ArcView® Spatial Analyst

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ArcView Spatial Analyst

ArcView GIS Extensions: Easy-to-Add Capabilities

ArcView® GIS software lets users see, explore, and analyze spatial data on their desktop. Its basic mapping functionality and advanced geographic information system (GIS) capabilities allow you to create maps showing your data and integrate and see data in powerful new ways.

ArcView GIS enables you to present your work attractively. You'll find that communicating geographically is a powerful way to inform and motivate others. Working geographically enables you to understand relationships between the forces that drive your business, so you'll make better decisions and get the power you need to solve problems faster.

ArcView GIS software's extensible design makes it easy to add new capabilities when you need them. These extensions are plug-ins to ArcView GIS that you can load and unload at any time as you work. In addition to the set of extensions that come with ArcView GIS, numerous optional extensions are available.

The following diagram shows the numerous extensions for ArcView GIS. Note that some extensions are not available for all platforms.

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ArcView GIS gives you tools for visualizing, analyzing, and presenting your data. The optionally available ArcView Spatial Analyst extension to ArcView GIS provides additional analytic capabilities. These new capabilities can solve problems you encounter every day, helping you make more informed decisions, saving time and money.

To tap into this level of geographic analysis technology, users previously had to purchase high-end, professional GIS software. Now, you can integrate it into the already proven capabilities of ArcView GIS. You can perform complex analysis of geographic data from your desktop all within the intuitive, easy-to-use ArcView GIS graphic user interface.

Let's take a closer look at ArcView Spatial Analyst.

ArcView Spatial Analyst Extension

ArcView Spatial Analyst lets users

- Convert feature themes (point, line, or polygon) to grids.

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- Create raster buffers based on distance from any raster or vector feature.
- Create density maps of point features.
- Create continuous surfaces from point features.
- Create slope, aspect, hill shade, and contour from surface maps.
- Perform Boolean queries and algebraic calculations on multiple grid themes simultaneously.
- Do neighborhood and zone analysis.
- Display and reclassify grid data.
- Import data from standard formats: TIFF, BIL, Sun raster, USGS DEM, and DTED.
- Access a set of even more advanced raster analysis tools through Avenue™ software requests. Avenue is ArcView GIS software's object-oriented scripting language.

Using ArcView Spatial Analyst

Jenkins Consulting

George Jenkins is an agricultural consultant, advising farmers how to get the most crop out of their soil. Jenkins just got the results back from the lab on the soil samples he took at the Smith farm. He pulls out paper and plots the source points of these data. He writes the data next to these points. Around and between them, he'll draw lines to show roughly the varying concentrations of soil nutrients in Smith's fields. It will take hours to plot the concentration of even one of the soil nutrients he tested for. It will take days to plot them all, map out exactly where to spread each nutrient, and show just how much to buy, and determining total cost will take even longer.

With ArcView Spatial Analyst, Jenkins could do the same job faster and more accurately. He'd simply enter the tabular data he received from his chemist into his desktop and let ArcView Spatial Analyst do all this work in a matter of seconds. ArcView Spatial Analyst not only works fast, but also produces more readable maps and clearer reports. Smith will soon hold a map that clearly illustrates a thoroughly detailed report.

In the diagram below, Jenkins has shown, in tabular form, the varying concentrations of four important soil nutrients and properties: P, K, NO_3, and Ph level. The extrapolated contour lines show what levels of these nutrients need to be applied in various areas of the field.

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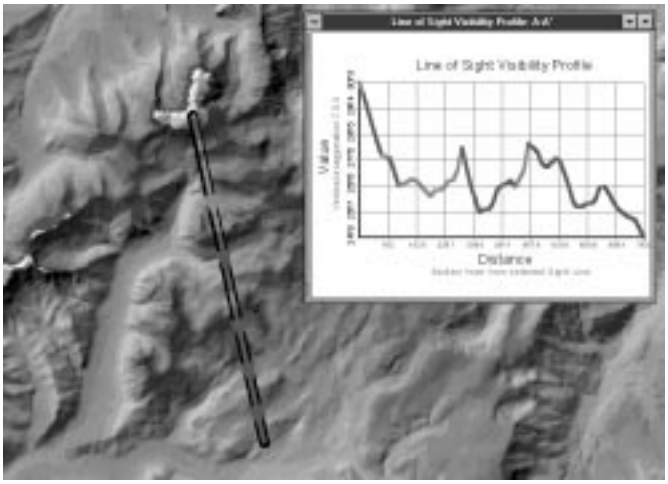
Greyback Mountain State Park

State officials have determined that Greyback Mountain State Park needs to build a new Visitor Center. Since most visitors come to this park to climb the peak and enjoy the view, park planners need to answer the question, "Can I see the new Visitor Center from the peak?" They can answer this question without leaving their offices.

They use ArcView Spatial Analyst to show a terrain relief map. Hill shading and colored elevation make the lay of the land immediately recognizable. ArcView Spatial Analyst software's visibility function shows the land visible from the peak. ArcView GIS presents the results in integrated planimetric and profile views. This analysis shows the areas not visible from the peak.



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Key Features

Brings Sophisticated Raster Data Analysis to the Desktop

ArcView Spatial Analyst adds an entirely new dimension to desktop mapping and GIS analysis by making sophisticated new spatial analysis and visualization tools easily accessible to a whole new audience through ArcView GIS. ArcView Spatial Analyst enables desktop GIS users to create, query, and analyze cell-based raster maps; derive new information from existing data; query information across multiple data layers; and fully integrate cell-based raster data with traditional vector data sources.

Cell-based raster data sets, or grids, are especially suited to representing traditional geographic phenomena that vary continuously over space, such as elevation, slope, precipitation, and so on, and can also be used to represent less traditional types of information such as population density, consumer behavior, and other demographic characteristics. Grids are also the ideal data representation for spatial modeling and analysis of flows and trends over data represented as continuous surfaces such as hydrologic modeling or the dynamics of population change over time.

The combination of these new spatial analysis and visualization tools for raster-based data with ArcView GIS software's vector-based spatial operators brings unprecedented seamless analysis, modeling, visualization, and mapping capabilities to your organization in an affordable desktop package.

ArcView Spatial Analyst provides quick access to fundamental raster data creation and modeling capabilities such as surface generation (conversion of feature themes to grid themes from your existing data sources), surface analysis (create buffers of distance from features, determine the proximity to a feature, derive density surfaces, and perform site suitability analysis), terrain modeling (slope, aspect, hill shade, watershed delineation, visibility), and contouring.

Integrating these tools directly into ArcView GIS software's graphic user interface means that users can quickly and easily leverage these key spatial operations with just a few mouse clicks.

Additional capabilities available through the standard user interface include queries on multiple grid themes, neighborhood and zone analysis, grid classification and display, summary histograms, and more.

Integrate

ArcView Spatial Analyst integrates all your data together allowing interaction between data of all types. Images, elevation models, and other raster surfaces can be combined with all of ArcView GIS software's map data, expanding the power of your data.

ArcView Spatial Analyst lets you do integrated raster–vector theme analysis such as aggregating properties of a raster data theme based on an overlaid vector data theme. For instance, regional or national maps showing the mean or the maximum precipitation for states or counties could be created by overlaying state or county boundary lines on a raster precipitation map.

ArcView Spatial Analyst can create a raster data source from any point, line, or polygon feature source (including computer-aided design [CAD] data sources supported by

ArcView GIS), or import data from standard formats including TIFF, BIL, Sun raster, USGS DEM, DTED, and others.

Visualize

ArcView Spatial Analyst is not just high powered analysis and modeling; it allows you to visualize your data as never before. Combined with ArcView GIS software's powerful legend editor, you can classify your data as you need to create stunning visual displays. ArcView Spatial Analyst allows you to create a hill shade grid that provides you with a shaded surface representation of your data. If you combine this shaded surface with other data, using the innovative Brightness Theme you can create stunning realistic images across surfaces.

The distribution of information and the pattern within this information is often very important. Histograms have long been used to evaluate data and patterns, and ArcView Spatial Analyst allows you to create histograms from your grids either from selected features or from interactively defined graphic shapes.

Analyze and Solve

Ranging from simple display and query to complex topographic modeling, ArcView Spatial Analyst has the functions to analyze and solve your problems.

A key component of ArcView Spatial Analyst is the ability to perform queries across grids, allowing you to ask questions that span multiple data types and levels of information (e.g., what areas are zoned for residential development and have a high water table on a steep slope >15 percent?). This gives you the ability to leverage existing data to make more informed decisions.

Your data may frequently be available for point locations, and you may need to interpolate a continuous grid through these points. ArcView Spatial Analyst includes a robust set of spatial interpolation functions allowing you to generate results for areas of missing data (e.g., you can use your global positioning system [GPS] points to interpolate an elevation surface).

Sometimes you need aggregated information across a surface. ArcView Spatial Analyst provides the ability to generate a density grid across an area where the value of each cell is the result of a units-per-specified-area calculation. This could be population density per square mile or grasshopper infestations per square kilometer. Density grids can be used as weights for modeling, such as business models or pesticide models, to best make use of your limited resources.

Once you have either opened or generated a grid you can explore the data in a more conventional manner using the contour functionality. You can generate contours by interactively picking locations on the screen or by asking ArcView Spatial Analyst to generate a set of contours at a specified interval.

Contours are useful in showing topographic relief across a surface. However, sometimes you need more detailed information about a grid such as the topographic attributes. Topographic attributes are often very important to agriculture and natural resource applications. Many natural and human processes are dependent on functions of these variables such as slope, aspect, curvature, and stream flow.

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You can use both attributes and location to solve your problems with ArcView Spatial Analyst. One application of this concept is to use the distance and proximity functions to ask questions concerning how far something is and to generate allocated areas. You can also use the least-cost-path function to find the best path between two locations based on values from multiple grids.

Using ArcView Spatial Analyst you can use statistics to drive your models and generate your information. Statistics can be generated on the local level (e.g., mean rainfall at a given spot), for a given area (mean rainfall in the lodgepole forest), or on a neighborhood level (smooth anomalies by filtering the rainfall amount by replacing each value with the mean value within 5 miles of it).

Additional functions are available to perform more operations on grids. These include such things as reclassification and transforming grids.

Customize

ArcView Spatial Analyst also includes an extensive suite of more advanced raster analysis tools that can be accessed through Avenue. Developers will be able to deliver very sophisticated spatial analysis applications based on these extended capabilities.

Technical Specifications

Designed for Power

- True 32-bit architecture.
- Multiplatform design for portability (Windows [NT and 95] and UNIX).

Integrate Data

- Use existing ArcView GIS features directly.
- Import data from across the office or across the Web (USGS DEMs, DTED, ASCII, or binary).

Create Data

- Interpolate a continuous surface from point measurements using kriging, inverse distance weighting, spline, or trend surface.
- Determine the density per unit area using existing data.
- Calculate the Euclidean distance from any feature.
- Find the closest feature for any location.
- Derive the least-cost path between locations using a series of grids as cost surfaces.

Contour Data

- Interactively point and click to generate contours on the fly.
- Specify a contour interval for automatic contour generation from any grid.

Visualize

- Create shaded relief images.
- Use histograms to explore relationships.
- Generate profiles across your data.
- Use brightness themes to add another dimension.
- Classify using ArcView GIS software's standard legend interface.

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Calculate New Information

- Build arithmetic expressions with a grid or between grids.
- Use multiple grids as input to complex equations.
- Perform cross-tabulation between grids.

Model Topographic Surface Attributes

- Find the aspect direction for any location.
- Calculate the surface curvature for modeling input.
- Model the steepness of landscapes using slope.
- Determine the visibility to or from a location.

Answer Questions with Statistics

- Calculate a local statistic for each location from multiple grids.
- Find the statistics within a zone.
- Model an area of cells using neighborhood statistics.

Examine Hydrology

- Derive watershed boundaries.
- Model stream flow.
- Investigate accumulation.

Transform Data

- Merge data together into a single data set.
- Shift grids in all directions.
- Warp grids to fit specified dimensions.

Customize the Answers

- Reclassify grids into your units.
- Extract data to new files based on location or value.
- Select data for analysis.
- Identify a location.
- Set a working environment.

ArcView Spatial Analyst and ARC GRID

Because ArcView Spatial Analyst is fully integrated with the ArcView GIS environment, it is very easy to use. Display and query of data is simple. Commonly used functions have been provided in ArcView Spatial Analyst graphical interface. Selecting reclassifications, symbolsets, color palettes, and so forth, is easy, especially for those already familiar with the ArcView GIS legend editor. With ArcView Spatial Analyst, you get an annotated legend with every display. Composite displays of two grids are easy to do.

ArcView Spatial Analyst raster–vector integration is the most advanced technology available. Wherever possible and sensible, ArcView Spatial Analyst will take vector data as input to raster modeling functions. No longer do you need to convert your vector data to raster in order to use them in a raster function. ArcView GIS software's selected set applies to ArcView Spatial Analyst functions that take vector data as input. For example, ArcView Spatial Analyst has interactive data exploration tools to display and query cells and their attributes in a table or draw histograms of data distribution within selected features or interactively defined shapes. (ArcView Spatial Analyst allows you to select a vector polygon and draw a histogram of the distribution of cell values within the polygon.)

ARC GRID™ software on the other hand, is a complete raster modeling and analysis extension package to ESRI's ARC/INFO® professional GIS software. ArcView Spatial

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Analyst is a subset of the ARC GRID™ software package, integrated with ArcView GIS and packaged with an easy-to-use graphic user interface.

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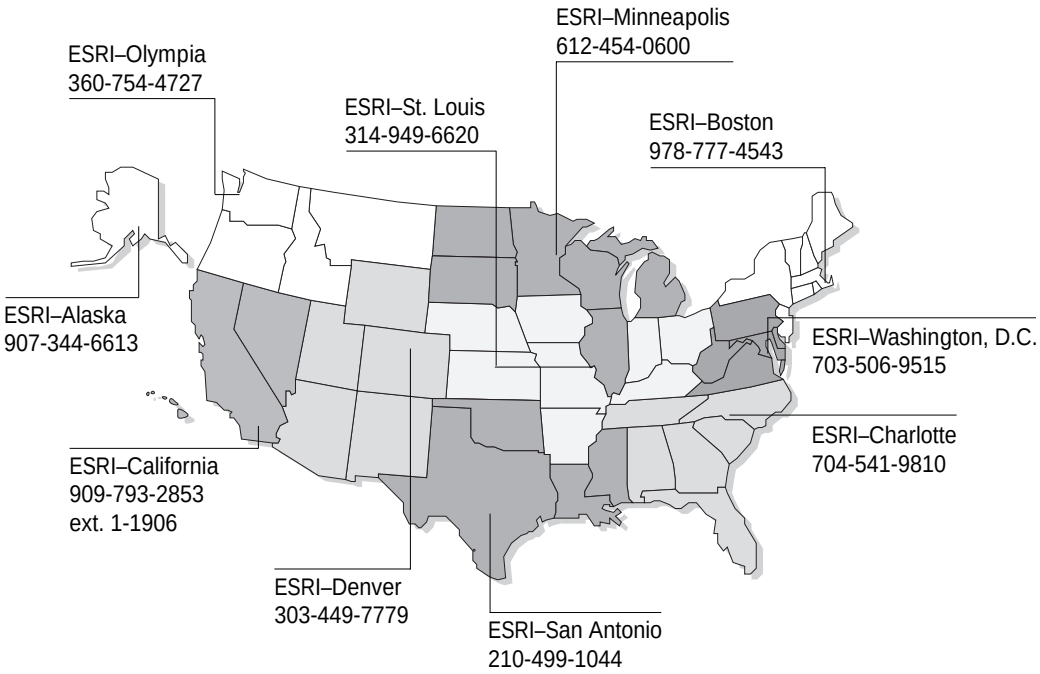

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