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Exploring ArcGIS Analysis methodology and GeoProcessing tools

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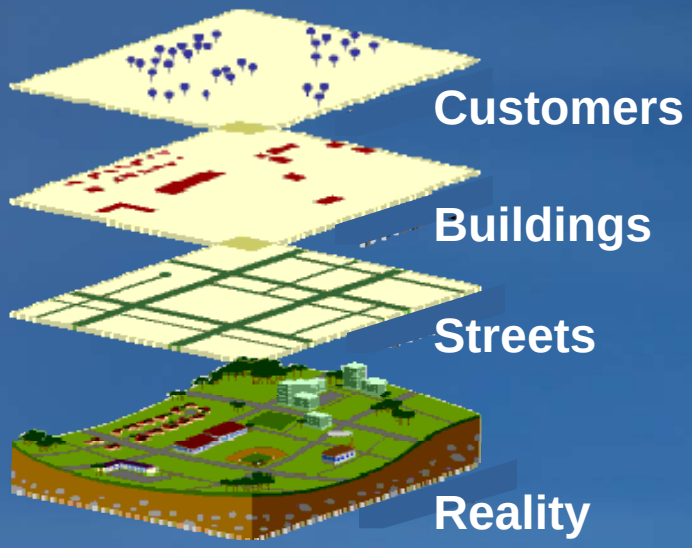
What is GIS analysis?

- Analysis is one of six GIS functions
- Process for highlighting patterns and relationships in geographic data
- Most people are still only using GIS to make maps
- GIS can do much more - Analysis



Capture

Store

Query

Analyze

Display

Output

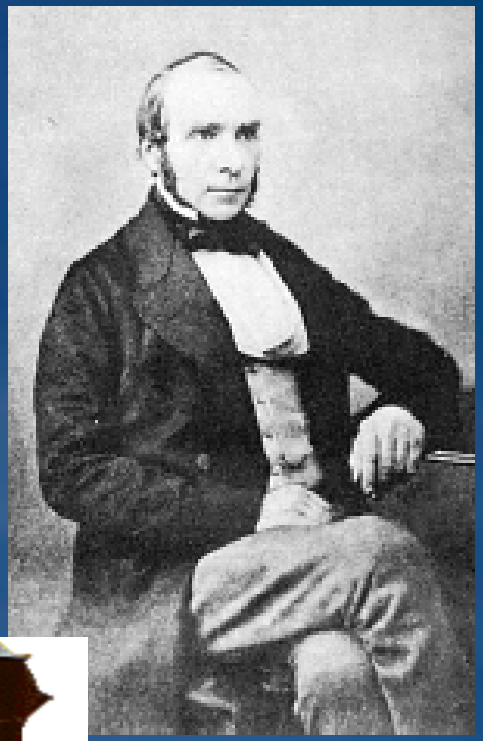
Early spatial analysis

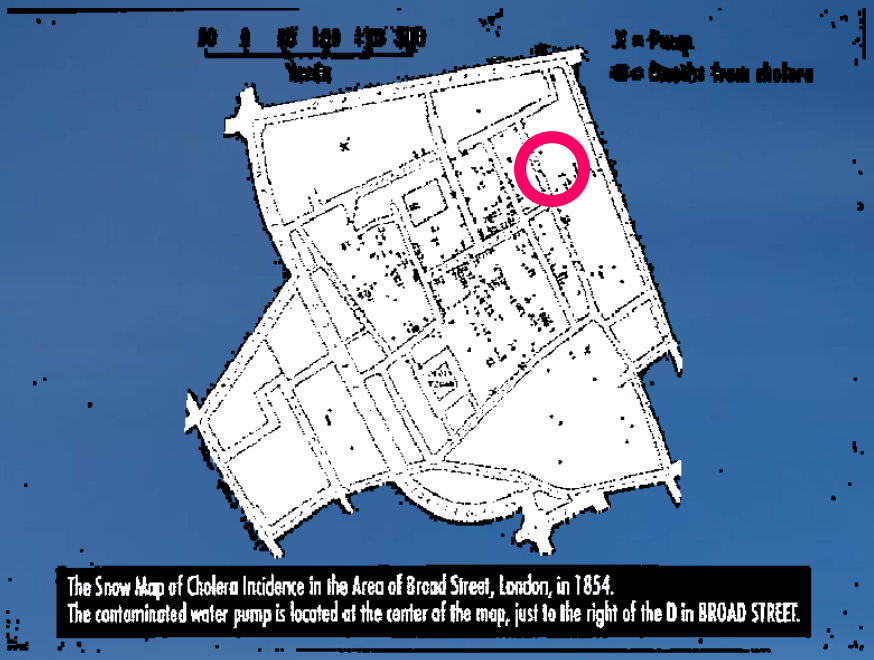
- John Snow, 1854
- Cholera via polluted water, not air
- “John Snow’s pump”

Learn More at

www.jsi.com

http://www.ph.ucla.edu/epi/snow.html



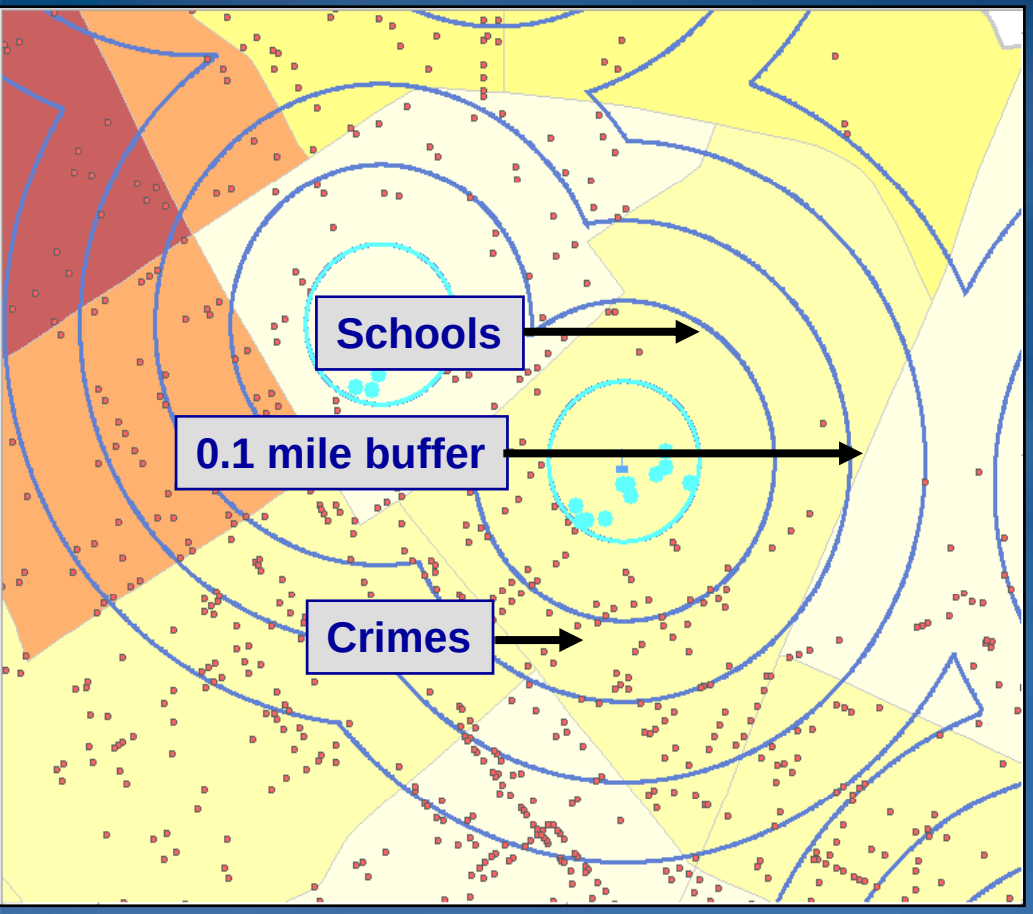


The Snow Map of Cholera Incidence in the Area of Broad Street, London, in 1854.
The contaminated water pump is located at the center of the map, just to the right of the D in BROAD STREET.

Broad Street water pump

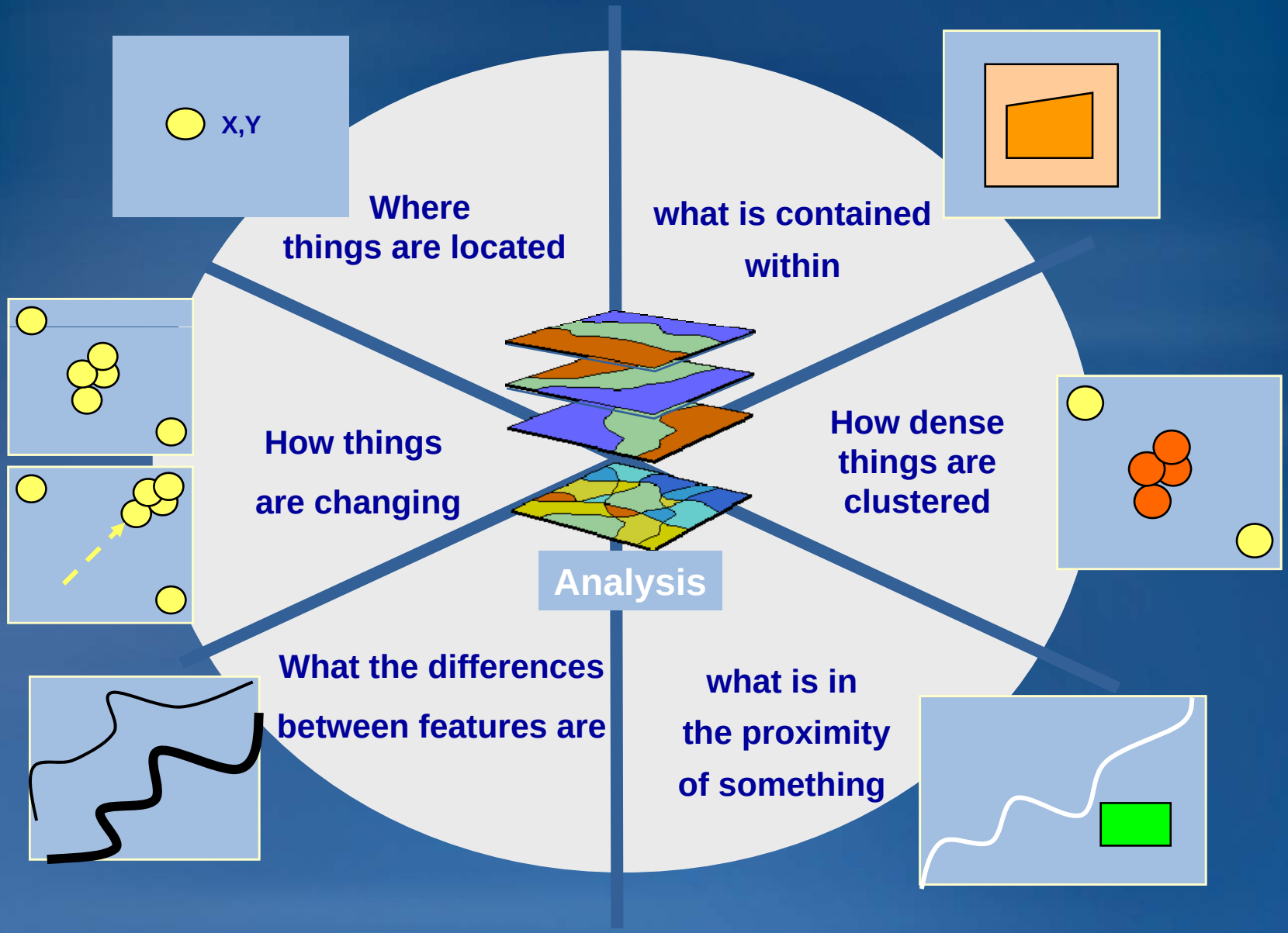
Why do analysis?

- Gives insight into places of interest
- Helps identify trends and patterns to focus actions better

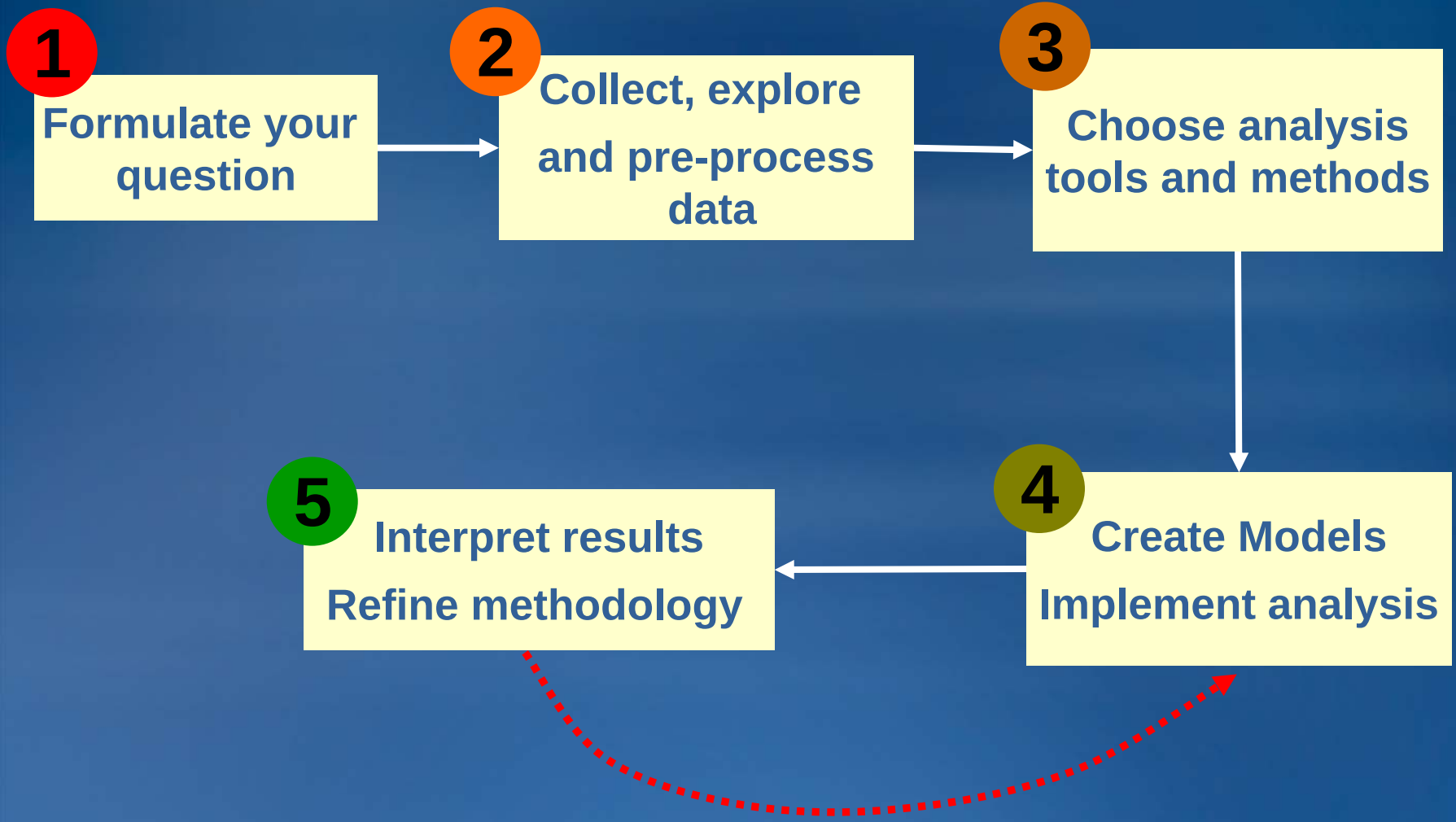


Determine the relationship between crime locations and schools

What questions can analysis answer



What are the 5 steps of the analytical process



What are the 3 basic analysis operations

Analysis Operations

Attribute queries

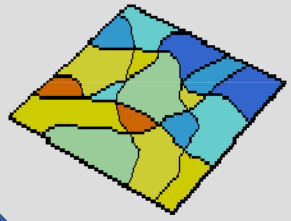
Spatial queries

Geoprocessing

(Generation of new datasets based on data attribute information and/or spatial relationships)

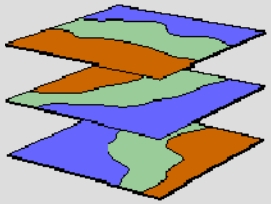
Start simple evolve to more complex

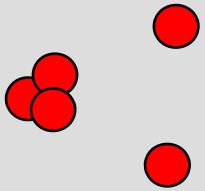
What are the most common analysis tasks



Single-layer operations

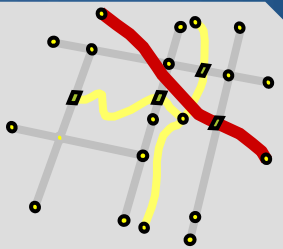
Multiple-layer operations

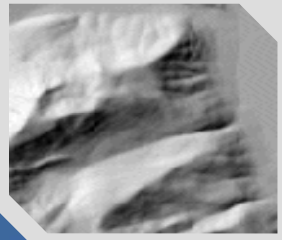




Point pattern analysis

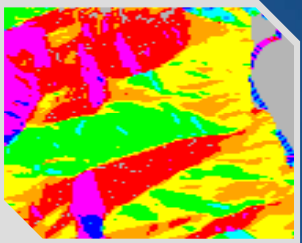
Network analysis





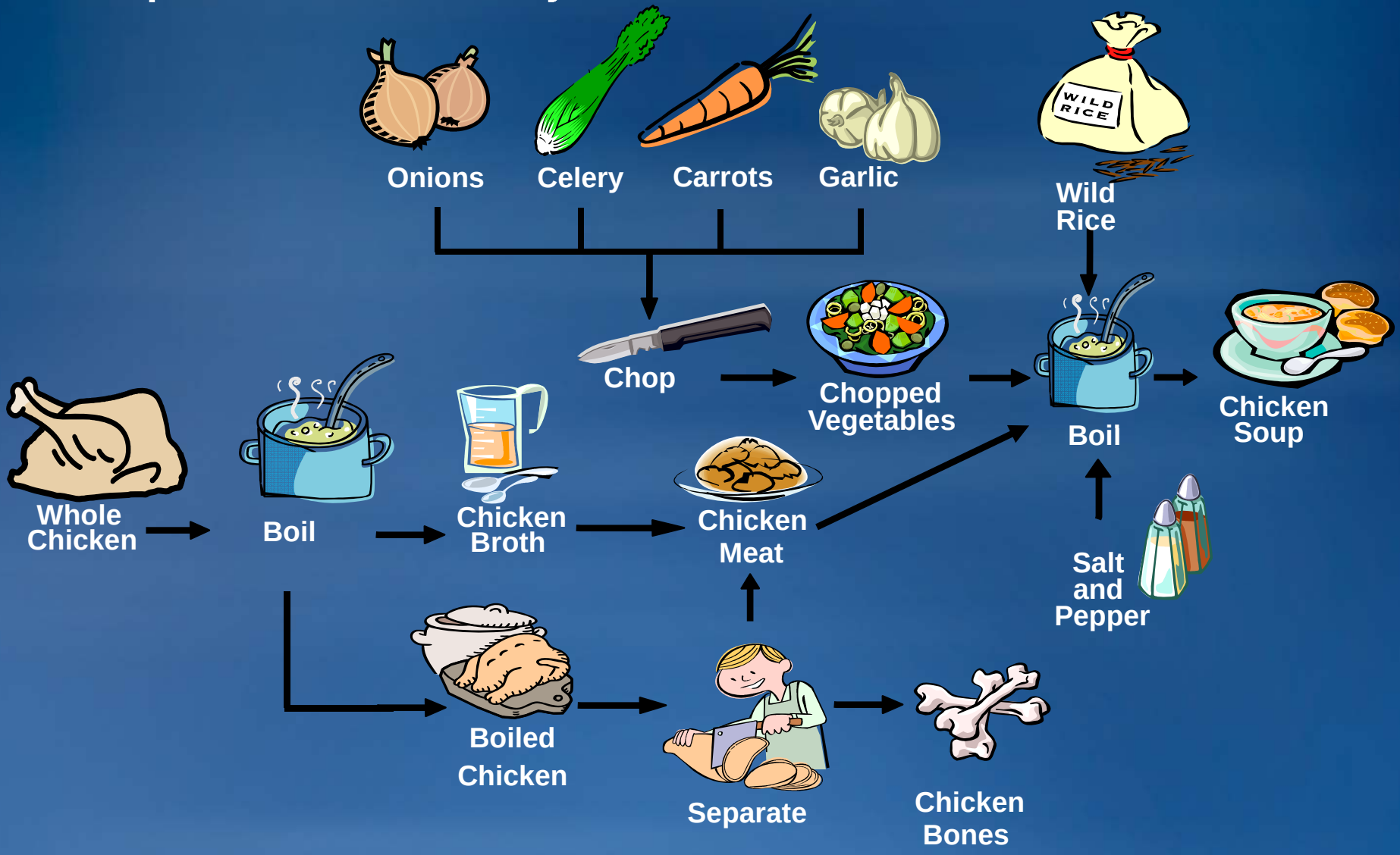
Surface analysis

Raster analysis



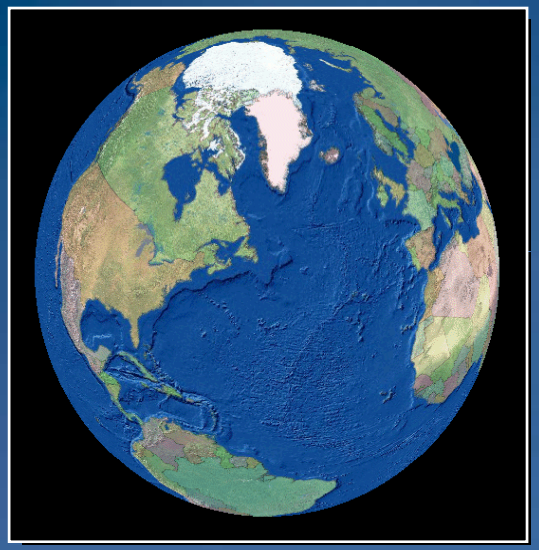
What is a model?

- A representation of reality

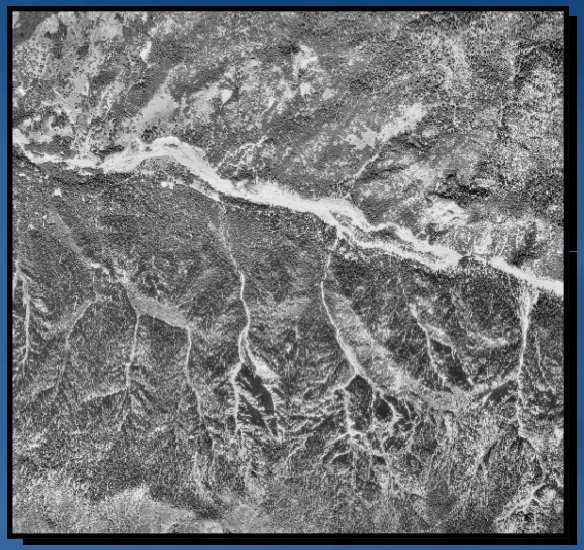


What are spatial models

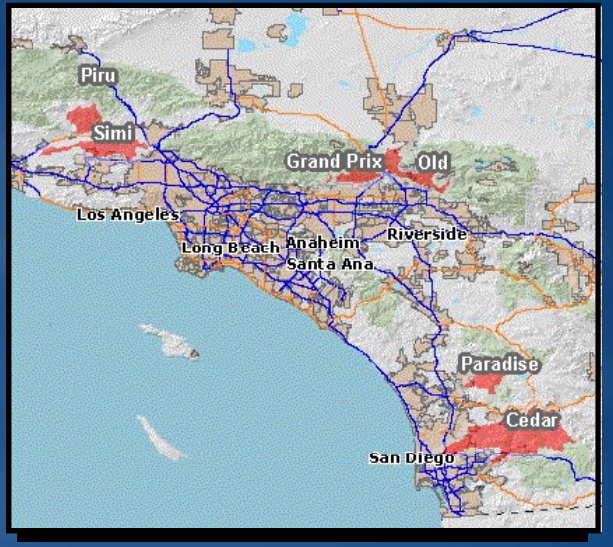
- Models that deal with geographic features



A globe is a model of the Earth



An aerial photograph is a model of surface features



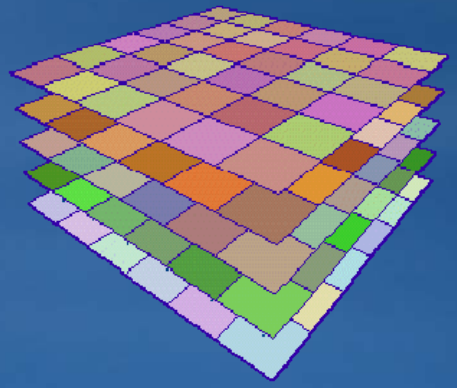
A wildfire map is a model of wildfire locations

Modeling spatial problems

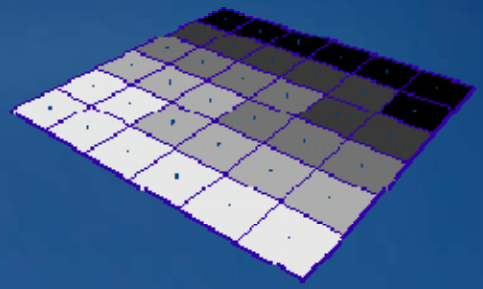
- Models help us understand and solve complex problems
  - –Simplify reality
  - –Combine geographic layers to answer questions
    - e.g., “Where should you build your next store?”

Reality

GIS layers



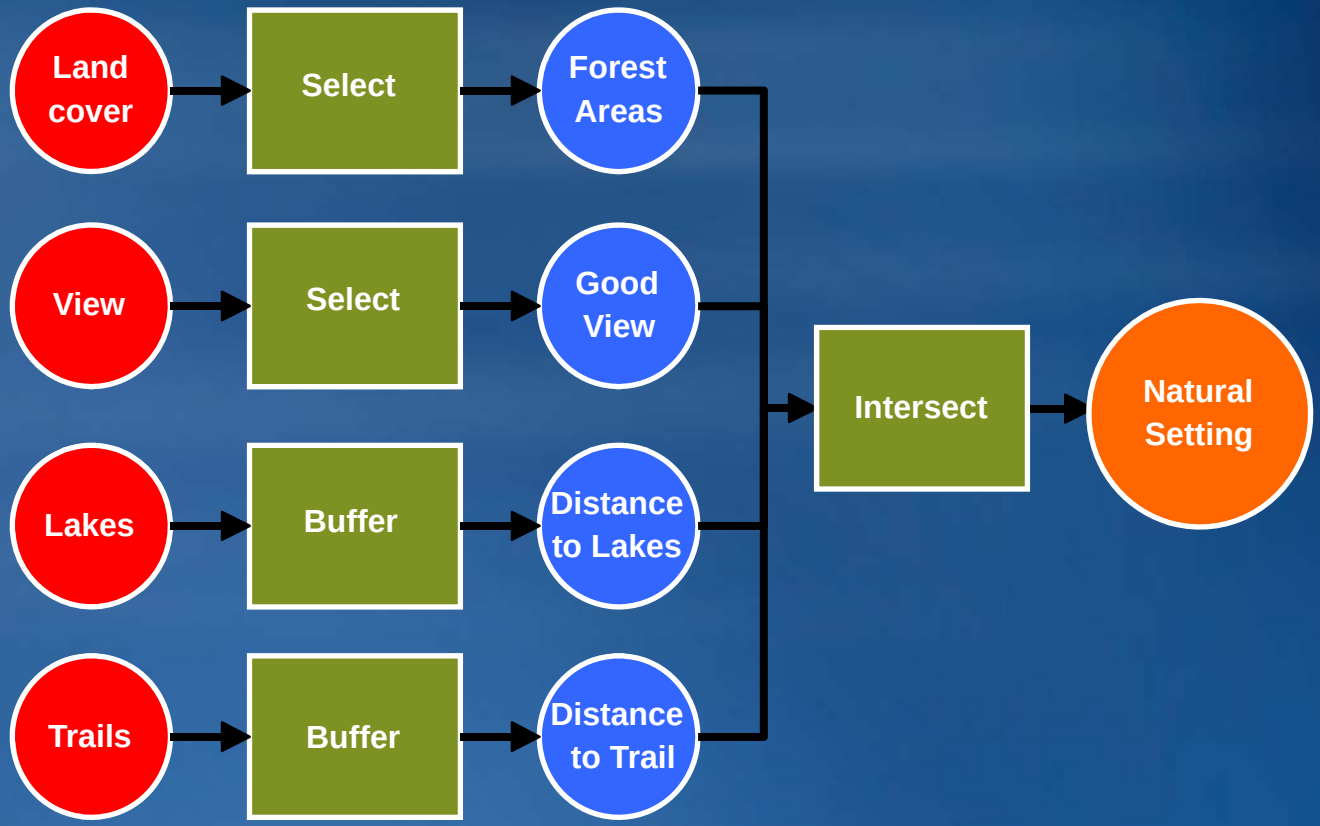
Suitability for store



Model criteria:
- Zoned commercial
- Near target population
- Away from competition

Why use models?

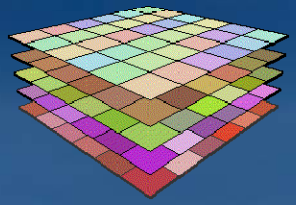
- Share process with others
- Framework for understanding real-world processes
- Document work
- Easy to modify
  - Rerun
  - Explore scenarios



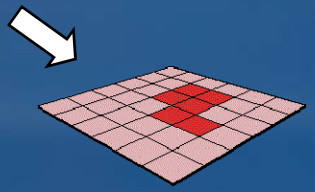
What are the different types of models

Representation models

Suitability models

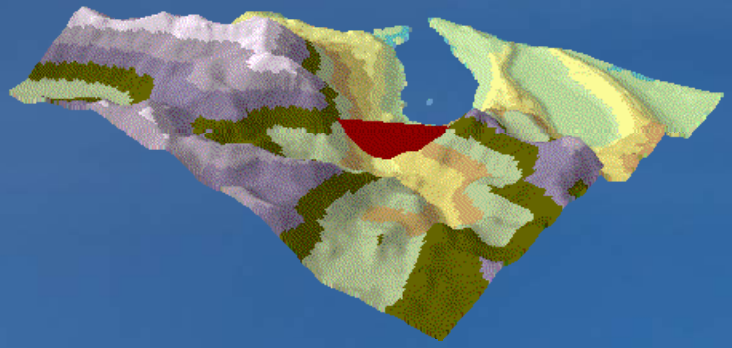


GIS data layers



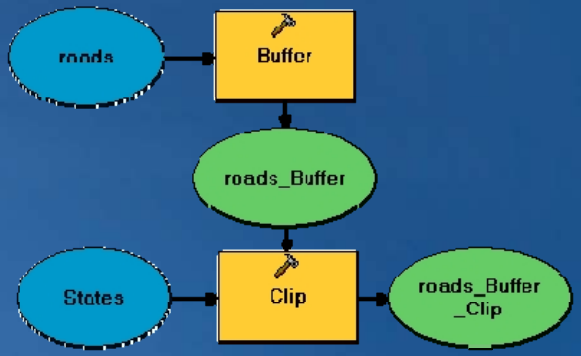
Best store location

Process models



Filling a reservoir

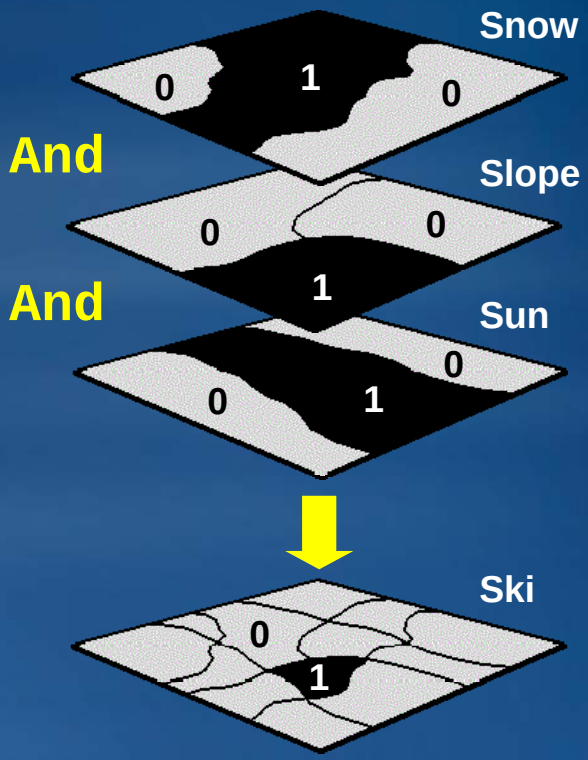
Automated workflows



Suitability models - Binary

- Use for simple problems
  - Like a query
- Classify layers into good (1) and bad (0)
  - Combine with AND, addition, or multiplication:

    `Ski = Snow And Slope And Sun`
- Advantages:
  - Easy
- Disadvantages:
  - No ‘next-best’ sites
  - All layers have same importance
  - All good values have same importance

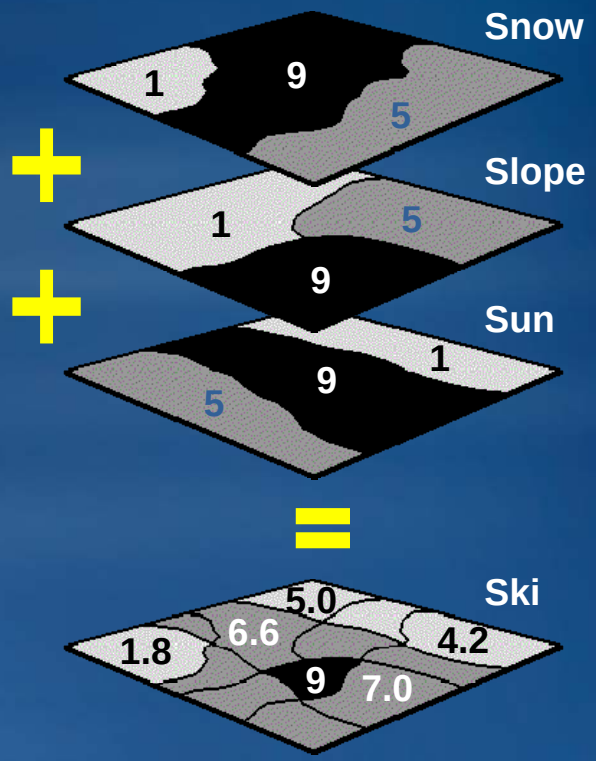


Suitability models - Weighted

- Use for complex problems
- Classify layers into suitability 1–9 (9 = best)
  - Weight and add together:

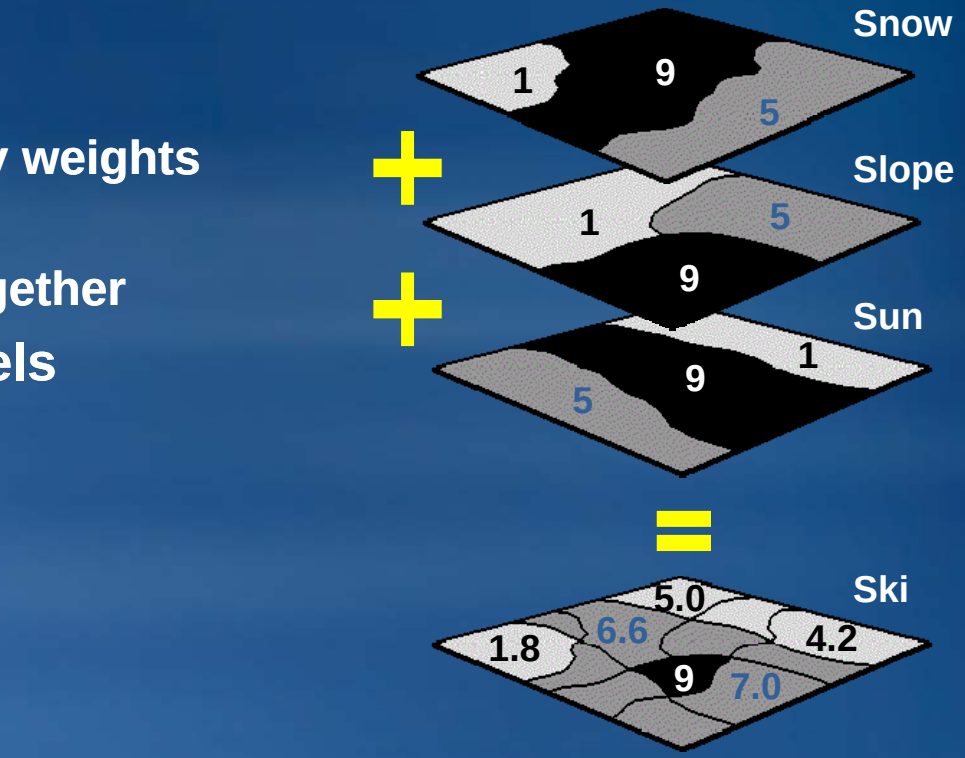
```
Ski = (Snow  * 0.5)
    + (Slope * 0.3)
    + (Sun   * 0.2)
```

- Advantages:
  - All values have relative importance
  - All layers have relative importance
  - Returns suitability on a scale 1–9
- Disadvantages:
  - Preference assessment is harder



Weight and combine the layers

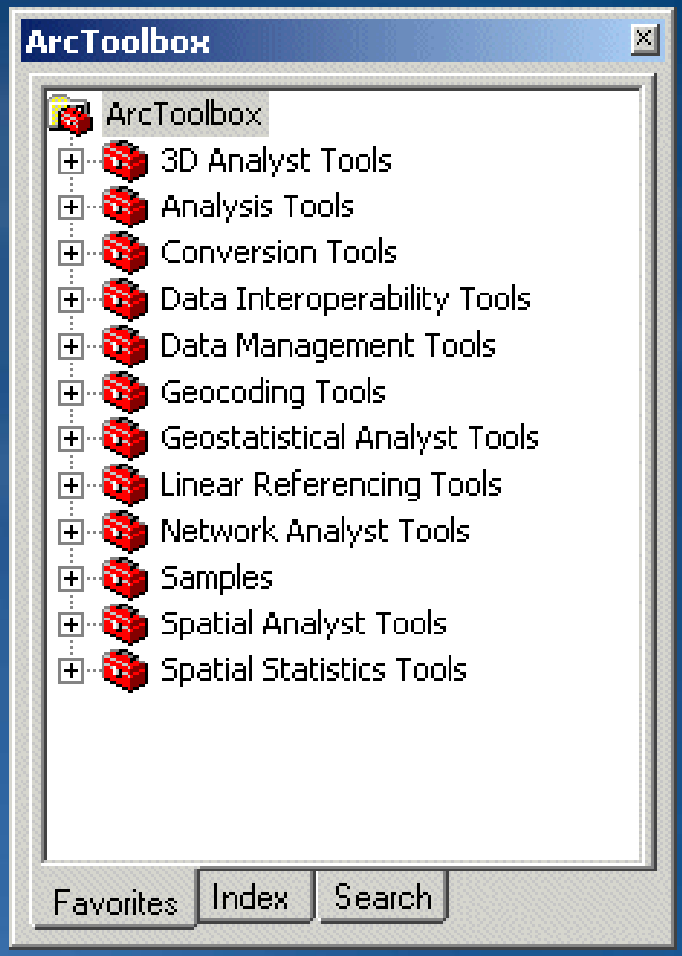
- For each submodel
  - Multiply suitability layers by weights
    - Weights must add up to one
  - Add the weighted layers together
- Repeat to combine submodels




```
Ski = (Snow * 0.5) + (Slope * 0.3) + (Sun * 0.2)
```

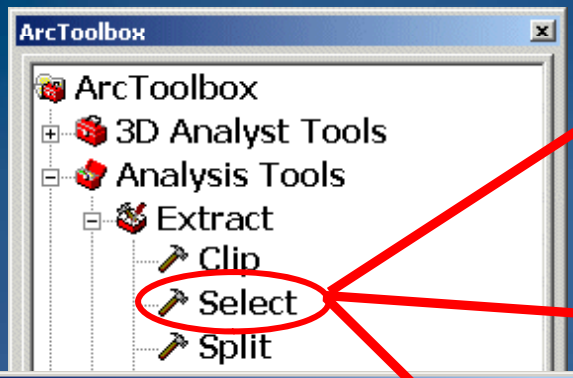
Modeling & Analysis tools in ArcGIS

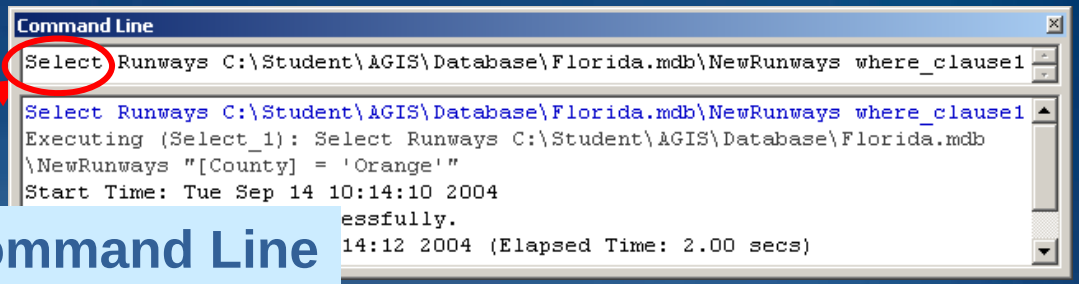
- Mostly GeoProcessing tools
- Used within ArcGIS GeoProcessing framework
  - **Toolbox**: Container for tools and toolsets
  - **Toolset**: Logical container of tools and other toolsets
  - **Tool**: Single GeoProcessing operation



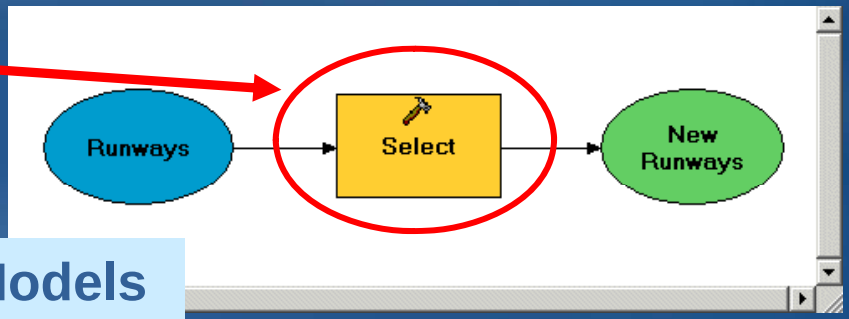
Geoprocessing framework

- Multiple environments

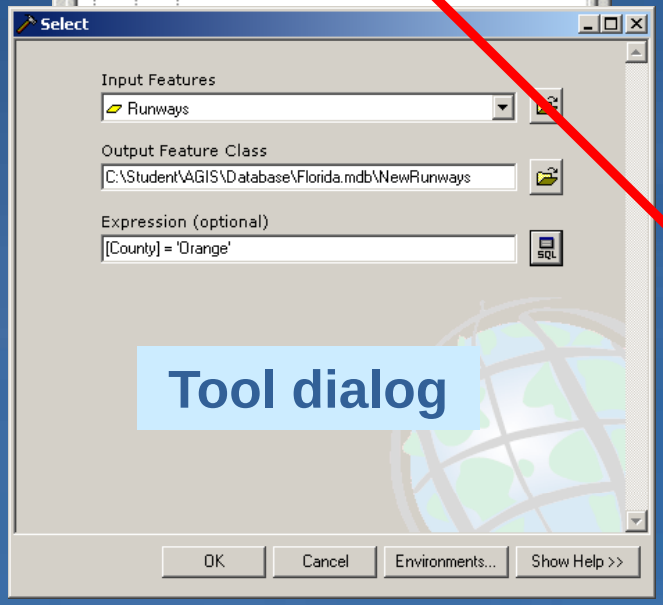




Command Line



Models

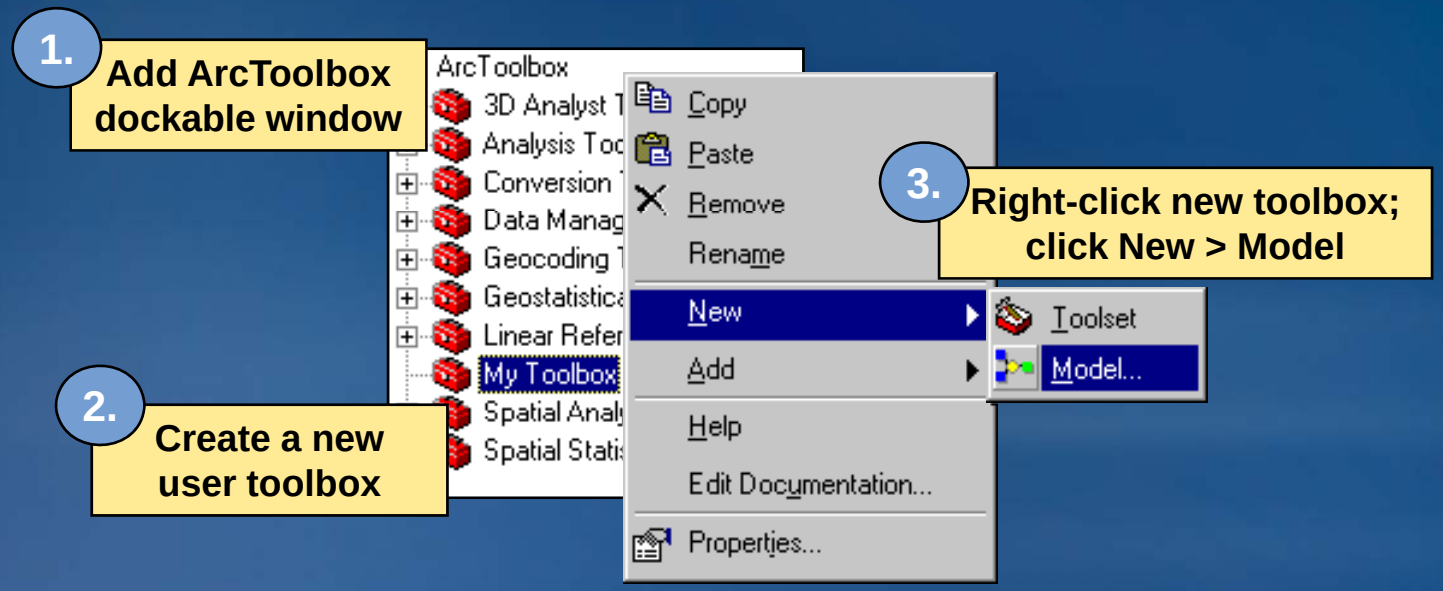


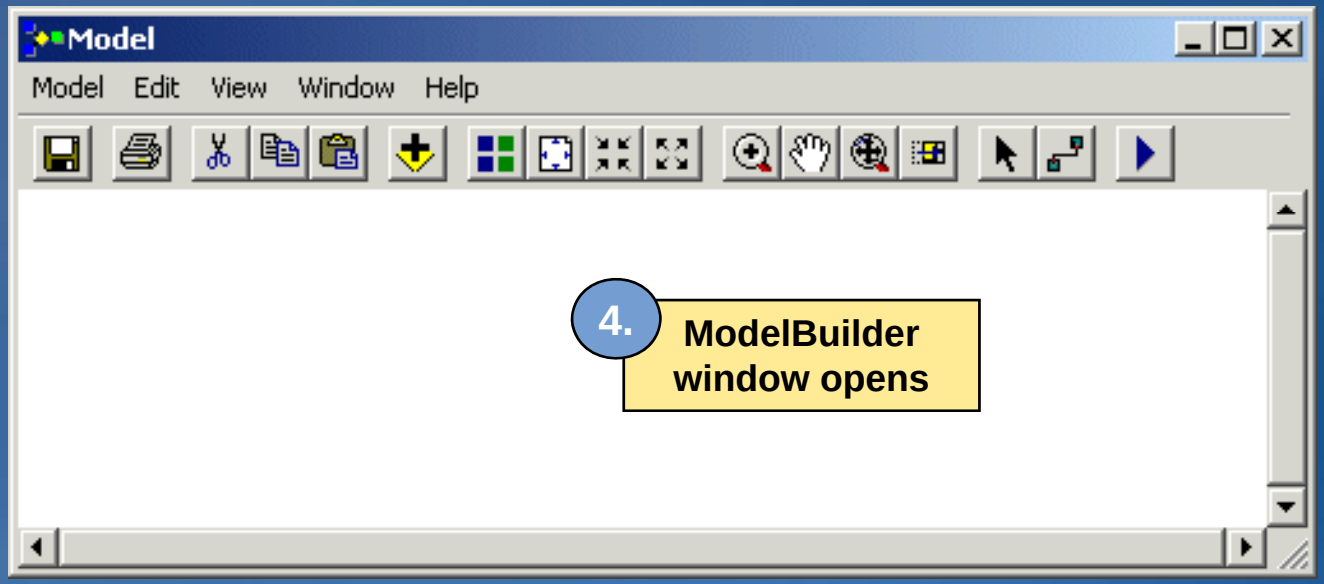
Tool dialog

Scripts

```
pGP.Select("Runways", "NewRunways", '[COND
```

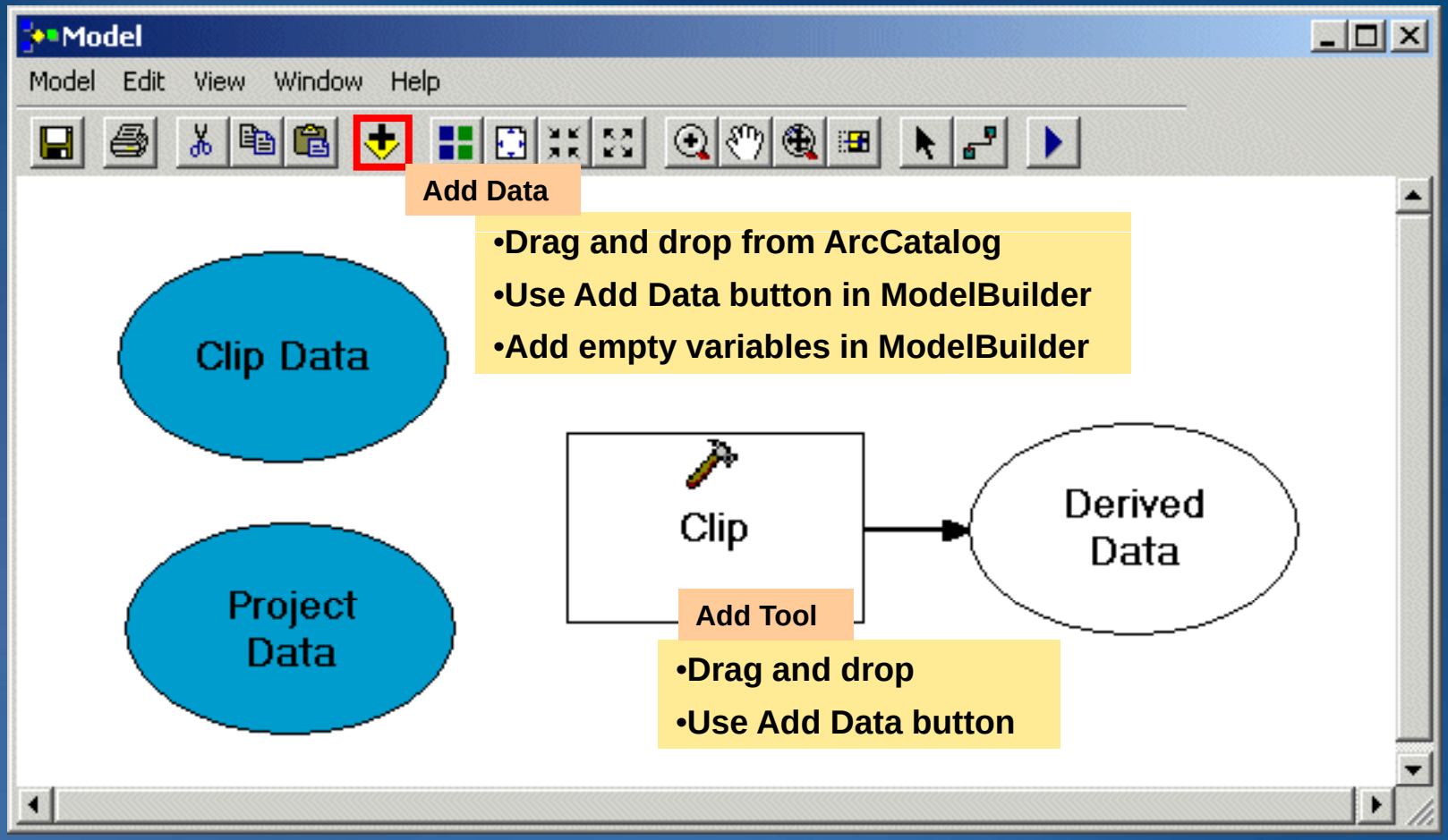
Creating a model





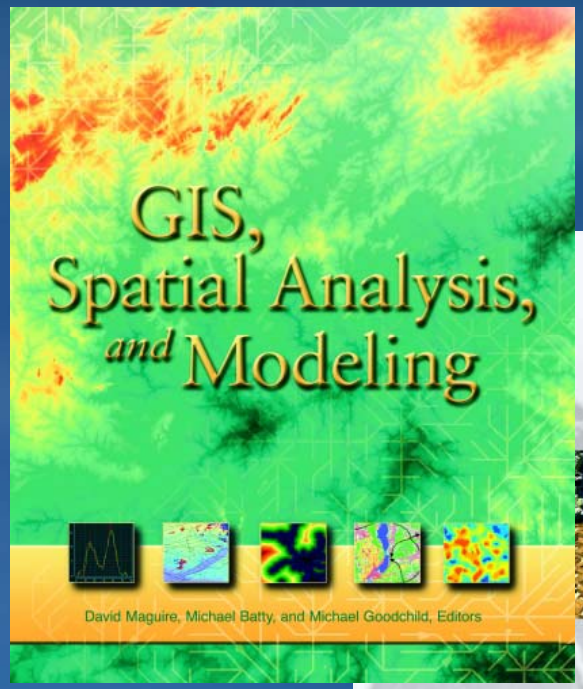
Constructing a model

- Add data and tools



Helpful Literature

- ***The ESRI Guide to GIS Analysis, Volume 2***
- ***The ESRI Guide to GIS Analysis, Volume 1***
- ***GIS, Spatial Analysis, and Modeling***
- ***Advanced Spatial Analysis***



Questions ?