

# Sistem Informasi Geografis

## Analisis Spasial

Oleh: Politeknik Elektronika Negeri Surabaya  
2020



Politeknik Elektronika Negeri Surabaya  
Departemen Teknik Informatika dan Komputer

# Tujuan Perkuliahan

- Mahasiswa dapat memahami konsep analisis spasial
- Mahasiswa dapat memahami jenis-jenis analisis spasial
- Mahasiswa dapat memahami aplikasi dari analisis spasial

# Apa itu Spatial Analysis?

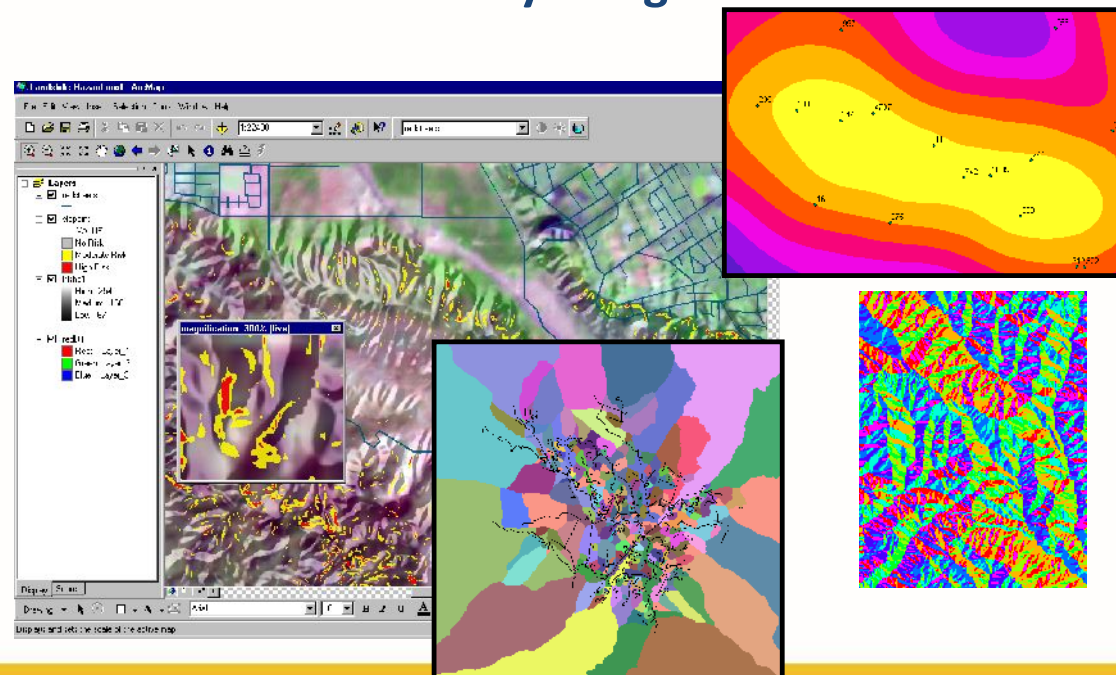
- Mengidentifikasi lokasi dan bentuk dari fitur-fitur geografis dan relasi diantaranya.
- Berguna untuk evaluasi kesesuaian
- Berguna untuk meningkatkan pemahaman yg baik akan bagaimana fitur-fitur geografis dan fenomena dilokasikan dan di distribusikan.

# Spatial Analysis Membantu dalam:

- Menjawab pertanyaan<sup>2</sup> geografis
  - Dimana sekolah yang terdekat dgn rumah?
- Membantu pengambilan keputusan
  - Memilih dlm menentukan dimana lokasi kilang minyak
- Menambil tindakan, membuat perubahan<sup>2</sup>
  - Mengubah rute hiking
- Membangun model-model yg akurat
  - Pemodelan dampak peningkatan CO<sub>2</sub> .

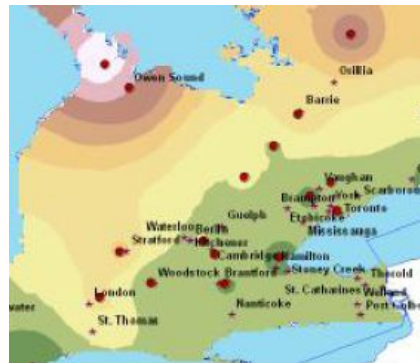
# Apa itu Spatial Analyst?

Extension ArcGIS yg dpt digunakan utk mengintegrasikan analisa data raster dan vector serta create, query, map, dan analisa data raseter berbasis cell dan masih banyak lagi!



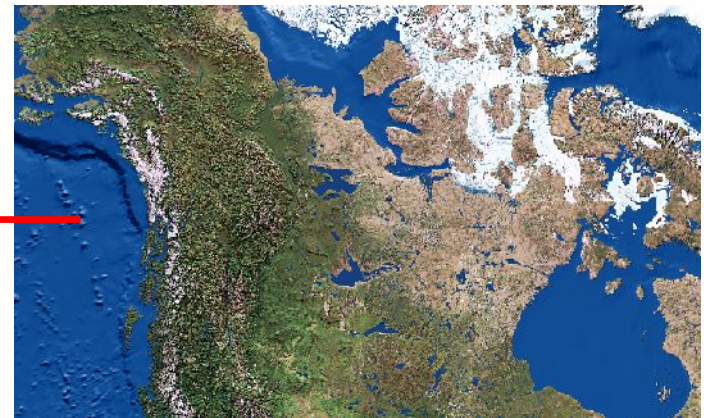
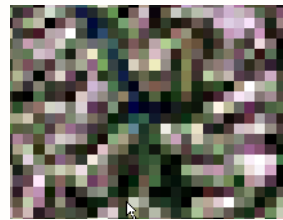
# Raster Data

- Raster adalah data berbasis cell
  - Cells disusun menjadi baris dan kolom, rows and columns, diberikan nomor posisi index
  - Beberapa format storage: spt. TIFF, Jpeg, Imagine, ESRI Grid, MrSid
  - Model Raster model berguna utk menyimpan data yg continuous, spt elevation (ketinggian), slope (lekuk,lereng), and temperature.



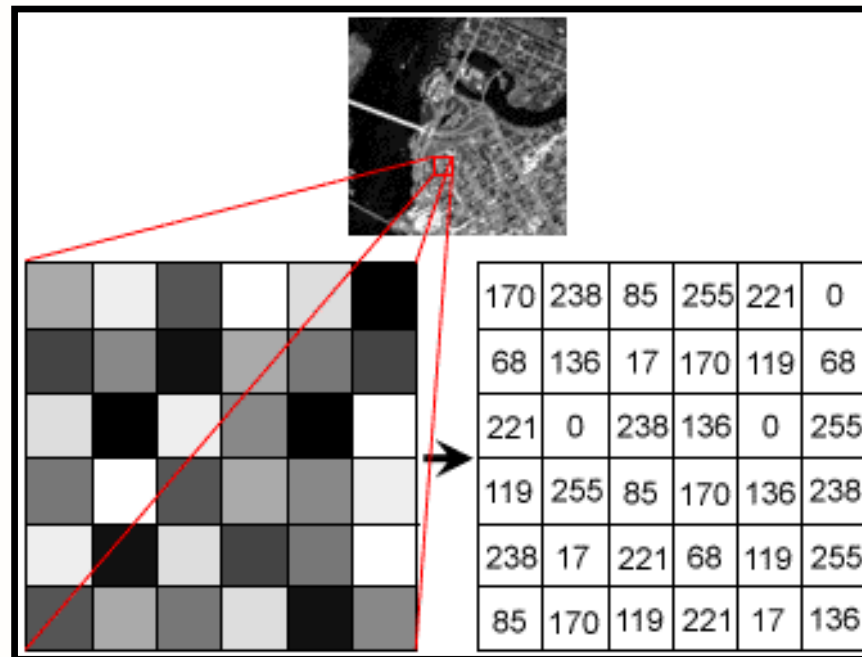
# Raster = Data Continuous

- Secara Continuous mengubah nilai
- Tersimpan sbg nilai floating point
- Elevation, noise pollution, rainfall, slope, temperature



# Foto Digital merupakan Raster

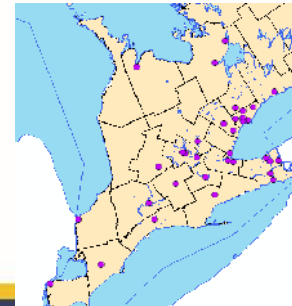
- Satu cell = Satu pixel
- Misal. TIFF, JPEG, GIF
- Foto Satellite





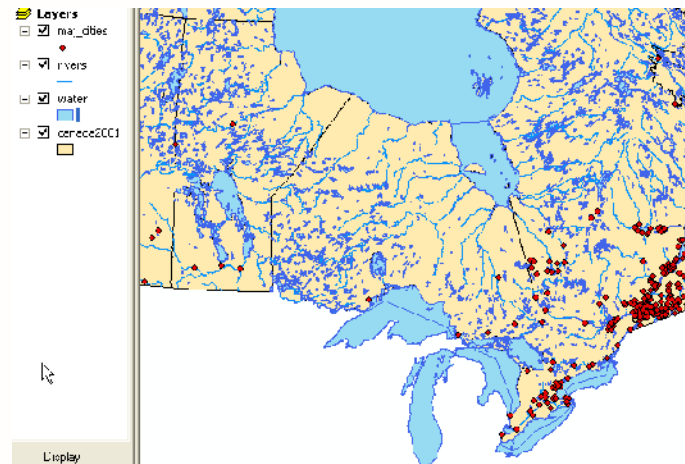
# Data Vector

- Vector adalah data berbasis shape (bentuk)
  - Representasi dari dunia menggunakan points, lines, dan polygons.
  - Model-model Vector berguna utk menyimpan data yg memiliki batas-batas pemisah yg jelas spt batas wilayah negara, bidang tanah dan jalanan.



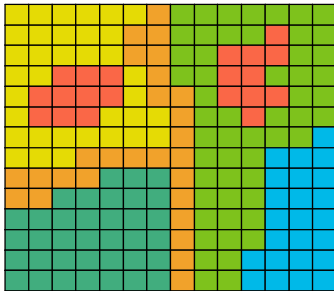
# Vector = Data Discrete

- Menggunakan points, lines, and polygons
- Batas-batas (Boundaries)/locations diikat dgn coordinate.
- Batas-batas negawa. land parcels, streets, rivers, trees.



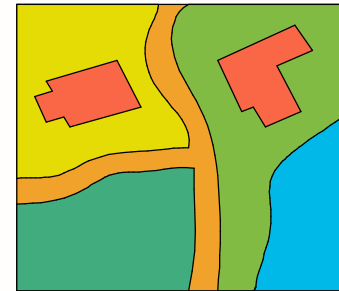
## Raster

- Cells
- Continuous
- Cell-based



## Vector

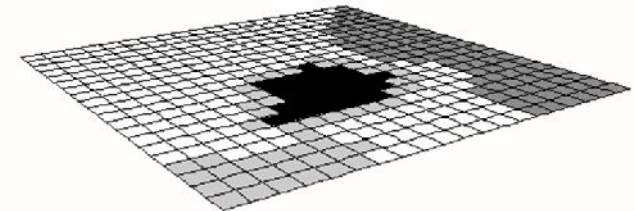
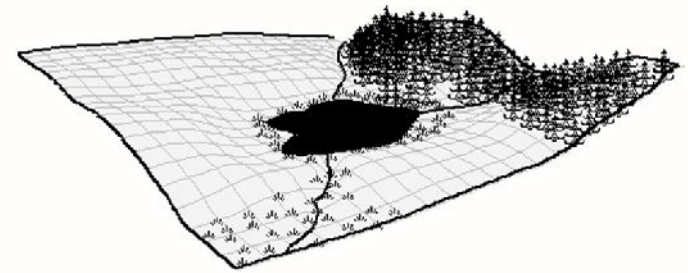
- Points, lines, polygons
- Discrete
- Shape-based



# Feature and Grid Layers

ArcGIS represents elements of the real world for analysis:

- Feature layers use vectors
- Grid layers use rasters



# Operations



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# The ArcGIS Spatial Analyst Toolbar

The image shows the ArcGIS Spatial Analyst toolbar and three dialog boxes. The toolbar is on the left, with 'Surface Analysis' and 'Raster Calculator...' highlighted. A red arrow points from 'Surface Analysis' to the 'Aspect' dialog box. Another red arrow points from 'Raster Calculator...' to the 'Raster Calculator' dialog box. A third red arrow points from the toolbar area down to a text box. The 'Aspect' dialog box has 'Elevation' as the input surface, '30' as the output cell size, and 'C:\Workspace\AspGrid' as the output raster. The 'Raster Calculator' dialog box has 'Elevation' in the layers list and the expression `Sin(Aspect([Elevation]) * DEG)` in the text area.

**Has dialogs for the most commonly-used tools**

**Can compose Map Algebra expressions**

**Has its own environment (not part of geoprocessing)**



# ArcGIS Spatial Analyst and the ArcToolbox Window

The image shows a screenshot of the ArcGIS interface. On the left is the ArcToolbox window, which is a tree view of tool categories. The 'Spatial Analyst Tools' folder is expanded, showing sub-categories like 'Surface' and 'Contour'. The 'Aspect' tool is selected under 'Surface'. A red arrow points from the 'Aspect' tool in the toolbox to the 'Aspect' dialog box on the right. Above the dialog box is a yellow callout box that says 'Provides dialog interface for tools'. The 'Aspect' dialog box has fields for 'Input raster' (set to 'Elevation') and 'Output raster' (set to 'C:\WorkSpace\AspGrid'). It also has a 'Help' button and a 'Hints and link to help' button. A red arrow points from the 'Hints and link to help' button to a yellow callout box that says 'Hints and link to help'. At the top of the interface is the 'Standard' toolbar, which contains various icons for file operations and navigation. A red arrow points from the 'Standard' toolbar to the ArcToolbox window, with a callout box that says 'Opens ArcToolbox'. Below the dialog box is a yellow callout box with two bullet points: 'Uses geoprocessing environments (right-click to set)' and 'Has Map Algebra tools'. At the bottom left of the slide is the logo for 'pens' (Politeknik Elektronika Negeri Surabaya).

**Opens ArcToolbox**

**Provides dialog interface for tools**

**Hints and link to help**

- Uses geoprocessing environments (right-click to set)
- Has Map Algebra tools

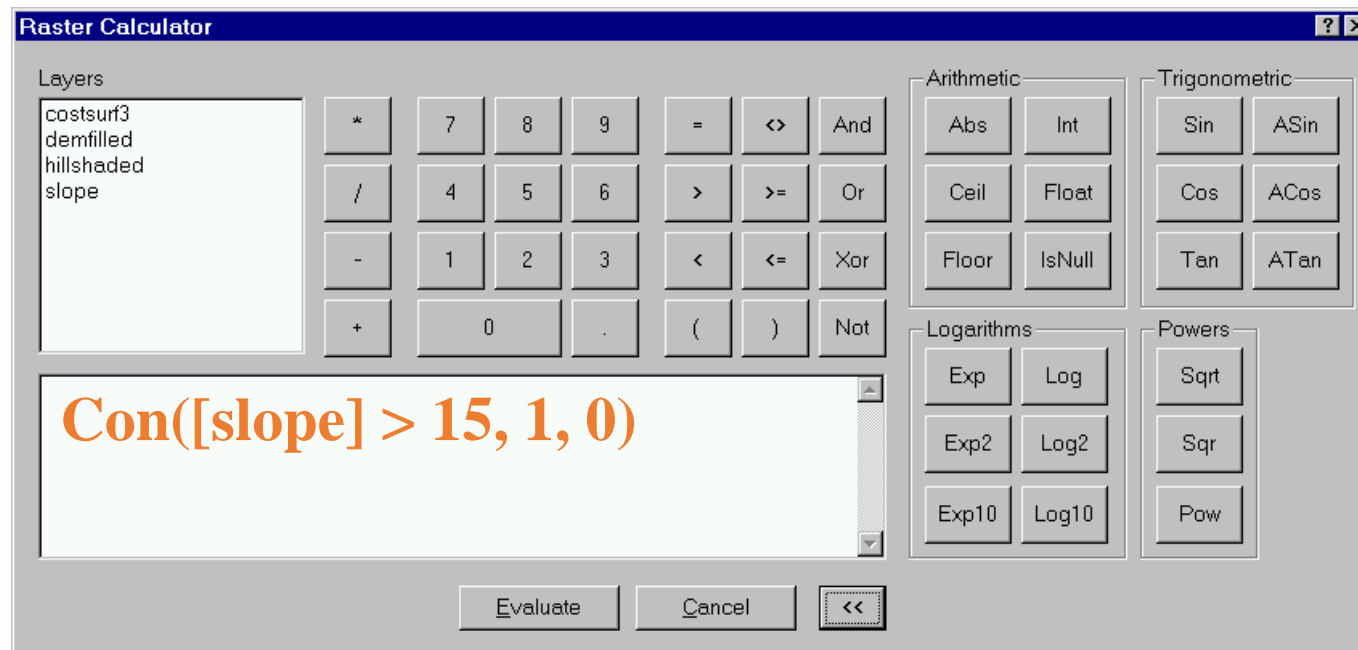
# Raster Calculator

- Works on ArcMap raster layers and grid data sets
  - Uses environment settings for layer input
- Type in GRID Map Algebra
- Perform mathematical functions
- Combine multiple rasters



# Raster Calculator

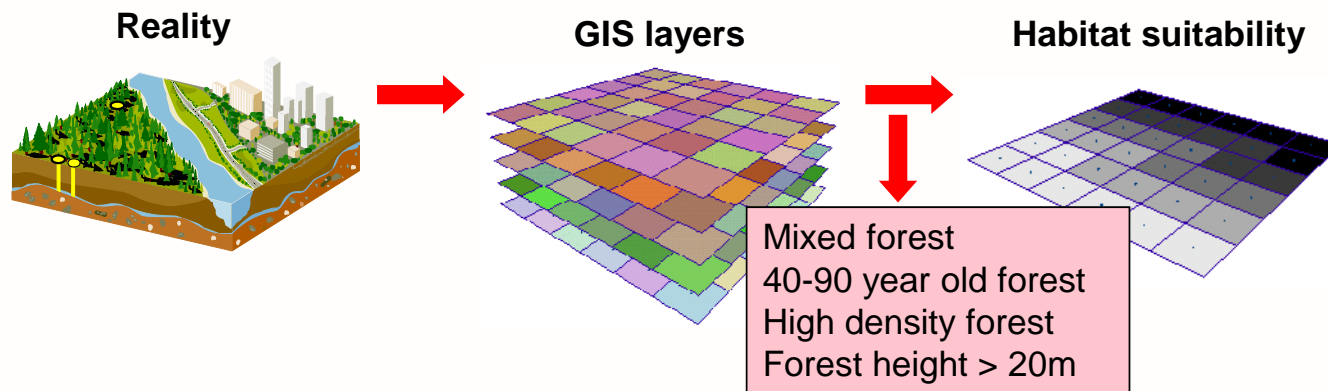
Where is the ground suitable to build a house?



**Condition (If Slope is greater than 15 , Output = 1 if less than 15, Output raster = 0)**

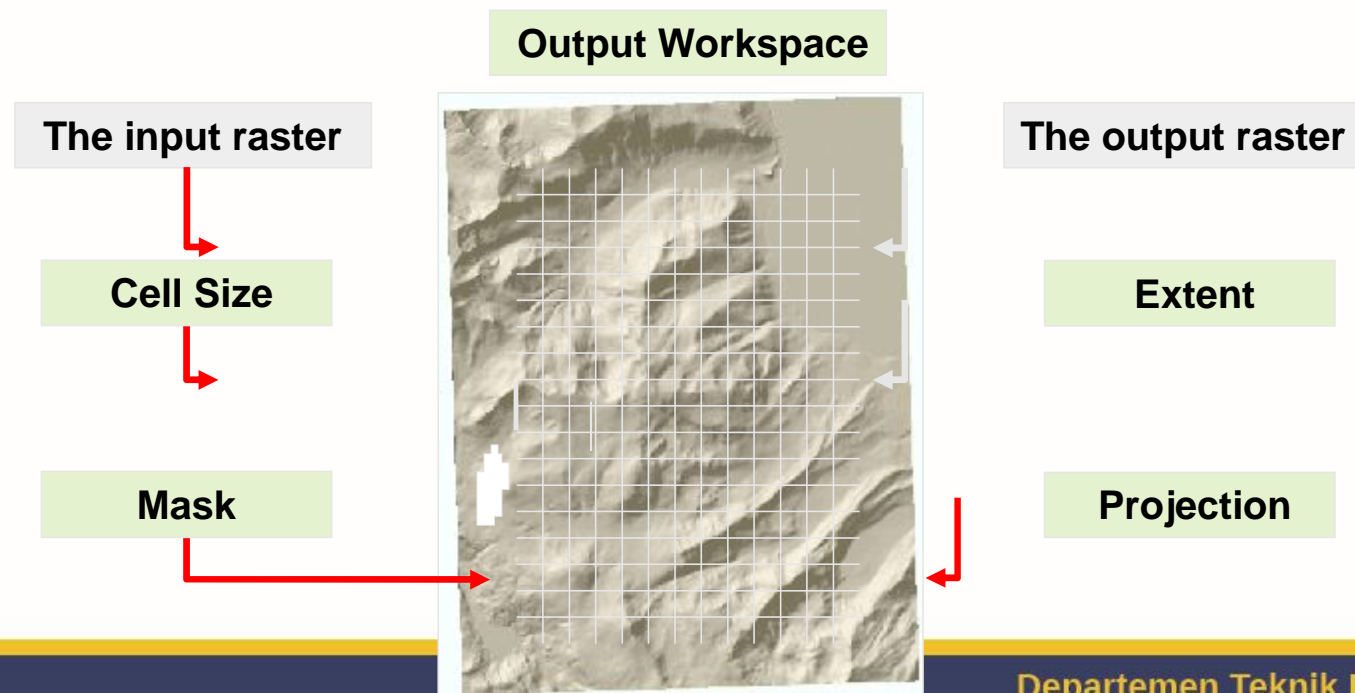
# Modeling spatial problems

- Models help us understand and solve complex problems
  - Simplify reality
  - Combine geographic layers to answer questions
    - Example: “What type of forest does the pine marten prefer?”



# The analysis environment

- Control how an output raster is created
  - Settings for geoprocessing and Spatial Analyst are independent



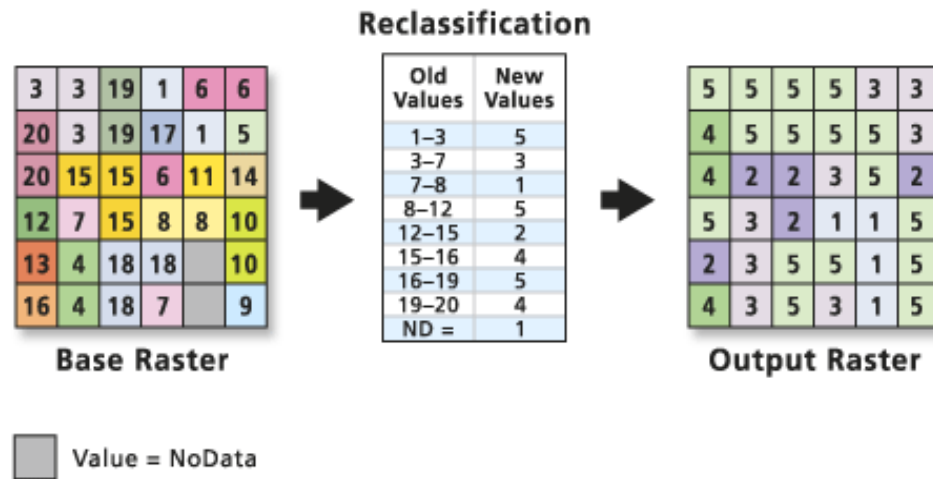
# Types of Analysis



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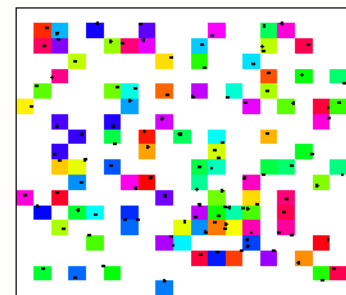
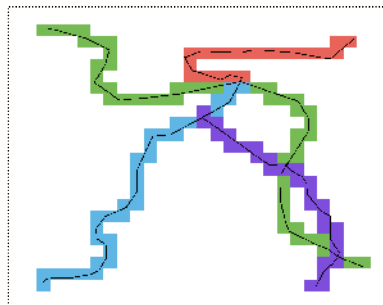
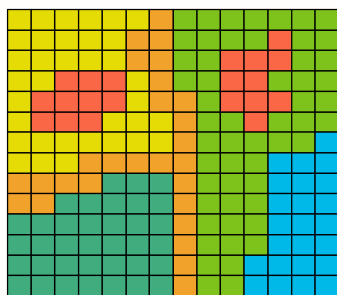
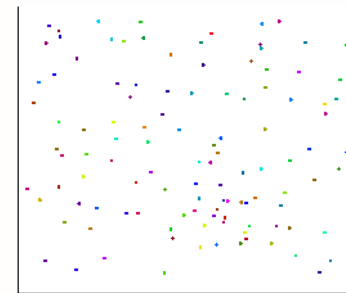
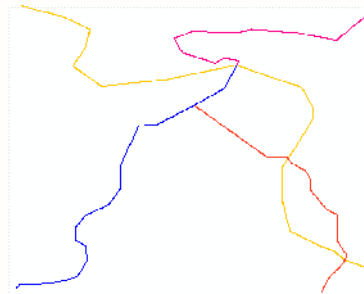
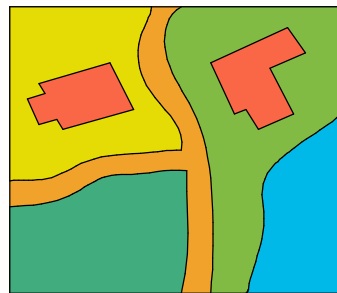
# Reclassification

- Everything within a range becomes the same value
  - E.g.: temperature:  $-10 - 0 = 1$  (cold)  
 $0 - 10 = 2$  (cool)  
 $10 - 20 = 3$  (warm)  
 $30 - 40 = 4$  (hot)



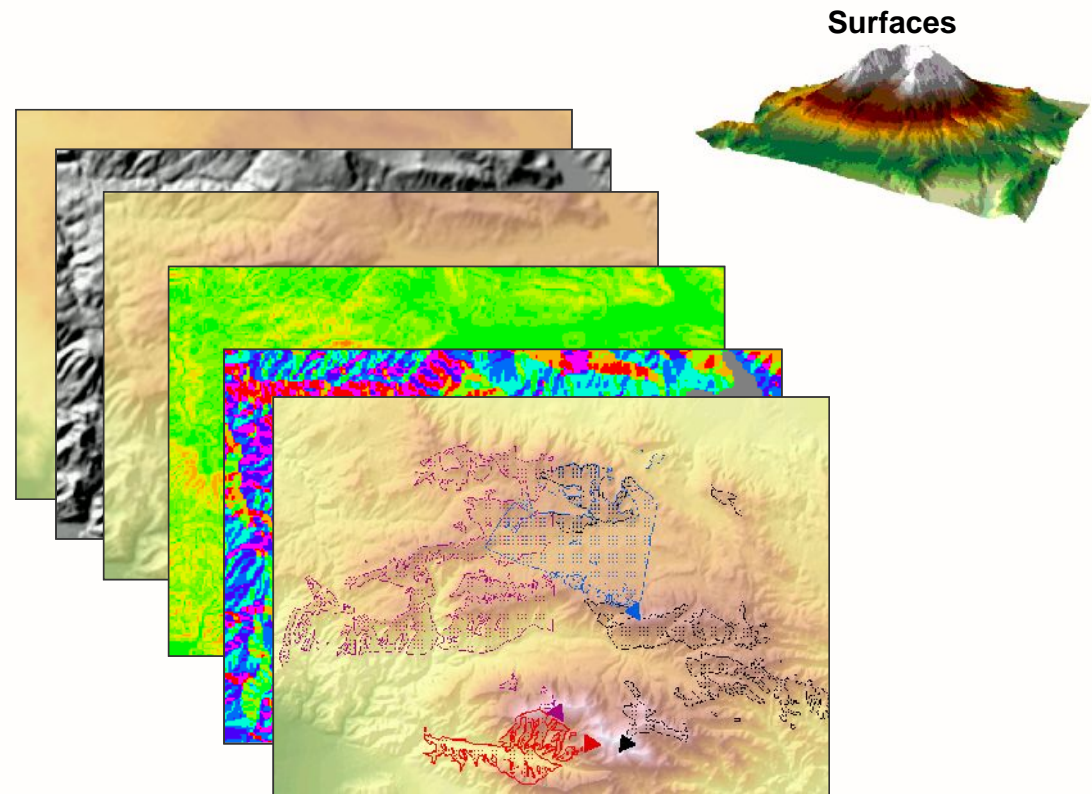
# Converting Vector Layers to Raster

- Useful for making raster calculations with vector data



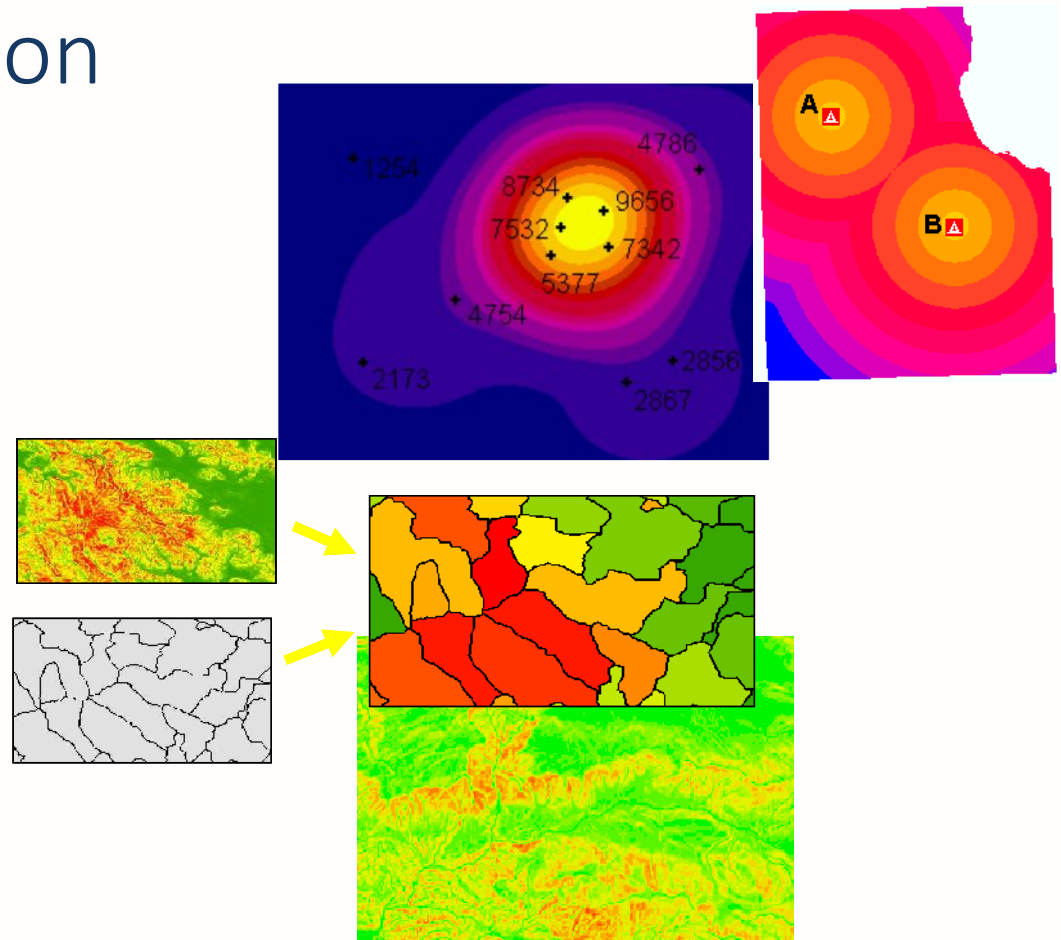
# Surface Analysis

- Hillshade (lereng bukit)
- Slope (lekuk)
- Aspect (arah)
- Viewshed
- Cut/Fill
- Curvature



# Distance and Location

- Distance and proximity (kedekatan) analysis
- Density mapping
- Zonal overlay





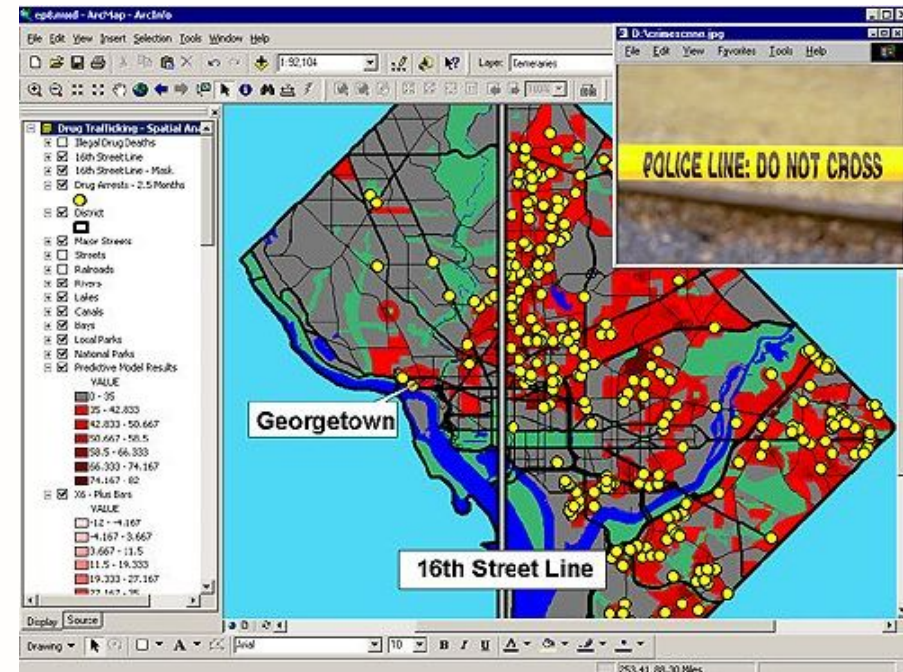
# Applications



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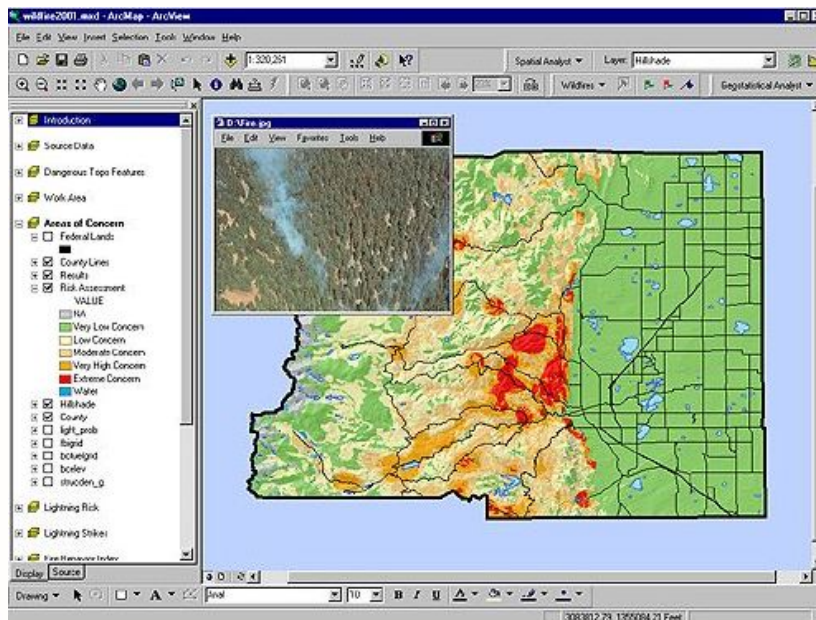
# Crime Analysis

- Mitigate (mengurangi) crime
- Locate areas of high risk for burglaries (pencuri)



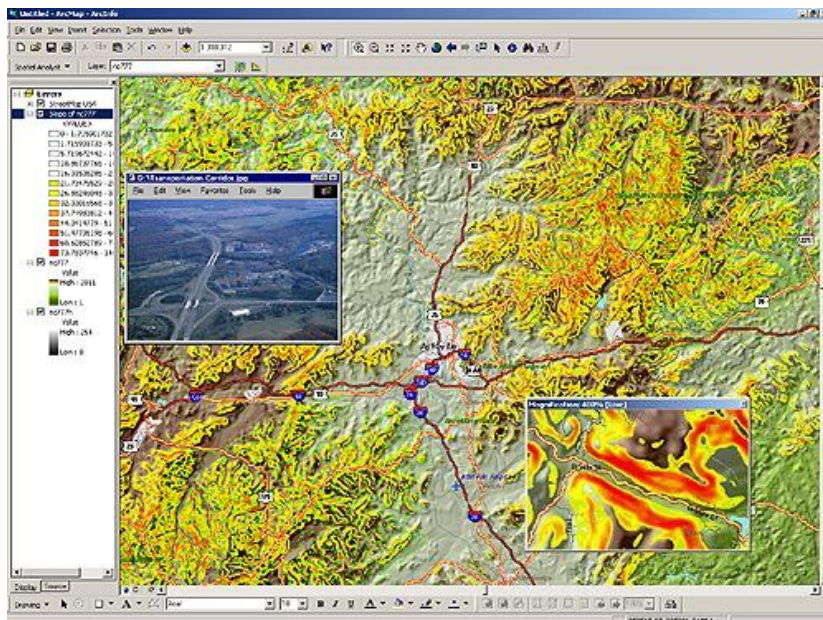
# Fire Analysis

- Locate areas of high risk
- Analyze 'what if' scenarios
- Analyze the spread potential
- Preplan fires

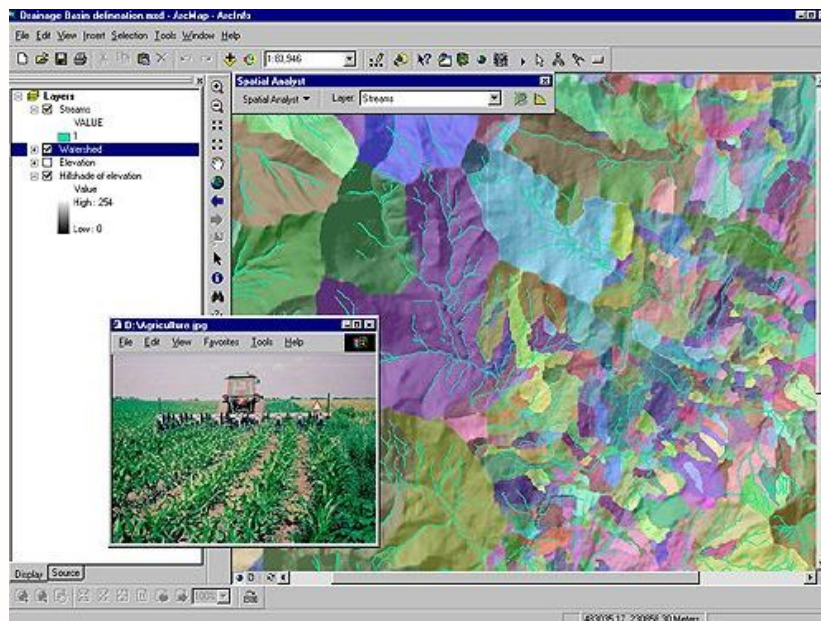


# Analyze Transportation Corridors

- Assess and propose new transport routes
- Foresee problems with new corridors



# Watershed (tanggul/batas air) Analysis



- Locate areas that need protection
- Assess run-off and flood damage
- Analyze soil erosion

# Referensi

1. Wilpen L. Gorr & Kristen S. Kurland, GIS Tutorial Basic Workbook, Esri Pers, 2008
2. *Eddy Prahasta, Tutorial ArcGIS, Informatika, 2015*

# bridge to the future

<http://www.eepis-its.edu>

