What is Modeling?

Solving Problems with Spatial Modeling in GIS

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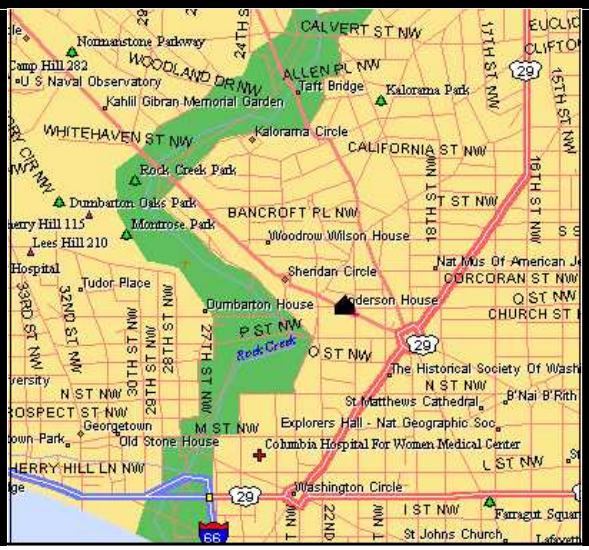
What is a Model?

A model is an idealized and simplified representation of reality

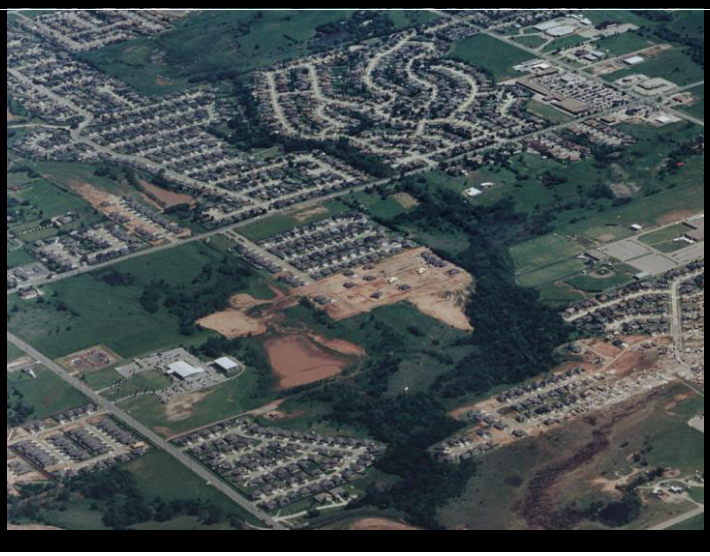
Not always!

A Globe is a model of the Earth

A Map is a graphical model of the earth surface



A Photo is a pictorial model of surface features



Models are of many different types

A model could be a theory, a law, a hypothesis, an equation, or even a structured idea

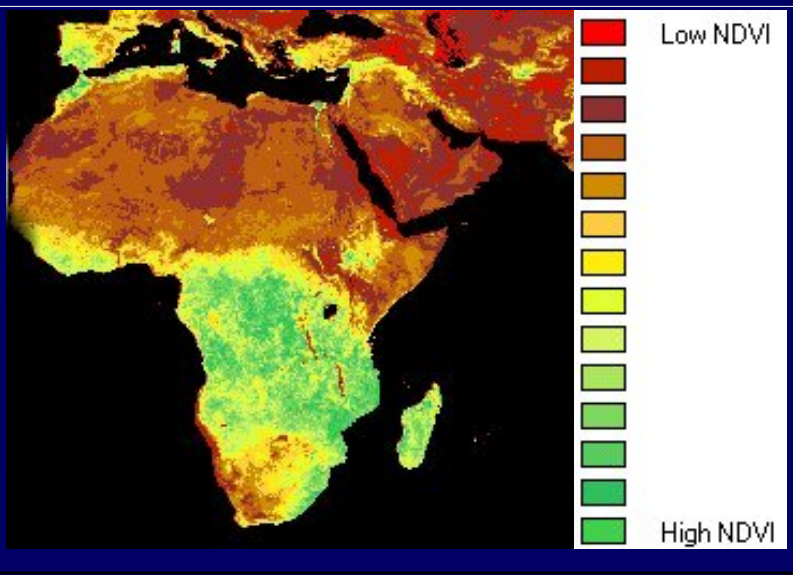
From Haggett and Chorley, 1967

Vegetation Index Model

Normalized Difference Vegetation Index(NDVI) is used to model the abundance of living plant material from satellite data:

$$NDVI = \frac{IR-R}{IR+R}$$

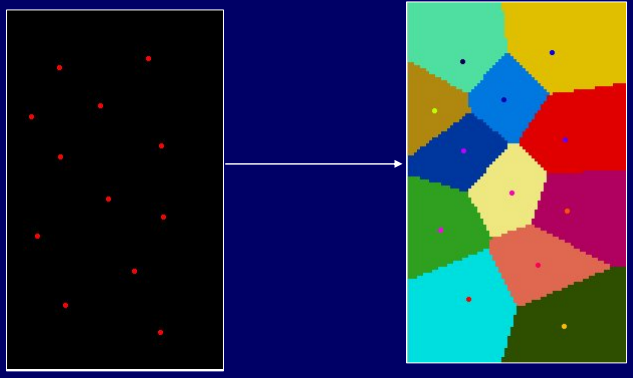
Vegetation Index Model



Digital Elevation Model

Weather Forecasting Model

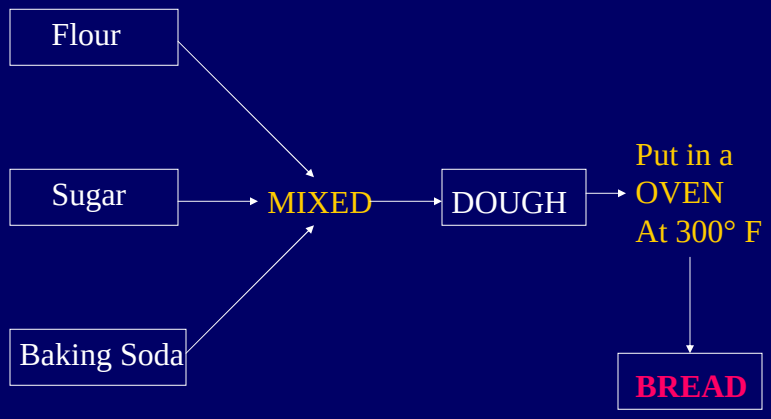
Thiessen Polygon:



Weather Station

Predicted Model

A cooking recipe is a model



What is Modeling?

- **Modeling is the process of making a model**
- **The process of making a map is known as:**

Cartographic Modeling

What is Spatial Modeling ?

Is the process of manipulating and analyzing spatial/geographical data to generate useful information for solving complex problems

Why Spatial Modeling ?

Finding relationships among geographic features to understand and address any particular problem

Source: ESRI

Why Spatial Modeling ?

- Defining the problem clearly and logically
- Providing a framework for understanding real world processes
- Simulation to extract information which is impossible or too expensive to measure

Modeling Process

- Identify the problem
- Breakdown (simplify) the problem
- Organize the data required to solve the problem
- Develop a clear & logical flowchart using well defined operations
- Run the model and modify it if necessary

Land Suitability Model

Finding the suitable forest land for harvesting

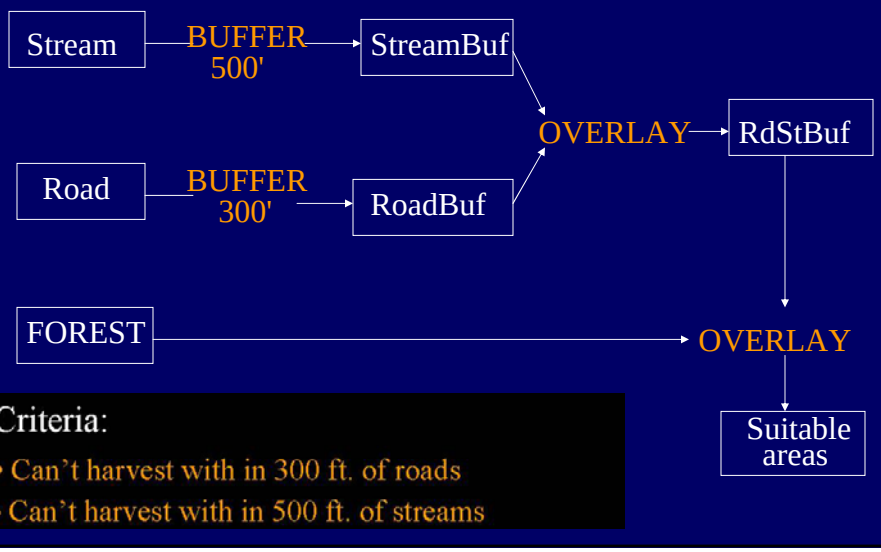
Criteria:

- Can't harvest with in 300 ft. of roads
- Can't harvest with in 500 ft. of streams

Required data sets:

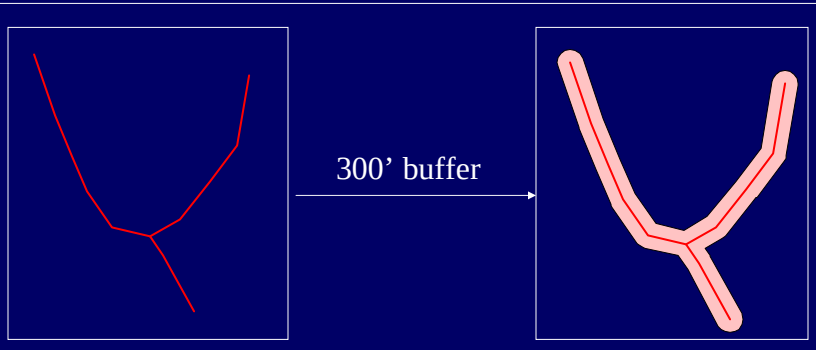
- Roads
- Streams
- Forest

Land Suitability Model



Land Suitability Model

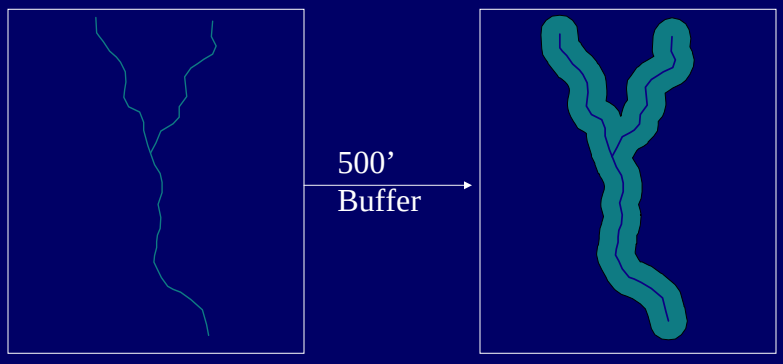
Land Suitability Model



Roads

Restricted Area

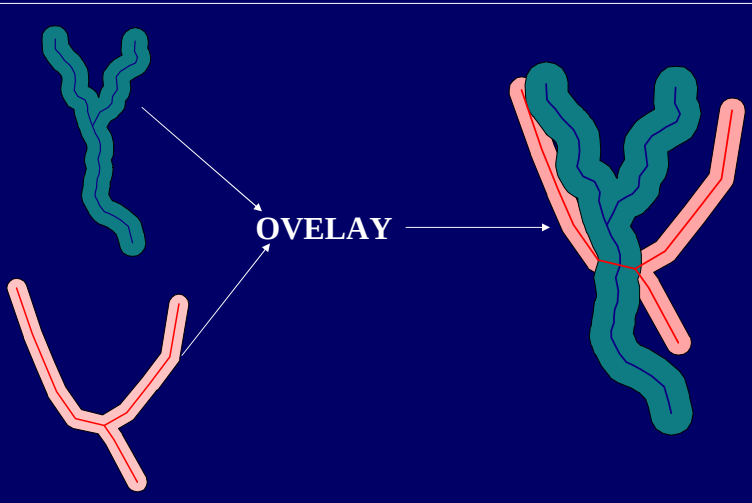
Land Suitability Model



Streams

Restricted Areas

Land Suitability Model



Suitable areas for harvesting

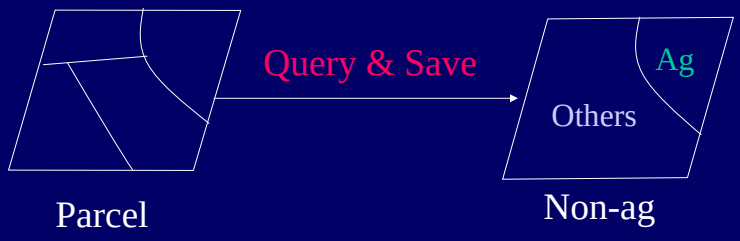
Solving Spatial Problem with GIS

Find a suitable site that meets the following criteria:

1. Can't be located on existing ag. Land
2. Should be within 2000' of roads
3. Should be located beyond 500' but within 3500' of existing railroads
4. Should be within industrial zone
5. The proposed site should be at least 45 acres

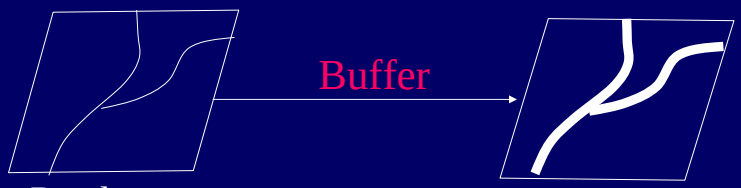
Criteria1: Can't be located on the existing agricultural land

Step 1:



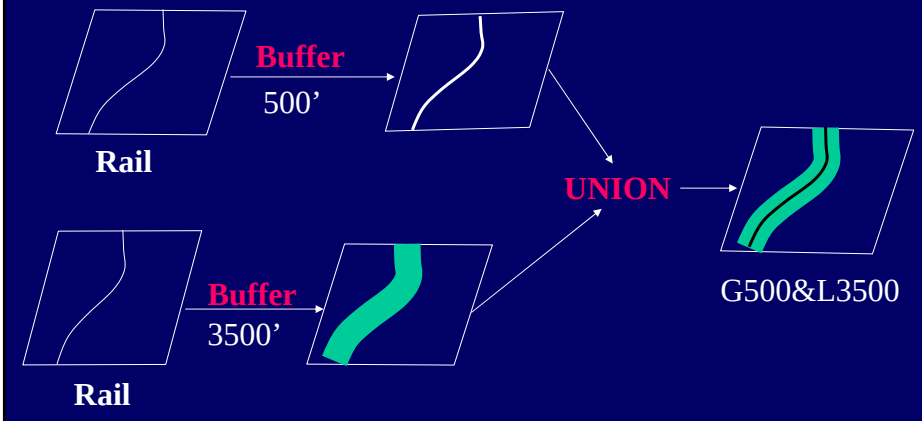
Criteria 2: Should be within 2000 feet of existing roads

Step 2:

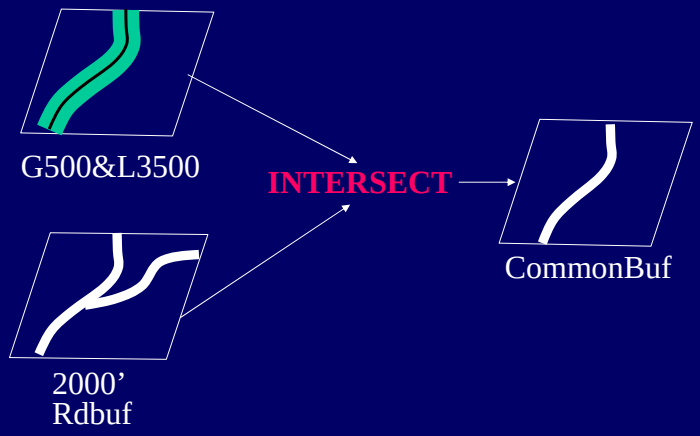


Criteria 3: Should be beyond 500’ but within 3500’ of existing rail lines

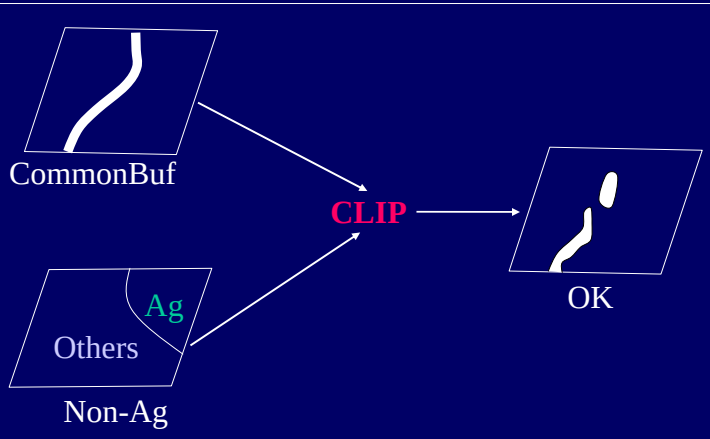
Step 3:



Step 3(cont.): Areas that are with in 2000’ of road AND beyond 500’ but within 3500’ of existing rail lines

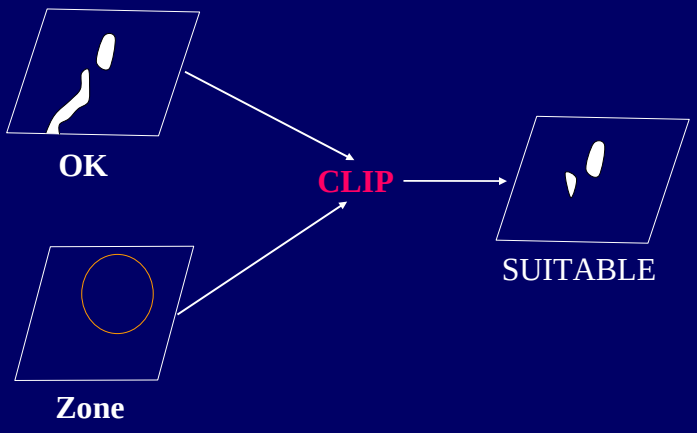


Step 3(cont.): Non-agricultural land that are with in 2000’ of road AND beyond 500’ but within 3500’ of existing rail lines

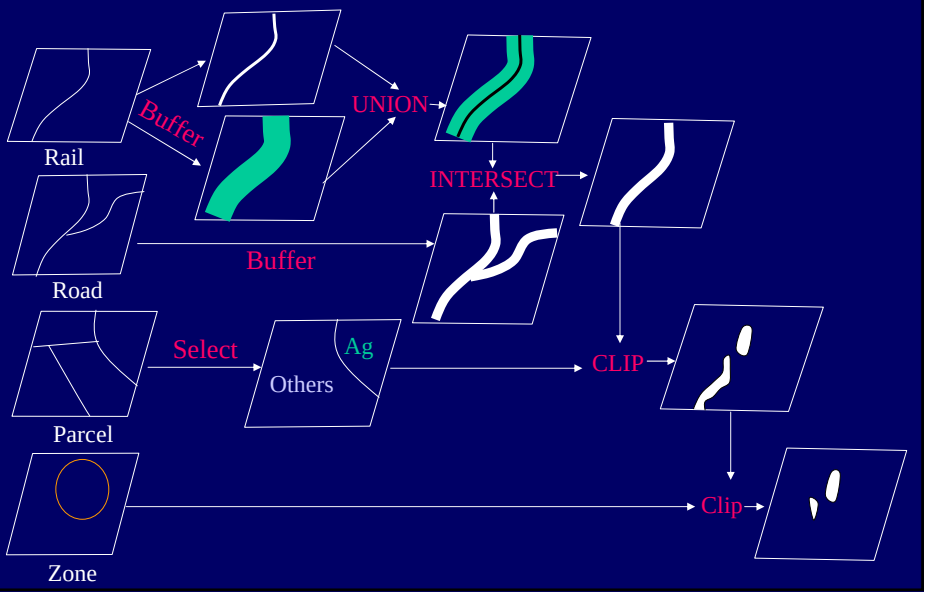


Criteria 4: Should be within Industrial zone

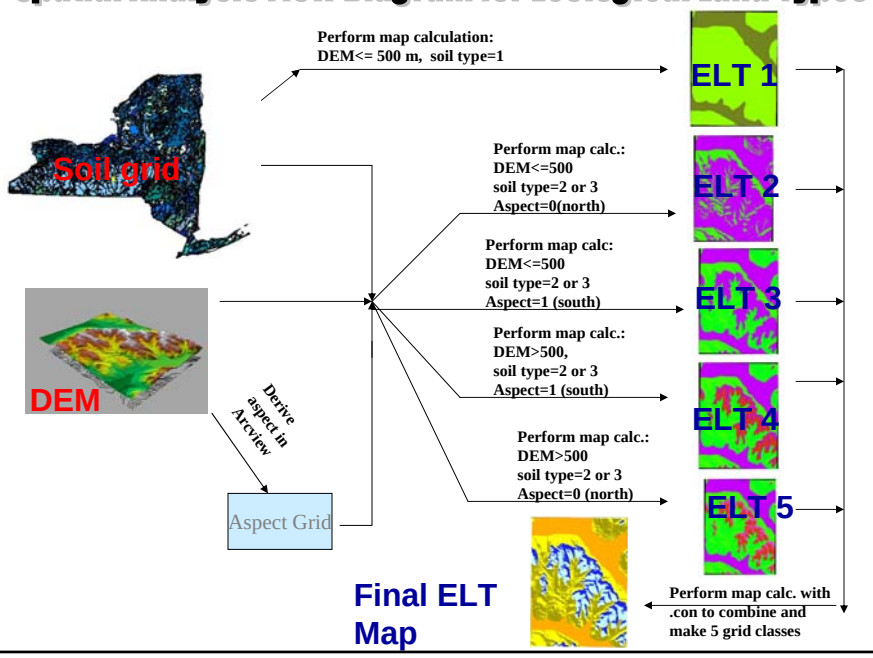
Step 4:



Spatial Model for selecting the proposed industrial sites

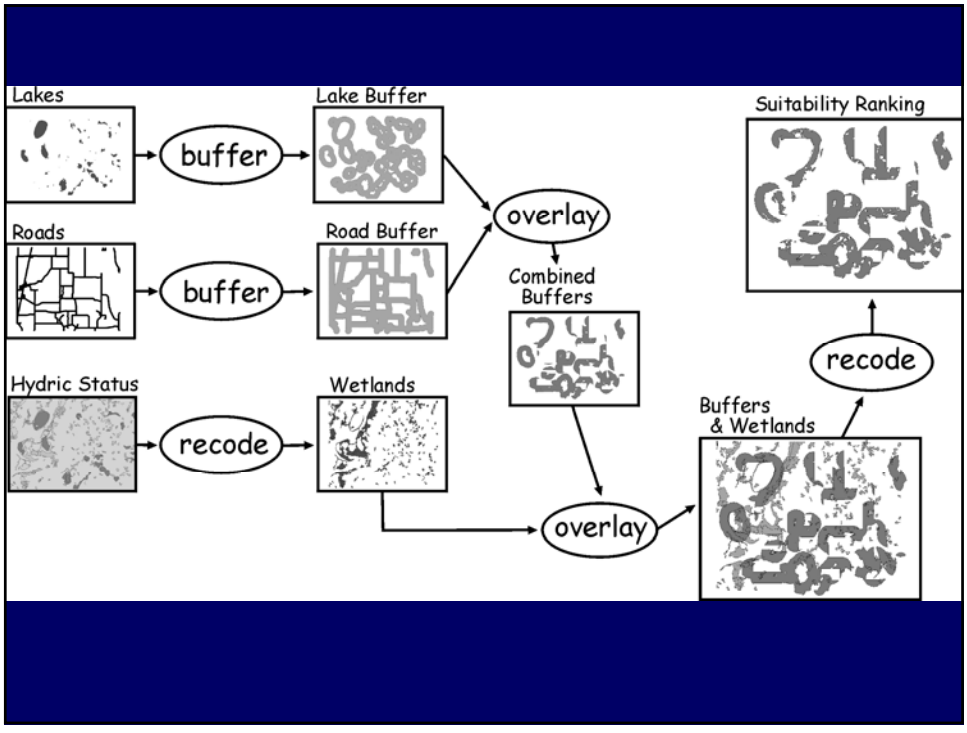


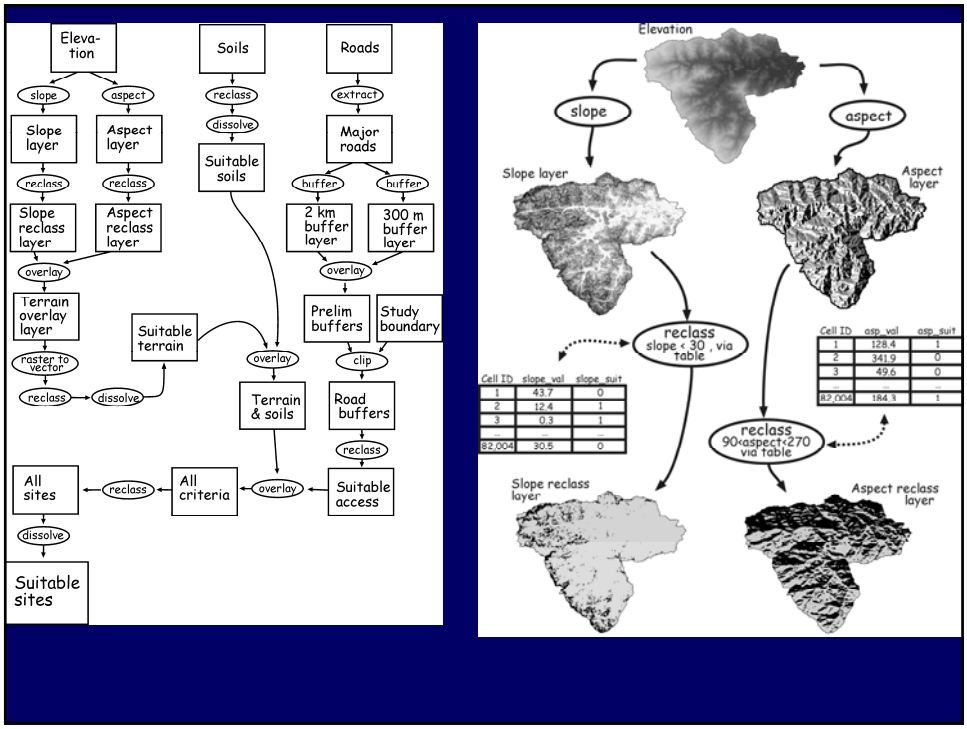
Spatial Analysis Flow Diagram for Ecological Land Types

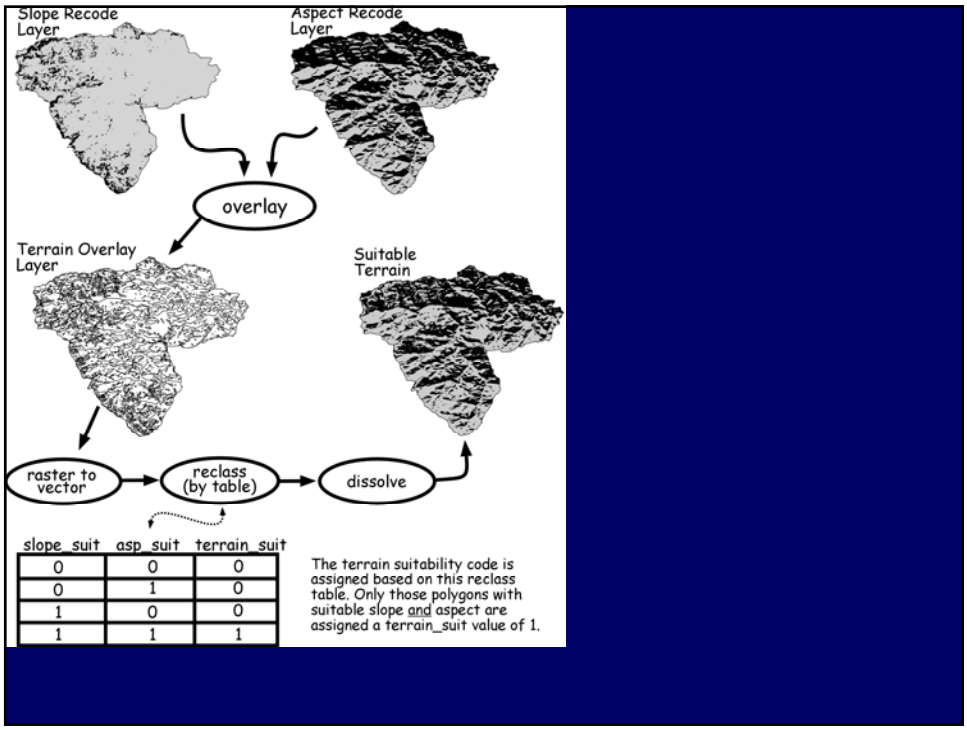


The Con Statement

- Performs a conditional if/else evaluation
  - Con(*Conditional Raster*, *True Raster* , *False Raster*)
- In the Raster Calculator:
  - Con(*ELT1 = 1*, *1* , *Con(ELT2 = 1, 2, Con(ELT3 = 1, 3,…)*
  - Basically, we are saying:
    - If the ELT1 value is 1, then the output pixel should be 1
    - If the ELT1 value is not 1, then check the ELT2 value
      - If the ELT2 value is 1, then the output pixel should be 2
      - ……




Eleva-tion
slope
aspect
Slope layer
Aspect layer
reclass
reclass
Slope reclass layer
Aspect reclass layer
overlay
Terrain overlay layer
raster to vector
reclass
dissolve
Suitable terrain
Soils
reclass
dissolve
Suitable soils
overlay
Terrain & soils
Roads
extract
Major roads
buffer
buffer
2 km buffer layer
300 m buffer layer
overlay
Prelim buffers
Study boundary
clip
Road buffers
reclass
Suitable access
overlay
All criteria
reclass
All sites
dissolve
Suitable sites
Elevation
slope
aspect
Slope layer
Aspect layer
reclass
slope < 30 , via table
reclass
90<aspect<270 via table
Slope reclass layer
Aspect reclass layer
Cell ID slope_val slope_suit
1 43.7 0
2 12.4 1
3 0.3 1
82,004 30.5 0
Cell ID asp_val asp_suit
1 128.4 1
2 341.9 0
3 49.6 0
82,004 184.3 1


Slope Recode Layer
Aspect Recode Layer
overlay
Terrain Overlay Layer
Suitable Terrain
raster to vector
reclass (by table)
dissolve
slope_suit asp_suit terrain_suit
0 0 0
0 1 0
1 0 0
1 1 1
The terrain suitability code is assigned based on this reclass table. Only those polygons with suitable slope and aspect are assigned a terrain_suit value of 1.