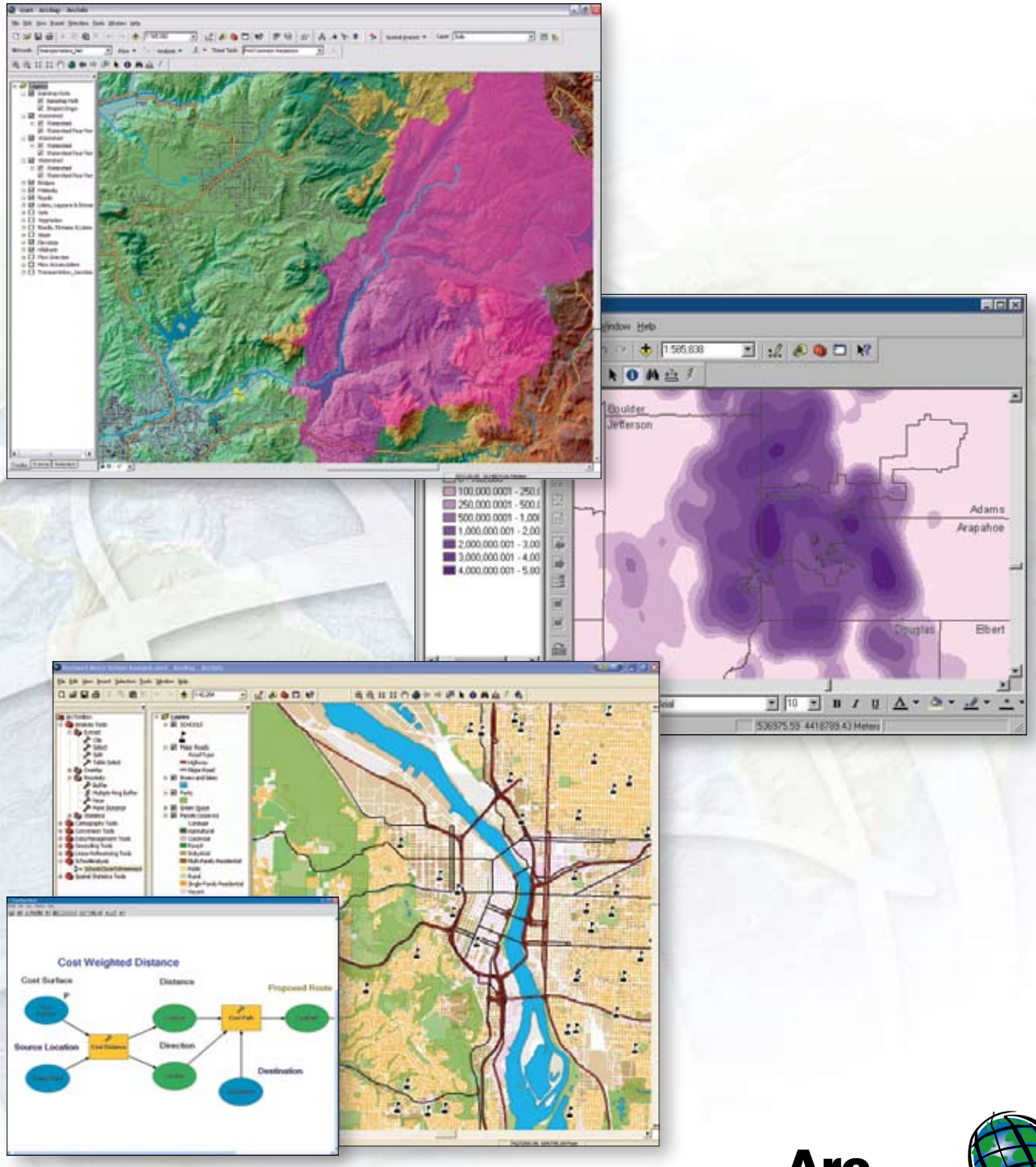
ArcGIS® Spatial Analyst

Advanced Raster Spatial Analysis



ArcGIS™ ESRI

ESRI®

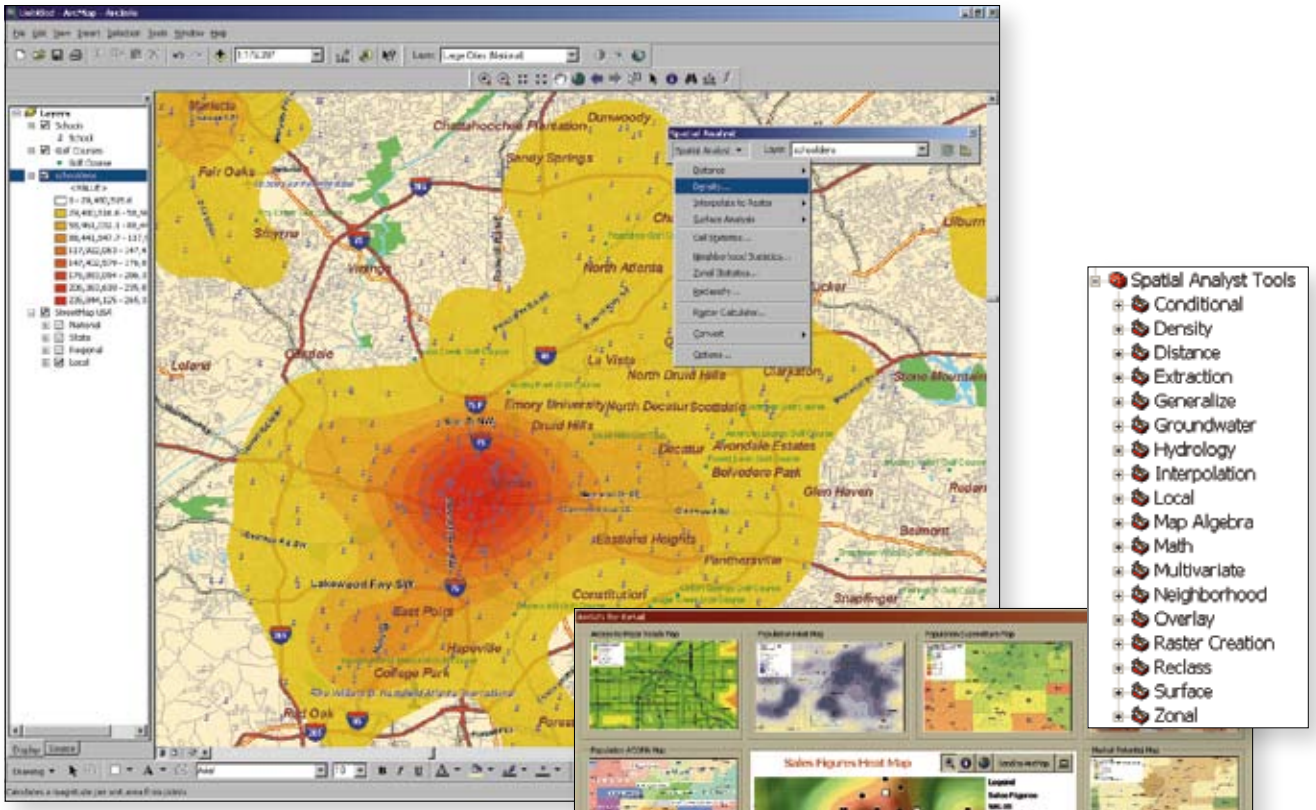
ArcGIS® Spatial Analyst

Advanced Raster Spatial Analysis

ArcGIS® Spatial Analyst, an optional extension to ArcGIS Desktop (ArcInfo®, ArcEditor™, and ArcView®), provides powerful tools for comprehensive, raster-based spatial analysis. With ArcGIS Spatial Analyst, users can employ a wide range of data formats to combine datasets, interpret new data, and perform complex raster operations such as terrain analysis, surface modeling, surface interpolation, hydrologic analysis, statistical analysis, and much more.

Through its simple yet powerful interface, ArcGIS Spatial Analyst provides an integrated environment within ArcGIS Desktop for doing advanced raster analysis. ArcGIS Spatial Analyst software's strong integration with the ArcGIS Desktop geoprocessing environment allows users to create and implement analysis models quickly and easily. These models are self-documenting and can be saved so others can understand the spatial analysis process applied and "What if" scenarios can be easily executed and results compared.

Users of ArcGIS Spatial Analyst include those who need to build complex site location analysis models as well as those users who are interested in conducting terrain and visibility modeling or who want to perform density mapping, overlay, distance analysis, or interpolation. Typical uses of ArcGIS Spatial Analyst include digital elevation model (DEM) generation, crime and population density mapping, surface runoff modeling, wildland modeling, site location analysis, and more.



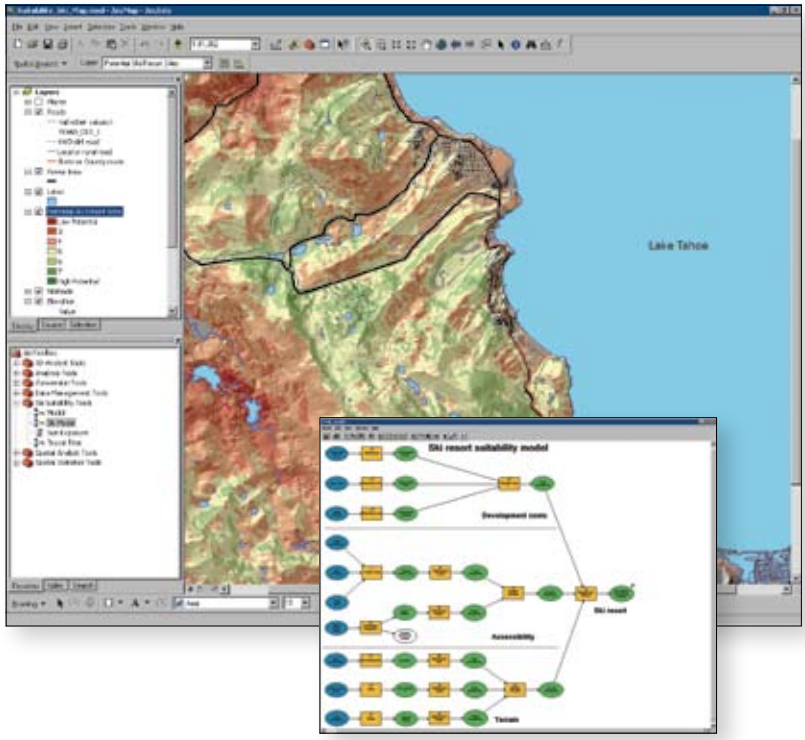
Density Analysis

Retail Model

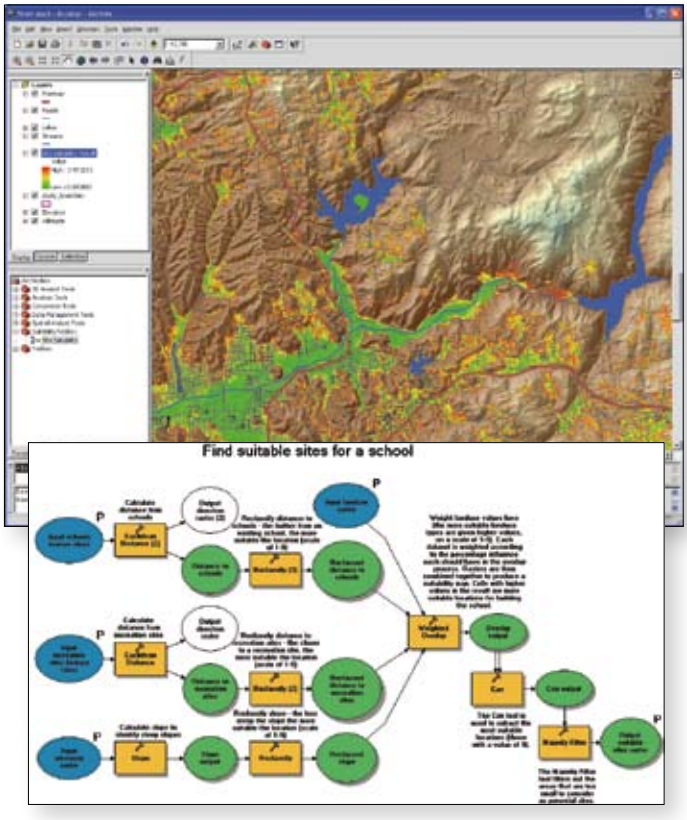
Key Features

With ArcGIS Spatial Analyst, You Can

- Create, query, map, and analyze cell-based raster data.
- Derive additional information about your data.
- Create surfaces using interpolation tools such as IDW, Spline, and Kriging.
- Perform statistical analysis based on local environment, small neighborhoods, or predetermined zones.
- Calculate complex terrain attributes.
- Find suitable locations based on multiple attributes.
- Perform distance and cost-of-travel analysis.
- Clean up data to prepare it for further analysis or display.



Ski Resort Suitability Model



School Site Suitability Model

ArcGIS Spatial Analyst Is Used To

- Perform terrain analysis.
- Find the best store location.
- Perform land use analysis.
- Predict fire risk.
- Analyze transportation corridors.
- Determine pollution levels.
- Perform crop yield analysis.
- Determine erosion potential.
- Compute distance to streams or roads.
- Determine areas of high value.
- Perform demographic analysis.
- Conduct risk assessments.
- Model and visualize crime patterns.
- Analyze customer behavior.

Requirements

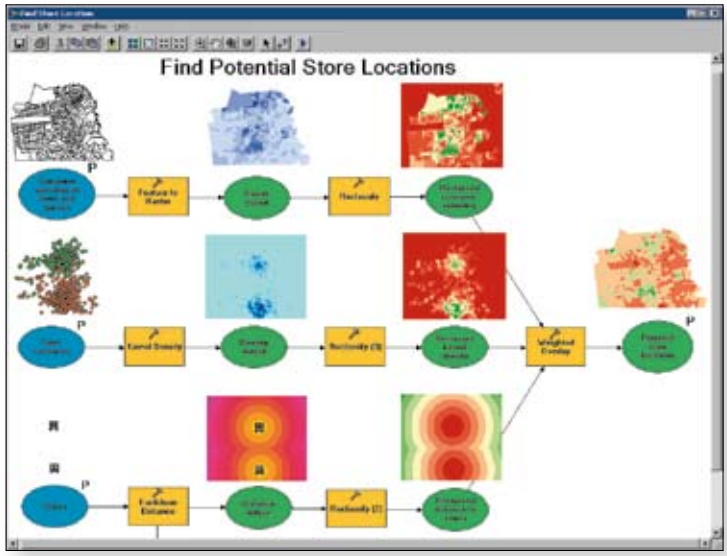
ArcGIS Spatial Analyst requires ArcInfo, ArcEditor, or ArcView.

ArcGIS Spatial Analyst

Advanced Raster Spatial Analysis

Modeling and Analysis

ArcGIS Spatial Analyst is fully integrated with ArcGIS Desktop and provides more than 150 tools and functions that users can access in the same environment as the more than 200 other ArcGIS Desktop tools. This allows users to conduct analysis and modeling tasks via ModelBuilder™, scripts, dialog boxes, and the command line without having to change environments between processes.



Site Selection Modeling

Suitability Modeling

A suitability model typically answers the question, "Where is the best location?"—whether it involves finding the best location for a new road or pipeline, a new housing development, or a retail store. For instance, a commercial developer building a new retail store may take into consideration distance to major highways and any competitors' stores, then combine the results with land use, population density, and consumer spending data to decide on the best location for that store. ArcGIS Spatial Analyst derives new information from the overlay of multiple layers, which can then be used to suggest possible answers to the original question, "Where is the best location?"

Surface Creation

Spatial interpolation is used to take known values and interpolate them into a surface, deriving new estimated surface values. ArcGIS Spatial Analyst uses Inverse Distance Weighted (IDW), Kriging, Spline Polynomial Trend, and Natural Neighbor interpolation methods to estimate elevation, rainfall, temperature, chemical dispersion, or other spatially continuous phenomena. Using these methods, users can create surfaces from sampled locations without having to visit every location of a study area, saving time and effort. For example, users can measure phenomenon, such as rainfall, at strategic locations in order to derive a surface. Some interpolation methods also allow the use of barriers, such as streams or faults, to realistically constrain the interpolation.

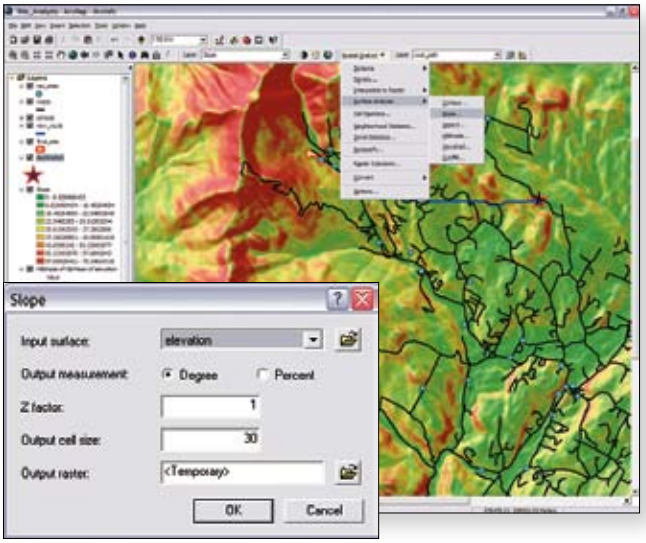
Functions in ArcGIS Spatial Analyst can also derive density surfaces of demographic and other business data for analysis of households and neighborhoods, or distance-based surfaces of travel influences to retail locations and service centers. Derived surfaces can be visualized to provide insights into consumer behavior, store performance, crime analysis, and many other types of business and economic development analysis.

More than 150 Spatial Analyst Tools

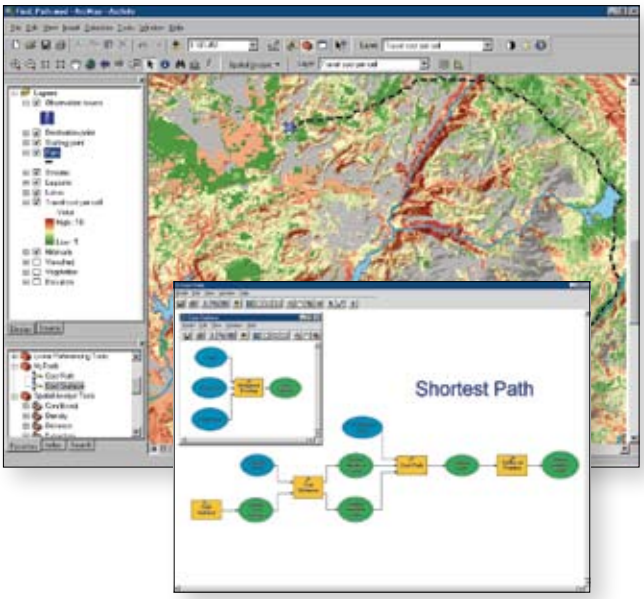
Dynamic Modeling and Advanced Visualization

Surface Analysis

With ArcGIS Spatial Analyst, users can build and analyze complex surfaces to identify patterns or features within the data. Many patterns that are not readily apparent in the original data can be derived from the existing surface. These include contours, angle of slope, aspect, hillshade, viewshed, curvature, cut/fill, and solar radiation modeling.



Slope Analysis



Cost Path Model

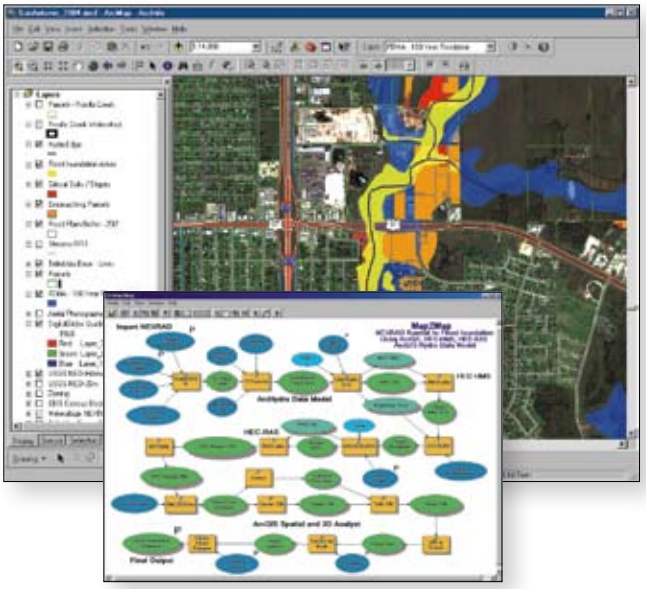
Distance Analysis

Calculating the accumulated cost of traveling, or mapping distance, can provide the user with additional data from which to make decisions. ArcGIS Spatial Analyst provides several distance mapping tools for measuring both straight-line (Euclidean) distance and distance measured in terms of other factors such as slope, current road infrastructure, and land use. With ArcGIS Spatial Analyst, users can also calculate cost-weighted distance, least-cost path, and shortest path distance.

Hydrologic Analysis

ArcGIS Spatial Analyst contains specialized tools for working with and deriving new information from hydrologic and landscape data. Its toolset includes methods for describing hydrologic characteristics and tools to calculate flow across an elevation surface and derive features such as watersheds and stream networks.

With these specialized hydrologic tools and models, hydrologists can analyze temporal changes in the sedimentary process for a given terrain or build a flood forecasting model to find areas subject to flooding during a storm, then use the resulting flood map to identify affected parcels.



Flood Inundation Model

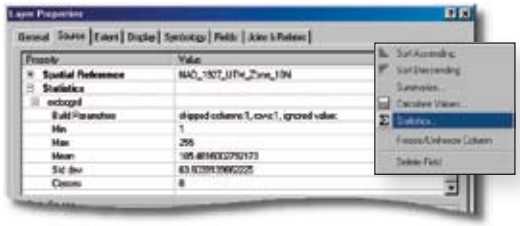
Evaluate ArcGIS Spatial Analyst today: www.esri.com/spatialanalyst

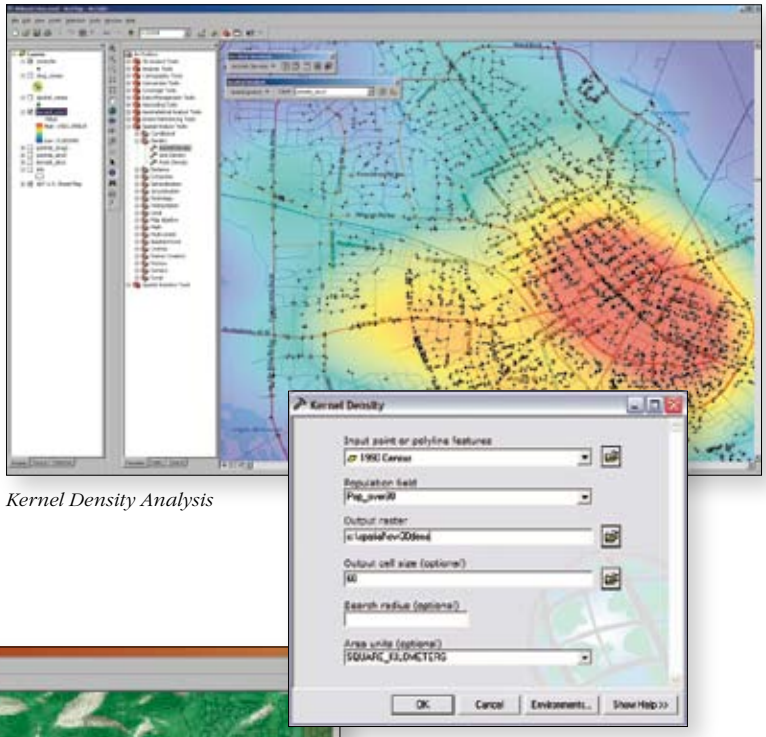
Statistical Analysis Tools

Statistics

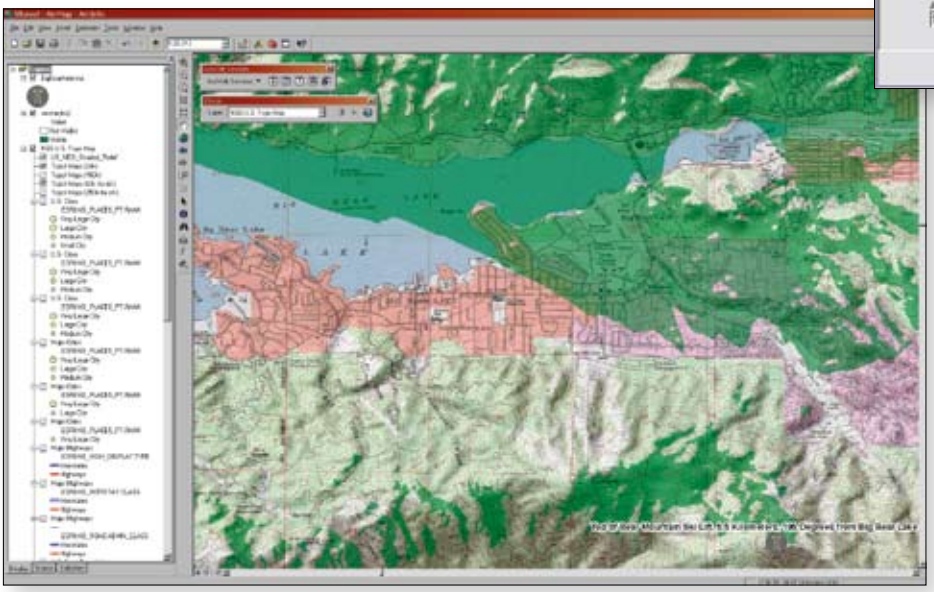
ArcGIS Spatial Analyst includes a number of statistical techniques that users can apply to the modeling of their spatial data.

Cell Statistics are used to calculate a statistic between multiple rasters, for instance, to analyze a certain phenomenon over time such as the average crop yield over a certain time period or the range of temperatures between years.





Kernel Density Analysis

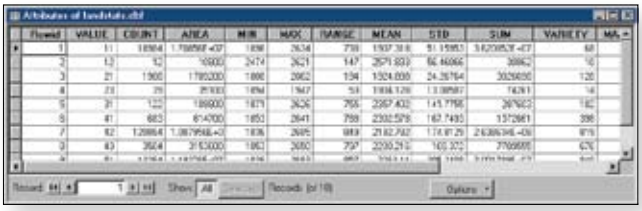


Viewshed Analysis of Antenna Point

Neighborhood Statistics calculate a statistic for each cell based on the value of that cell and the values in a neighborhood specified by the user. For example, by using neighborhood-based statistics, users can find the most dominant species in a neighborhood or see how many species are located in each neighborhood.

Users can also define custom neighborhoods for image processing filters such as high-pass or edge detection filters.

Multivariate Statistics allow exploration of relationships between many different data layers or types of attributes. These tools can be used for traditional image processing applications, such as transforming a multispectral image into a categorized land cover map displaying forest types, urban areas, and agricultural use, as well as for other statistical analysis of multivariate data such as terrain stratification or demographic analysis.

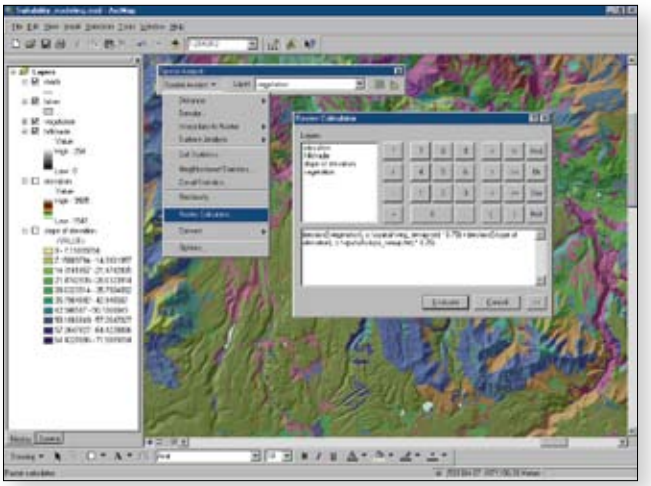


Zonal Statistics calculate a statistic for each zone of a zone dataset (all cells in a raster that have the same value) based on values from another dataset, for example, calculating the mean elevation for each forest zone or the total number of accidents along each street of a town.

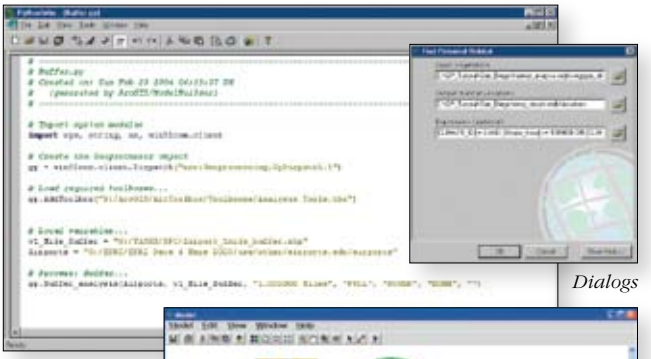
Data and Customization

Map Algebra

Map Algebra is the analysis language for ArcGIS Spatial Analyst and provides an easy-to-use and powerful way to define geographic analysis as algebraic expressions. This allows users to take their real-world data and apply algebraic functions to derive new results. For example, a single expression can be constructed to find the combined value of two datasets [(Raster1)+(Raster2)]. These algebraic expressions can be simple arithmetic expressions or can consist of complex spatial and algebraic functions.

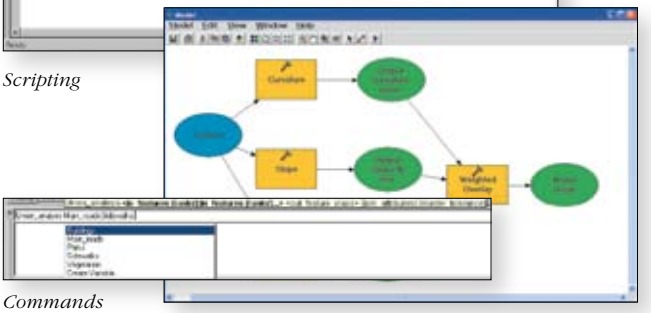


Raster Calculator



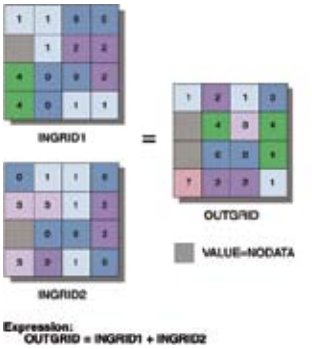
Dialogs

Scripting



Commands

ModelBuilder



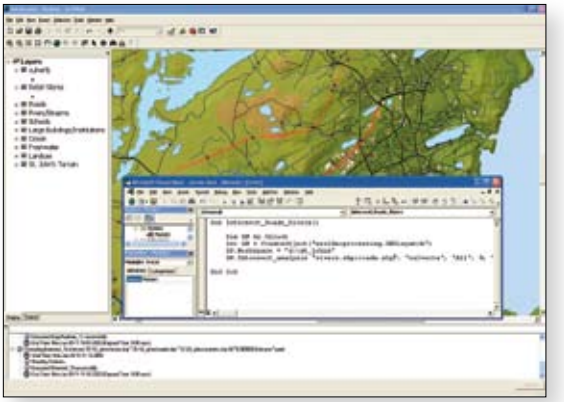
Supported Data Formats

ArcGIS Spatial Analyst works with all of the ArcGIS standard data formats. These include coverages, shapefiles, geodatabase features, computer-aided design (CAD) files, vector product format (VPF) files, United States Geological Survey (USGS) DEM data, Digital Terrain Elevation Data (DTED), and many more image formats. In addition to supporting many vector and raster data formats, ArcGIS Spatial Analyst allows for easy conversion between data types.

Customization Options

ArcGIS Spatial Analyst expands the standard ArcGIS customization framework with additional functions. With standard ArcGIS tools, users can build new geoprocessing functions or create custom tools and models for specific spatial analysis using common programming and scripting languages such as Visual Basic (VB), .NET, C++, Java, Python, and more. Once created, custom tools and models can be incorporated directly into the ArcGIS interface and shared. Customization capabilities include

- User-defined analysis functions
- User-created DLL or EXE files
- Support for new data formats



ArcObjects™ VB, C++, C#, .NET, Java

For more information on ArcGIS Spatial Analyst or to request an evaluation copy, please visit

www.esri.com/spatialanalyst

ESRI
380 New York Street
Redlands, California
92373-8100 USA

Phone: 909-793-2853
Fax: 909-793-5953
E-mail: info@esri.com

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.

For More Information

1-800-GIS-XPRT (1-800-447-9778)

www.esri.com

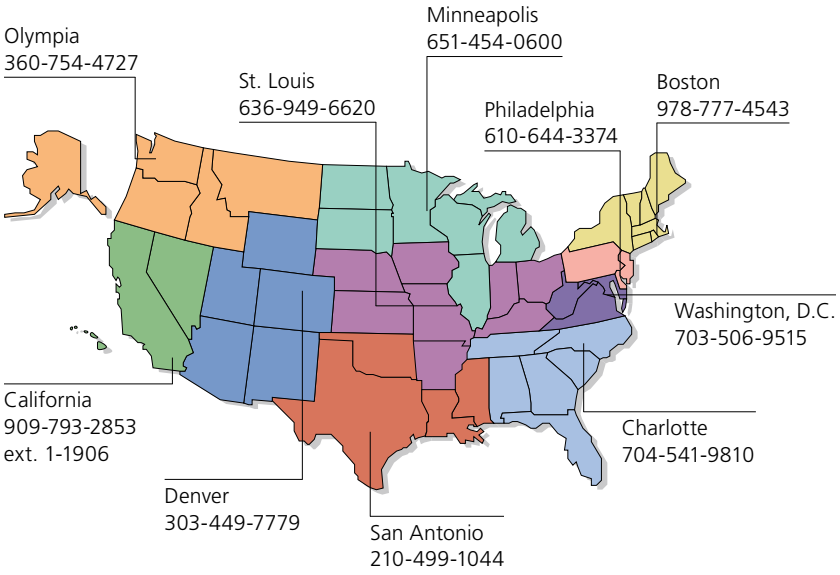
Locate an ESRI value-added reseller near you at

www.esri.com/resellers

Outside the United States, contact your local ESRI distributor. For the number of your distributor, call ESRI at 909-793-2853, ext. 1-1235, or visit our Web site at

www.esri.com/distributors

ESRI Regional Offices



ESRI International Offices

Australia
www.esriaustralia.com.au

Belgium/Luxembourg
www.esribelux.com

Bulgaria
www.esribulgaria.com

Canada
www.esricanada.com

Chile
www.esri-chile.com

China (Beijing)
www.esrichina-bj.cn

China (Hong Kong)
www.esrichina-hk.com

Finland
www.esri-finland.com

France
www.esrifrance.fr

Germany/Switzerland
www.esri-germany.de
www.esri-suisse.ch

Hungary
www.esrihu.hu

India
www.esriindia.com

Indonesia
www.esrisa.com.my

Italy
www.esriitalia.it

Japan
www.esrij.com

Korea
www.esrikr.co.kr

Malaysia
www.esrisa.com.my

Netherlands
www.esrinl.com

Northeast Africa
202-516-7485

Poland
www.esripolska.com.pl

Portugal
www.esri-portugal.pt

Romania
www.esriro.ro

Singapore
www.esrisa.com

Spain
www.esri-es.com

Sweden
www.esri-sweden.com

Thailand
www.esrith.com

United Kingdom
www.esriuk.com

Venezuela
www.esriven.com

GSA Federal Supply Schedule
No. GS-35F-5086H

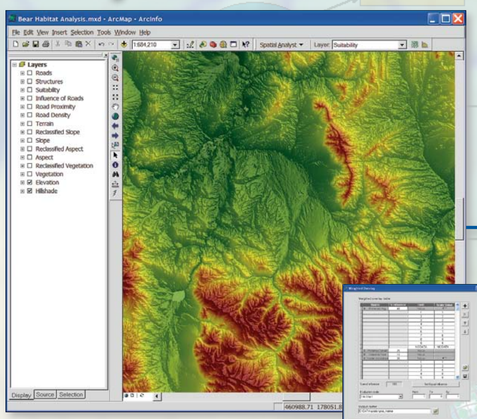
98215
12/06sp

Printed in USA

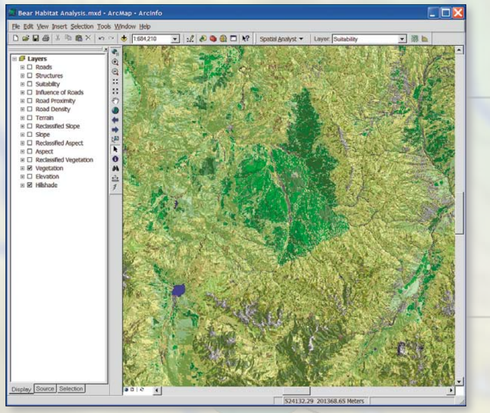
ArcGIS® Spatial Analyst

Habitat Suitability Analysis

Input Sources

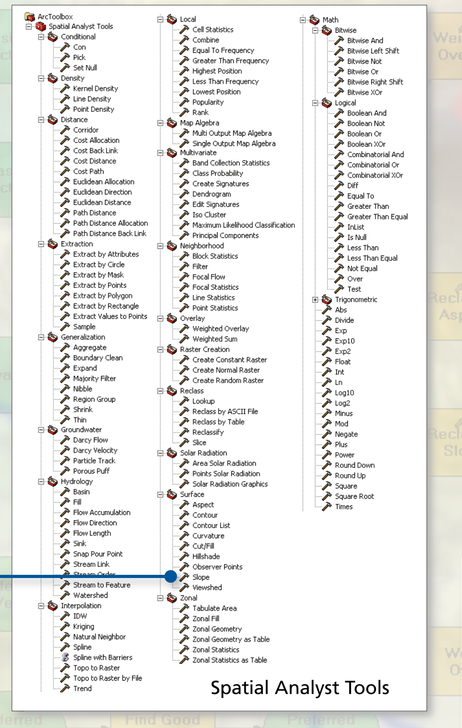


Elevation

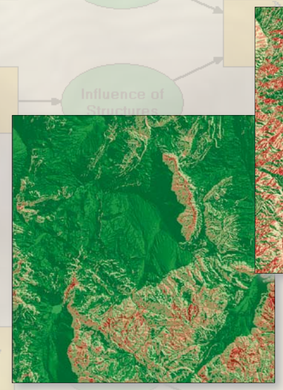


Vegetation

Tools and Processes

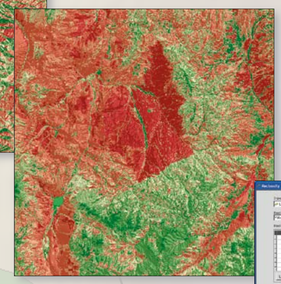


Spatial Analyst Tools

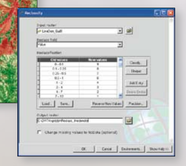


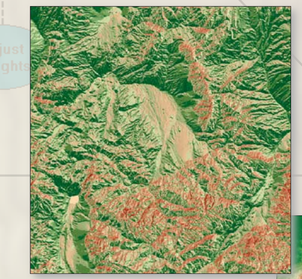
Reclassified Slope (optimal)

Reclassified Aspect (optimal)

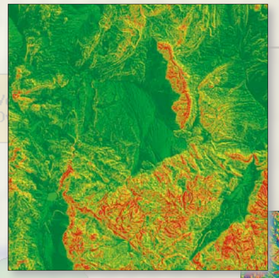


Preferred Vegetation

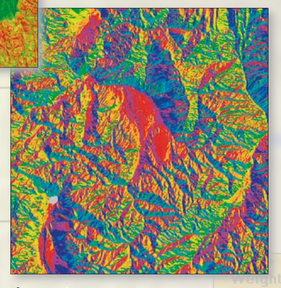




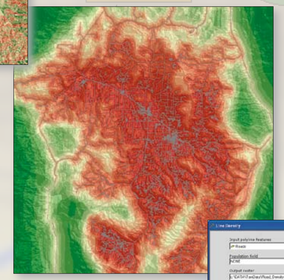
Preferred Terrain



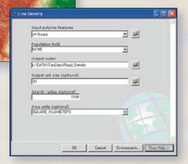
Slope

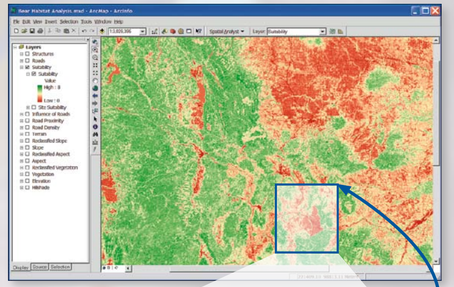


Aspect

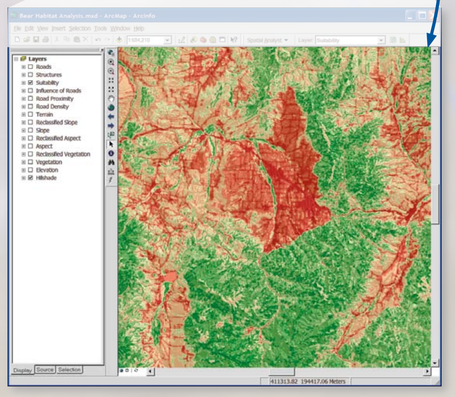


Reclassified Road Density

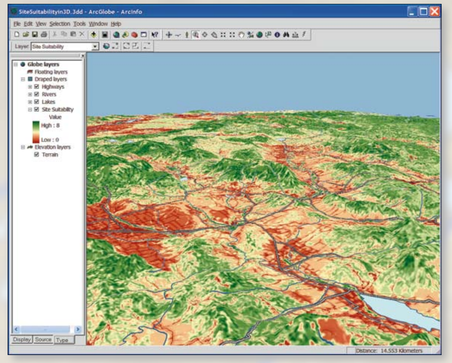




Final Grizzly Bear Habitat Suitability Map



Enlarged View of Habitat Suitability Area Map



3D Perspective View of Habitat Suitability Map

ArcGIS Spatial Analyst

The following extensions work with ArcGIS Spatial Analyst

- ArcGIS 3D Analyst™
- ArcGIS Geostatistical Analyst
- ArcGIS Network Analyst
- ArcGIS Data Interoperability
- ArcGIS Publisher

- Create, query, map, and analyze cell-based raster data.
- Derive additional information about your data.
- Find suitable locations based on multiple attributes.
- Calculate complex terrain attributes.
- Perform distance and cost of travel analyses.
- Create surfaces using interpolation tools (IDW, Spline, Kriging).

This poster illustrates the common use of ArcGIS® Spatial Analyst to find suitable locations by ranking a landscape into categories of high and low desirability via a process known as weighted overlay modeling.

In this example, suitability or site selection modeling was used to find a suitable habitat for grizzly bears. The same process can be applied to many other types of spatial problems such as finding the best location for a new store, deciding where to purchase a home, or determining the best route for a proposed road.

Applying analysis tools to input data creates new information such as density of roads or slope of a DEM. Combining different data, such as density in units of roads per square kilometer and slope in units of degrees, requires a common measurement scale to assess the likelihood that a grizzly bear would prefer a particular location.

These derived datasets are reclassified into categories of interest to the problem being solved. We know bears prefer to be away from roads, so data is reclassified into several categories of varying road density and proximity.

Using the Weighted Overlay tool, weights are assigned to each category for each dataset representing bear habitat suitability. Vegetation types such as white bark pine, moist grasses, and berry patches are assigned a "most preferred" weight value of 9, and areas with very dense roads are assigned a "least preferred" weight value of 1. In addition, the Weighted Overlay tool is also used to assign a percentage of influence to each input dataset. For example, vegetation can be assigned higher importance than proximity to roads.

With the powerful Weighted Overlay tool, parameters of a suitability model such as this can be easily set and changed in a single dialog window, allowing the user to test many different scenarios.

Data and modeling guidelines are provided courtesy of the Craighead Environmental Research Institute (www.grizzlybear.org).

ArcGIS Spatial Analyst

To request an evaluation copy, please visit

www.esri.com/spatialanalyst

ESRI®