

PROPERTY/CASUALTY INSURANCE

ADVANCEMENTS IN THE MAPPING LANDSCAPE

The technology explosion over the last decade has brought mapping capabilities to insurance company decision makers. Opportunities abound on how they can take advantage of these new products to deal with geographic issues.

By David R. Langdon and Klayton N. Southwood

It has taken some time, but the use of mapping technology is now commonplace within the insurance industry. Geographic information systems (GIS) combine a relational database and digital maps, allowing advanced spatial analysis of existing data. With GIS, insurance companies can evaluate the concentration of their property, workers compensation, and life and health exposures in a number of new ways that can help improve management of the business.

For example, insurance companies can map individual locations to see where concentrations exist. The locations can also be mapped against particular hazards such as potential terrorism targets or historical tornado outbreaks. Each location can be further analyzed by the creation of a thematic map using different colors or patterns to reflect information such as building value. In addition, the individual location values can be aggregated to a geographic region, such as ZIP code or county, and the region can be shaded to reflect the summarized values. *Exhibit 1* provides an example of shading both locations and ZIP codes based on available data. In addition to displaying information related to policies, GIS can display insurance company territory definitions and external data such as demographics.

Despite the advances made in GIS technology, it is important to remember that it is still just a tool. Because they are so visual, maps can be deceiving if not properly designed. The use of colors and the way ranges are set can influence how the data

are interpreted. The success of the analysis depends on the user's ability to create maps that effectively communicate the desired information.

CHANGES IN GIS USERS

The evolution of GIS software has been similar to that of the spreadsheet. For a while, there was a large gap in the quality of spreadsheet applications that were being developed, which provided a competitive advantage to companies with individuals experienced in the use of spreadsheets. These days, due to the number of experienced users of spreadsheets and competition among software vendors, sophisticated spreadsheets are available to most companies. However, fewer experienced GIS users, particularly within certain business fields like insurance, still mean large differences in the quality and functionality of GIS applications.

Today, GIS is being used in many areas, including catastrophe management, growth strategy, underwriting, marketing and ratemaking. Easier-to-use software as well as increased computer speed have moved GIS use out of the hands of a few experts and into the hands of managers and practice leaders. Users have multiple options for spatially analyzing data, with products ranging from desktop systems that cost a few hundred dollars, to customized Internet/intranet systems, to full-blown desktop GIS systems with Web-publishing functionality. These changes allow mapping tools to play a larger role in corporate planning and day-to-day operations.

In the end, the overall analysis is greatly impacted by the expertise and experience of the user as well as the quality of the data. Inaccurate data may lead to false conclusions, and invalid or incomplete addresses can reduce the effectiveness of certain analyses. For example, without accurate street address information, it is not possible to examine concentrations near major terrorist targets.

ADVANCEMENTS IN TECHNOLOGY

When GIS tools first became widely available to insurance companies in the late 1980s, it was clear that many companies were not familiar with the software. While companies recognized the need to do spatial analysis, they were used to doing analysis by hand with tools such as pushpins and wall maps.

The technology in the early days was slow and cumbersome, and digitized maps were not widely available. Early applications included the analysis of auto territories for competitive rating analysis. Creating digital maps of a company's rating territories required tracing streets and other features from paper maps using a large board with electronic sensors called a digitizing tablet.

Although labor intensive, GIS technology allowed for an in-depth analysis of competitive position by creating the intersection of all the overlapping territories. (For a more in-depth review of this capability, see "Mapping the Future," *Emphasis* 1990/2, at www.towersperrin.com/reinsurance.)



David R. Langdon is a vice president with Towers Perrin in Hartford. He specializes in catastrophe risk management and has pioneered the use of geographical information systems within Towers Perrin. Mr. Langdon is a Chartered Property Casualty Underwriter, an Associate of Reinsurance and an Associate of Risk Management.



Klayton N. Southwood is a consultant with Towers Perrin in the Bloomington, Illinois, office. He specializes in personal lines ratemaking, rating plan design, loss reserving and competitive analysis. Mr. Southwood is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries.

Today, the prevalence of worldwide digital maps and extensive external data sources has vastly increased the ease of performing more complex analysis. For example, digital street files and rate quotation software make it easier to create territory maps and to perform rating comparisons.

The advancements in software and increased number of data sources are leading to several new products that have the potential to rapidly change the GIS industry. Applications like Google Earth and NASA's World Wind are changing how people view mapping software. The seamless mosaic of satellite and aerial imagery provide a fascinating view of spatial relationships. What remains to be seen is whether the functionality that is available in these products becomes robust enough to rival the capabilities of existing GIS products.

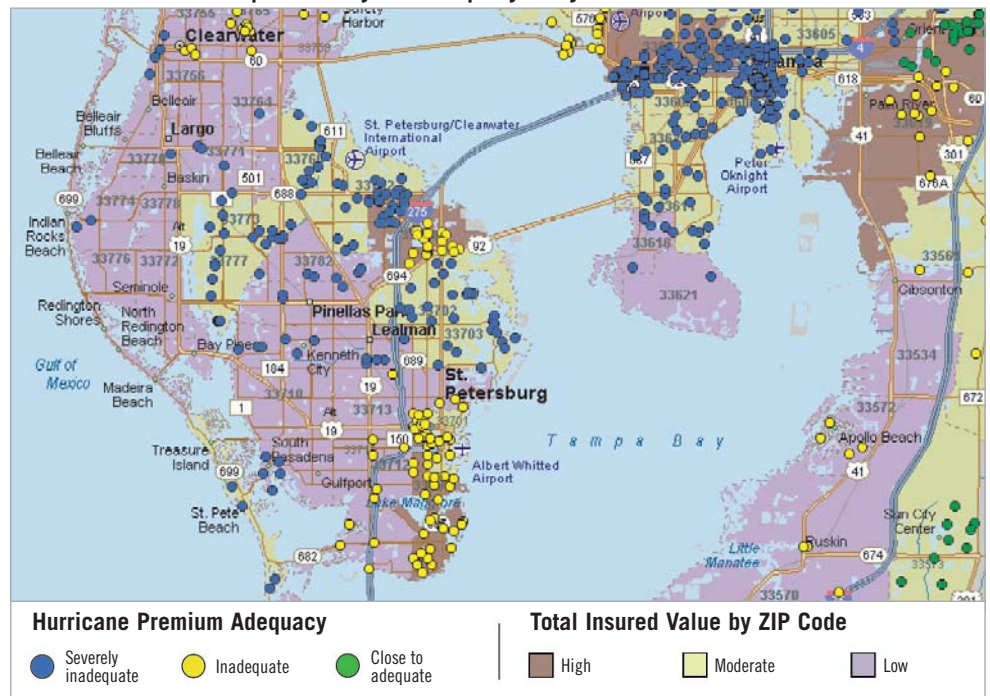
Although functionality will vary, there are some common basics to desktop mapping software. For example, in order to plot locations on a map, the product needs to assign each location a latitude and longitude using the street address (a process called geocoding). If the street address is not valid, the location will be assigned a latitude and longitude based on the ZIP code, city or county.

SOFTWARE OPTIONS

Although mapping software products proliferate in the market today, with a variety of applications, there are three broad categories of functionality:

- The first is the basic and inexpensive system, designed to create great-looking thematic maps without the complication of full-blown GIS systems. An example is

EXHIBIT 1
Prioritize concentration problems by rate adequacy analysis



Source: Microsoft Corp. and/or its suppliers

MapPoint from Microsoft, which provides the ability to geocode and create maps worldwide. The overall map quality is very good and can be seen in Exhibit 1. It is also easy to use.

- The second category is a full-blown GIS system produced by companies like MapInfo and ESRI. These products usually require a longer learning curve, but provide significant additional functionality, like the ability to overlay polygons to create new regions based on the intersection. This is particularly useful when comparing rates for different insurance companies. The territory maps for two or more companies can be combined to show all of the intersections and thus create a comparison of rates for every location.

- The final category can have features that span both of the previous categories, but additionally are Internet- or intranet-based.

Online products have an advantage because all users, from any location, have access to the same data. This eliminates the concern that different offices may be accessing different versions of the data. In managing exposure concentrations, this solves the problem of underwriters incorrectly assuming they can add risks to an area that had already reached management limits due to recent writings.

Sophisticated GIS products also have moved to Web-based applications through the development of Web-publishing products.

In these cases, the maps are created by a desktop user and published to a Web page. While these products can provide GIS functionality, it is often fairly restricted compared to the full system.

The big advantage of Web-based systems is that the technology is moved away from the specialists and into the hands of the decision makers. In the past, by the time the analysis reached the decision maker, the final product was a printed report with maps and analysis. Recent GIS products produce a more in-depth analysis by allowing managers to drill down into areas of interest and view data at specific locations.

EMERGENCE OF GIS TECHNOLOGY

There are many ways that GIS technology can help the insurance industry. It has such diverse uses as:

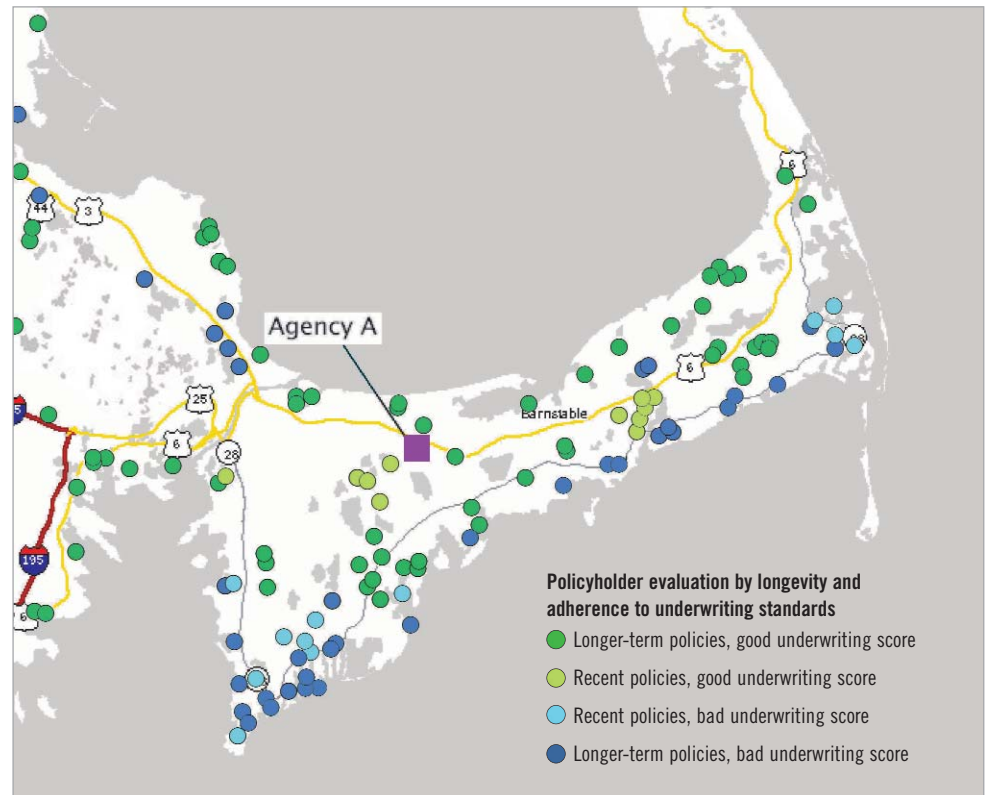
- optimizing exposure
- defining rating territories
- evaluating agencies
- locating target markets
- identifying exposures in proximity to a catastrophe
- helping with underwriting variables
- analyzing medical provider plans.

Some examples include the following:

Catastrophe Management

GIS technology allows the user to move from an overview of exposure and loss concentrations to policy and location details and back again. This is particularly useful for identifying key drivers of catastrophe

EXHIBIT 2 Evaluate agencies by longevity and quality of business



Source: Questerra, LLC and its suppliers

loss based on the results of catastrophe models. One of the primary metrics to evaluate locations is the ratio of modeled average annual loss to premium. Locations that contribute a disproportionate share of modeled loss compared to their premium can be identified and actions taken to decrease modeled loss or improve premium adequacy.

For example, Exhibit 1 identifies high concentrations of property value while also identifying individual locations where the base rates are the most inadequate.

Agency Review

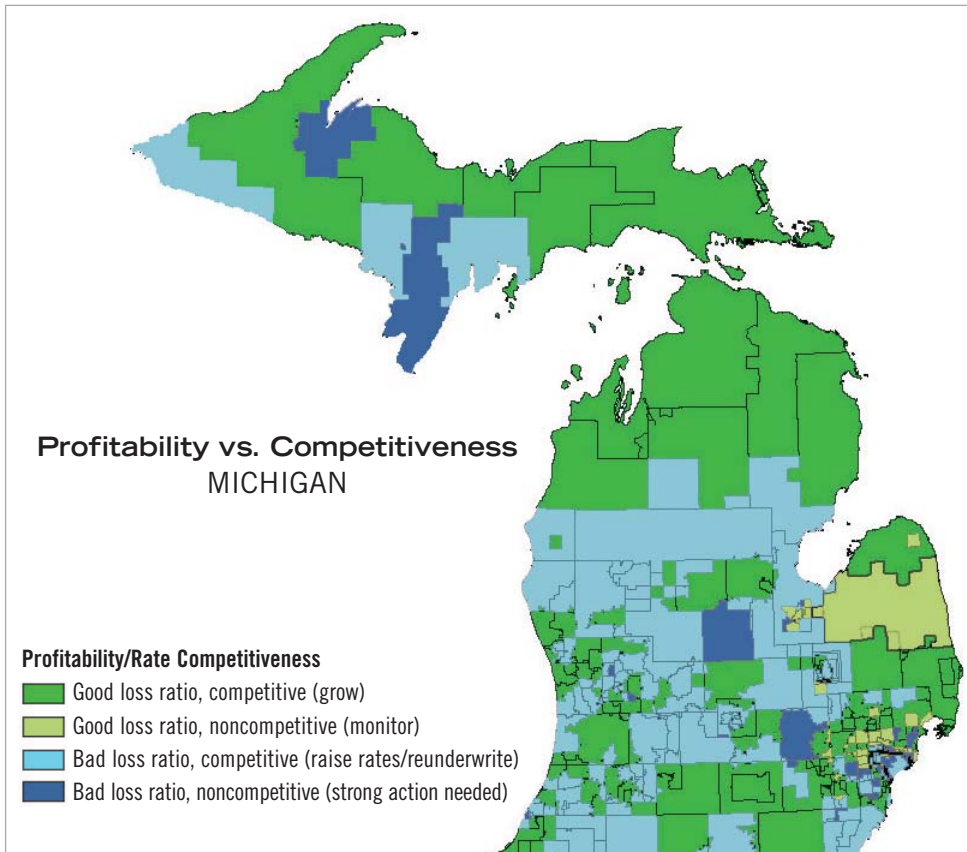
For insurance companies that use independent agents to sell their product, the evaluation of each agency is an important process that can determine the status of the agency for the upcoming year. The review has traditionally used metrics such as three-year loss ratio, renewal percentage, growth in new business and adherence to underwriting guidelines.

An aspect of the business often overlooked is where the agent writes business geographically. If there is a particular concern for catastrophe exposure or other underwriting criteria, a map produced by GIS technology can show the locations of the business written by a particular agency and show if there is a pattern of underwriting that may lead to adverse selection (see *Exhibit 2*).

Market Analysis

Personal auto and homeowners insurance have seen major advancements in rating plan sophistication over the last decade. This was made possible by increases in personal computer speed and sophistication, along with newer software tools designed for multivariate analysis. (See the article “Gaining Position with Technology” in the 2005/3 issue of *Emphasis*.)

One variable — geographic location — is key to accurate risk measurement, yet is often overlooked as an opportunity to apply the full power of GIS mapping systems.

EXHIBIT 3**Review territories by profitability and rate competitiveness**

Source: Claritas

Maps of current boundaries, statistically optimal boundaries and competitor boundaries can be compared and used to hone business strategy.

Color-shaded maps can be extremely valuable in decision making relative to market strategy. Competitive indexes and profitability measures can be combined on a map, serving to highlight problems and opportunities not usually obtained by numerical tables.

An example is shown in *Exhibit 3*. Areas on the map where the insurer is both competitive and profitable can be targeted for growth. If rates are very competitive, but financial results are unacceptable, some of the competitive advantage needs to be sacrificed to improve the financial situation. Where profitability is good but

rates are not competitive, management might consider a rate reduction to capture more of the market.

When both competitive position and profitability are poor, more drastic action is needed. In the sample case in *Exhibit 3*, the clustered nature of the problem implies that perhaps agency selection is a problem. In other cases, it might indicate an operational review via an underwriting audit or a claim audit.

For marketing purposes, these competitive and profitability indexes can also be combined with a wealth of publicly available census data to identify areas with a high concentration of target risks so that management can analyze relationships across three different dimensions.

NEW MAPS, NEW OPPORTUNITIES

In addition, existing new technology and imagery are becoming more readily available, leading to high expectations of continued rapid improvement.

This is an exciting time for the use of GIS in the insurance industry. Technological advances have helped to make the functionality available to a broader set of users. A full spectrum of options is available, from low-cost yet effective software, to higher-end systems with more sophisticated capabilities, to Web-based hybrid systems that combine ease of use and significant functionality.

The end users are not only underwriters, market strategists and claim managers, but also senior executives. And users can move from a high-level overview of problems and opportunities to location-specific information without having to rely on existing standard reports. This flexibility provides insights into important business objectives such as key drivers of catastrophe loss or areas where territories need redefining.

Once locations are geocoded in the insurer database, this rapidly evolving GIS technology is only waiting for imaginative users to create insightful maps to help manage the business and plan new opportunities.

Comments or questions may be e-mailed to david.langdon@towersperrin.com or klayton.southwood@towersperrin.com.