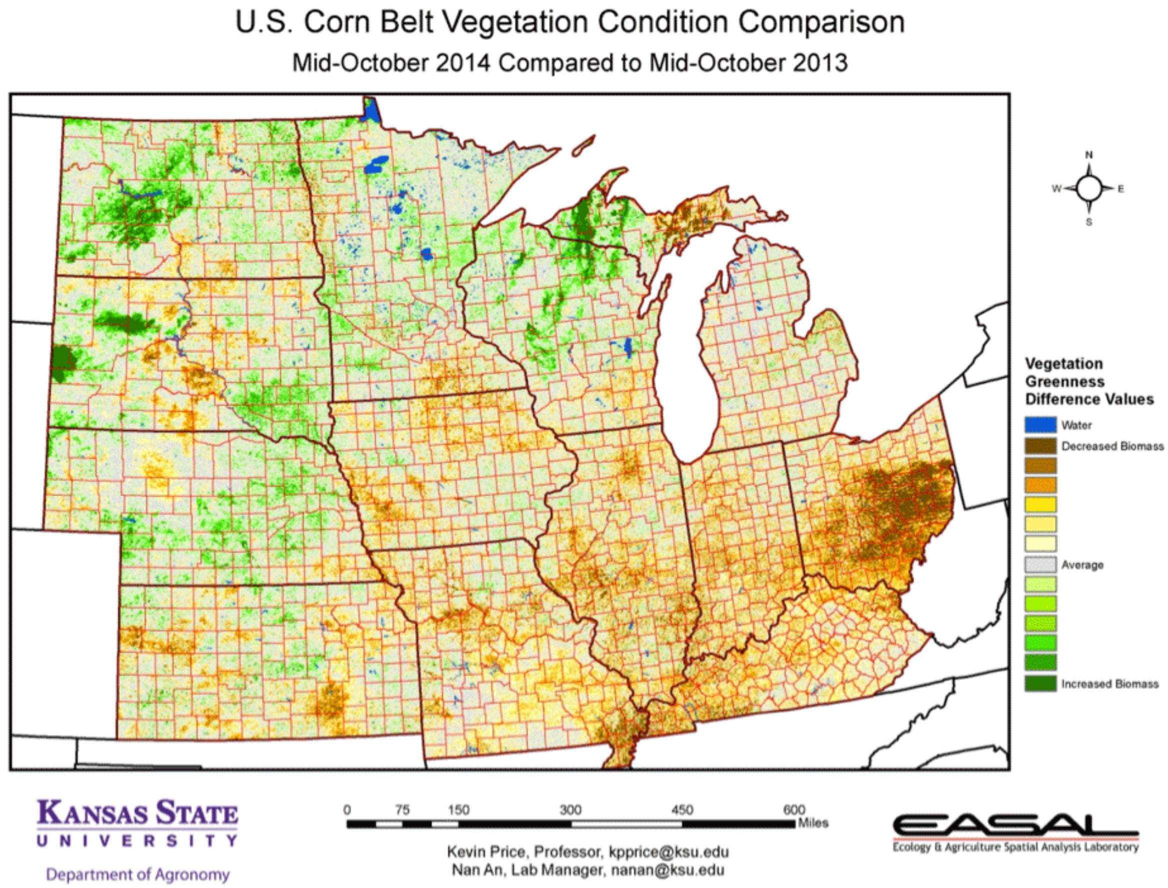

Figure 5. The comparison to last year in the Corn Belt for the period October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the biggest change continues to be in the western parts of the Dakotas. Impacts from last year's unusually early and severe winter storm were still being felt, and for that reason NDVI values appear much higher this year. In Ohio, winter wheat planting has been delayed by wet conditions. Only 21 percent of the wheat has emerged compared to 51 percent last year.

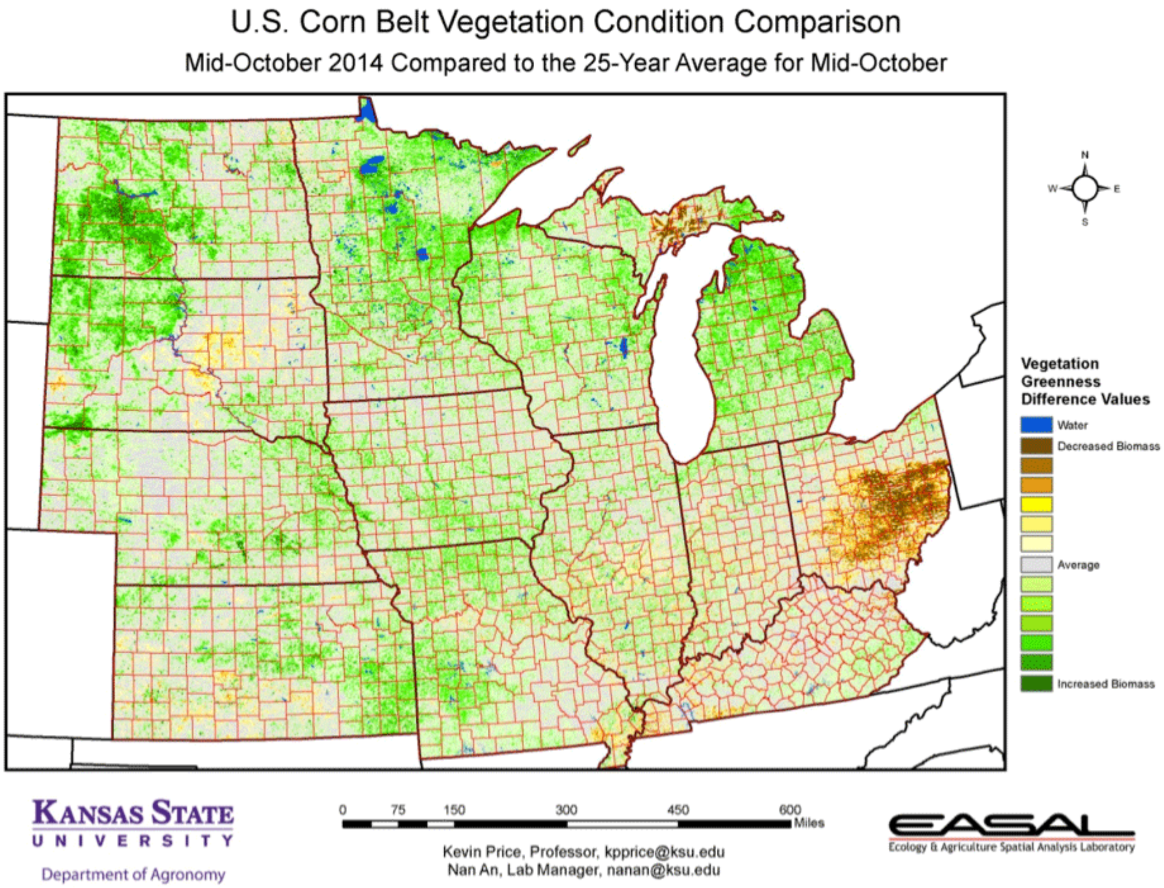

Figure 6. Compared to the 25-year average at this time for the Corn Belt, this year's Vegetation Condition Report for October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that most of the region is very close to average. There continues to be an area of higher-than-normal biomass productivity in the western parts of the Dakotas, while Ohio has much lower-than-normal biomass productivity. In the northern portions of the region mild weather favored photosynthetic activity, while in Ohio wet conditions have delayed planting of winter wheat.

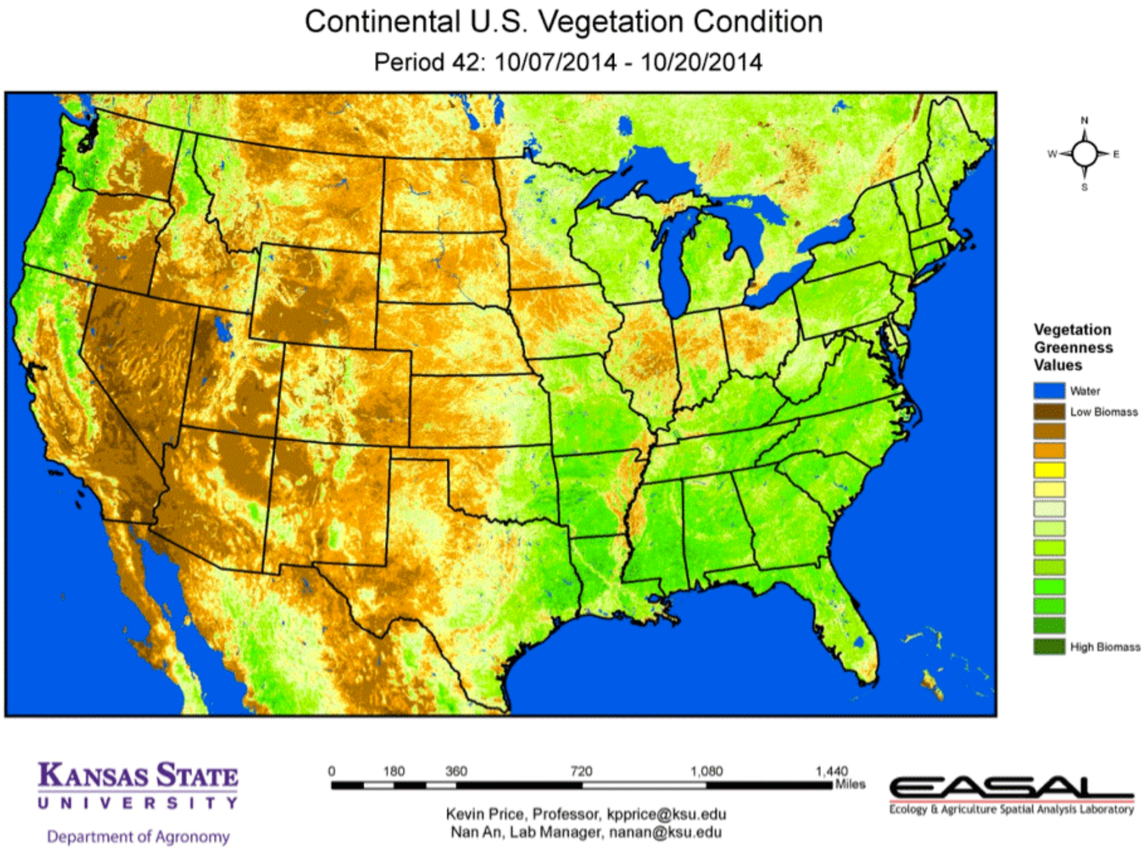

Figure 7. The Vegetation Condition Report for the U.S. for October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that moderate to high photosynthetic activity continues be visible along the Pacific Northwest into the mountains of California, where the snow season has had a slow start.

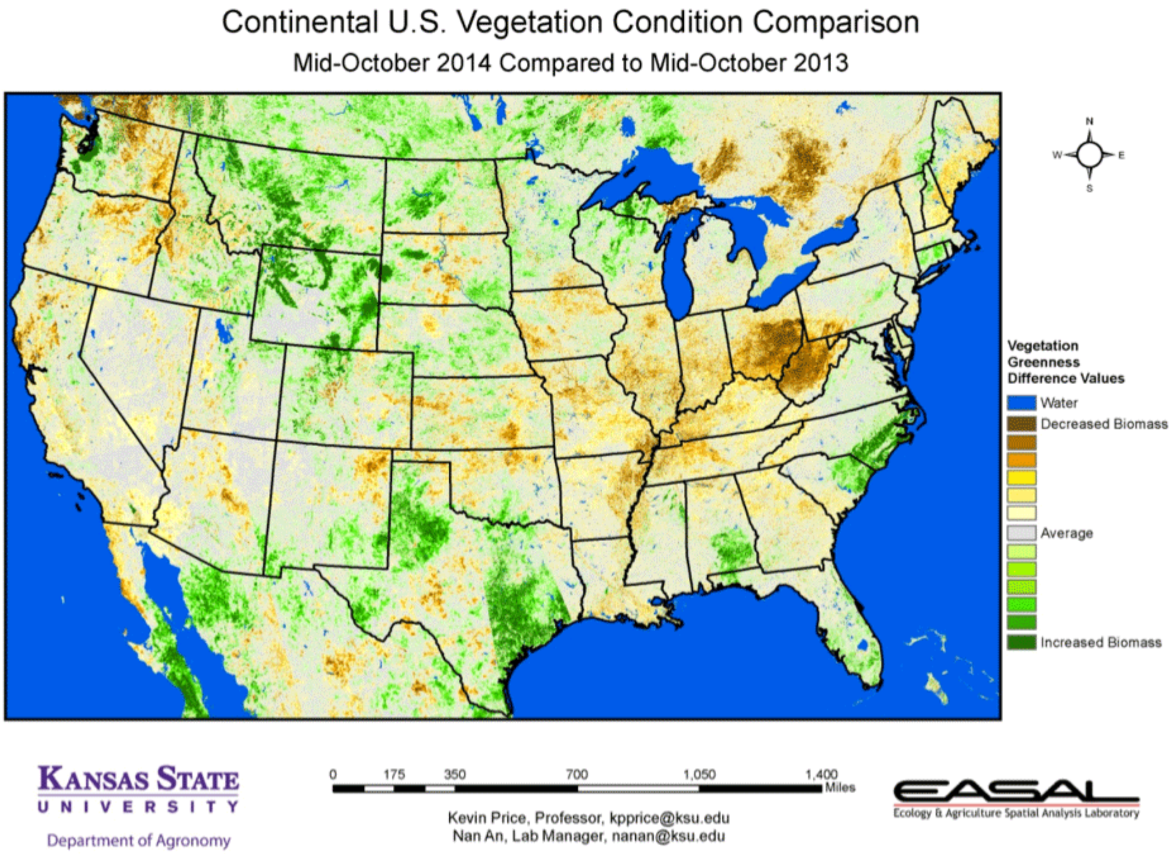

Figure 8. The U.S. comparison to last year at this time for the period October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that higher NDVI values are visible in the area from Idaho to the western parts of the Dakotas. Last year during this period, a major winter storm reduced photosynthetic activity while this year conditions have been close to normal. In contrast, the Texas Panhandle has had greater photosynthetic activity this year due to favorable moisture and temperatures.

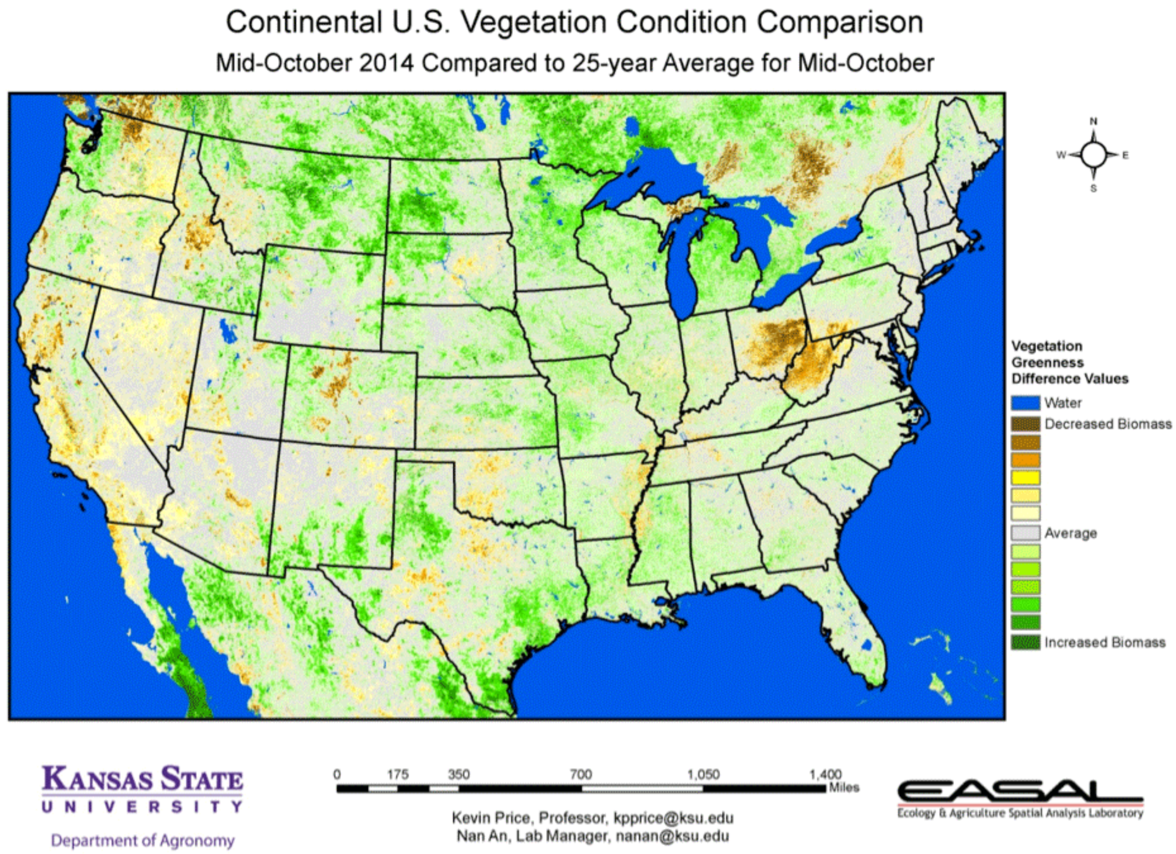

Figure 9. The U.S. comparison to the 25-year average for the period October 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that cool, wet weather has limited photosynthetic activity in Ohio and West Virginia. Greater-than-average biomass productivity can be seen in the Northern Plains, with greatest increase in Montana and the western Dakotas. Ample moisture has also fueled high biomass production along southern New Mexico into Panhandle region of Texas.

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