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1. Starter fertilizer rates and placement for corn

Many producers in Kansas could benefit by using starter fertilizer when planting corn. Starter fertilizer is simply the placement of some fertilizer, usually nitrogen (N) and phosphorus (P), near the seed -- which "jump starts" growth in the spring. It is not unusual for a producer to see an early season growth response to starter fertilizer application. But whether that increase in early growth translates to an economic yield response is not a sure thing in Kansas. How the crop responds to starter fertilizer depends on soil fertility levels, tillage system, soil temperature, and N placement method. Phosphorus source is not an important factor.

Soil fertility levels

The lower the fertility level, the greater the chance of an economic response to starter fertilizers. A routine soil test will reveal available P and potassium (K) levels. If soils test low or very low in P, below 20 ppm, there is a very good chance that producers will obtain an economic yield response to applying a starter fertilizer containing P, even in some low-yield environments. If the soil test shows a medium level of P, 20-30 ppm, it's still possible to obtain a yield response to P fertilizer. But the yield response will not occur as frequently, and may not be large enough to cover the full cost of the practice. If the soil test is high, above 30 ppm, economic responses to starter P fertilizers are rare. The chances of an economic return at high P soil test levels are greatest when planting corn early in cold, wet soils. In general, the same principles apply with K. If soil tests are low, below 130 ppm, chances of a response to K in starter are good. The lower the soil test level, the greater the odds of a response.

All of the recommended P and/or K does not need to be applied as starter. If the soil test recommendation calls for high rates of P and K in order to build up or maintain soil test levels, producers will often get better results by splitting the application between a starter and a preplant broadcast application. As a general rule, starter fertilizer should be limited to the first 20-30 pounds of P or K per acre, with the balance being broadcast for best responses.

Phosphorus source

Does the type of phosphorus used as a starter make any difference? In particular, what about the ratio of orthophosphate to polyphosphate in the fertilizer product? This has been a concern for many producers.

Liquid 10-34-0 is composed of a mixture of ammonium polyphosphates and ammonium orthophosphates. The dissolved ammonium orthophosphate molecules are identical to those found in dry MAP (e.g. 11-52-0) and/or DAP (e.g. 18-46-0). Ammonium polyphosphates are simply chains of orthophosphate molecules, formed by removing a molecule of water, and are quickly converted by soil enzymes back to individual orthophosphates identical to those provided by MAP and/or DAP.

Polyphosphates were not developed by the fluid fertilizer industry because of agronomic performance issues. Instead, polyphosphates were developed to improve the storage characteristics of fluid phosphate products (and other fertilizers made from them) and to increase the analysis of liquid phosphate fertilizers. Ammonium polyphosphate is equal in agronomic performance to ammonium orthophosphates when applied at the same P_2O_5 rates in a similar manner. And liquid phosphate products are equal in agronomic performance to dry phosphate products if applied at equal P_2O_5 rates in a similar manner.

The University of Nebraska evaluated the effect of phosphorus application from orthophosphate or polyphosphate applied at identical P_2O_5 rates on corn yield (Table 1). There was no yield difference between phosphorus sources. The simple reason for this is that when polyphosphate is added to soil, a process called hydrolysis breaks down the polyphosphate chains into orthophosphates. The concern of many people is the length of time it takes for this process to occur. Previous studies indicate that **although it may take a few days to complete the hydrolysis process, the majority is completed in 48 hours.** As a result, phosphorus in soil solution will typically be similar from either source shortly after application.

Table 1. Corn Yield Response in Nebraska to Different Sources of P Fertilizer

	Phosphorus Source	
P_2O_5 Rate (lb/ac)	Polyphosphate	Orthophosphate
	----------------------Corn bu/ac----------------------	
15	124	124
30	134	134
45	142	142

Tillage system

No-till corn will almost always respond to a starter fertilizer that includes N – along with other needed nutrients – regardless of soil fertility levels or yield environment. This is especially so when preplant N is applied as deep-banded anhydrous ammonia or UAN, or where most of the N is sidedressed in-season. That's because no-till soils are almost always colder and wetter at corn planting time than soils that have been tilled, and N mineralization from organic matter tends to be slower at the start of the season in no-till environments.

In general, no-till corn is less likely to respond to an N starter if more than 50 pounds of N was broadcast prior to or shortly after planting.

In reduced-till systems, the situation becomes less clear. The planting/germination zone in strip-till or ridge-till corn is typically not as cold and wet as no-till, despite the high levels of crop residue in the row middles. Still, N and P starter fertilizer is often beneficial for corn planted in reduced-till conditions, especially where soil test levels are very low, or low, and where the yield environment is high. As with no-till, reduced-till corn is also less likely to respond to an N starter if more than 50 pounds of N was broadcast prior to or shortly after planting.

Conventional- or clean-tilled corn is unlikely to give an economic response to an N and P starter unless the P soil test is low.

Starter fertilizer placement

Producers should be very cautious about applying starter fertilizer that includes N and/or K, or some micronutrients such as boron, in direct seed contact. It is best to have some soil separation between the starter fertilizer and the seed. The safest placement methods for starter fertilizer are either:

-- A subsurface-band application 2 to 3 inches to the side and 2 to 3 inches below the seed, or
-- A surface-band application 2 to 3 inches to the side of the seed row at planting time, especially in conventional tillage or where farmers are using row cleaners or trash movers in no-till.

If producers apply starter fertilizer with the corn seed, they run an increased risk of seed injury when applying more than 6 to 8 pounds per acre of N and K combined in direct seed contact on a 30-inch row spacing. Nitrogen and K fertilizer can result in salt injury at high application rates if seed is in contact with the fertilizer. Furthermore, if the N source is urea or UAN, in-furrow application is not recommended regardless of fertilizer rate. Urea converts to ammonia, which is very toxic to seedlings and can significantly reduce final stands.

Work several years ago at the North Central Kansas Irrigation Experiment Field near Scandia illustrates some of these points (Table 2). In this research, former Agronomist-In-Charge Barney Gordon compared in-furrow, 2x2, and surface band placement of different starter fertilizer rates in a multi-year study on irrigated corn. Excellent responses from up to 30 pounds of N combined with 15 pounds of P were obtained with the both the 2x2 and surface-band placement. In-furrow placement however, was not nearly as effective. This was due to stand reduction from salt injury to the germinating seedlings, likely due to the high application rate of N plus K in furrow, indicating the importance of monitoring the N+K rates for in furrow application. Where no starter, or the 2x2 and surface band placement, was used, final stands were approximately 30-31,000 plants per acre. However, with the 5-15-5 in furrow treatment, the final stand was approximately 25,000. The final stand was just over 20,000 with the in-furrow 60-15-5 treatment.

Table 2. Effect of Starter Fertilizer Placement on Corn Yield at North Central Irrigation Experiment Field

	Yield (bu/acre)		
Fertilizer Applied (lbs)	In-Furrow Placement	2x2 Band Placement	Surface Band Placement
Check: 159 bu	--	--	--
5-15-5	172	194	190
15-15-5	177	197	198
30-15-5	174	216	212
45-15-5	171	215	213
60-15-15	163	214	213
Average	171	207	205

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2. Recommendations for plant analysis for wheat

Wheat producers may want to start planning soon for taking tissue samples of wheat for plant analysis. Sampling can be done at tillering-jointing stage, or later in the season near the boot stage. If sampling is done early, this can allow time for corrective measures to be taken.

There are two primary ways plant analysis can be used: as a routine monitoring tool to ensure nutrient levels are adequate, and as a diagnostic tool to help explain some of the variability in wheat growth we see in fields this time of year. Keep in mind, however, that any plant stress (drought, heat, frost, etc.) can have a serious impact on nutrient uptake and plant tissue nutrient concentrations. Sampling under stress conditions for monitoring purposes can give misleading results, and is not advisable.

Sampling at tillering-jointing for routine monitoring

For monitoring purposes, 40-50 whole plants, without roots, should be collected at random from the field. The plants should be allowed to wilt overnight to remove excess moisture, placed in a paper bag or mailing envelope, and shipped to a lab for analysis. Do not place the plants in a plastic bag or other tightly sealed container, as they will begin to rot and decompose during transport, and the sample won't be usable.

The data returned from the lab will be reported as the concentration of nutrient elements, or potentially toxic elements in the plants. Most labs/agronomists compare plant nutrient concentrations to published sufficiency ranges. A sufficiency range is simply the range of concentrations normally found in healthy, productive plants during surveys. It can be thought of as the range of values optimum for plant growth. The medical profession uses a similar range of normal values to evaluate blood work.

The sufficiency ranges change with plant age (generally being higher in young plants), vary between plant parts, and can differ between varieties. So a value slightly below the sufficiency range does not always mean the plant is deficient in that nutrient, but it is just an indication that the nutrient is relatively low. However, if that nutrient is significantly below the sufficiency range, then one should ask some serious questions about the availability and supply of that nutrient.

Levels above sufficiency can also indicate problems. High values might indicate over fertilization and luxury consumption. Plants will also sometimes try to compensate for a shortage of one nutrient by loading up on another. This occurs at times with nutrients such as iron, zinc, and manganese. In some situations very high levels of a required nutrient can lead to toxicity. Manganese is an example of an essential nutrient which can be toxic when present in excess.

Plant analysis as a diagnostic tool

Plant analysis is also an excellent diagnostic tool to help understand some of the variation seen in the field. When using plant analysis to diagnose field problems, try to take comparison samples from both good/normal areas of the field, and problem spots. Collect soil samples from the same good and bad areas. Don't wait for the boot stage to take diagnostic samples. Early in the season (prior to stem elongation) collect whole plants from 20-30 different places in your sampling area. Later in the season take the upper most, fully developed leaves (those with leaf collars visible). Handle the samples the same as those for monitoring.

Sufficiency ranges

The following table gives broad sufficiency ranges for wheat early in the season, prior to jointing (Feekes 4-6), and later in the season, at boot to early heading (Feekes 9-10). Keep in mind that these are the ranges normally found in healthy, productive wheat.

		Growth stage	
Nutrient	Unit	Whole plant at tillering-jointing	Flag leaf at boot to heading
Nitrogen	%	3.5-4.5	3.5-4.5
Phosphorus	%	0.3-0.5	0.3-0.5
Potassium	%	2.5-4.0	2.0-3.0
Calcium	%	0.2-0.5	0.3-0.5
Magnesium	%	0.15-0.5	0.2-0.6
Sulfur	%	0.19-0.55	0.15-0.55

		Growth stage	
Nutrient	Unit	Tillering-jointing	Boot
Iron	ppm	30-200	30-200
Manganese	ppm	20-150	20-150
Zinc	ppm	15-70	15-70
Copper	ppm	5-25	5-25
Boron	ppm	1.5-4.0	1.5-4.0
Aluminum	ppm	<200	<200

In summary, plant analysis is a good tool to monitor the effectiveness of your fertilizer and lime program, and a very effective diagnostic tool. Consider adding this to your toolbox.

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3. Kansas Flint Hills Smoke Management Plan: The grassland manager's perspective

The Kansas Flint Hills Smoke Management Plan is entering its second year in 2012. This comprehensive plan is designed to minimize the movement of concentrated smoke plumes into large metropolitan areas through voluntary participation. All Flint Hills landowners and managers who conduct prescribed burns should know what is in this plan.

To help educate all those affected, a series of radio interviews is being broadcast weekly each Monday on K-State's *Agriculture Today* talk show. These programs will explain the many aspects of the new plan. *Agriculture Today* is part of the K-State Radio Network. The broadcast interviews are podcast online at www.ksre.ksu.edu/news/DesktopDefault.aspx?tabid=66.

The following is a slightly edited transcript of the first in the 2012 series of *Agriculture Today* radio broadcasts on the Kansas Flint Hills Smoke Management Plan. This is an interview with Mike Holder, Agricultural Agent, Flint Hills Research and Extension district office, conducted by Eric Atkinson of the K-State Radio Network.

Q: Take us back to the origins of the plan from your perspective and how it came together last year.

A: The original reason for the plan goes back to the occasional occurrences of ozone exceedances in urban areas over the past 10 years, which have been linked to smoke from our Flint Hills burning. Over the course of time, K-State Research Extension and grassland managers worked with KDHE and the U.S. Environmental Protection Agency worked together to develop the smoke management plan to reduce these occurrences and yet ensure our ability to burn rangeland annually as needed. Everybody was a little apprehensive in its first year last year as to how this was going to work. But we were optimistic that it would work, and it did. It worked well. We had generally very good acceptance among ranchers. They understood why we need a smoke management plan and how important air quality is in urban areas, and to all of us. The ranchers jumped into it very enthusiastically for the most part.

Q: After last year's burn season was over, were you able to do some followup with producers about the smoke management plan and the web site that provides vital information on the timing of the burn?

A: Yes we were. Doing an evaluation was an important part of the smoke management plan. Carol Blocksome, K-State Research and Extension Research Assistant Professor of Agronomy, headed up that evaluation. Everyone who was part of the followup evaluation knew about the ksfire.org website, and about the smoke management plan. They understood the why and the how, and what we have to do. So from that standpoint, I look at our efforts to implement the plan as being very successful. As to how the ranchers utilized all that information, it varied quite a bit. But I felt good about the fact that a lot of ranchers went to the web site and used the weather and smoke management information. Some of them, not all of them, used that information to make burning decisions and some may have altered some of their burning plans as a result.

Q: There were a few days last spring when the smoke got pretty intense. Some of that had to do with the extraordinarily heavy fuel load left over from the previous year. That's not always going to be the case, is it?

A: That's correct. Going back to the grazing season of 2010, we had a lot of rainfall and good grazing conditions. We had a lot of grass and a lot of residue that carried through over the winter. So when it came time to burn in 2011, we had a heavy fuel load. When that happens, we burn a lot of acres. In Chase County, more than 80 percent of our native grass acres was burned last spring. With the heavy fuel load and the limited number of days that burning was possible, we expected there would be some days when there would be a lot of smoke in the air and the potential for some air quality problems in the urban areas -- and there was. This spring, the fuel load will not be as heavy so I think we'll burn a lot fewer acres. Hopefully we'll have fewer exceedances. But we'll still have the smoke management plan, and we'll still follow it.

Q: So although the plan was a success last year, this is not a time for ranches to rest on their laurels. They need to continue utilizing this information, correct?

A: That's correct. Burning of the Flint Hills is not just a good practice. It is an absolute necessity to maintain the integrity and productivity of grasslands in the Flint Hills. So we have to make a commitment to follow the smoke management plan, and do whatever we can to make it work for everyone.

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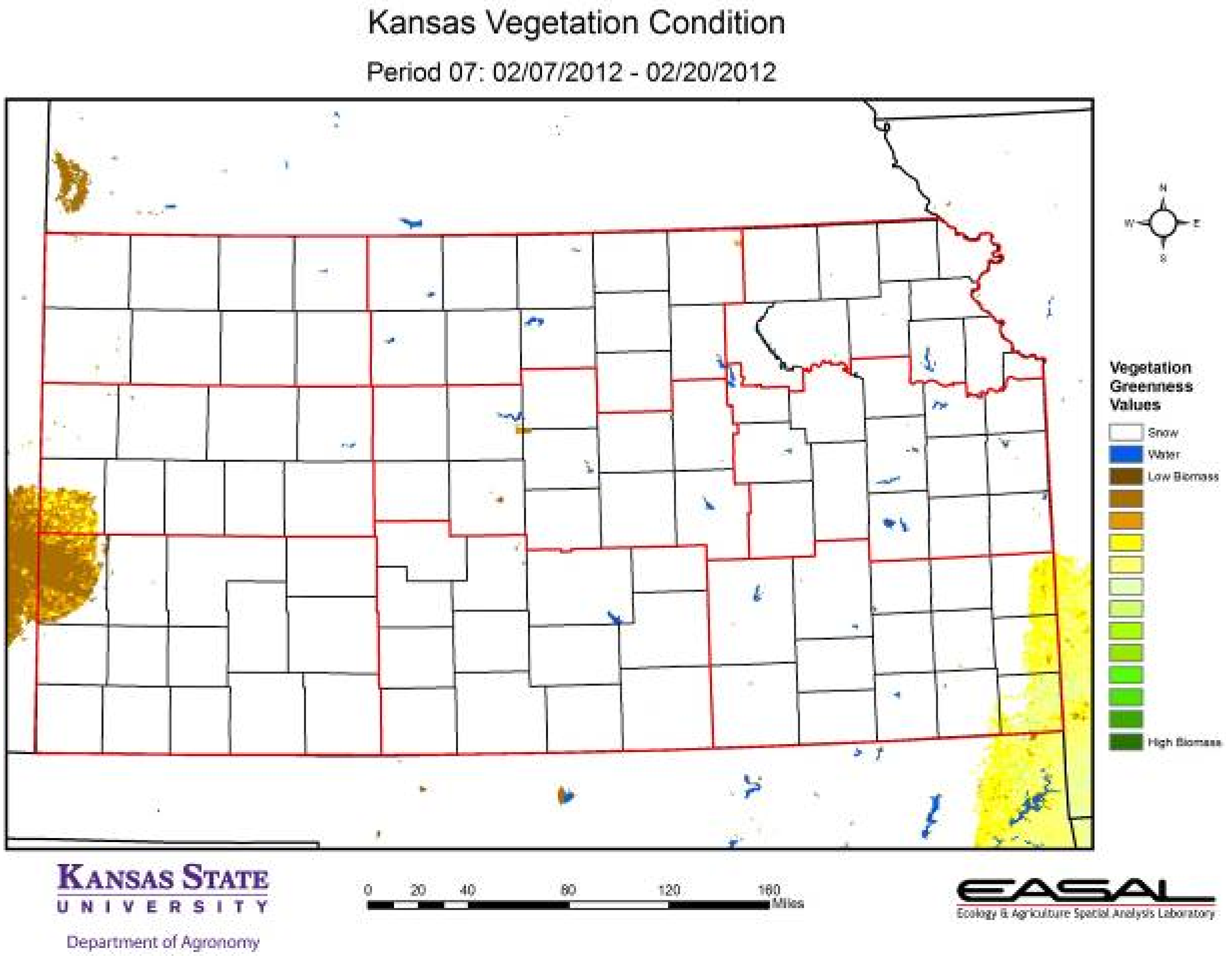
4. Comparative Vegetation Condition Report: February 7 – 20

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.

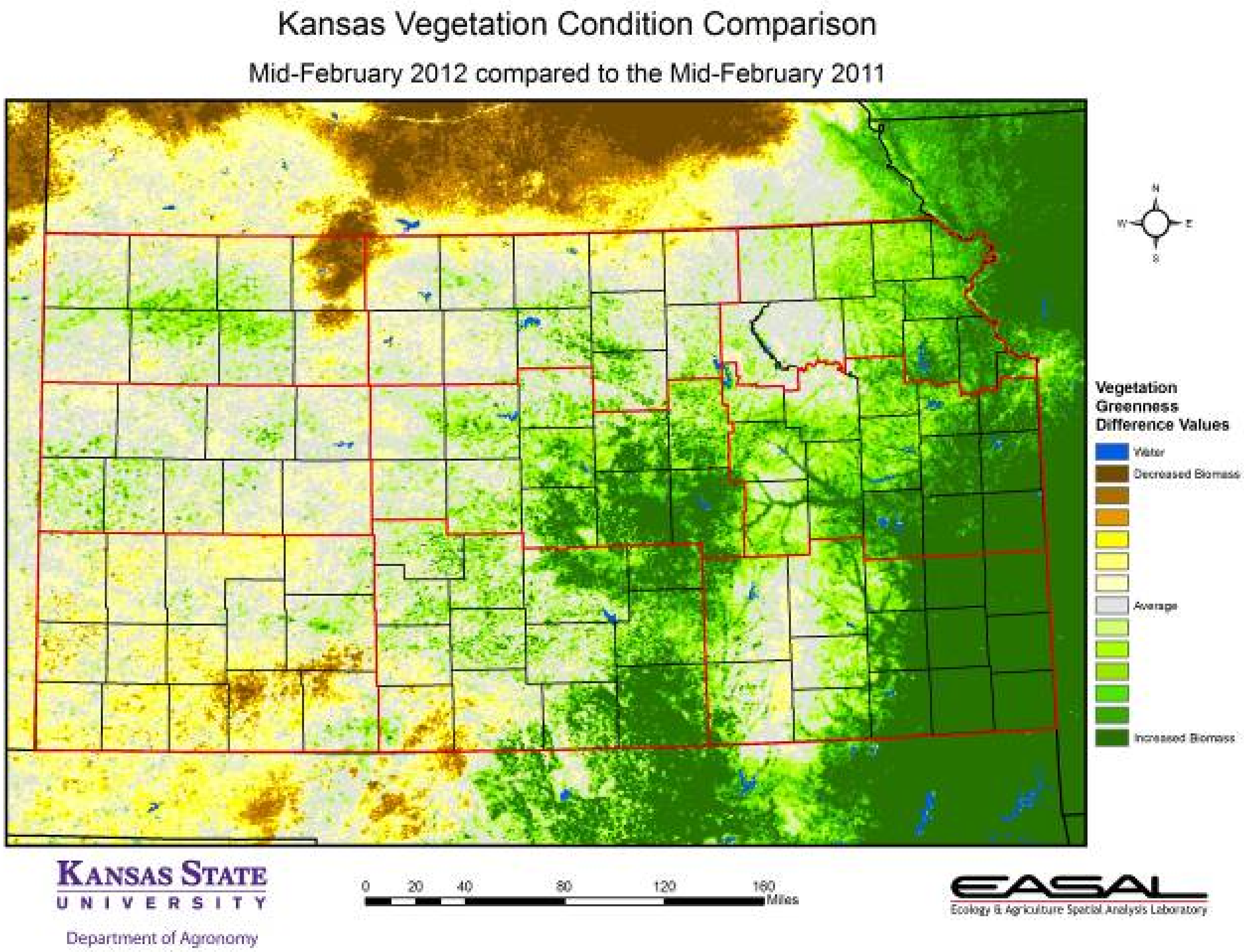
Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:
http://www.youtube.com/watch?v=CRP3Y5NIggw
http://www.youtube.com/watch?v=tUdOK94efxc

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 21-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.

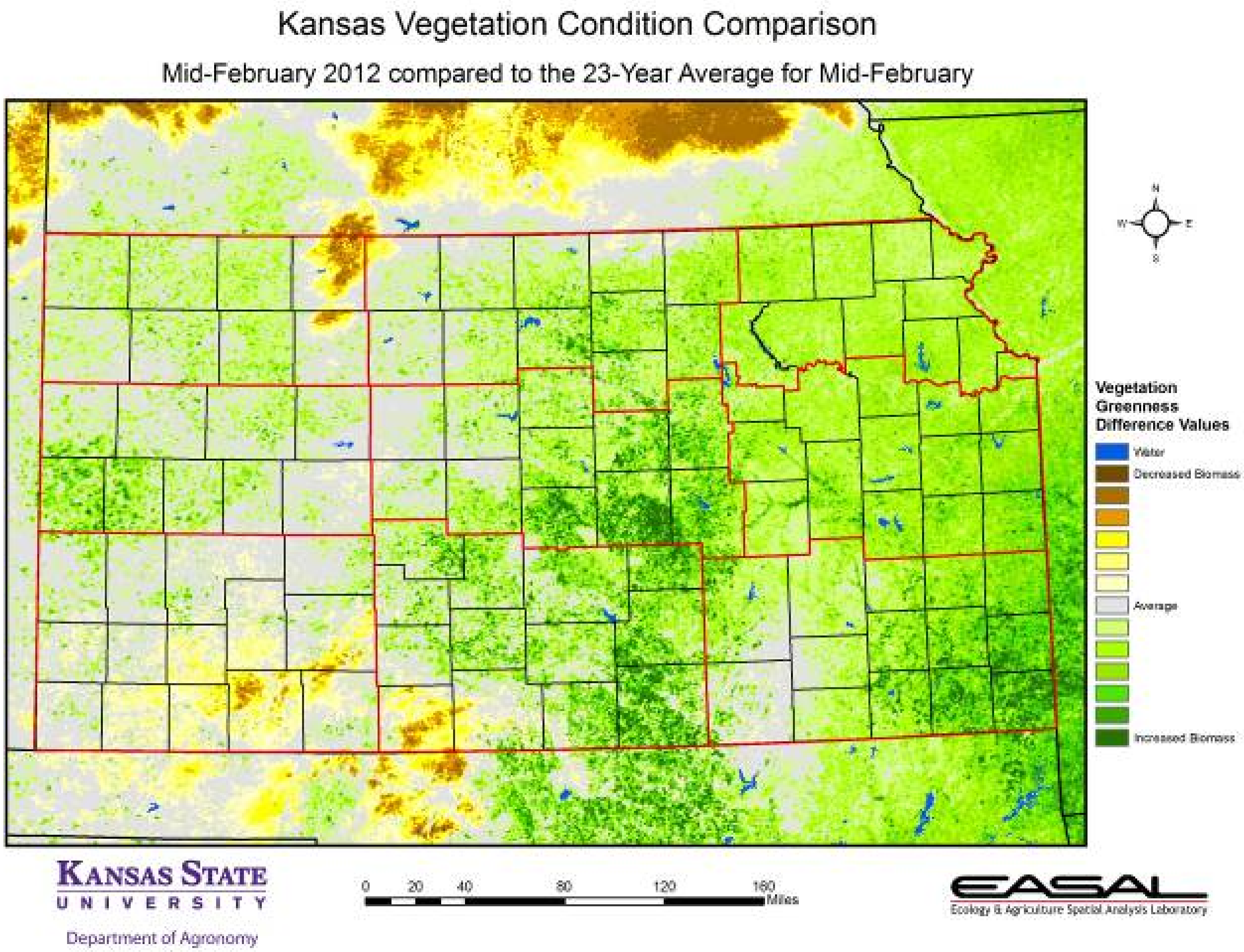
The maps below show the current vegetation conditions in Kansas, the Corn Belt, and the continental U.S, with comments from Mary Knapp, state climatologist:



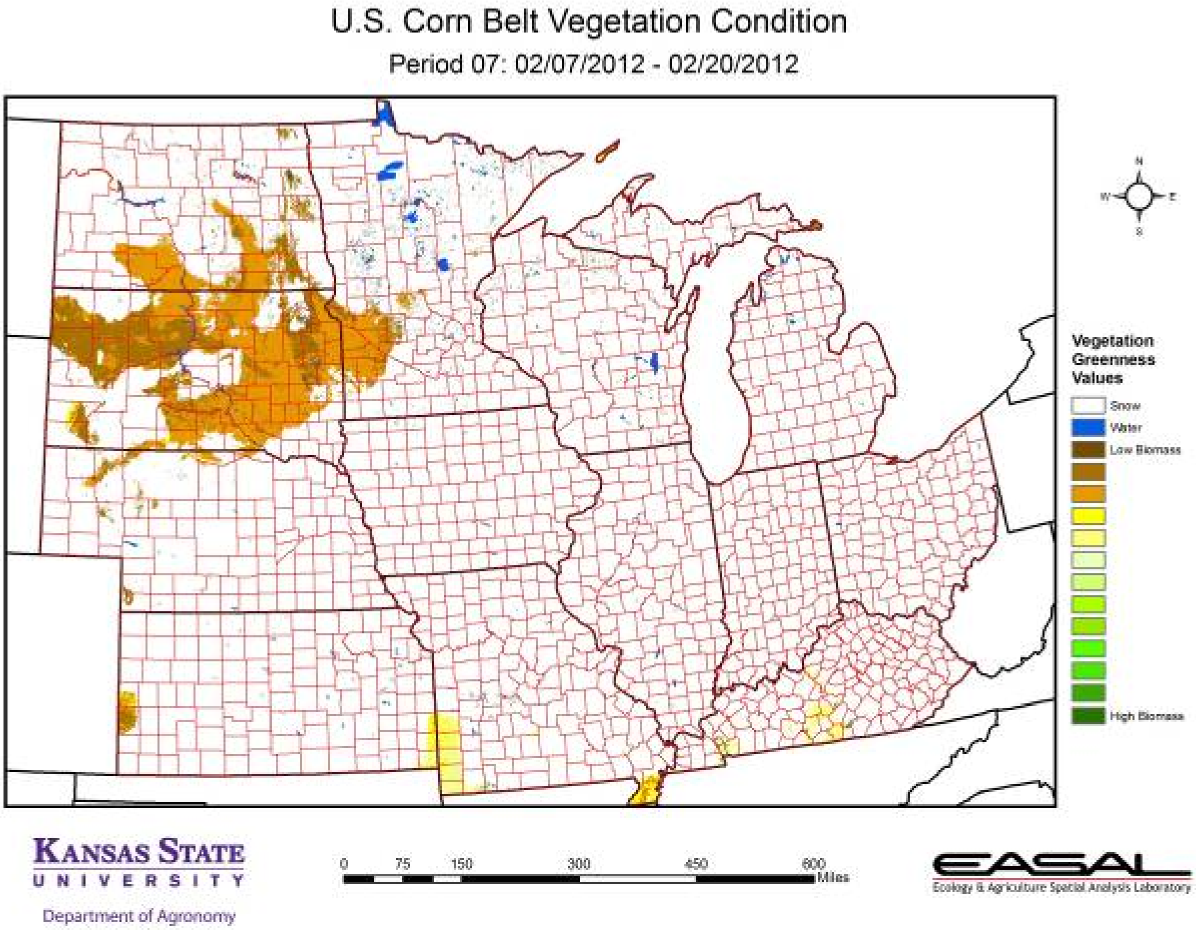
Map 1. The Vegetation Condition Report for Kansas for February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows snow again made an appearance. However, the amounts were light, and remained on the ground for only a short period. The Northwest and North Central Divisions had the greatest percent of the normal precipitation at 158 percent and 118 percent. The South Central Division had only 8 percent of normal for the period.



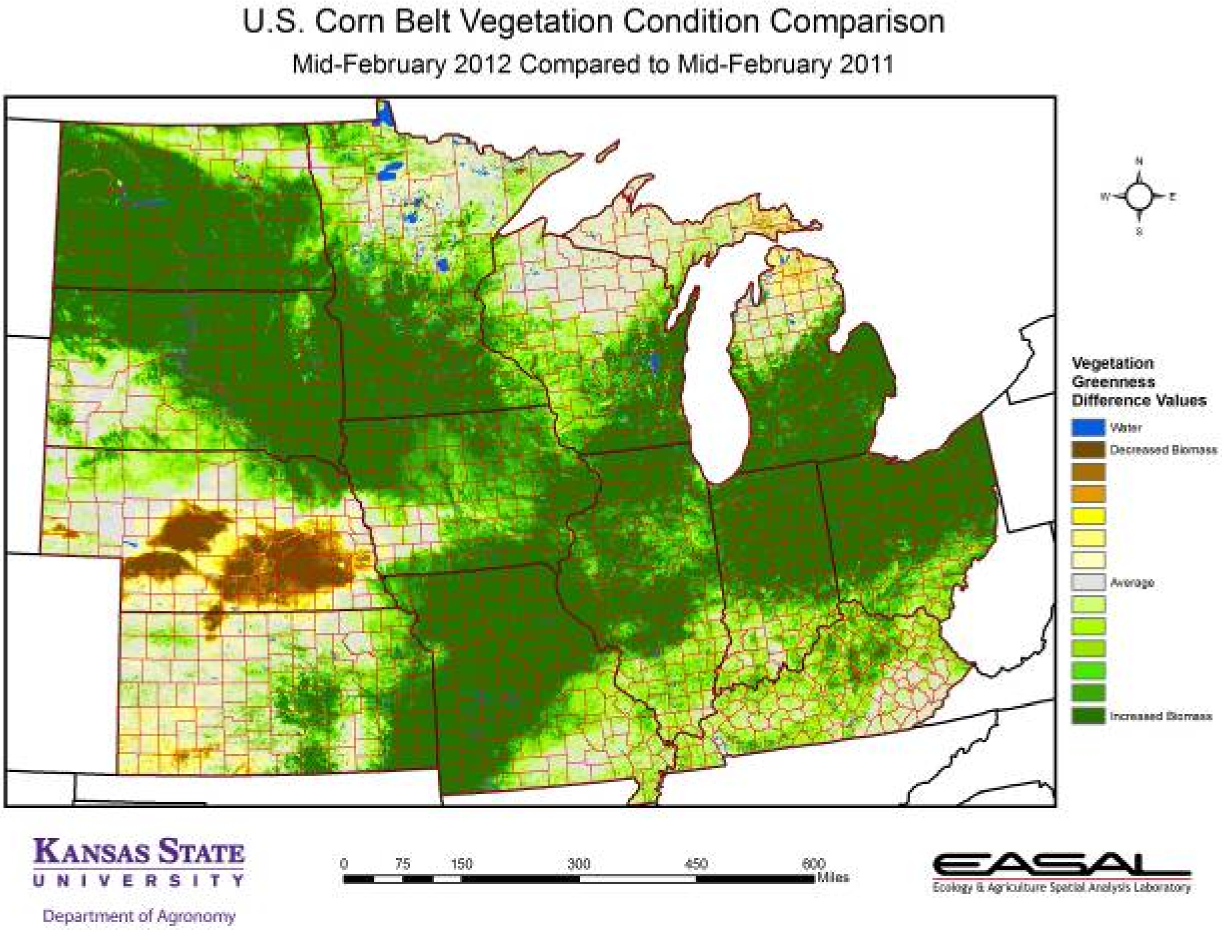
Map 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows much of the state has significantly higher NDVI values. In eastern Kansas, this is mainly due to less snow cover this season. Lower values in southwest Kansas show the continued impact of drought in this region.



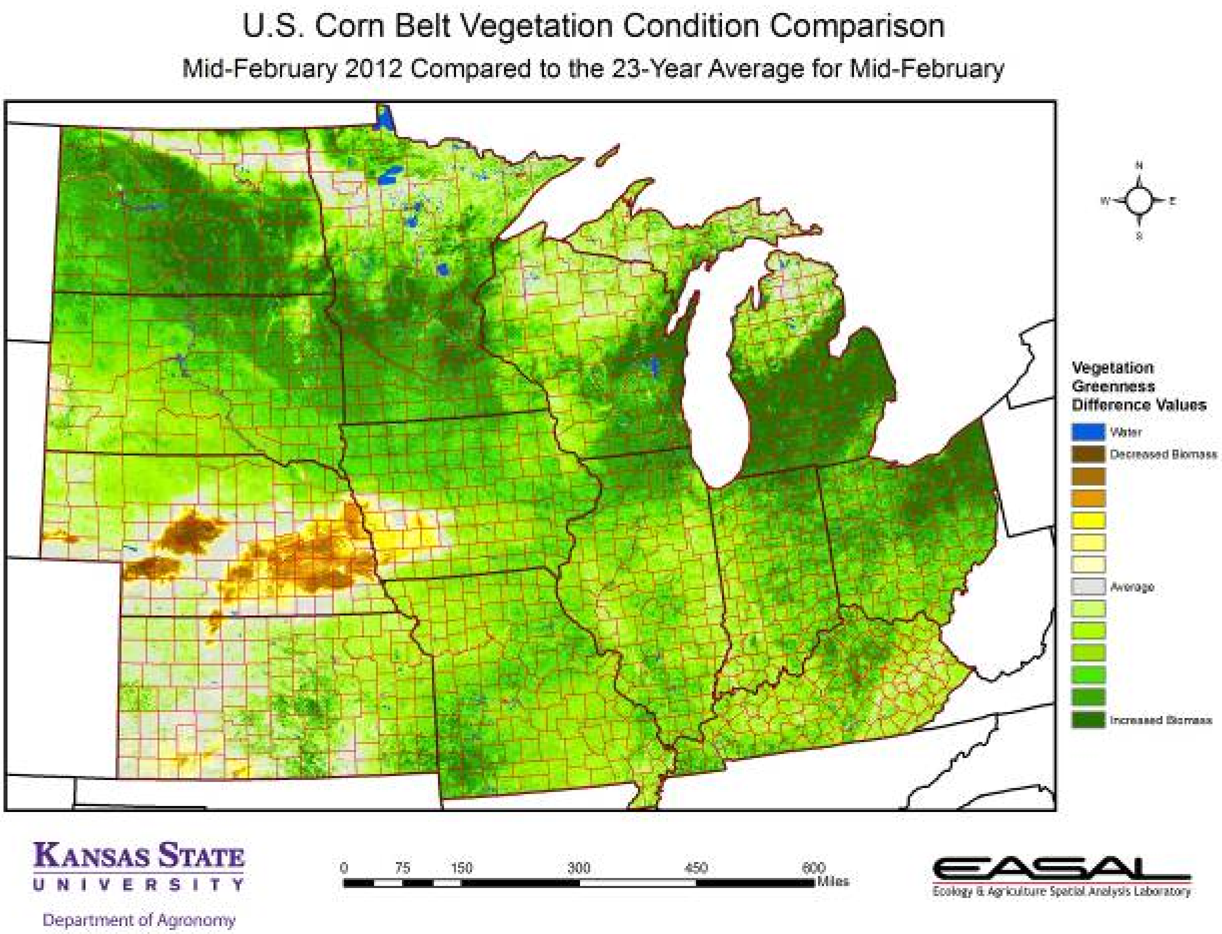
Map 3. Compared to the 23-year average at this time for Kansas, this year's Vegetation Condition Report for February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that photosynthetic activity is above average for most of the state. It is particularly pronounced in central and south central Kansas, as well as southeastern Kansas. Lower NDVI values from Meade County up through southern Ford County are due to lingering impacts of drought in these areas.



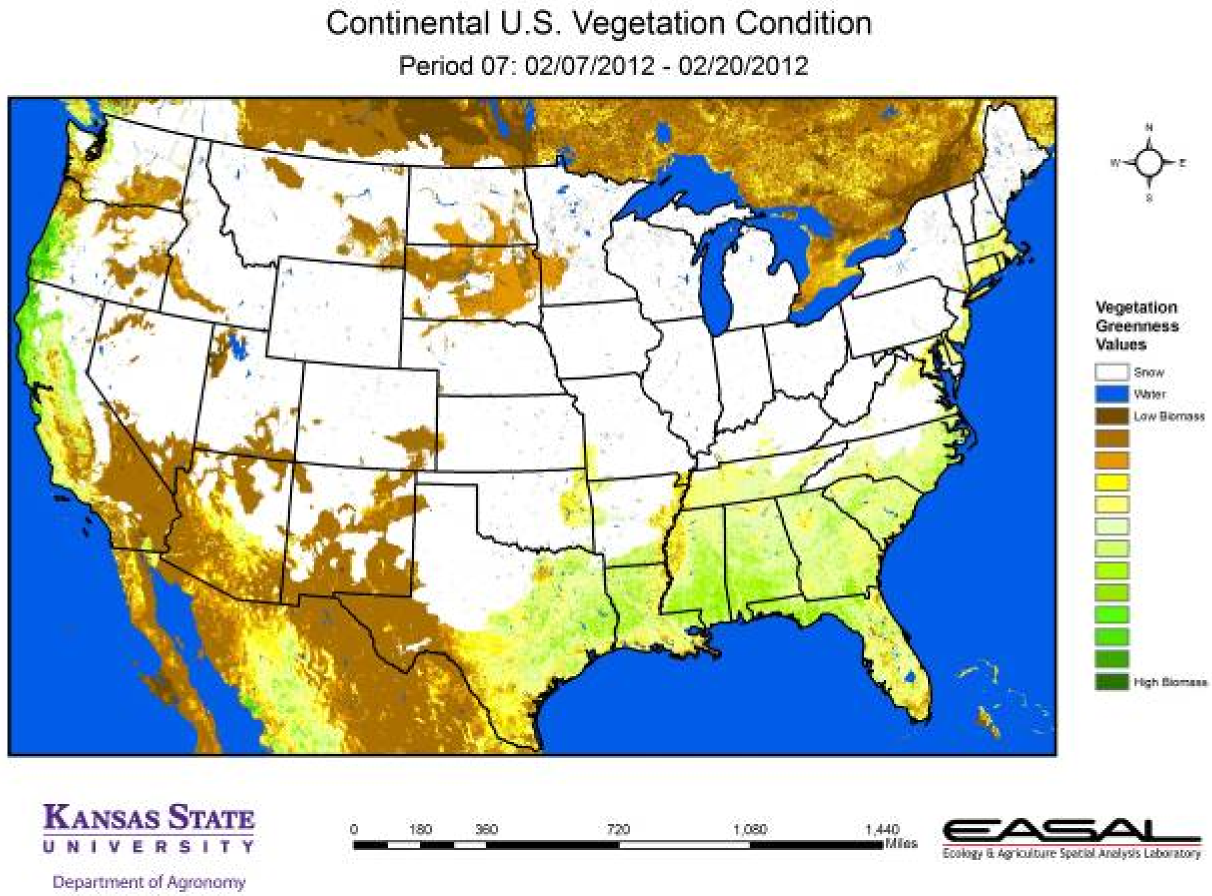
Map 4. The Vegetation Condition Report for the Corn Belt for February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that parts of southern North Dakota, as well as much of South Dakota, missed on the snowfall that was seen across much of the Corn Belt.



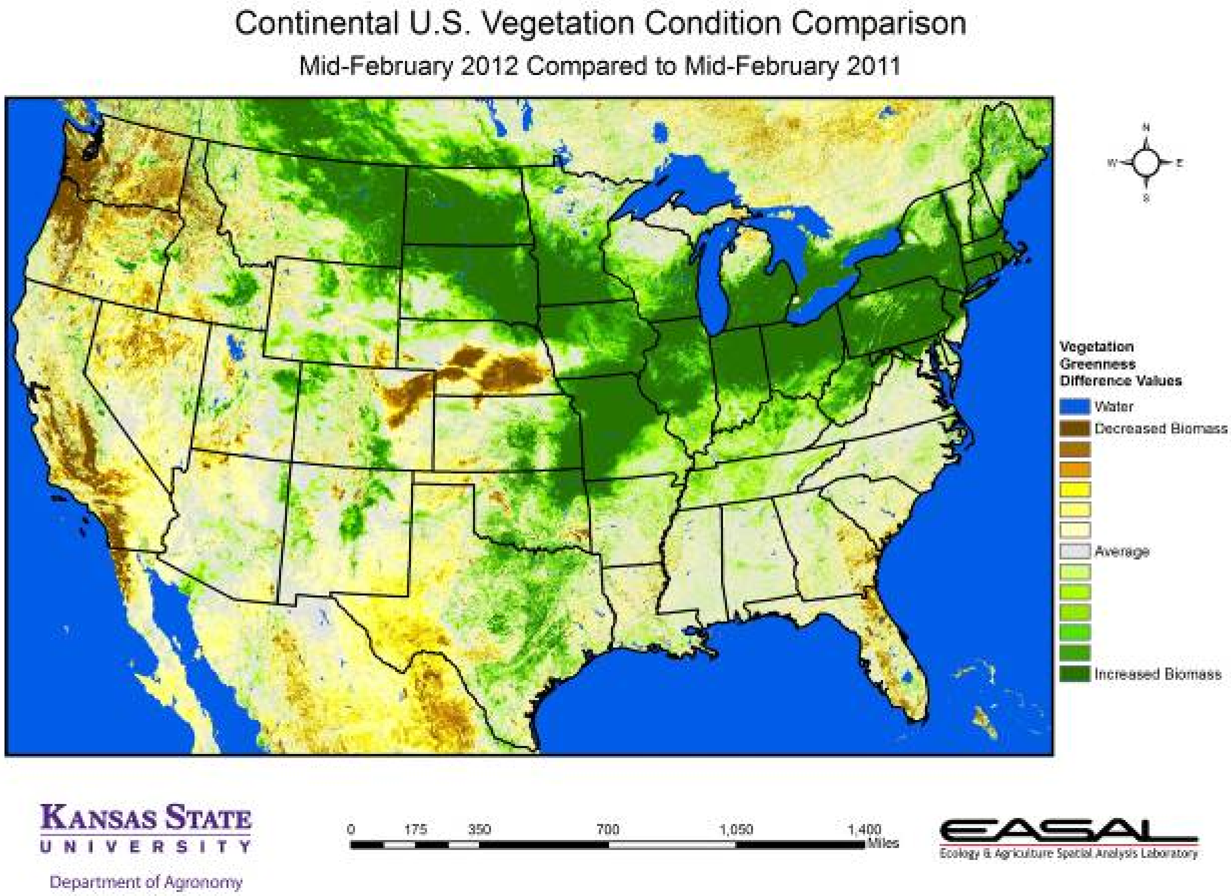
Map 5. The comparison to last year in the Corn Belt for the period February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows higher NDVI values. Lack of continuous deep snow cover continues to be a problem. Upper Midwest averaged 83 percent snow cover as of February 20th, with an average depth of 3 inches. Last year at this time, snow coverage was 99 percent with an average depth of 13 inches. Lower NDVI values in Nebraska are the result of the recent snow in that area. Parts of the region saw 5 to 9 inches of snow during the period.



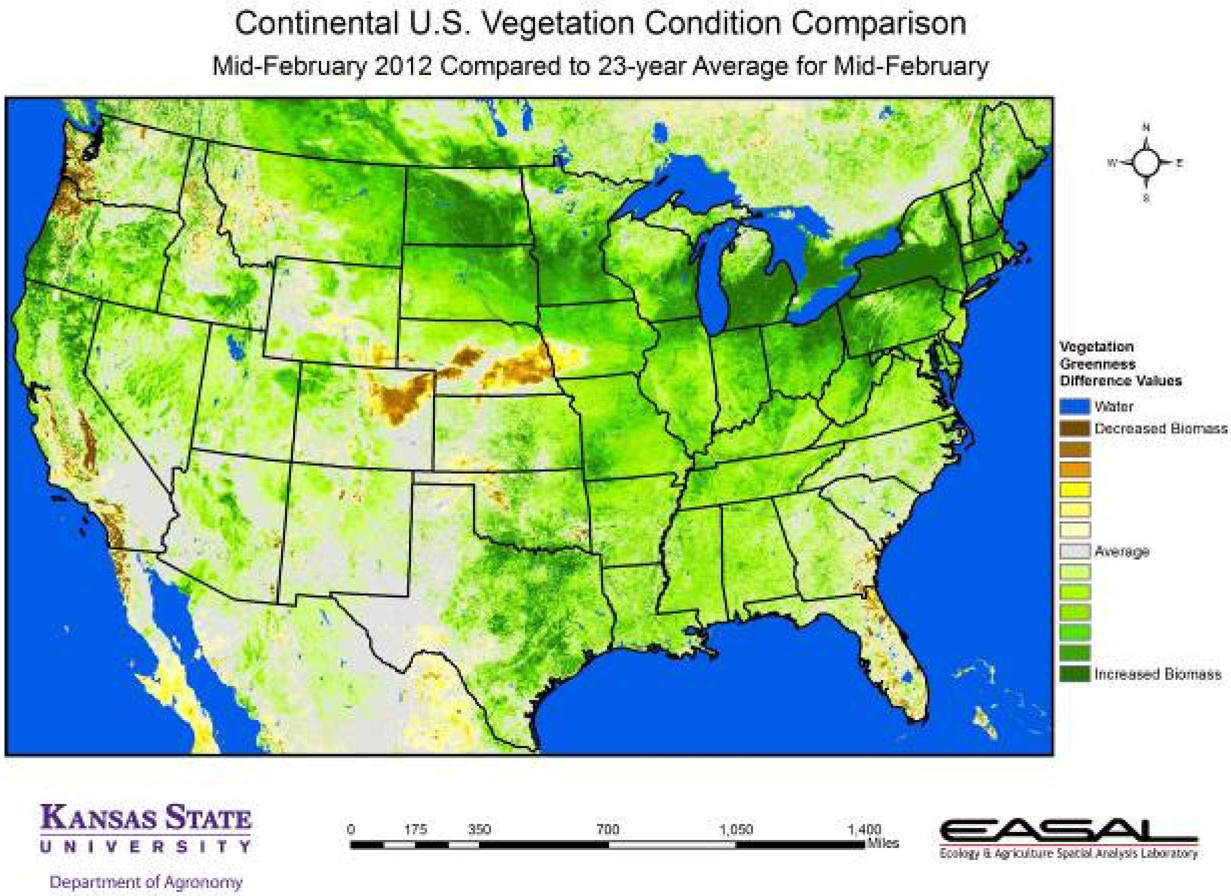
Map 6. Compared to the 23-year average at this time for the Corn Belt, this year's Vegetation Condition Report for February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows most of the Corn Belt has greater-than-average NDVI values. The area of central Nebraska into west central Iowa is an exception.



Map 7. The Vegetation Condition Report for the U.S. for February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that snow cover extended as far south as central Texas. However, national snow analysis continues to show the season is running behind average.



Map 8. The U.S. comparison to last year at this time for the period February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows lower snow levels resulting in higher NDVI values, particularly in the northern U.S., as well as the mountains in the western U.S. Texas and Oklahoma continue to see increased photosynthetic activity compared to last year, as mild temperatures and favorable moisture are resulting in greater biomass production.



Map 9. The U.S. comparison to the 23-year average for the period February 7 – 20 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that eastern Colorado and central/southern Nebraska stand out with lower NDVI values. This is partly due to a significant snow event that moved through the area in early February.

Note to readers: The maps above represent a subset of the maps available from the EASAL group. If you'd like digital copies of the entire map series please contact us at kpprice@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.

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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.
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