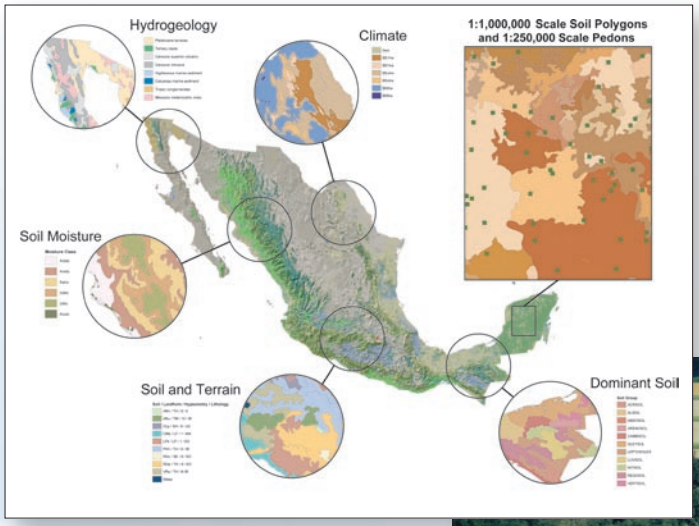
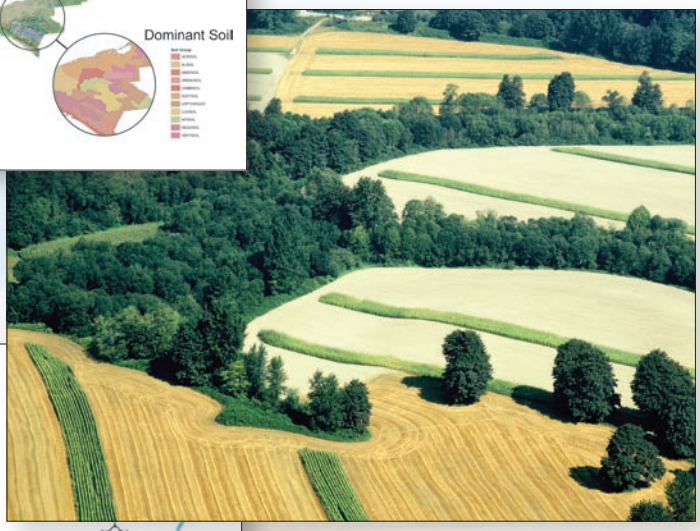
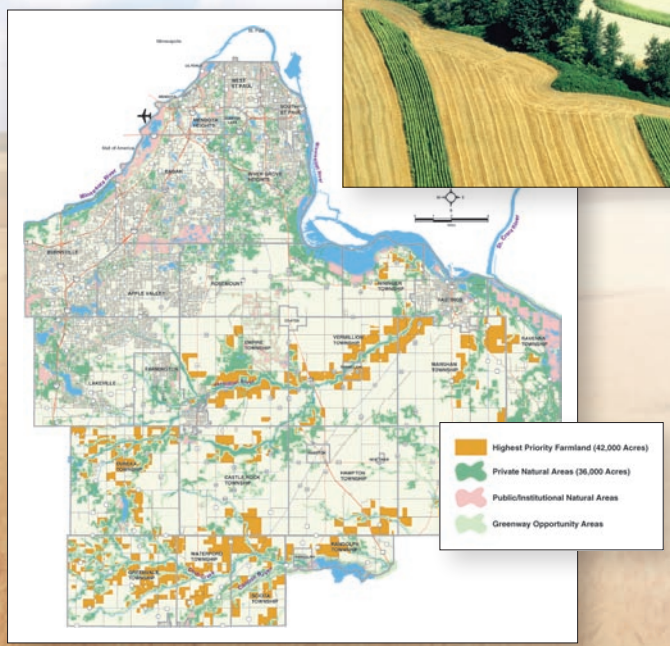
GIS Solutions for Agriculture

Solutions for Production, Agribusiness, and Government





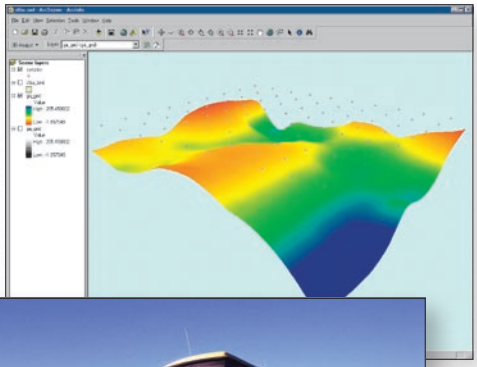


ESRI

GIS Solutions for Agriculture

All sectors of the agriculture industry use ESRI's geographic information system (GIS) technology to share data, increase yields, predict outcomes, and improve business practices. By applying GIS technology to their operations, agricultural operations are able to manage resources and responsibilities more efficiently, devise data portals that disseminate vast amounts of agricultural data and interactive maps, and support farming communities.

Producers use GIS to better manage their farms by creating information-dense reports and maps that give them a unique perspective of their operations. The powerful analytical capabilities of GIS offer an array of options for visualizing farming conditions, as well as measuring and monitoring the effects of farm management practices. Combined with remote-sensing technology, GIS can be used to precisely determine and control inputs, saving preventive expense and reducing the amount of harm to the soil. Farm managers also use GIS to submit government program applications, simplifying what used to be time-consuming multistep processes.



ESRI's GIS technologies support people working in agriculture by providing

- Greater analytical support for precision farming
- Better understanding of risk factors
- Higher revenue generation and cost recovery
- Greater efficiency through task automation
- Greater access to government services and data
- More accurate support for decision making
- Greater insight to policy making
- Easier reporting for government applications and regulatory compliance
- Better resource management

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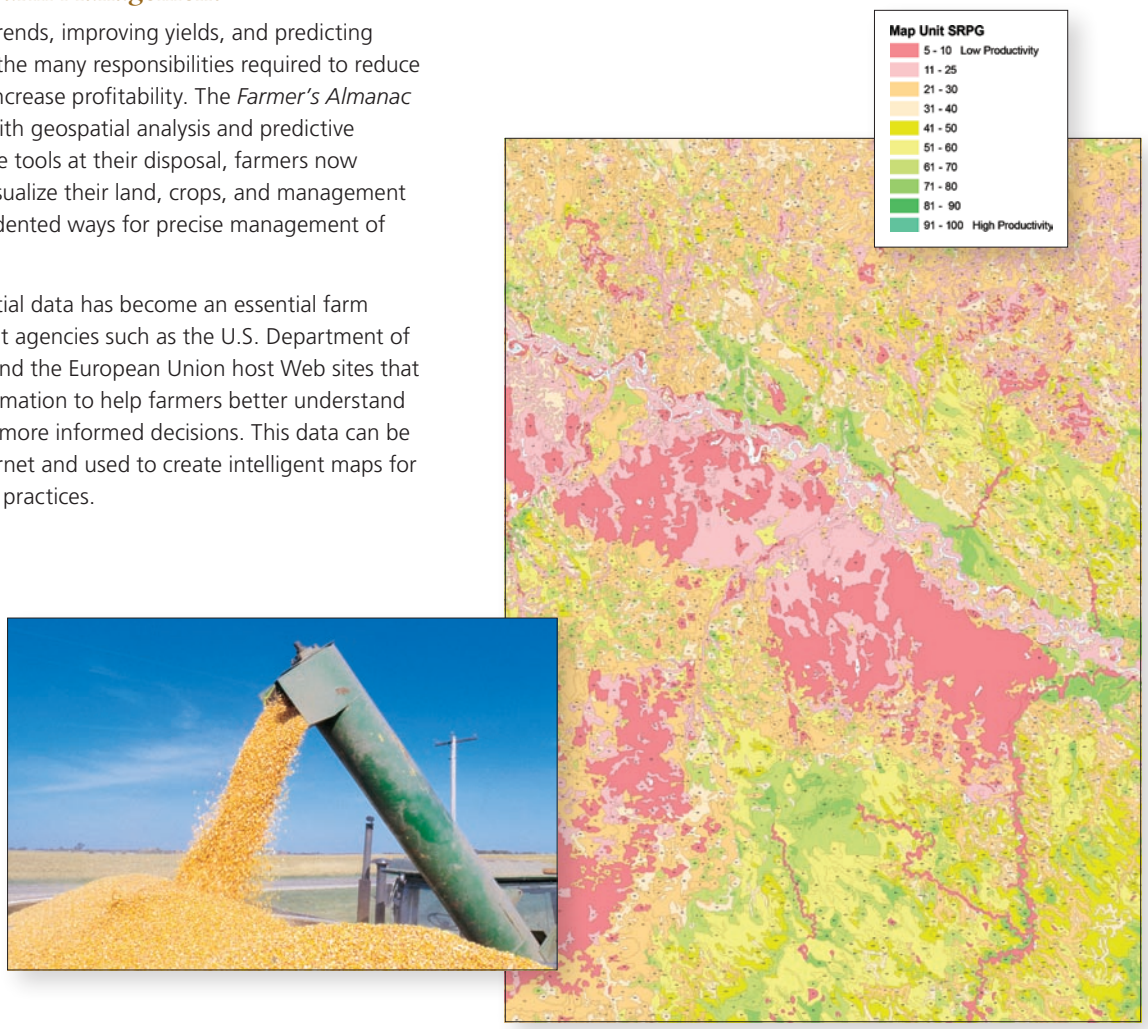
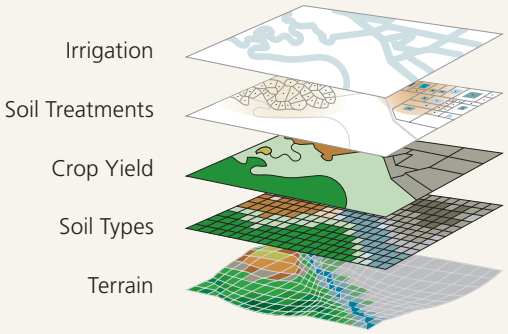
GIS for Precise Farm Management

Monitoring market trends, improving yields, and predicting weather are among the many responsibilities required to reduce the risk of loss and increase profitability. The *Farmer's Almanac* has been replaced with geospatial analysis and predictive modeling. With these tools at their disposal, farmers now have the ability to visualize their land, crops, and management practices in unprecedented ways for precise management of their businesses.

Today, accessing spatial data has become an essential farm practice. Government agencies such as the U.S. Department of Agriculture (USDA) and the European Union host Web sites that deliver valuable information to help farmers better understand their land and make more informed decisions. This data can be accessed on the Internet and used to create intelligent maps for better farm business practices.



Detailed soil survey atlas map for Antelope County, Nebraska

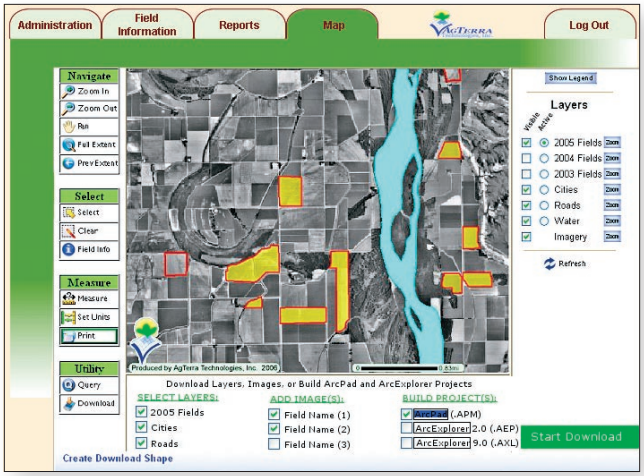


In a map of an agricultural area, one layer might represent the boundaries of a piece of land; a second layer, soil types; another, the crop yield or a specific soil treatment; and still another, irrigation. GIS can show, for example, how the relationships between soil type, fertilizer, and water affect crop yield on a given square acre of land. A map depicting how soil variability influences crop yield suggests precise soil management solutions.

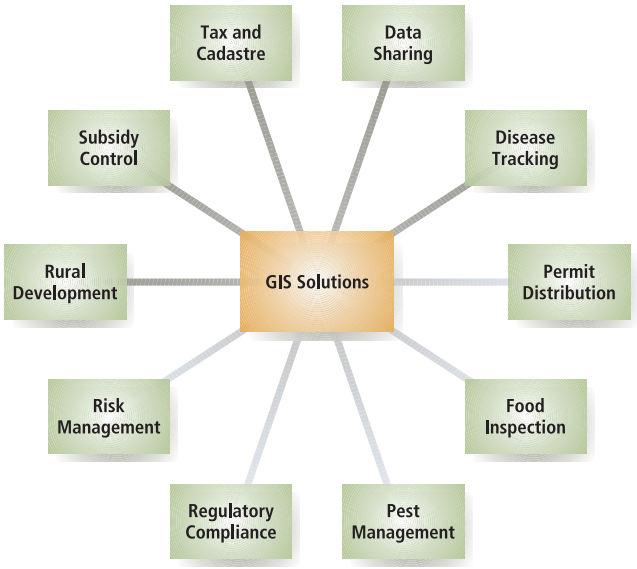
GIS for Government Agriculture

Federal, state, and local agricultural agencies serve and share information with many different groups. Throughout the supply chain, from producer to consumer, agricultural ministries and institutions collect, collate, manage, and disseminate data. With growing public awareness of farming practices and legislation, these activities will inevitably become more complicated. If there is a common theme in new efforts to better conduct these activities, it is communication. A powerful medium of communication, GIS enables the sharing of information not only internally but also between government and consumer.

The agricultural industry uses GIS to meet the challenges of farm management including regulatory compliance, permit distribution, subsidy tracking, and pest management. By improving the way producers collect, store, and access information related to these activities, GIS enables a more complete command of their businesses.



Based on ArcIMS, AgTerra's AgTrac application helps link tabular field data with spatial data to help direct field-based activities such as crop scouting, soil sampling, and ground-truthing remote imagery.



Agriculture Information Delivered Online

In the agriculture industry, those unacquainted with GIS technology need to view and print custom maps and be able to download these maps to desktop and GPS-enabled mobile applications. Using ESRI® GIS software, AgTerra Technologies Inc., a manufacturer of agriculture management applications located in Sheridan, Wyoming, set out to make this happen.

AgTerra uses its Internet map server program in conjunction with its AgTrac application to make it easier to build an online map that can be downloaded as an ArcGIS®, ArcExplorer™, or ArcPad® project. To make system data more accessible to workers, AgTerra uses ArcIMS® for many reasons, the foremost being its highly scalable framework for GIS Web publishing. ArcIMS gives users the ability to serve maps and other data to a variety of clients ranging from wireless devices, such as cellular phones and personal digital assistants (PDAs), or lightweight browser-based clients to full-featured GIS desktop clients. As a result of this project, AgTerra improved AgTrac's ability to manage and facilitate improved business.

GSA Schedule

ESRI's GIS software and services are available to federal agencies through ESRI's GSA Schedule. To order GIS software from ESRI's GSA Schedule, call 1-800-447-9778. Refer to ESRI's GSA Schedule No. GS-35F-5086H.

Publishing Volumes of Data

Server-Based Case Study—USDA Web Soil Survey

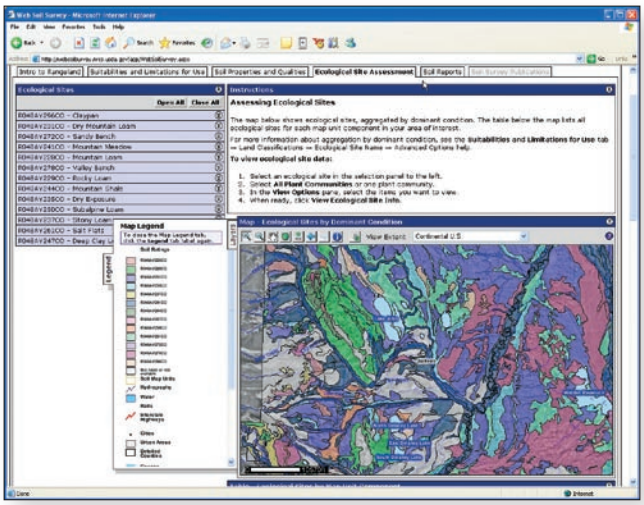
In August 2005, the USDA Natural Resources Conservation Service (NRCS) launched the Web Soil Survey, a Web-based version of the National Cooperative Soil Survey. The Web Soil Survey helps the USDA meet two of the U.S. president's management agenda items: to eliminate paperwork and to make government services accessible to more people. Prior to the Web Soil Survey going live, soil survey maps and data were largely contained in soil survey books housed at local USDA service centers, NRCS field offices, and public libraries. Today, soil survey users can simply connect to the Internet, select a land parcel anywhere in the country, see the specified parcel on a map, generate soil interpretations, and download or print a PDF file.

The Web Soil Survey application was built using ESRI ArcIMS, ArcGIS Server, and ArcSDE® software. The server software is being fully integrated with the soil survey's master database, which contains all soil information on a national basis. ArcIMS is the front end for delivering the application, while ArcGIS Server delivers the information. In addition, ESRI's ArcWeb℠ Services provide address-finding functionality, enabling users to type an address and receive a map view of that area.

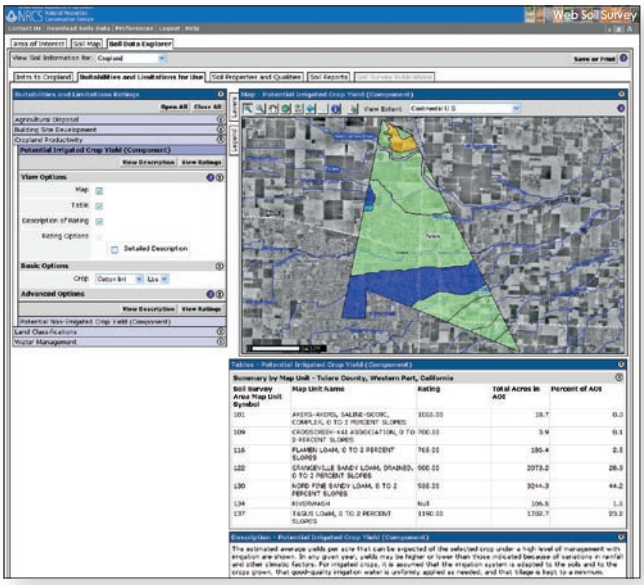
An application suite, the Web Soil Survey contains a front-end application that accesses the Soil Data Mart—the centralized repository of the Web Soil Survey's spatial and tabular soil data. Because the Web site provides single-point access, users can access available historical and current soil survey data. Past publications are available as PDFs for viewing or downloading for selected areas. On the interactive GIS map, the user can outline an area of interest (from 3 to 10,000 acres) and select a usage option. The application provides suitability levels of the area for the selected land use.

The Web Soil Survey offers approximately 50 national standard interpretations. Some examples of interpretations are land applications; productivity of cropland, rangeland, and forestland; and suitability for different recreational developments such as paths and trails, campsites, and picnic grounds.

Adding new functionalities to the Web Soil Survey project is a constant endeavor. Eventually, USDA customers will be able to log in to their USDA case files and drop in information, such as property boundaries, for quick access to information about selected properties in their files. The Web Soil Survey is the beginning of a new era for NRCS and delivery of soil survey information.



Online users select a plant community and assess the suitability and limitations of a specified ecological site. They can also read about the specific details and view a map.



Web Soil Survey allows the user to select any location in the United States and access available soil information, suitability levels, and property potential. Here, the Web site user assesses an area for potential cotton lint yield.

Improving Crop Yield

Case Study—Ravensdown, New Zealand

Fertilizer Application System Uses GIS/GPS for Precision Farming

Today more than ever, farmers rely on inputs to increase the quality of the produce they grow. These inputs vary from seed, fertilizer, and pesticides to machinery parts and monitoring equipment.

In past generations, farmers tended to spread fertilizer evenly over the entire field. Now, thanks to geospatial technology, spreading methods can be more exact by type, quantity, and location of application. Outfitting the spray rig with computerized controllers and GPS navigation systems is an approach to farming that is both friendly to the environment and profitable for the farmer.

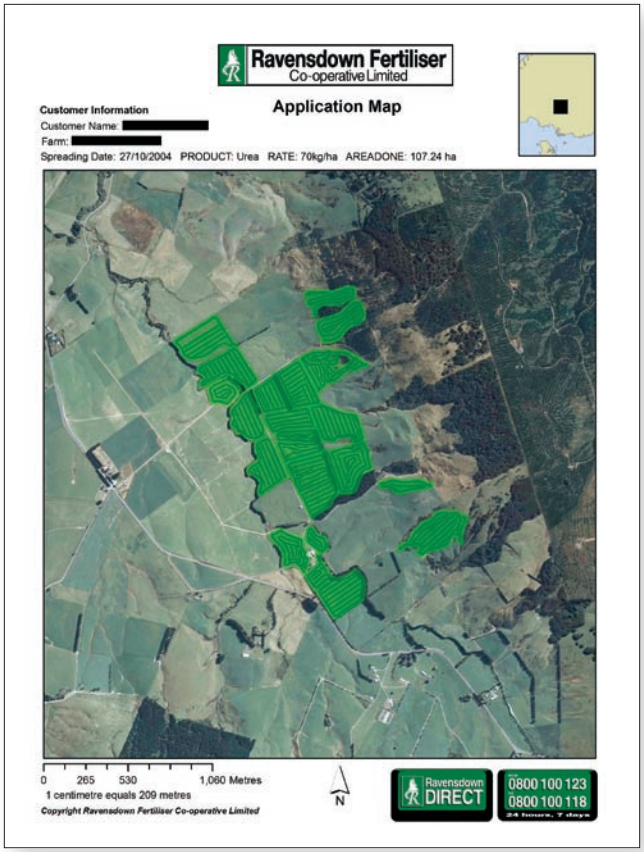
Ravensdown, New Zealand's largest manufacturer and distributor of fertilizers, is using geospatial technology to improve the way New Zealand farmers manage their inputs. By using GIS and GPS to guide the application of fertilizers, farmers are decreasing the amount of wasted resources that can potentially cause harmful runoff into streams and waterways. At the same time, they are reducing their total fertilizer expenditure by up to 10 percent per year.

Ravensdown worked with Eagle Technology Group to design the solution that is built on ESRI's ArcGIS software. The system accurately records where and how much fertilizer has been applied to a certain area. This information is merged with digital orthophotos and the farm's relational databases to create a vivid picture of the farm's overall soil sustainability.

Ravensdown's GIS architecture includes ESRI's ArcGIS Server, ArcSDE, ArcIMS, and ArcExplorer. Once the raw spatial and attribute data is captured from GPS transceivers on the trucks, it is transmitted wirelessly to Ravensdown's facility where it is loaded into the GIS and processed in near real time.

The onboard GIS creates a map-based display that shows fertilizer application data as a series of color-coded "snail trails" that are overlaid on the map, giving a very good representation of the process. An additional benefit is that the system can be used as evidence to verify "proof of placement." With geospatial technology, it is easy to demonstrate that the fertilizer has been spread in a manner consistent with best environmental practices.

Ravensdown had already equipped a number of its fertilizer application trucks with GPS-controlled guidance systems and spreaders that captured location, fertilizer type, and spreading data.



Once the data has been uploaded and processed, Ravensdown field staff can log on to the system from a remote location via the Internet. They can call up a customer's farm, view the results of earlier soil tests, see what types of fertilizers have been applied, then make recommendations about which type of fertilizers are appropriate.

Eagle used the development capabilities available in ArcGIS Server to embed the map interface in Ravensdown's customer relationship management (CRM) system. Ravensdown wanted seamless access to the spatial and attribute data, so Eagle developers used the .NET framework to build an interactive map viewer that the call center staff can access with a click of the mouse. Staff members can query the database, manipulate the display, and print or fax hard-copy maps.

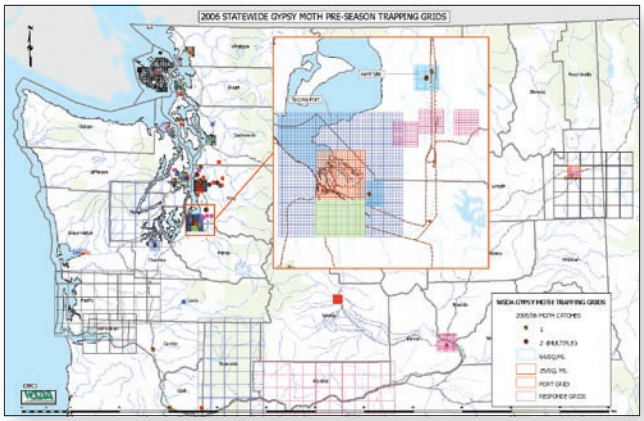
Ravensdown is planning to build on this foundation. "Eventually, we want to incorporate GIS into our quoting system to calculate the road distance between our depots and the fields to be fertilized," says Mark McAtamney, CIO at Ravensdown. "The distance is a significant component of the cost to our clients."

GIS: The Geographic Approach

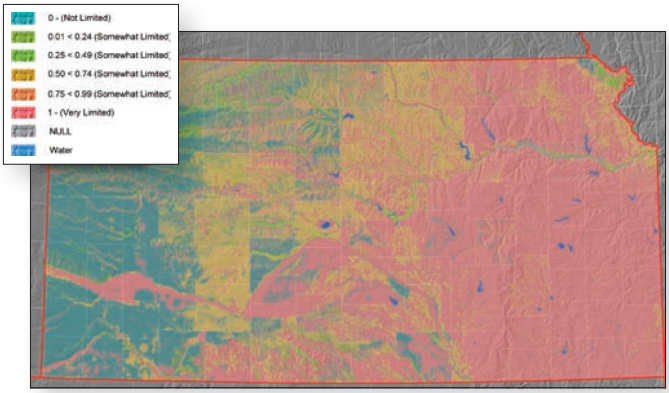
ESRI software offers scalable solutions for agricultural departments, universities, and businesses. From field-based products such as ArcPad to server-level software such as ArcGIS Server, data can be collected and managed more easily than ever before. ArcGIS provides all the necessary tools to analyze the spatial components of agricultural datasets. Below are a few examples where organizations are benefiting from taking a geographic approach to their operations.

Invasive Species Response—Washington State

The gypsy moth is one of the worst agricultural pests in North America today. To deal with the burgeoning threat, the Washington State Department of Agriculture (WSDA) recently implemented GIS and GPS technology into the state's eradication efforts. As a result, the department has reduced the amount of paper used in the data collection process and increased the number of moth catches, significantly improving WSDA's monitoring efforts. The accuracy of GPS units, combined with ArcView® software's state-of-the-art mapping capabilities, gives trappers a better picture of where to set the traps to better manage this voracious pest.



Map depicting trapping grids in Washington State generated in ArcView



Map depicting soil suitability for catastrophic large-animal disposal pit in Kansas.

Vineyard Inspection—Washington State

Chateau Ste. Michelle Wine Estates maintains a wealth of spatial data for its numerous vineyards. To keep the grapes growing at peak level, crews routinely inspect the vineyards using ESRI's ArcPad mobile platform. Data on the mobile devices is synchronized using TC Technology's GO! Sync™ for ArcPad. The remotely captured data is stored centrally in an enterprise geodatabase, allowing Chateau Ste. Michelle to analyze a vast amount of information relating to the numerous conditions that affect the health of its vines such as weed growth, disease presence, and pest infestation. This field-collected data is then synchronized with the winery's centrally stored data.

Mass Animal Burial Soil Suitability—Kansas

The quick disposal of large dead animals following a catastrophe is critical. The pit method disposes dead animals by placing carcasses in successive layers in an excavated pit. The chemical and physical properties of soils can help distinguish areas that are most suitable for excavating pits and disposal of large animals as well as areas with the least number of soil limitations.

Using ArcGIS Desktop software, the USDA obtained soil data from the National Soil Information System and combined it with the Soil Survey Geographic Database to map the soil suitability for large-animal disposal pits. This interpretive map demonstrates how important soils are in determining which areas may be suitable for these emergency response uses.

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For more than 35 years, ESRI has been helping people make better decisions through management and analysis of geographic information. A full-service GIS company, ESRI offers a framework for implementing GIS technology and business logic in any organization from personal GIS on the desktop to enterprise-wide GIS servers (including the Web) and mobile devices. ESRI GIS solutions are flexible and can be customized to meet the needs of our users.

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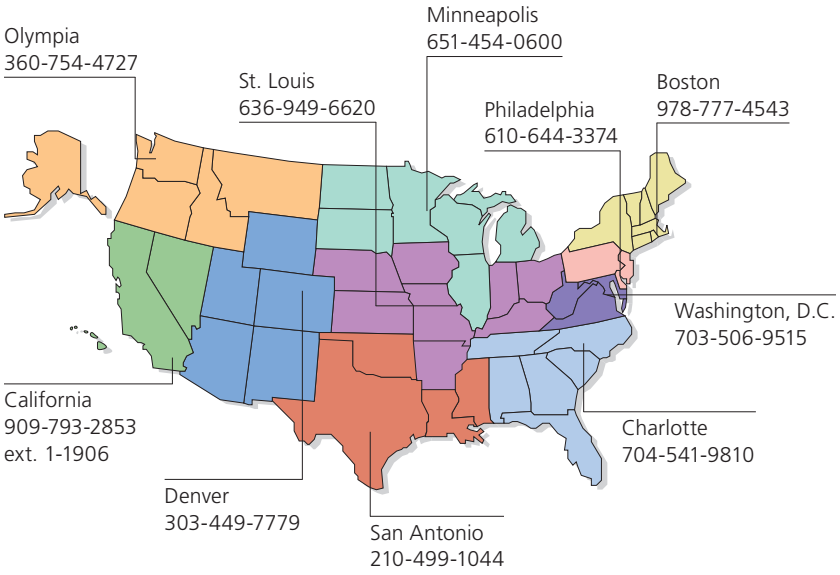

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