



# ArcView Spatial Analyst

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## An ESRI White Paper

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# ArcView Spatial Analyst

## Introduction

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

ArcView GIS enables you to present your work attractively. You will discover 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 can make better decisions and get the power you need to solve problems faster.

## ArcView GIS Extensions

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 table shows the numerous extensions for ArcView GIS. There are also hundreds of ESRI Business Partner extensions available and the option to create your own extensions. Note that some extensions are not available for all platforms.

Optional Extensions	Extensions Bundled with ArcView GIS
<ul style="list-style-type: none"> <li>■ ArcView Spatial Analyst</li> <li>■ ArcView 3D Analyst™</li> <li>■ ArcView Image Analysis</li> <li>■ ArcView Tracking Analyst</li> <li>■ ArcView Business Analyst</li> <li>■ ArcView Network Analyst</li> <li>■ ArcView StreetMap™</li> <li>■ ArcView StreetMap 2000</li> <li>■ ArcPress™</li> </ul>	<ul style="list-style-type: none"> <li>■ CAD Reader</li> <li>■ Database Access</li> <li>■ Dialog Designer</li> <li>■ DIGEST (ASRP/USRP)</li> <li>■ Digitizer</li> <li>■ DXF Export</li> <li>■ GeoProcessing</li> <li>■ Graticules and Measured Grids</li> <li>■ Image Readers</li> <li>■ Legend Tool</li> <li>■ MGRS Coordinate Display</li> <li>■ Military Data Reader</li> <li>■ Projection Utility</li> <li>■ Report Writer</li> <li>■ RPF Indexer</li> <li>■ S-57 Data Converter</li> <li>■ SDTS Data Import</li> <li>■ VPF Viewer</li> </ul>

## ArcView Spatial Analyst

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. With ArcView Spatial Analyst, you can perform powerful spatial modeling and complex analysis of geographic data from your desktop all within the intuitive, easy-to-use ArcView GIS graphic user interface.

The ArcView Spatial Analyst extension allows you to create, query, map, and analyze cell-based raster data and to perform integrated vector–raster analysis. The ArcView Spatial Analyst extension for Windows also includes ModelBuilder™ technology for building and sharing spatial models.

ArcView Spatial Analyst lets users

- Create and manage automated and self-documenting spatial models using ModelBuilder.
- Convert feature themes (point, line, or polygon) to grids.
- 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, JPEG, BMP, SunRaster, USGS DEM, DTM, NIMA DTED, generic ASCII, MrSID, and others.
- Access a set of even more advanced raster analysis tools through Avenue™ software requests. Avenue is ArcView GIS software's object-oriented scripting language.

## Key Features

ArcView Spatial Analyst adds an entirely new dimension to desktop mapping and GIS analysis by making sophisticated spatial analysis and visualization tools easily accessible to a large 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; fully integrate cell-based raster data with traditional vector data sources; and create sophisticated spatial models using ModelBuilder.

## Brings Sophisticated Raster Data Analysis to the Desktop

Cell-based raster data sets, or grids, are especially suited to representing traditional geographic phenomena that vary continuously over space, such as elevation, slope, and precipitation, 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 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 Your Data

ArcView Spatial Analyst integrates your data enabling 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, JPEG, BMP, SunRaster, USGS DEM, DTM, NIMA DTED, generic ASCII, MrSID, and others.

## Visualize Your Data

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 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 Your Data Problems

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.

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.

## Create Spatial Models Using ModelBuilder

ModelBuilder is a tool in ArcView Spatial Analyst that helps you build, manage, and automate spatial models for geographic areas. A model is a set of spatial processes that converts input data into an output map in ArcView GIS using a specific function such as buffer or overlay. Without ModelBuilder, the management of models and of the data supporting them can be difficult.

A sophisticated model contains a number of interrelated processes. The input data, function, and derived data together constitute a complete process. Processes are defined by the type of function they perform, that is, converting vector data to raster format, deriving slope from elevation, and so on. At any time, you may add new processes, delete existing processes, or change the relationships among processes. In addition, you may replace old data sets with newer ones, change assumptions or model parameters, and consider alternative scenarios in which input factors are prioritized differently.

















