
Average Onset of Greenness Date for Kansas Vegetation
Onset of Greenness

Green Space

Researchers view crops from on high through a satellite's eye

Kevin Price carefully unrolls a map of Kansas. But this map looks more like a *photograph* of the state, taken from miles above, a view usually reserved for astronauts. The photo shows Kansas covered by splotches of brown, yellow and especially green—dark green in some places, light green in others.

Green. The color of money.

Every August, the U.S. Department of Agriculture predicts the size of the coming corn harvest, then revises its estimate once a month until fall harvest.

Most people probably don't think much about corn crops, at least not until they have to pay more for their Post Toasties. But if you make your living by growing corn, if you trade commodities, or if you feed corn to cattle (or even if you live in a state like Kansas that depends heavily on corn and the cattle that eat it), these crop predictions matter a lot.

Using those high-altitude photos, and with funding from NASA, KU researchers have found another way of predicting yields. Here's how.

Every day, satellites send back extremely detailed images of the earth's surface. On KU's Campus West, in Nichols Hall, those images go to Kevin Price and a group of graduate students (see sidebar) at the Kansas Applied Remote Sensing program. In a room filled with computers, printers, and fans (to deal with the heat the machines throw off), researchers electronically splice the images and clean up the cloud cover, revealing an accurate, intricate image of the landscape.

They're looking for the color green.

Greenness—the portion of green in the landscape at a given time—is an excellent indicator of crop yields. When the land is lush early in the year, when we've had a fair amount of precipitation and temperatures are sufficiently high, those are signs of a good crop to come. When fields stay brown longer and green up later, the harvest will likely be disappointing.

The folks at KARS have historical images of the landscape's greenness, and they can compare each image with the amount of corn eventually produced that year. In other words, they know how much corn was produced under each set of weather conditions. When new photos show conditions similar to those on past photos, researchers have a good idea of what to expect from crop sizes. This process, which requires mathematical models and analysis, produces improved estimates of the crop to come.

"We can correlate color with eventual productivity," says Price, associate director of KARS and associate professor of geography. "The more green the landscape, the more biomass is being produced. So, the greener things are, the more productive."

In June, the KARS staff uses this information to forecast the corn production for states in the Corn Belt, a full month before the USDA comes out with its first prediction.

"We can get within seven bushels of the eventual average per acre for corn production in the Corn Belt," Price says. "In June, we can predict the size of the coming corn crop within 8 percent. By the time we get close to harvest, we can come within 3 or 4 percent."

KARS staff have developed a similar forecast for winter wheat, and they're working on one for soybeans.

"Wheat is tougher to predict than corn," Price says. "It has a longer growing season and so many things can happen to wheat. Soybeans should be easier. We should be able to really nail soybeans."

Such information obviously helps commodity traders. But it's just as important to others. Imagine one part of the Corn Belt looks like it's headed for a

BY REX BUCHANAN

bumper crop, while another appears to be in trouble. If your job is to move grain, then you'd want to divert trucks and boxcars to the elevators where the corn will be.

Maybe even more intriguing is the possibility of combining greenness with weather forecasting. With improved computer models, today's meteorologists make better long-range weather forecasts. Meld those forecasts with current conditions as revealed by satellite images, and you have a powerful tool.

Here's an example: Satellite photos show a late onset of greenness in West Texas—probably a sign of low soil moisture. Then the long-term weather models predict that West Texas is in for a drought over the next 18 months or so. That combination means the region faces serious trouble ahead, worse than an ordinary weather forecast alone might indicate.

On the other hand, let's say that central Kansas has an early onset of greenness, meaning that conditions are good for crops in the ground or those about to be planted. Plus the long-term forecast is for decent amounts of precipitation. That's a sign of a bumper crop, knowledge that's useful even before the crops are planted.

Of course, none of this information does any good if it merely stays in a lab on KU's Campus West. So the KARS folks have posted much of their work on the World Wide Web at a site called the Green Report (www.kars.ukans.edu). Updated weekly, the site gets thousands of hits.

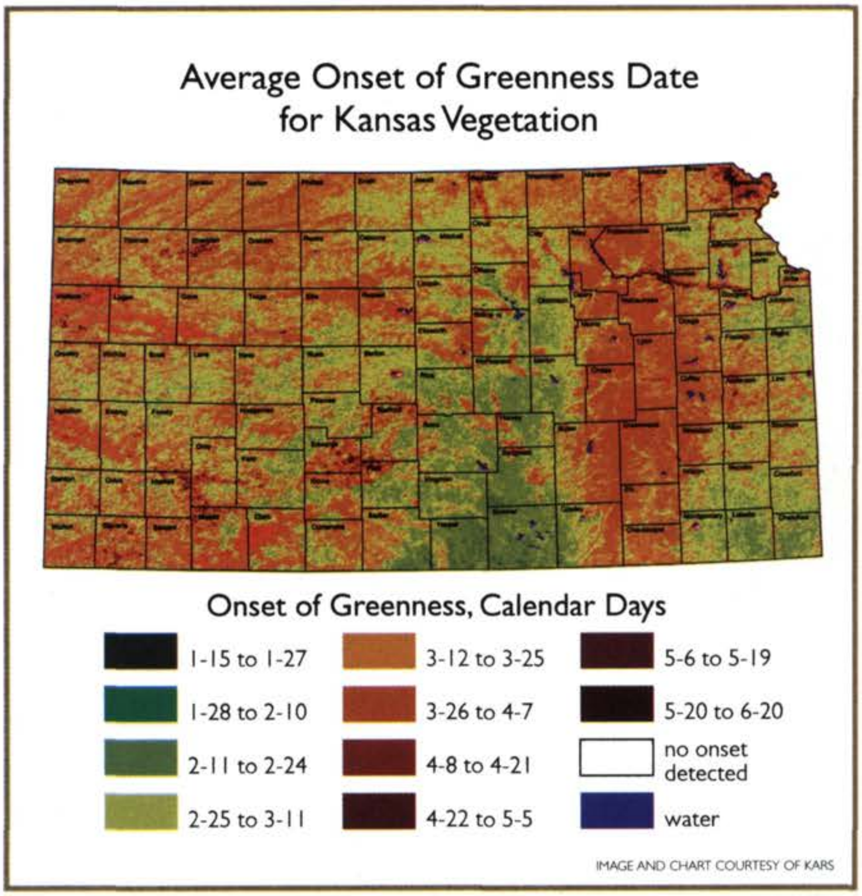

IMAGE AND CHART COURTESY OF KARS

Color is the key for crop forecasts

A typical satellite image analyzed at the Kansas Applied Remote Sensing program shows, with different shades of greens and yellows, the average time that crops green up across the state.

The dark green in the swath from Harper and Sumner counties in the south to Saline, Dickinson, and Ottawa counties in the north indicates winter wheat, which stays green all winter long into early spring. The lighter yellows, reds and browns cover places that usually turn green in late March and early April. In the Flint Hills of east-central Kansas and the Smoky Hills in Ellsworth and Russell counties, the prairie grasses green up midway through spring. The darker reds represent areas that turn green the latest in the growing season. These regions produce soybeans or corn, such as irrigated corn in Sheridan County or non-irrigated corn in Doniphan County in extreme northeastern Kansas. Corn and soybeans are planted in late April and turn green later than surrounding vegetation.

These colors also outline natural features in the landscape. The image delineates the Flint Hills almost as clearly as a geological map. A bright red line representing corn follows the path of the Kansas River valley in northeastern Kansas. In other words, an image of plants provides a good picture of other natural features.

The KARS program produces a variety of maps, including a wall-sized full-color map of vegetative cover for the state and soon a full-color satellite view of Kansas. For more information, see the Web site at www.kars.ukans.edu.

—R.B

"We have a great deal of potentially useful information," Price says. "We have to determine what kind of information end users want."

The KARS staff has begun working with private companies to figure out the best ways to share their information. Quite simply, KARS scientists know their way around computer models and satellite images. They don't know much about sales (which isn't their job anyway).

About 10 years ago, KARS began working with Sam Campbell, c'71, g'73, the president of Campbell-Becker, a venture-capital firm in Lawrence, to form a company called Terrametrics.

"We're attempting to commercialize some of this excellent technology," Campbell says. "Our role is to help facilitate getting some of their technology into the marketplace."

So KARS research ultimately represents a convergence of technology—satellite images, powerful computers, sophisticated mathematical formulas, the Web—with an entrepreneurial start-up company and farm-boy common sense.

The result may not be an exact prediction of the future. But it should be a pretty exciting glimpse.

—Buchanan,'92, is associate director of the Kansas Geological Survey

WALLY EMERSON

Dietrich (left) and Jude Kastens

Brothers turned space-image analysts are experts in the field

It's pretty rare to find a couple of bona fide farm boys at KU. Dietrich and Jude Kastens grew up on a Rawlins County farm, near the small town of Herndon, north of Atwood. Jude, d'96, c'96, g'99, just finished a master's in mathematics and has started on a PhD. Dietrich, c'95, will soon complete a master's in geography. Both work at KARS, but they regularly return to Rawlins County, to the 8,500-acre farm where, together with their parents, an uncle and aunt, they raise winter wheat and corn, and run a cow/calf operation.

They've brought in-the-field knowledge of farming to the high-tech world of satellite images and mathematical models.

"To be a successful farmer, you've got to be a mechanic, a plumber, an economist, an electrician, a businessman, know something about animals," Dietrich says. "You develop a problem-solving ability and a confidence that's helped us here."

Maybe just as important, the Kastens know their market.

"We've been around farmers all our lives," Jude says. "We know farmers, the clients for many of the products we develop here. We know what kinds of problems farmers face, and what products will work for them."

The Kastens' parents, Terry, c'73, and Marilyn Franklin Kastens, d'75, were big influences on their sons, who say they never really considered going to school anyplace but KU, even though their dad is a professor of agricultural economics at Kansas State University. Jude and Dietrich profess to being right at home in Lawrence, although Dietrich plans to go back to the Rawlins County farm in the summer of 2001.

—R.B.