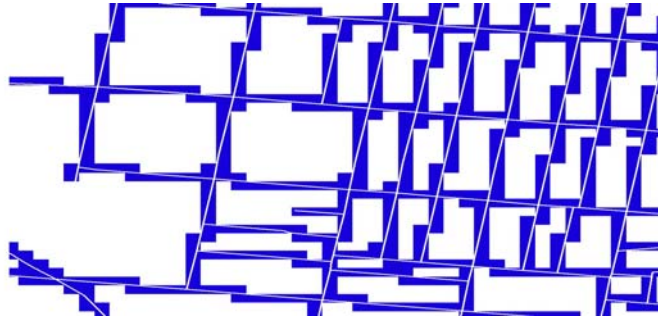


Beyond The Vector Data Model



Introduction

- **Collecting, Managing, and Analyzing Data**
- **The Raster World**
- **Adding Functionality with Spatial Analyst**
- **Managing Grid Themes**
- **Introduction to Lab 6**

Vector Data Model (ArcView)

Models boundaries of feature data

Vector feature types include points, lines, and polygons

Vector data formats include *.shp, *.shx, and *.dbf

Files are easily moved and copied

Demonstration #1

ArcView using vector data model (points = crime events, lines = streets, and polygons = public school parcels)

Point, Polyline, Polygon

Corresponding Files

<i>*.shp (required)</i>	Stores the feature geometry
<i>*.shx (required)</i>	Stores the index of the feature geometry
<i>*.dbf (required)</i>	Stores the attribute information features
<i>*.sbn and *.shx (optional)</i>	Stores the spatial index of features

*(Note: adding a shape that has a corresponding *.avl file)*

A quick look at functionality that comes with ArcView

How to load and unload extensions

Adding functionality to your ArcView session

In the Project Window --- Help, Help Topics, Extensions, Spatial Analyst

What is Spatial Analysis?

Approach used to answer complex geographic questions by **evaluating** suitability, **predicting** and **interpreting** patterns.

Spatial modeling involves analytical procedures to abstract and **simplify complex systems**. We will use geographic data to describe, simulate, or predict real-world problems or systems.

There is more than one answer, and our role is to compare **alternative solutions**.

ArcView's Spatial Analyst

The software provides several tools to perform **spatial queries using grids**: overlay analysis, surface analysis like distance, proximity, density, slope, aspect, hillshade, viewshed, and contours.

Vector Vs Raster Data Models

There are two spatial models for storing geographic data - the vector data model and the raster data model.

(Note: A surface can also be represented as a TIN - triangulated irregular network. TIN is a vector model that can represent continuous surfaces as a series of linked triangles. While Spatial Analyst does not support TIN datasets, ArcView 3D Analyst does.)

VECTOR	RASTER
Data stored as (x, y) coordinates	Data stored as cell values

Defines boundaries	No boundaries
Feature shape is accurate	Feature shape is generalized

Spatial Analyst allows the user to integrate vector and raster themes.

RASTER DATA MODEL CREDO

- Earth is treated as one continuous surface
- Each location is represented as a cell
- Cells are organized into a matrix of rows and columns called a grid
- Each grid contains cells that represent some kind of geographic phenomenon

EXAMPLES (OF THE RASTER DATA MODEL)

- Information from satellites

- Scanned data
- Aerial photographs
- Other forms of image data where each pixel (grid cell) has a value

What is a Grid Theme?

A grid divides geographic space into uniform blocks or cells

Every cell represents a portion of the earth (square kilometer, square meter, etc.)

Each cell has a value that describes its location

The grid theme is the [primary data source used by Spatial Analyst](#)

Spatial Analyst stores raster themes as directories in the ARC GRID format

Uniform structure important when combining or comparing data types

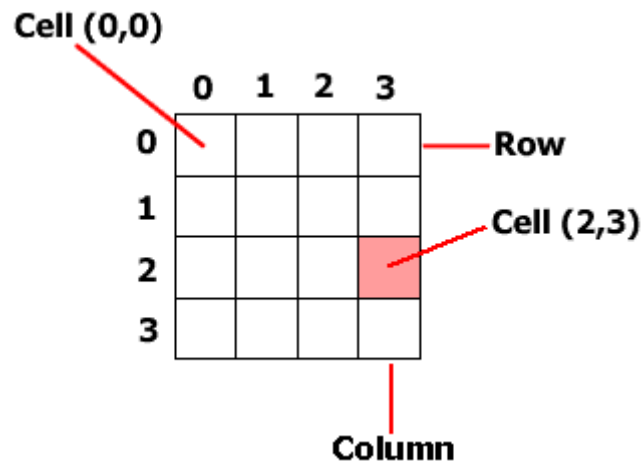
(Note: Grid themes with integer values have a theme table, value attribute table that store the codes and categories. In a floating point grid theme, each cell stores a value that represents a measure of geographic phenomena have no theme table.)

What is a Cell?

Cell is the basic spatial unit for a grid theme

CELL CREDO

- Cells are squares (equal height and width)
- User defines cell size
- Cell locations are referenced by their row and column position
- Every cell can be uniquely identified by its row and column position



- Top left cell in a grid is at the 0,0 position
- Rows and columns are numbered from 0,0 position
- The 0,0 cell is the row and column index position/origin of the grid
- Number of rows and columns does not have to be the same

CELL VALUES

- Cells are assigned an integer, floating point, or NO DATA value

2	2	1	2
No Data	1	1	1
2	1	1	2
No Data	2	2	2
No Data	No Data	2	2

INTEGER

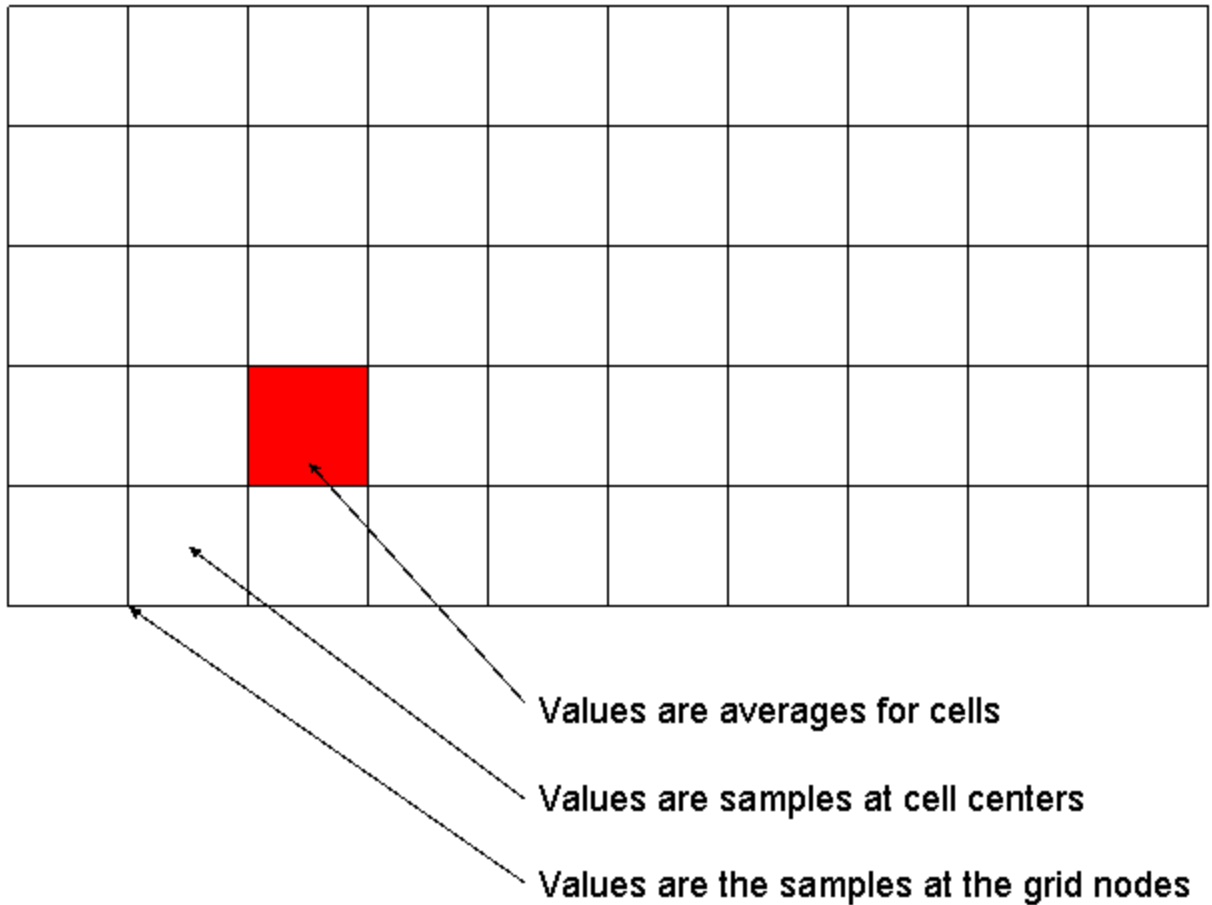
Grid stores
categorical data

1.22	1.12	1.17	1.52
1.42	1.33	1.32	1.19
No Data	1.36	2.12	No Data
2.13	2.17	No Data	No Data
No Data	2.18	1.11	1.79

FLOATING POINT

Grid stores
continuous data

Value of the cell may represent...



- User can perform analysis cell by cell, by groups of cells, and for the entire grid
- Each cell can be referenced by an X,Y location

Converting Vector Data (Themes) and Raster Data (Grids)

Themes, including feature and image themes, can be converted to grids

Vector to raster conversion is called *rasterization*

Raster to vector conversion is called *vectorization*

Demonstration #2

Examine Streets Feature Theme

Convert Street Feature Theme to Street Grid Theme (using 50 foot radius)

Convert Street Feature Theme to Street Grid Theme (using 10 foot radius)

Compare Grid Themes and Consider Advantages and Disadvantages

Why Would You Want to Convert From Feature to Grid or Visa Versa?

Storing and managing grid themes

Grid and INFO subdirectories

Using source manager to copy, delete, and rename files

Things to Consider When Choosing a Cell Size

Resolution of input data

Resulting database size and disk capacity

Desired response time (processing speeds)

The application and analysis being performed

Storing Grid Themes

User defines workspace where grid datasets will be stored

ArcView creates the INFO subdirectory and grid subdirectories

There is one INFO subdirectory and a subdirectory for each grid

INFO subdirectories contain several files that relate to each grid's theme table

Grid subdirectories contain several files that store geographic data

Grid Subdirectory

Grid subdirectories store data files about each grid

Some grid data files have related INFO files, some do not

If you alter a grid, ArcView automatically updates corresponding information

dblwnd.adf - contains the minimum and maximum X,Y coordinates of the grid theme

hdr.adf - contains grid cell resolution, type, etc.

sta.adf - contains statistics about cell values (min, max, mean, etc.)

vat.adf - stores unique cell values and a cell count for each value (only integer grids)

W001001.adf - stores the first tile (*W001002.adf - stores the second tile*)

prj.adf - optional ASCII text file used to store map projection information
log - contains history of the grid dataset (type and time of operation performed)

INFO Subdirectory

arc.dir - contains data dictionary

***.nit and *.dat - some vat.adf (grid data files) have related INFO files that occur in pairs**

Managing Grid Themes

Storage of grid datasets in subdirectories complicates data management

Important to use Source Manager to manage grid datasets

This includes copying, deleting, and renaming grids

Vector Vs Raster

Vector Advantages	Raster Advantages
Very high resolution	Simple structure
High spatial accuracy	Grid structure makes analysis easier
Require less storage space	Allows integration of imagery and GIS data
Easier for the general public to understand	Modeling can be performed easily and rapidly

Introduction to Lab 6

We will use raster models to create a housing value surface for Cambridge

It will be necessary to convert vector data sets into raster data sets

We will rasterize the 1989 housing sales and 1990 Census data for Cambridge

The key steps are as follows:

Open Project

Load Spatial Analyst Extension

Add Themes - cambtigr, camborder, cambbgrp.shp, sales89

Set View Properties - meters

Set Analysis Properties - cell size 100

Convert camborder to grid - it will later be used as a mask

Now we will explore different ways to estimate housing values for cambridge

- City assessor's database (*agency monitors accuracy, but constituents lobby for lowest assessment*)
- Recent sales (*reflects market value, but not all sales reflect market value*)
- Census (*median housing values aggregated at the block group level, but values are self-reported*)