NEWS & VIEWS

A regional newsletter published by the Potash & Phosphate Institute (PPI) and the Potash & Phosphate Institute of Canada (PPIC)

Dr. H.F Reetz, Midwest Director
April 1998

The Many Faces of GIS

THE GROWING adoption of site-specific precision farming systems is putting some new technology tools in the hands of farmers and their input suppliers and advisers. Farmer ingenuity is following closely behind with the desire to find other uses for those tools. As an example, geographic information systems (GIS) are an important tool for the management and analysis of data collected for site-specific management. Initially, their application was to handle soil test information to develop maps for variable-rate fertilizer and aglime application. This was soon followed by using GIS to manage soil survey data, yield data and other management information. For the farmers, dealers and consultants who have learned to use GIS tools, there are a growing number of applications in managing and interpreting data about their fields

The power of GIS goes far beyond the development of maps showing variability of soil tests or yields. The GIS software packages have been developed with a full range of mathematical capabilities that help manipulate the data, three-dimensional projections to help display the data for visual interpretation, and capability to interface with other computer operations to further extend the analytical capabilities. Soil test data, for example, can be interfaced with fertilizer recommendation software that integrates soil test, projected yield, soil survey information, management history, and other data to formulate a variable-rate based nutrient management plan for the field.

The ability to "stack" maps in the GIS data base is dependent upon all of the data being geographically-referenced in a digital, orthogonal system. That means all of the geo-referenced points "line up" from one layer to the next, so that the relationships among layers can be evaluated. This is where the real power of GIS can be realized. Simulation models, expert systems and other electronic decision aids can be developed that pick information from each of several layers to produce a geographically referenced set of response data or interpretations or recommendations.

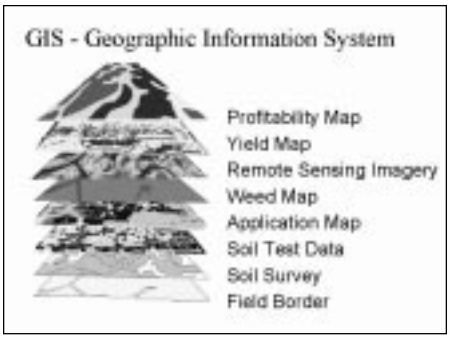

Figure 1. Various layers of information in a GIS record and analysis system can be stacked electronically to determine spatial relationships among them and to compute additional layers of interpretive information.

Some examples of expanded uses for GIS might include:

- **Exact field boundary maps** related to yield maps, soil survey information and soil test maps to determine the optimum nutrient application map and develop an accurate fertilizer spreading map. An "as applied" fertilizer map should also be generated to reflect any possible changes from the intended application. Such databases can be accumulated over years to help develop nutrient management budgets for the fields.
- **Digitized soil survey maps** including soil texture, slope and depth to subsoil used with digitized aerial remote sensing images and yield maps to determine areas needing drainage tile or surface waterways and an economic assessment of the losses incurred due to the drainage problem. These are useful in guiding decisions relative to improving drainage systems crop selection, etc.

Agronomic market development information provided by:
Dr. Harold F. Reetz, Midwest Director
Potash & Phosphate Institute (PPI)
1497 N 1050 East Road, Monticello, IL 61856-2074
Phone: (306) 652-3535, E-mail: hfreetz@ppi-far.com

- **Nutrient removal maps** calculated from yield maps. These in turn form part of the basis for the recommendations for the next cycle of nutrient applications. With several years of data on fertilizer application, crop removal and soil test readings, a GIS analysis can be used to develop a nutrient response relationship for the field—or better yet, for various management zones within the field. Site-specific response functions can eventually be developed for the specific soil-climate-management system for that field.
- **Creation of maps** showing variation in profitability for a field, based upon interpretation of maps (or databases) showing variability in nutrient application, pest management, yield, grain moisture at harvest and other factors. Related maps could show variation in the cost of production per bushel for different parts of the field.
- **Land valuation maps** can be developed for use in determining fair market value for assessment, land sale, or cash rent determination. Some farmers might view this as a "negative" but it can provide an equitable basis for land valuation based on soil characteristics and productivity.
- **Another added value for databases** developed by many farmers using GIS tools is a collection of maps and databases that illustrate farmers' relative management abilities. They use these when interviewing for possible rental of farmland. Landowners and farm managers often can better evaluate management ability on the basis of economic maps than yield data and tabular records.
- **Drainage maps** might be used in conjunction with nutrient and pesticide application maps to develop a "loading" database to track total inputs into a field and its potential contribution to water quality problems. Linking with yield maps can help provide proof that rates applied are consistent with recommendations and crop removal so that water quality impact should be minimal.

We have just begun to explore the possibilities for dealers and consultants to use GIS as a tool to manage and interpret information for their customer base as a whole. Tracking demographics of product sales, geographic distribution of pest problems and geographic distribution of grain quality factors are examples of GIS data sets that could be useful in business development and management.

Some dealers are using GIS as a tool to track equipment usage, to help schedule field activities to minimize road time, and even to decide on the value of adding application equipment. Matching product usage with yield data in a GIS analysis can help build a case history on responses, problems or best management practices (BMP).

New GIS tools on the market include handheld computers with GIS linked to a video or digital still camera to record crop problems or observations when scouting fields. With geographic referencing using a backpack or handheld global positioning system (GPS) receiver, these observations can be cataloged into a GIS database. Some people are adding voice recordings describing the situation. All of these photos, videos, and sound recordings can become a part of the permanent GIS record for the field. The GPS referencing makes it possible to use these observations when trying to evaluate causes of yield variability after harvest and aid in planning corrective management decisions for the next season.

These are just a few of the ways in which GIS, a relatively new addition to the farmer's management toolbox, is being used to tackle problems we could not begin to handle a few years ago. We can go far beyond mapping of soil tests and yields as we explore the many faces of GIS, one of the most useful tools of site-specific crop and soil management. ■

RN 98069

NEWS & VIEWS

Midwest Region
April 1998

Potash & Phosphate Institute (PPI)
655 Engineering Drive, Suite 110
Norcross, GA 30092-2837