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1. First hollow stem in wheat determines timing of management practices

As soon as wheat begins its first flush of growth in late winter or early spring, producers might want to start examining plants to determine if the wheat has reached the "first hollow stem" (FHS) stage, especially if the wheat is being grazed or if planned topdress nitrogen (N) has not yet been applied.

Identifying the First Hollow Stem (FHS) stage

This stage occurs as the wheat switches from the vegetative stage to the reproductive stage of growth. Once the embryo head has developed, the first internode will begin to elongate pushing the head up through the leaf sheaths. This first internode will be hollow. This will be visible before you can actually feel the first node (joint, located just above the first internode). Prior to this stage the nodes are all formed but tightly packed together and hard to see.

FHS is the point at which a half-inch or so of hollow stem can first be identified above the root system and below the developing head. FHS occurs when the developing head is still below the soil surface, which means that producers have to dig plants out of the ground to do the examination.

To look for FHS, start by digging up some plants from fields that have not been grazed. Select the largest tillers to examine. Cut off the top of the plant, a couple inches above the soil surface. Then slice the stem open from the crown area up. Look for the developing head, which will be very small. Next, see if you can find any hollow stem between the developing head and the crown area. If there is any separation between the growing point and crown, the wheat plant is at FHS. FHS will occur between a few days and a week or more prior to jointing, depending on temperatures.

Nitrogen timing and FHS

When the leaf sheaths become strongly erect, the growing point, which is below the soil surface, will soon begin to develop a tiny head. Although the head is quite small when it begins to form, it has already established some important yield components. At this stage, the maximum potential number of spikelets is determined. Sufficient nitrogen (N) should already be available in the root zone at growth stage in order to avoid limiting the number of seeds per head.

Cattle grazing and FHS

If the wheat has reached FHS, cattle should be removed to prevent grain yield loss. Since the development of FHS is temperature-dependent, and will be different from one year to the next, it is important that producers base cattle removal decisions on actual field observations of wheat stage of growth rather than a set calendar date.

Yield losses from grazing after FHS may be up to 1.25 bushels per day according to OSU data, although losses may not be this great for the first few days of grazing after FHS those losses become greater the longer you go because more tillers will be present. Still, it is easy for producers to be late by a few days in removing livestock as they wait for obvious nodes and hollow stems to appear, and even the first few days can be significant.

Two things are observed when wheat is grazed too long: 1) fewer heads per acre because the primary tiller has been removed and 2) smaller and lighter heads than expected because leaf area has been removed. As cattle continue grazing, the wheat plant is stressed and begins to lose some of the tillers that would produce grain. A little later, if there is not enough photosynthate, the plant begins aborting the lower spikelets (flowers where seed develops) or some of the florets on each head. Finally, if there is not enough photosynthate during grain filling, the seed size will be reduced and if the stress is severe enough, some seed will abort.

First hollow stem. (Photo courtesy of Gene Krenzer, former Oklahoma State University Extension wheat specialist.)

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2. Weed of the Month: Kochia

Kochia (*Kochia scoparia* (L.) Roth) continues to be a serious weed problem in western Kansas, especially with the development of resistance to atrazine, ALS-inhibitor, and glyphosate herbicides. Controlling this weed can be challenging, but it helps to understand the biology of kochia. In particular, it helps to know when kochia emerges from the soil and for how long it can emerge during the season.

Kochia emergence

Previous studies have documented that kochia can emerge early in the spring and those seedlings can tolerate early frosts. It has been reported to survive temperatures as low as 9 degrees F. It thrives in hot weather, too, and can continue to germinate throughout the summer growing season. Lab experiments have shown kochia to germinate at temperatures from 39 to 106 degrees F.

In the spring of 2010, we followed the emergence of kochia from naturally occurring populations at several locations across western Kansas. Locations included kochia in fence row and non-cropped areas at Stockton, Hays, and Ness City, along with populations occurring in previously cropped fields at Hays and Garden City. Beginning March 15, any kochia seedlings that had emerged were counted and removed. These observations continued weekly until no new kochia plants were observed.

In order to make a uniform comparison of environmental conditions at emergence across these different locations from south to north, we used growing degree days (GDD in degrees C) accumulated since January 1, 2010 based on maximum and minimum air temperatures and a base temperature of 0 C (32 degrees F). For each plot, we described kochia emergence as a percentage of the total number of seedlings emerged through the entire season.

Populations of kochia seedlings observed at these locations ranged from as few as 4 seedlings per square meter to as many as 379,000 seedlings per square meter over the spring. To highlight the start, end, and duration of emergence, we determined the number of GDD that accumulated for 10% emergence (start) and 90% emergence (end), and the difference between the two (duration of emergence).

Cumulative GDD at start (10% emergence), end (90% emergence), and duration of emergence

Location	Field type	GDD to 10% Emergence	Local date for 10% Emergence	GDD to 90% Emergence	Local date for 90% Emergence	GDD for Duration of Emergence
Stockton	Non-cropland	282	4/3	343	4/9	61
Hays	Non-cropland	137	3/18	173	3/24	36
Hays	Cropland	238	3/31	365	4/10	127
Ness City	Non-cropland	114	3/11	475	4/18	361
Garden City	Cropland	283	3/31	1056	5/26	773

Comparing emergence at the non-cropland and cropland sites at Hays, there is a 2-week delay in kochia emergence in the cropped fields (Figure 1). This is also observed at the Garden City location, with similar start of emergence on March 31. Kochia in the non-cropland locations emerge earlier with March 11 at Ness City, March 18 at Hays, and April 3 at Stockton. Most seedlings emerged in six days or less at Hays and Stockton, but kochia emergence extended for five weeks or more at Garden City.

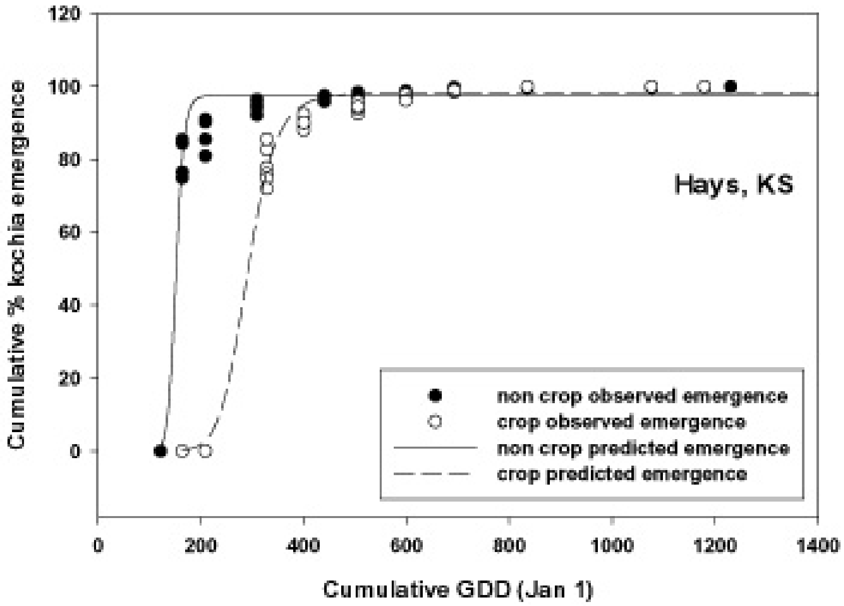

Figure 1. Kochia emergence in non-cropland (solid symbol) and cropland (open symbol) sites at Hays, as related to cumulative growing degree days. Symbols represent the individual plot observations and lines represent a fitted model. This generally shows that emergence began earlier and reached its peak earlier in noncropland sites compared to cropland sites.

Origin and growth habit

Kochia is native to southern and eastern Russia. It was actually introduced to North America as an ornamental and then escaped into areas where it was adapted. It is not just a Kansas problem. Kochia has been reported in 42 of the lower 48 states and in the seven Canadian Provinces neighboring the USA border.

In the absence of competition, kochia can be very bushy in appearance and achieve heights of greater than 7 feet. Kochia can have an extensive root system. Kochia roots grew to a depth of 16 feet in a sorghum field during a drought in Kansas. A single plant has been reported to have a root system 22 feet wide. Kochia is daylength sensitive and begins to flower sometime in mid-July to early August in Kansas. A critical light period triggering flowering ranges from 13 to 15 hours among kochia accessions.

Kochia is self-fertile. Initially, female flower parts are receptive to pollen prior to pollen actually being released from that same flower. This mechanism facilitates outcrossing. Kochia seed are brown, oval and flattened with a star shaped hull enclosing the seed. It has been reported that a single plant can produce as much as 14,600 seed. In a seed burial experiment in Nebraska, kochia seed viability was 5% after 1 year and zero after 2 years. However, seed burial experiments in Colorado indicate that a low percentage of both a dormant and a non-dormant kochia seed remained viable even after 3 years. Seed viability declined more rapidly when seed was buried 4 inches or less below the soil surface.

As the kochia plant matures, an abscission layer develops in the stem near the soil surface. In the presence of wind, this weakened area allows the dried plant to sever from the root system and tumble across the landscape spreading viable seed where ever it rolls. Thus some people call kochia tumbleweed.

Kochia in wheat stubble, showing the pattern of emergence after these "tumbleweeds" have blown across the field in waves. Photos by Curtis Thompson, K-State Research and Extension.

Kochia seedlings are quite pubescent. Kochia is susceptible to several broadleaf herbicides when young.

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3. Kansas Flint Hills Smoke Management Plan: Using a burn plan

The following is a slightly edited transcript of the seventh in a series of K-State's Agriculture Today radio broadcasts on the Kansas Flint Hills Smoke Management Plan. This is an interview with David Kraft, State Rangeland Management Specialist, USDA Natural Resources Conservation Service - Emporia, conducted by Eric Atkinson of the K-State Radio Network. Podcasts of all Agriculture Today interviews can be found at:
http://www.ksre.k-state.edu/DesktopDefault.aspx?tabid=197

Q: It's wise for grassland managers to develop a burn plan before lighting a fire, and smoke management can and should be weaved into that plan. What should be in a prescribed burn plan?

A: A prescribed burn plan is a plan that defines the target area that is going to be exposed to fire and elements of how the burn will be accomplished – the ignition sequence, the preparation prior to ignition, and equipment and manpower needs. Something new to this is an understanding of the impacts down range of the fire. In the past we've done a good job of illustrating the safety of the fire right on the site. But we're now increasingly realizing that the impact of prescribed burning has a very wide-ranging scope that can extend hundreds of miles down range.

Q: Let's walk through several of the ingredients in the preparation of a burning plan. That would include items such as fire breaks and lessening the fuel load in areas you don't want to burn, correct?

A: Certainly those are key aspects. The purpose of the burn plan is to document the objective you have for the particular unit that you're going to burn, and how you're going to reach that objective. It should identify the sequence of events for the purpose of carrying out that fire. It should also identify climatic conditions under which the fire can be conducted safely. That would include the time of day, the wind direction and speed, transport winds, moisture at the surface, and relative humidity. For smoke management purposes, also record the desirable mixing height and the transport winds that are going to move that smoke down range.

The burn plan should also identify the fuel types present, the volatility of those fuel types, and the types of dangers that the different types of fuels might present. Those factors help determine what kind of manpower and equipment a producer will need to manage the fire and account for contingencies if something goes wrong.

A good plan will help the producer identify hazard areas, and also identify safety areas so that if something does go wrong then the individuals involved in the fire will have a very clear and safe route to safety. A plan also provides managers with a tool to use in a pre-burn conference where the manager sits down with the people who are going to help conduct the fire and talk about how the fire is going to be conducted safely. Once everybody is very clear on what the objective is and what their roles are, it makes the fire go more smoothly.

The plan also provides a document to describe exactly the fire activity. The document can be referred to later to see if anything could have been done differently to reach the goal more effectively. And if something should go wrong and the volunteer fire department should be called in to provide assistance, if there's some kind of burn plan available then at least everybody will know where the hazards are and some of the things for which they need to be watching.

Q: One wants to cover all contingencies before the match is ever lit. You mentioned something a little earlier that may get lost in the shuffle when planning a burn, and that is whether we have adequate manpower. We probably short that aspect a little bit, don’t we?

A: That is one of the biggest elements that is underestimated. Like anything else, it’s always better insurance to have more help than you need and not have to call on additional help in an emergency than to try to shortcut that need up front and then realize you don’t have enough manpower to conduct that fire safely. A lot of times that involves not only manpower, but the experience of that manpower. A few experienced individuals might be able to conduct a fire safely while multiple inexperienced individuals may not be able to conduct that fire safely. So it’s important to not only understand what you have in the way of manpower, but the experience level of the manpower you have.

The other ingredient is sizing up what kind of equipment is available. Do you need to find someone to help out who not only has experience, but also has equipment that can help conduct the fire is done safely, and reach the objective?

Q: Should one incorporate smoke management into the burn plan?

A: Yes, now more so than ever. Today we have a lot of different tools available to us, including smoke prediction tools. We can more accurately predict where that smoke’s going to go than we could in the past. When the burn plan is being developed, you might have certain conditions in mind so that the smoke will move down range in a certain direction. The day of the fire, those conditions might not be there. You might still be able to conduct that fire safely on site, but it might have a very severe impact down range that you hadn’t originally anticipated. The advent of these new smoke prediction tools is going to improve our ability to predict where that smoke’s going to go, not only on-site but when it disperses down range.

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4. Fungicide application decisions

The higher commodity prices have stimulated a lot of interest in foliar fungicides for wheat this year. The following answers to key questions should be able to help producers think these decisions through for the 2011 growing season.

When is the best to apply a fungicide to wheat?
K-State research suggests that the largest and most consistent yield responses occur when fungicides are applied between flag leaf emergence through flowering. Protecting a *susceptible variety with fungicides in a high disease pressure situation* will typically result in a 10 percent yield response. We would expect some variability in this response, and it turns out that most observations fall between 4 and 13 percent yield response.

Most data I have seen suggests that fungicide applications made at green-up normally result in small yield responses (<1 bu/acre). Applications made at this time are most useful in continuous wheat, no-till production system. Please also remember that these early applications will provide no protection from diseases that occur later in the growing season (leaf rust, stripe rust, or head scab). Therefore, the grower should be prepared to use a second fungicide application between flag leaf emergence and flowering.

Which fields should be treated with fungicides?

I would suggest that growers use the susceptibility of the wheat varieties on their farm as a primary criterion for determining if a fungicide application is needed. Research for the past three years indicates that varieties with susceptibility to multiple leaf diseases are most likely to give a desirable fungicide response (at least 4 bu/acre). Jagalene, Jagger, PostRock, Overley, and Fuller are all in this category now. Varieties with resistance to multiple leaf diseases are less likely to give a desirable fungicide response (examples are Art, Santa Fe, and Everest). Producers can use this information to set priorities for spraying now and adjust the plan as more information about the condition of the crop becomes available.

The intensity of disease pressure within a year also influences the fungicide response. Taking the time to stay informed about the regional risk of the rust disease and scouting your fields will help you determine the potential need for a fungicide application. The largest yield responses are most likely to occur when a variety with multiple susceptibilities is experiencing pressure from one or more of these diseases. Finding even low levels of disease on the flag leaves or the second to the last leaf prior to heading is an indication that the risk of yield loss is high. Finding disease in the lower or middle canopy prior to heading indicates a moderate risk of disease. Here again, the varieties with susceptibilities to multiple diseases are most likely to respond to the fungicide applications. The chances of a desirable yield response are greatly reduced if disease cannot be found prior to heading, and the regional risk of disease is low (no reports of rust outbreaks in Texas or Oklahoma).

Do we need to adjust our approach if Fusarium head blight is a concern?

Adding Fusarium head blight (head scab) to the mix of diseases that we need to control complicates the picture significantly. The first impact of head scab on the fungicide decision is related to product options. The strobilurin class (Headline) and mixed mode of action fungicides (Quilt, Stratego, TwinLine) are not recommended for head scab control. In fact they can actually aggravate the toxin problems associated with head scab. The triazole fungicides such as Folicur, Prosaro, Caramba, and Tilt are the best options in areas where head scab is a concern (Prosaro and Caramba provide better control than Folicur, and Folicur is a little better than Tilt).

Application timing is also complicated by adding head scab to the mix. Fungicides must be applied to the head tissue to have any effect and the best time is just as the wheat begins to flower (push out the little yellow anthers). In most years, I think we can wait until flowering to make a fungicide application. These applications will normally provide protection against leaf diseases and head scab but we need to keep an eye on the pre-harvest interval (PHI). The triazole fungicides have a 30-day PHI.

Which fungicide products should I use?

The research results I have suggest that the efficacy of the products is very similar for most of the major diseases. It is not until we start considering Fusarium head blight that we start to see some clear direction on product choice. Producers not concerned about head scab have a pretty nice toolbox to choose from with lots of product and pricing options. The options are reduced when we enter head scab into the equation, but a grower should still have some flexibility in product and pricing options. I suggest growers interested in fungicides this year find the best match of availability and price to meet the needs of their farm.

You can find a summary of this efficacy information and PHI on line at: http://www.plantpath.ksu.edu/DesktopModules/ViewDocument.aspx?DocumentID=1200

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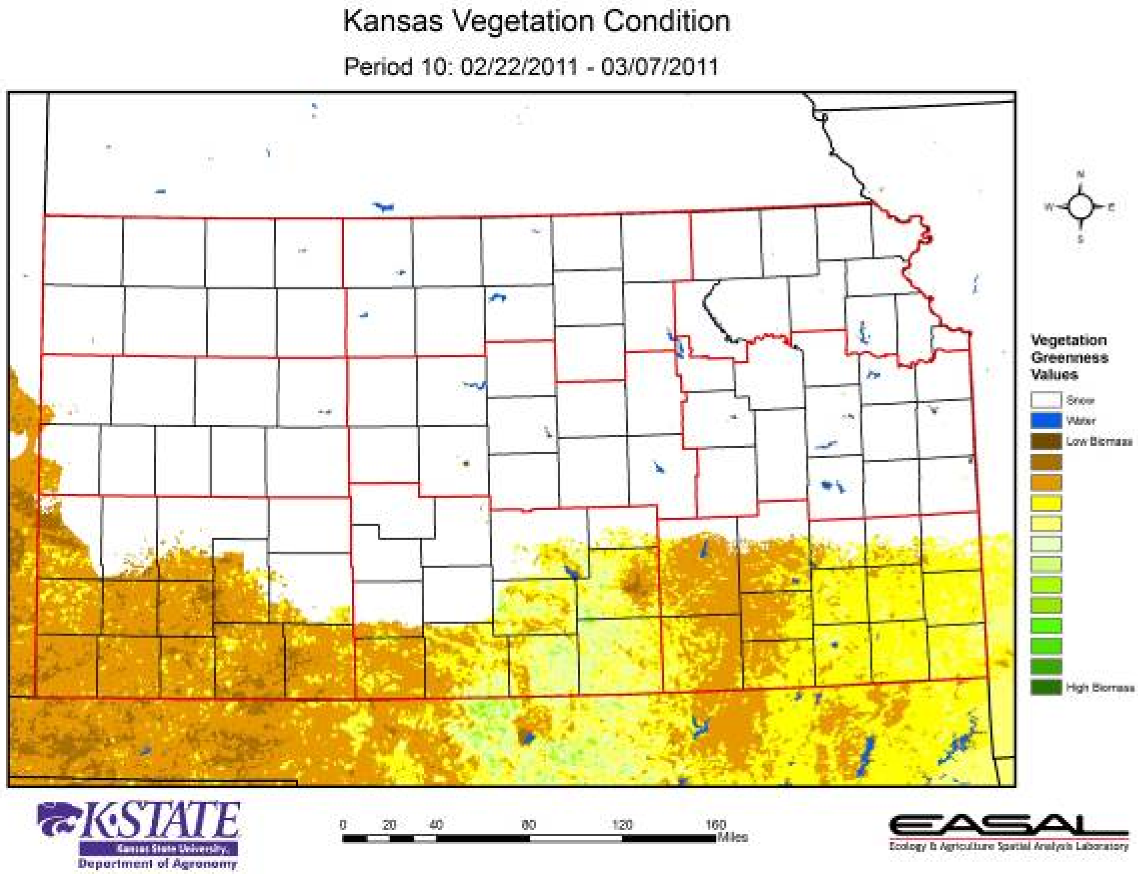
5. Comparative Vegetation Condition Report: February 22 – March 7

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.

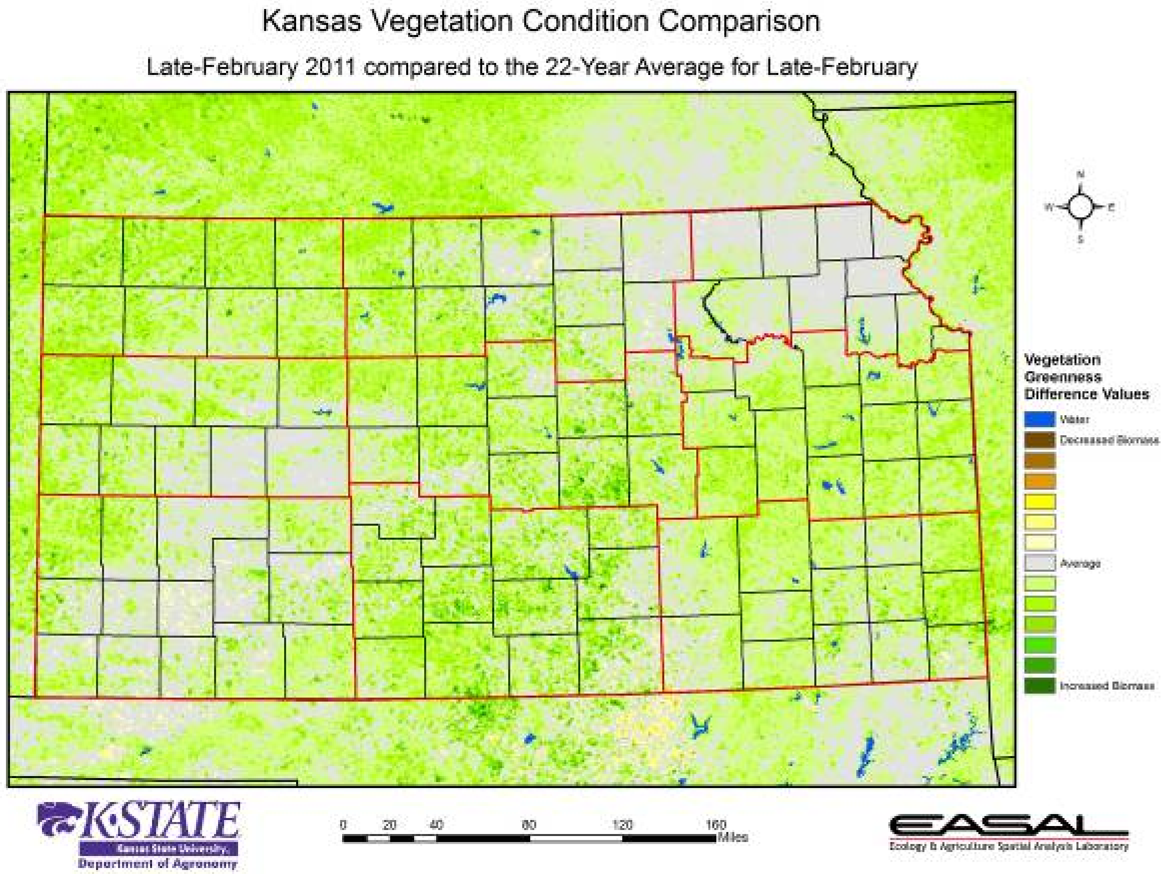
Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:
http://www.youtube.com/watch?v=CRP3Y5NIggw
http://www.youtube.com/watch?v=tUdOK94efxc

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.

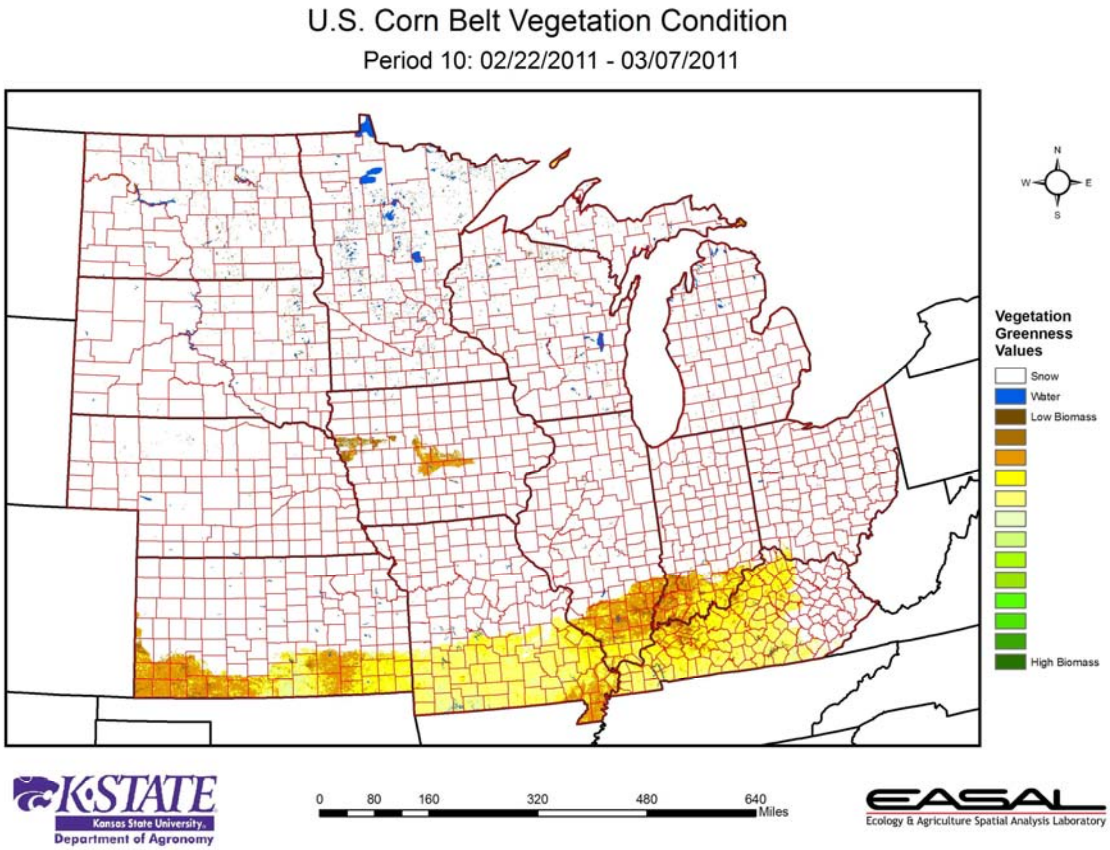
The maps below show the current vegetation conditions in Kansas, the Corn Belt, and the continental U.S, with comments from Mary Knapp, state climatologist:



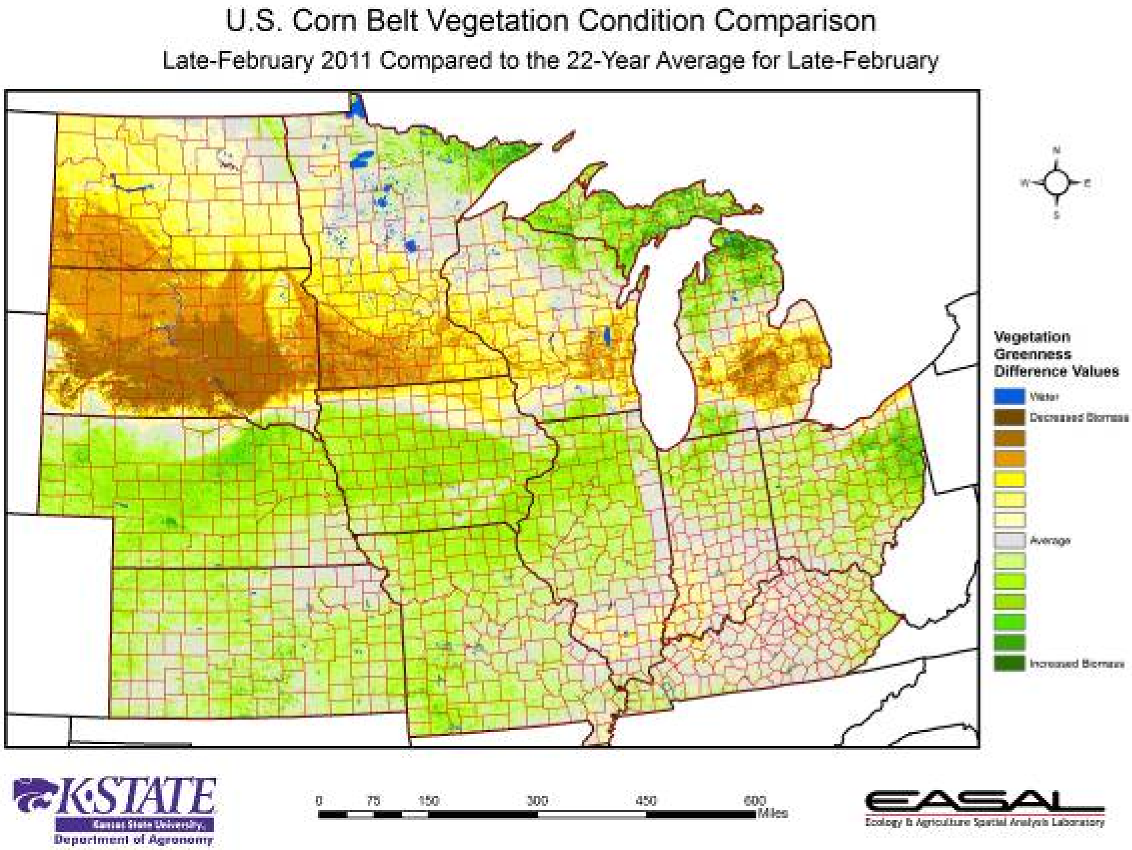
Map 1. The Vegetation Condition Report for Kansas for February 22 – March 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that snow continued to be a factor in the vegetation condition during this period. Some increase in photosynthetically active material can be seen in south central Kansas, particularly in the Harper County area.



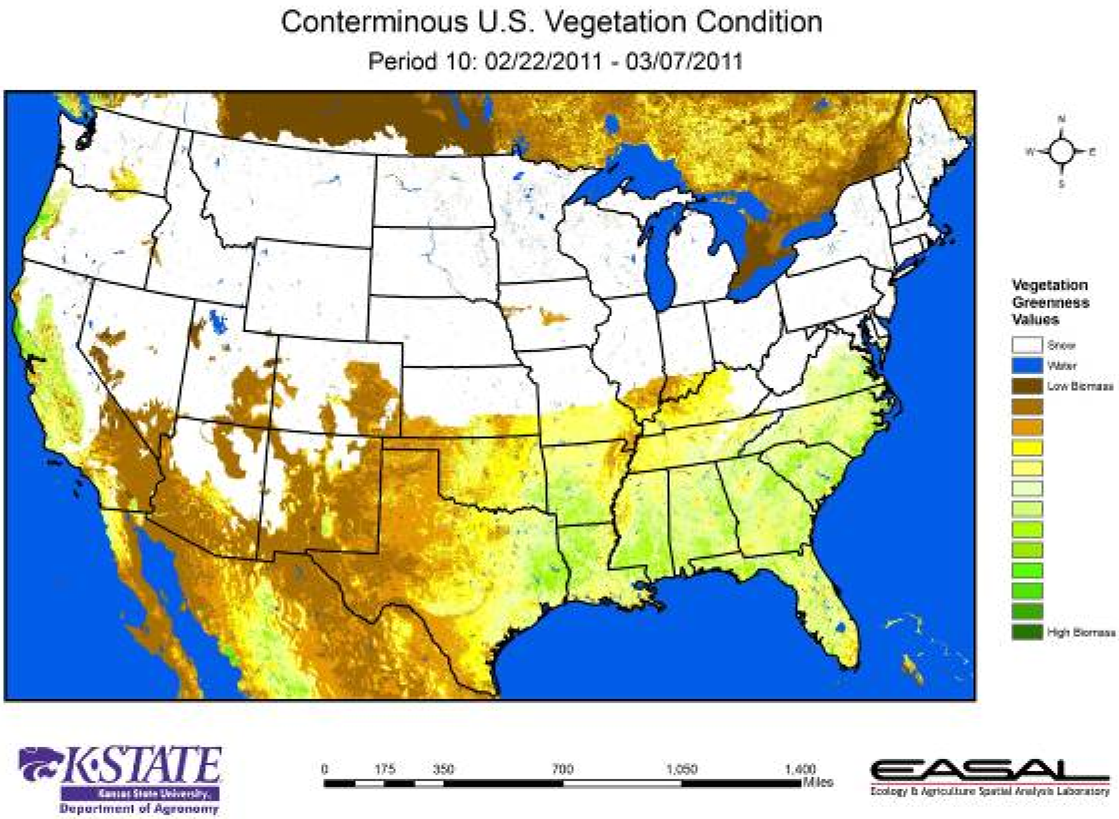
Map 2. Compared to the 22-year average at this time for Kansas, this year's Vegetation Condition Report for February 22 – March 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows greater-than-average photosynthetically active biomass for much of the state. This is particularly evident in the central areas of the state. In areas of western Kansas, particularly Lane, Finney, and Haskell counties, that aren't showing this pattern, drought is a major factor. In the northeast, the delay is due more to the cooler conditions and the snow cover in the region.



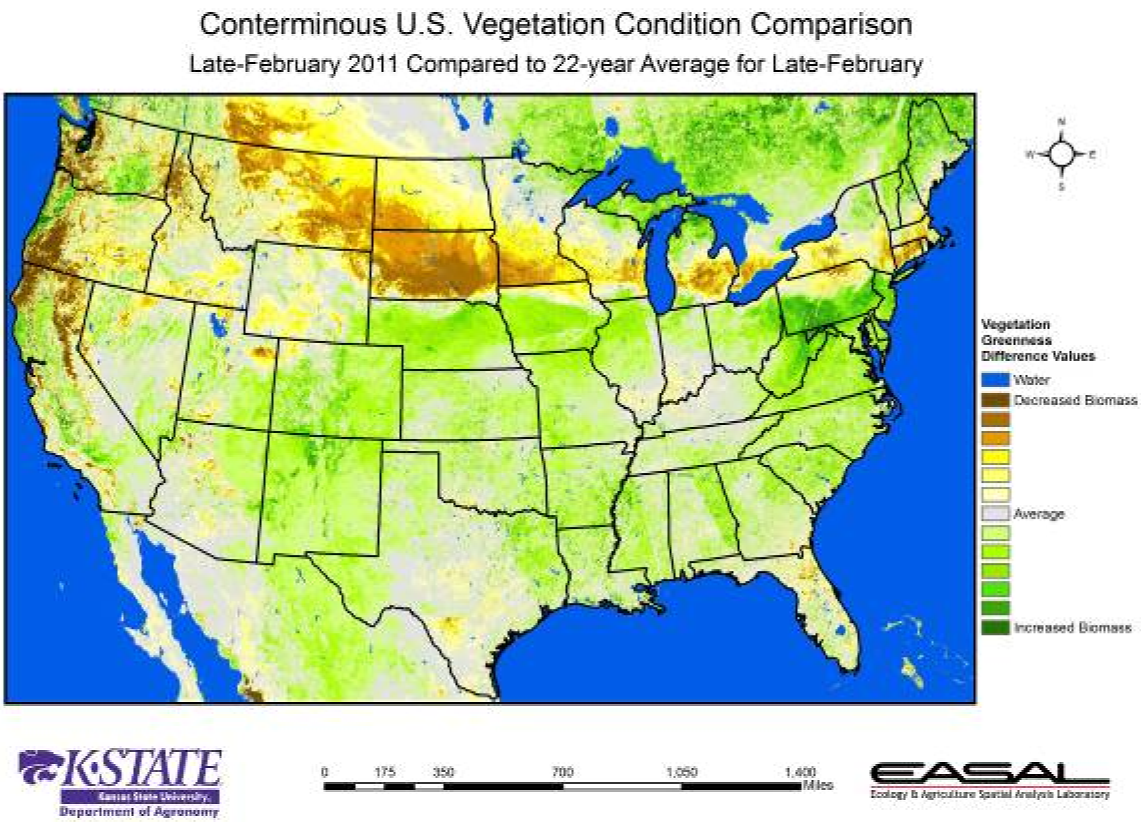
Map 3. The Vegetation Condition Report for the Corn Belt for February 22 – March 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows continuing snowpack. The areas of low photosynthetically active biomass in southern Illinois and Indiana are due to excessive moisture and flooding. In contrast, low biomass activity in southwest and south central Kansas is more due to the dryness in the region.



Map 4. Compared to the 22-year average at this time for the Corn Belt, this year's Vegetation Condition Report for February 22 – March 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory clearly show the northern areas of the region that are still being impacted by snow cover and cooler temperatures. Average snowdepth in the upper Midwest on February 28 was 13.7 inches, with a maximum of 67 inches.



Map 5. The Vegetation Condition Report for the U.S. for February 22 – March 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows shrinking snow cover and increasing greenness in the Southeastern United States.



Map 6. The U.S. comparison to the 22-year average for the period February 22 – March 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows despite the drought conditions in the Southern U.S., photosynthetically active biomass activity is a little ahead of the long-term average. Rainfall and moderate temperatures in the region could continue this pattern. Lingering snowpack and cold temperatures have delayed the biomass activity in the northern regions of the country.

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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. 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, or Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader 785-532-0397 jshroyer@ksu.edu