GIS for Agribusiness

Esri • Winter 2010/2011

In This Issue

Esri News	p4
Esri on the Road	p4
Your Food Environment Atlas	p4
Featured Maps	p5
APHIS: Sustaining the National Food Supply and Security	p6

Insuring America's Farmland

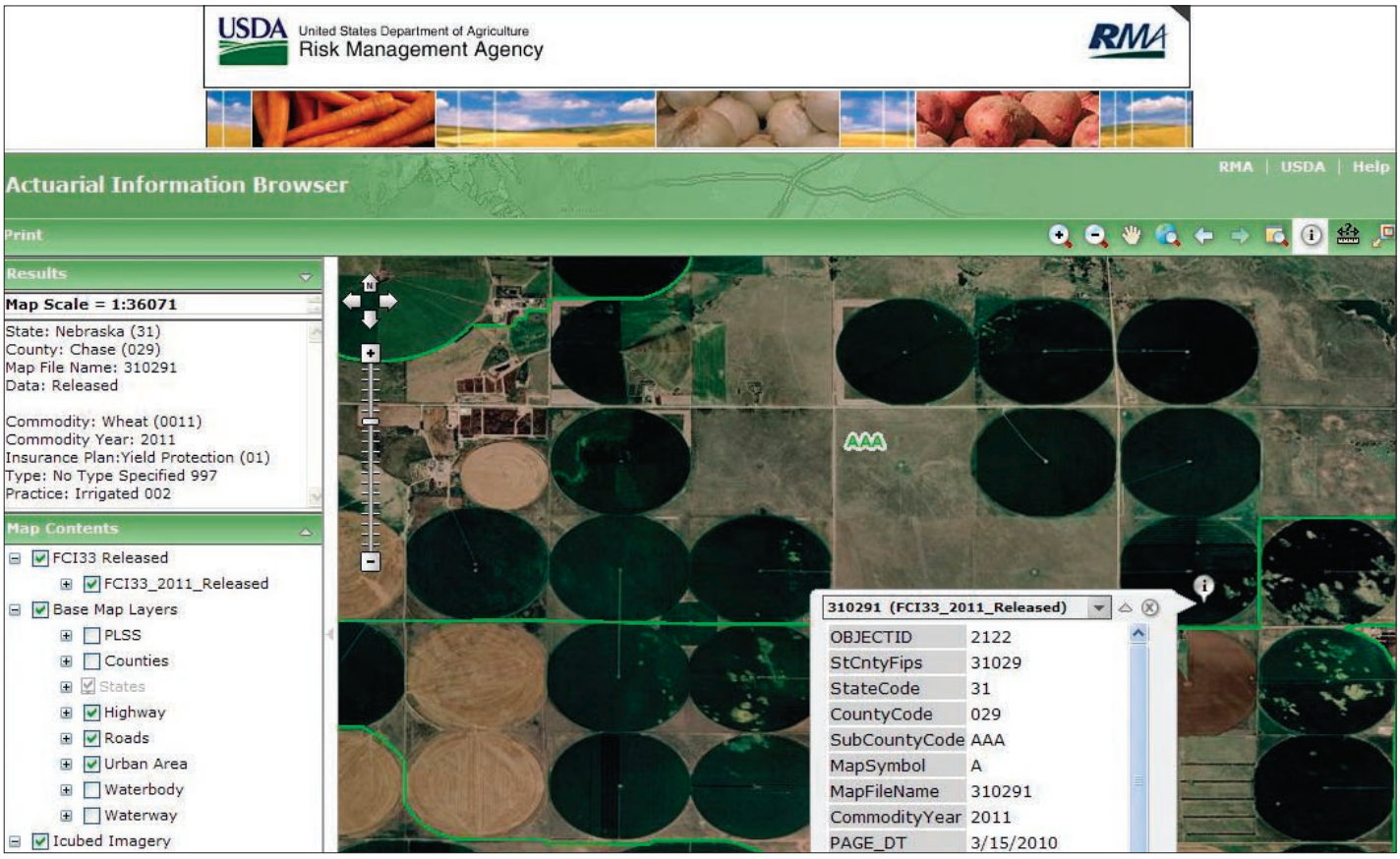
The USDA's Risk Management Agency Uses Actuarial Maps for More Equitable Premium Pricing

By Karen Richardson, Marketing Writer, Esri

The United States Department of Agriculture's Risk Management Agency (RMA), based in Washington, D.C., with supporting regional and compliance offices located throughout the United States, helps food producers manage their business risks through effective market-based risk management solutions. As part of this mission, RMA manages the Federal Crop Insurance Corporation (FCIC) to provide American farmers and ranchers with crop insurance. RMA develops and approves the premium rate, administers premium and expense subsidies, approves and supports products, and reinsures the private-sector insurance providers through the Standard

continued on page 2

This issue of *GIS for Agribusiness* highlights the use of GIS by the U.S. Department of Agriculture (USDA). Established in 1862 by President Abraham Lincoln, USDA has pioneered the use of scientific methodology to advance sustainable agricultural practices in the United States.



The RMA Actuarial Information Browser map viewer is used by farmers, crop insurance agents, approved insurance providers, and RMA to view insurance offers at a subcounty level.

continued from page 1

Insuring America's Farmland

Reinsurance Agreement (SRA). In crop year 2009, RMA managed nearly $80 billion worth of potential liability.

FCIC relies on actuarial maps for crop insurance to designate different areas within a county that have varying amounts of risk due to factors such as flooding or highly erodible soil based on type. These maps are used by 16 private-sector insurance companies that sell and service FCIC policies. While RMA had been using hard-copy actuarial maps for decades, it had no way to determine whether an agent or insurance company was reporting accurate claims or if the claims reported were in the correct areas.

Inaccurate reporting skews the adjustment of the risk rate for producers and can create unnaturally high premiums in areas where it is not necessary. Because of this, RMA incorporated geographic information system (GIS) technology to manage the information and analyze the program. Using GIS has helped RMA save $20 million a year and lower premiums for regular rated land, which in turn reduces the government subsidy on insurance across all acreage.

Saving Money and Man-Hours with ArcGIS

Since most federal agencies are standardized on Esri software and data formats, RMA chose to incorporate Esri software, beginning with ArcView in the early 2000s. ArcView was used to begin the FCI-33 Actuarial Map Digitizing Project to convert hard-copy maps into GIS using aerial photos and USDA Common Land Units (CLU). This process took several years, and by the end, RMA's 10 regional offices had digitized more than 1,500 maps into shapefile format.

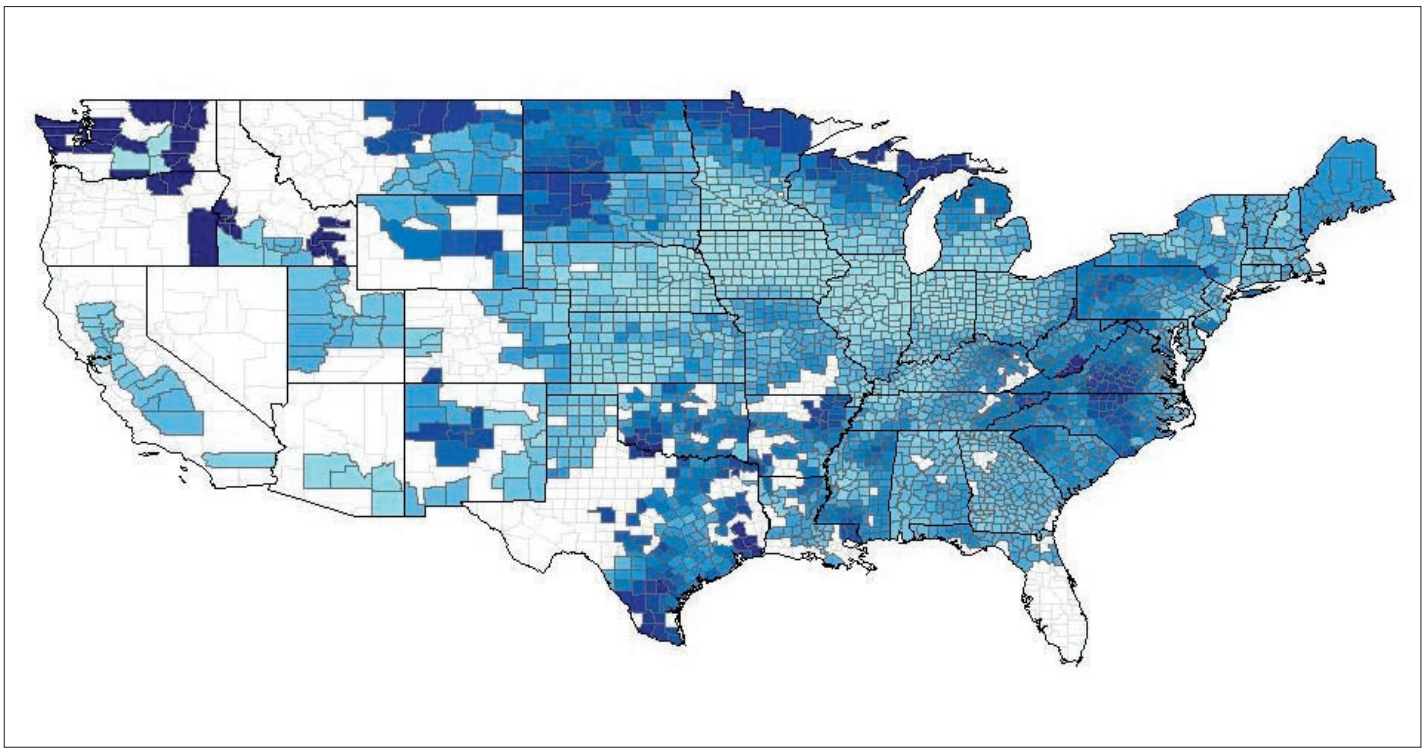
Managing such a large number of digital maps was difficult, prompting USDA to upgrade to ArcGIS when it was released and use a personal geodatabase to manage the digital files. The geodatabase allowed it to aggregate the maps into 10 more manageable feature classes instead of the 1,500 individual maps. In 2008, RMA upgraded to ArcGIS Server, which allows it to more easily share the data throughout its regional offices using a central server without keeping copies of maps on regional office computers.

RMA uses the digital actuarial maps to cross-check and approve maps generated by the regional offices. "The ability to validate these automatically instead of by hand has saved us so much time," says Greg Oetting, risk management specialist, USDA-RMA, Topeka Regional Office.

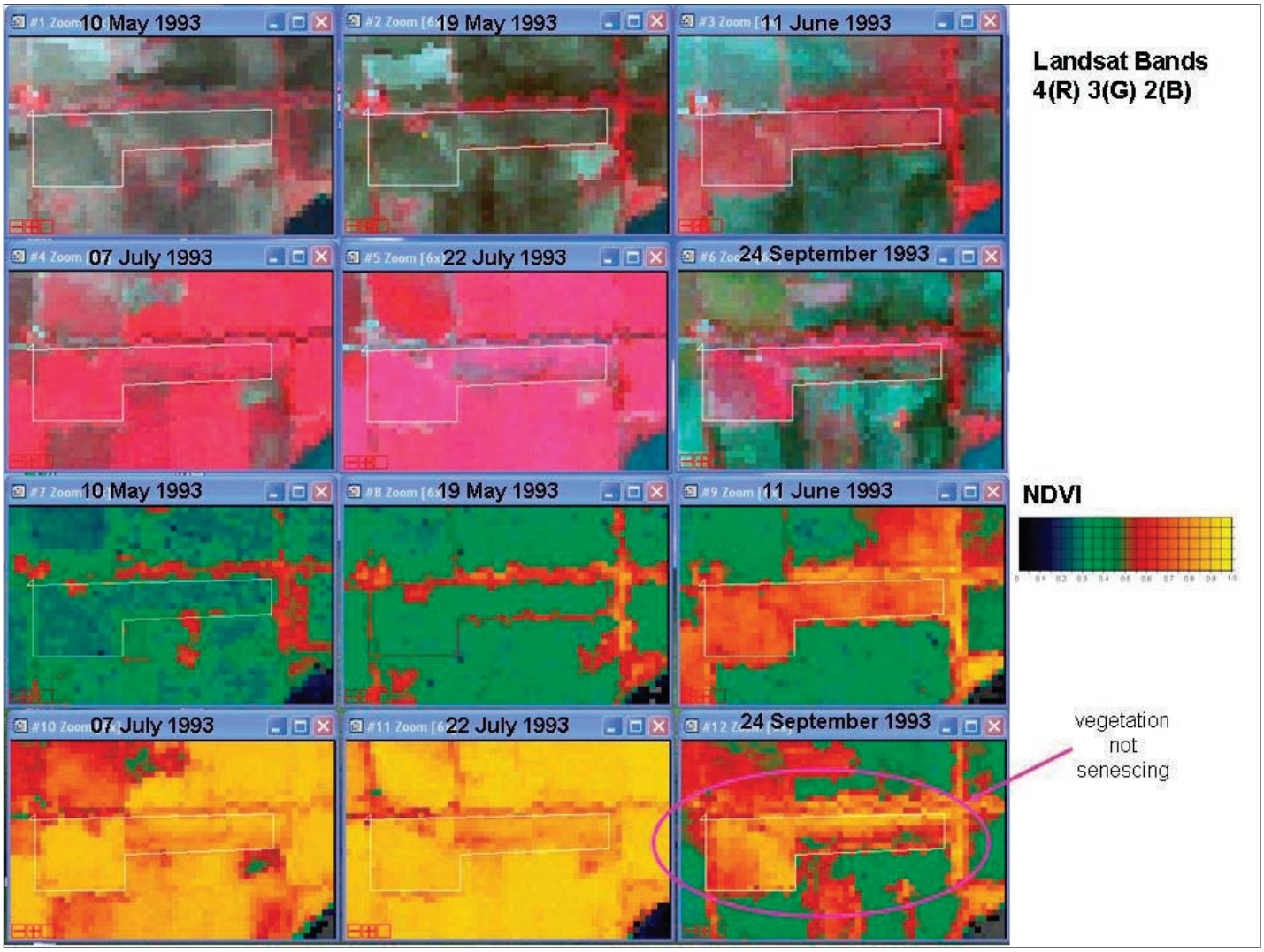
The actuarial maps for 2010 and previous years are published as PDF files on the Internet for the insurance companies to view. In 2011, RMA will roll out an interactive map viewer that is hosted publicly. Insurance companies have access to the data and can host it internally themselves. "This will be a real time-saver to RMA," says Oetting. "Creating the map viewer means we don't have to spend time building out and proofing 1,500 individual PDFs."

Analyzing the Crop Insurance Program

Over the last few years, RMA has been incorporating more satellite imagery into its program. "A majority of the maps we create are located in flood-prone land, which has a higher risk than any other insurance peril," states Oetting. Unlike on a FEMA map, however, where land is designated as a flood risk or not, RMA is interested in whether a certain area floods only during the specified growing



RMA's rate review mapping tool can easily visualize how rating components flow across the nation.



"Forensic remote sensing" is used by RMA to examine the growing conditions and crop health and vigor within a field.

season. For example, floods that occur in the winter months on a producer's land won't have any impact on the insurance policy for crops planted in the spring.

Satellite imagery provides a good source to find the extent of floods. "Flooding near major rivers like the Mississippi and Missouri are easy to determine," says Oetting. "But it's harder to determine flood extent and frequency on smaller tributaries. Using GIS to overlay satellite imagery provides an accurate visual of when and where the flood happened."

GIS is also used to update maps quickly and help RMA with the appeal process. If a producer doesn't agree with a particular rating class, he can appeal it. For example, a producer may argue that the land being cultivated is not flood prone. The ability to pull up satellite imagery for the day the river was at its highest during the year and see that, in fact, there was no water on the producer's land allows RMA to rectify the misclassification.

Transparency Leads to Equitable Pricing

Having the maps standardized across the country also helps with creating fair and equitable pricing and makes the process transparent to the producers. RMA has created handbooks for each office so it can standardize editing performed on maps. Now everyone is following the same standards, so producers have the same risk assessments across their lands and understand risk assignments in all geographic areas.

This is important, since where crops are physically located dictates the type of coverage offered. Insurance offers are based on the crop yield for a particular parcel of land. This information is garnered from the producer's production history, the harvest-time futures price set at a commodity exchange before the policy is sold, and the type of crop planted. The policy will pay an indemnity if the combination of the actual yield and the cash settlement price in the futures market is less than the guarantee.

Using GIS to drill down past the county designation, RMA can designate subcounty insurance offers that are considered high risk, which excludes the insurance history from the calculations that are used to determine the premium rates for the entire county. The end result is a premium rate decrease for most producers, as more high-risk acreage gets reported correctly.

In the past, reviewing premium rates involved the use of colored pencils and construction paper on which RMA staff would write down all the components of the premium

continued on page 5

Career Opportunities at Esri

Are you looking for a career where you can apply your industry expertise in a challenging new way? Join Esri and make an impact on the utilization of GIS in the agriculture sector.

- *Agriculture Industry Solutions Manager*—Develop, manage, and execute a global business strategy for the use of GIS in the agriculture industry; provide thought leadership within the industry and Esri.
- *Account Manager, Department of Agriculture, Washington, D.C.*—Work directly with the Department of Agriculture to facilitate information sharing, understanding, analysis, and decision making through the direct application of Esri's GIS technology.
- *Consultant/Project Manager, Natural Resources/Environmental*—Help clients translate and implement real-world needs into practical, state-of-the-art, GIS technology-driven solutions using Esri's enterprise GIS technology.

Learn more and apply online at esri.com/careers/enviro.

Esri on the Road

InfoAg 2011 Conference
July 12–14, 2011
Springfield, Illinois
infoag.org

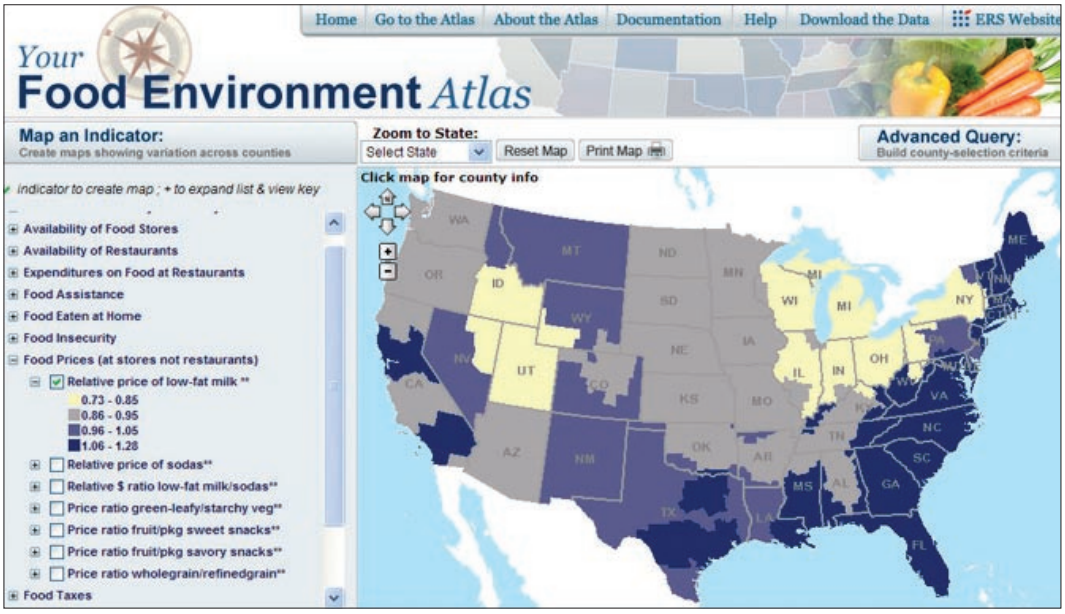
Esri International User Conference
July 11–15, 2011
San Diego, California
esri.com/uc

Share Your Story

Submit an article to *GIS for Agribusiness* to share your knowledge and innovative ideas about your work with GIS in agriculture. Please contact the editor, Jim Baumann, at jbaumann@esri.com for additional information.

Your Food Environment Atlas

Developed by the U.S. Department of Agriculture's Economic Research Service, *Your Food Environment Atlas* (ers.usda.gov/foodatlas/) is an interactive map of the United States that includes more than 90 factors contributing to the quantity and quality of the food eaten by U.S. residents. Aggregated from county and state levels, these factors include the proximity, number, and type of local grocery stores and restaurants; average income; transportation; nutritional assistance programs; local food costs; and other community characteristics. Atlas users can use this data to explore the relationship between the food available to local residents and their relative health.



This map displays the relative price of low-fat milk, ranging from $0.73 to $1.28 per quart, throughout the United States. The lighter colors represent the least costly areas to buy low-fat milk.

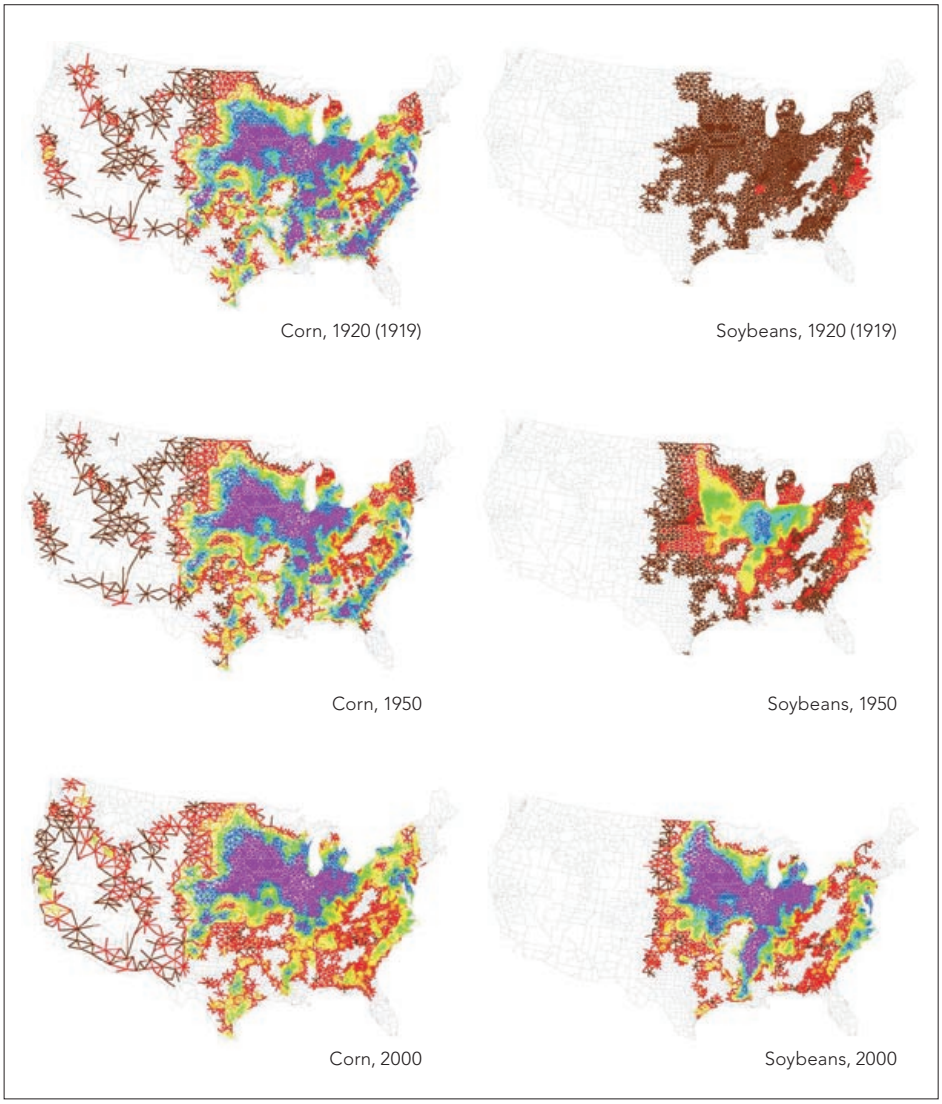
Featured Maps

Changes in Agricultural Crop Connectivity and Disease Susceptibility over the Last Century

By Margaret L. Margosian, Karen A. Garrett, J. M. Shawn Hutchinson, Kimberly A. With, Caterina Scoglio, and Patrick Westhoff

This map examines the relationship of soybean and corn crop connectivity and disease transmission in the United States for several time periods over the preceding century. Using graph theory, a number of thresholds for disease transmission are shown in map form, while a discussion of the factors that have influenced connectivity and the transmission of disease is presented.

Different regions of the United States show changes in crop planting patterns over time as soybeans became more widely accepted and crop technology improved. When the networks are examined through a gamma index metric, the range of values suggests that crop connectivity and disease susceptibility have increased over the last century.



(Courtesy of U.S. Department of Agriculture, Kansas State University, and the University of Missouri)

continued from page 3

Insuring America's Farmland

rate by county. Now, GIS can be used to thematically map areas and look for the anomalies. For example, if rates are going down all over Kansas except in one county, RMA can not only see the discrepancy quickly but also investigate why. "Trying to answer the why was impossible before," says Oetting. "We would have to find all the documents and papers and send someone out for a manual check just to chase down the answer. With GIS, everything is linked and very easy to find."

In cases of suspected fraud or abuse, RMA uses imagery to examine a producer's crop for a particular time frame and reconstruct the growing season. Using imagery allows RMA to perform, in essence, "forensic remote sensing" at any location to see what actually happened on the ground. When fraud or abuse is suspected, RMA can pull up the imagery and overlay the digitized map of the farm field boundary. RMA agents can see if the producer planted the land as was indicated. Since images are captured every 16 days, gathering this visual evidence is important because it provides the information required for a sound scientific protocol.

"The vast majority of farmers follow the rules," says James Hipple, PhD, physical scientist, USDA-RMA, Office of Strategic Data Acquisition & Analysis. "Remote sensing and GIS are part of the toolbox RMA utilizes in creating an actuarially sound agricultural safety net for America's producers while simultaneously minimizing the amount of fraud, waste, and abuse in the program."

For more information, contact RMA's External Affairs at rma.cco@rma.usda.gov.

APHIS: Sustaining the National Food Supply and Security

By Jim Baumann, Marketing Writer, Esri

With an increasing global population, rapid changes in weather patterns, and greater pressure on international agricultural production and safety, the United States Department of Agriculture (USDA) has expanded its focus on national agricultural issues to encompass a more global perspective. Today, USDA not only analyzes and sustains the needs of the American farmer and consumer through domestic initiatives but also assures the quality of U.S. agriculture to foreign trading partners to protect it from unjustified restrictions. Over the years, GIS technology has become an essential tool at USDA to support its efforts.

Says Todd E. Schroeder, USDA Animal Plant Health Inspection Service (APHIS), national data management coordinator for Emergency and Domestic Programs, "We have known for some time that while there are immeasurable benefits derived from the increase in domestic and international agricultural trade, it also poses some risks because of the possibility of the accidental introduction of foreign species that can imperil a country's food production capabilities. With our recently implemented enterprise GIS, we are now able to better track potential problems and take remedial action when necessary."

USDA began its use of GIS more than 25 years ago with the development of landcover and agricultural basemaps from its existing collection of aerial survey data. An enterprise-level GIS license followed, implemented at APHIS. This agency's responsibilities are broad and include protecting and promoting U.S. agricultural health, regulating genetically engineered organisms, administering the Animal Welfare Act, and carrying out wildlife damage management activities. In the event that a pest or disease of concern is detected, APHIS instigates emergency actions with affected states or regions to quickly manage or eradicate the outbreak. This aggressive approach has enabled APHIS to successfully respond to potential pest and disease threats to U.S. agriculture.

To meet its responsibilities, APHIS has implemented GIS-based projects across the country to address various agricultural and natural resource issues. These projects include monitoring the Asian longhorned beetle and emerald ash borer, alien pests that have destroyed millions of hardwood trees, and the development and implementation of the Citrus Health Response Program (CHRP), which helps the agency advise the U.S. citrus industry and protect it from invasive species.

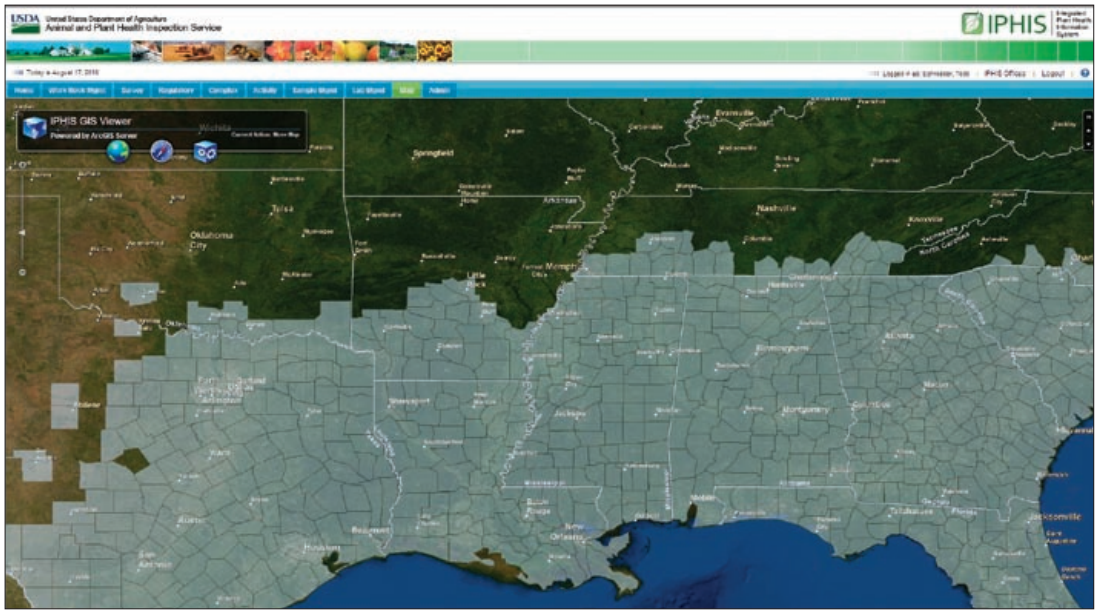
To be successful, APHIS relies on joint efforts between growers, federal and state regulatory personnel, and researchers. This allows the agency to sustain the sharing and consolidation of data resources across its various initiatives and inform and enhance the decision-making process. Due to the collaborative nature of its work, APHIS needed a nationwide GIS to provide a clear and complete picture of the American agriculture and natural resource landscape that would help the agency maximize the benefit from its various initiatives and meet the goals of USDA. In addition, stakeholders needed real-time data that is secure and easily accessible to be used for planning and operations.

In 2009, APHIS developed the GIS-based, enterprise-wide Integrated Plant Health Information System (IPHIS). The application is currently being implemented state by state for use by all plant health responders. IPHIS provides a real-time system that allows users from any APHIS-supported project to see plant health activities in their districts, share data about regional pest infestations, and view national quarantine areas. The system tracks infestations and diseases that impact plants and documents the response. IPHIS, with its underpinning GIS technology, helps USDA manage operations, increase efficiencies, and track scientific progress more accurately so that APHIS can quickly respond when the nation's agriculture and forests are threatened.

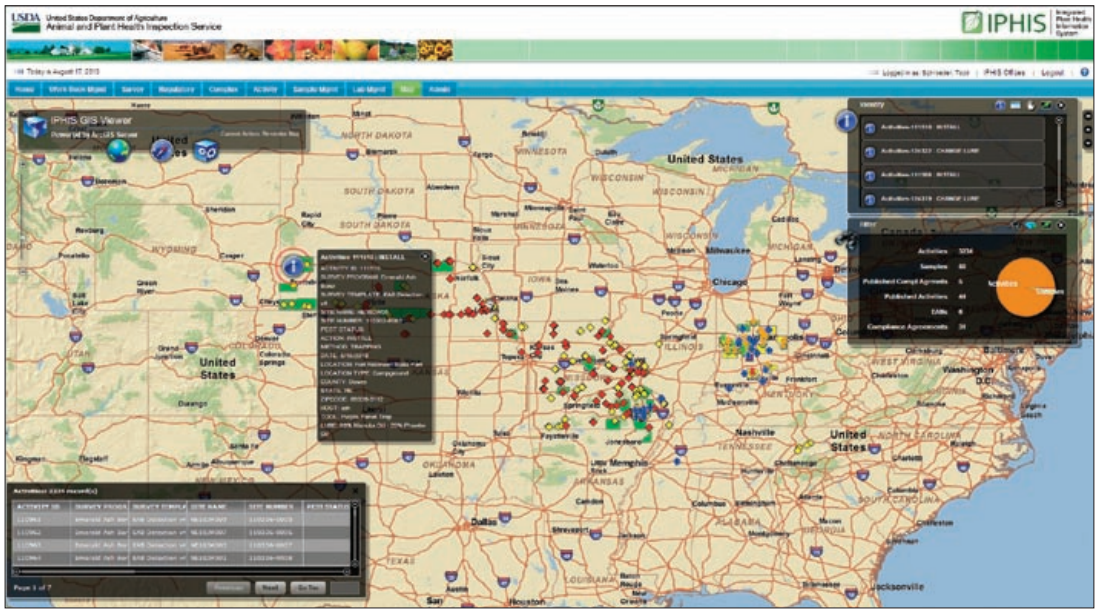
ArcGIS helps APHIS study the data entered by its field crews, providing a program-wide ability to detect and track invasive species of plants and insects. In addition, the GIS allows APHIS to analyze infestation patterns and make clear decisions on its efforts to control invasive species. ArcGIS has also provided APHIS with the ability to perform boundary mapping, route planning, risk analysis, and data filtering and use quality control indicators. Historic GIS data is used to see trends and predict the spread of pests. IPHIS allows users to create customized views of specified projects and provides the ability to drill down to detailed data at precise locations. Customizable charts can easily be generated to visualize operational statistics.

IPHIS has improved communication and transparency by sharing information between other programs and allows access to cooperating entities such as diagnostic laboratories at state, local, academic, and industry sites. This approach has provided APHIS with a modern, comprehensive, and scalable plant health data management system that promotes sustainable agriculture and safeguards the nation's food supply.

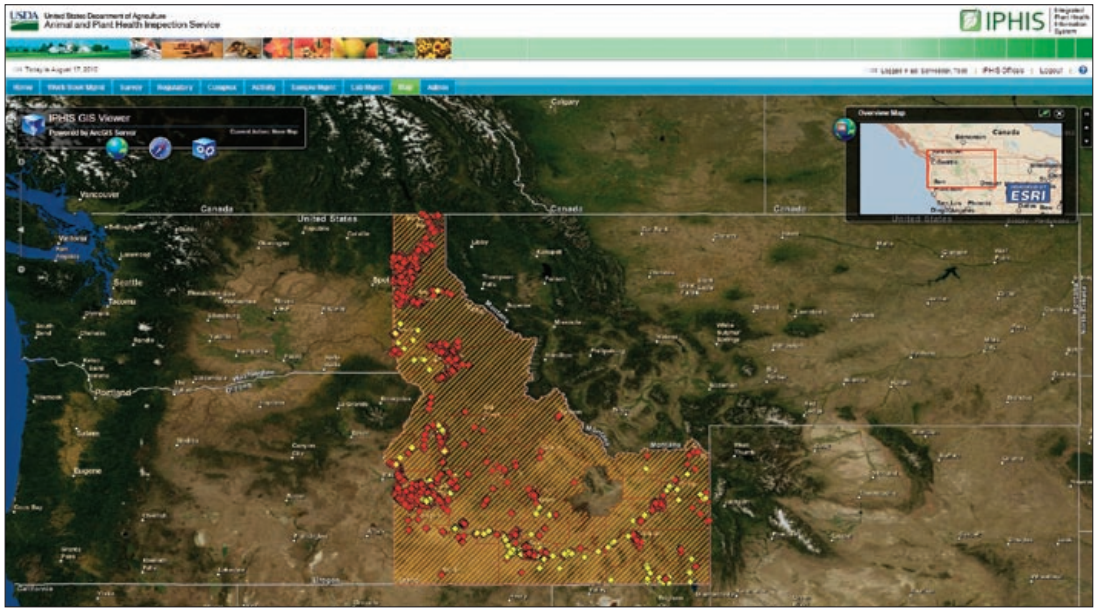
Concludes Schroeder, "The enterprise approach has improved efficiency by integrating and leveraging our existing plant health IT systems and isolated GIS programs, reducing redundancy throughout our network. As a vital part of IPHIS, ArcGIS has helped USDA achieve its goals by improving standardization, accuracy, consistency, and data exchange. In addition, it allows decision makers and scientists to manage current USDA activities and develop and implement long-range plans."



Offices across custom-defined regions can share and post data with custom layers.



APHIS users see a comprehensive view of local activities with the ability to drill down to detailed data at a specific location. Customizable charts provide operational statistics.



APHIS often defines program areas based on geographic and environmental factors. Interactive data is easily viewable by custom-defined areas.

GIS for Agribusiness is a publication of the Agriculture Solutions Group of Esri.

To contact the Esri Desktop Order Center, call
1-800-447-9778
within the United States
or
909-793-2853, ext. 1-1235,
outside the United States.

For the number of your distributor, call Esri at 909-793-2853, ext. 1-1235, or visit our website at **esri.com/distributors**.

View *GIS for Agribusiness* online at **esri.com/agriculture**.

124416
CREEL8.8M2/11tk

Advertise with Us
ads@esri.com.

Submit Content
To submit articles for publication in *GIS for Agribusiness*, contact Jim Baumann at jbaumann@esri.com.

Manage your subscription
To update your mailing address or subscribe or unsubscribe to Esri publications, visit esri.com/manageyoursubscription.

International customers should contact an Esri distributor to manage their subscriptions. For a directory of distributors, visit esri.com/distributors.

Circulation Services
For back issues, missed issues, and other circulation services, e-mail requests@esri.com; call 909-793-2853, extension 2778; or fax 909-798-0560.

Agriculture Solutions Group
Matt Bechdol, Federal Account Manager for USDA
E-mail: mbechdol@esri.com
Tel.: 317-459-5387

Peter Eredics, Forestry Solutions Manager
E-mail: peredics@esri.com
Tel.: 909-793-2853, ext. 1-2707

Belinda LeSage, Natural Resources Coordinator
E-mail: blesage@esri.com
Tel.: 909-793-2853, ext. 1-2021

Copyright © 2011 Esri. All rights reserved. Esri, the Esri globe logo, ArcGIS, ArcView, ArcObjects, @esri.com, and esri.com are trademarks, registered trademarks, or service marks of Esri in the United States, the European Community, or certain other jurisdictions. Other companies and products mentioned herein may be trademarks or registered trademarks of their respective trademark owners.

esri®
380 New York Street
Redlands, CA 92373-8100

My Esri News keeps you connected with GIS users and events in your area. Sign up today at esri.com/myesrinews.

Presorted
Standard
U.S. Postage
Paid
Esri