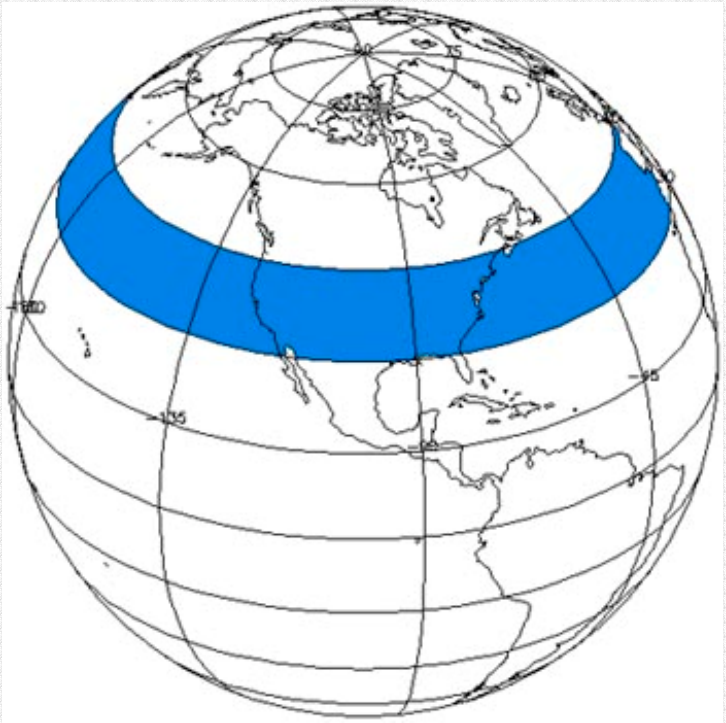
GIS

Geographic Information Systems (GIS)
and
Spatial Data



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What is a GIS?

At the most basic level, a GIS is a computer system capable of storing and manipulating spatial data

What is GIS?

GIS began in the late 1960's as software for cartographic analysis. GIS is now embraced by groups and disciplines who use data with a strong *SPATIAL* component:

- Examples:
  - Federal, State and Local governments
  - Utilities (water, electricity, gas)
  - Police (for Crime prevention)
  - Natural resources and conservation
  - Defense
  - Climate modeling

What is a GIS?

- Mapping is a key output of GIS but is not the whole story.
  - GIS stores the spatial data that is used to make maps.
  - GIS is an analysis tool

A GIS is a tool to answer spatial questions ...

- Where is a site where certain conditions are satisfied?
- What changes have occurred since the last time data was collected?
  - How will the runoff rate for a basin change if the land use changes?
- What spatial patterns exist in your data?

What makes GIS a special kind of database tool?

- SQL queries in a relational database plus information retrieval based on location – making maps interactive.

Questions the user needs to ask:

- Using a GIS, a suggested process for users:
  - What questions do you want answers for?
  - What data do you need to find the answers?
  - How do you process your data to find the answers to your questions?

How does a GIS work?

- Data acquisition
  - Field collection with GPS
  - Scan maps
  - Digitize Maps
- Data integration
  - Projection and registration
  - Data structures or data types (raster vs vector)
- Mapping and analysis tools

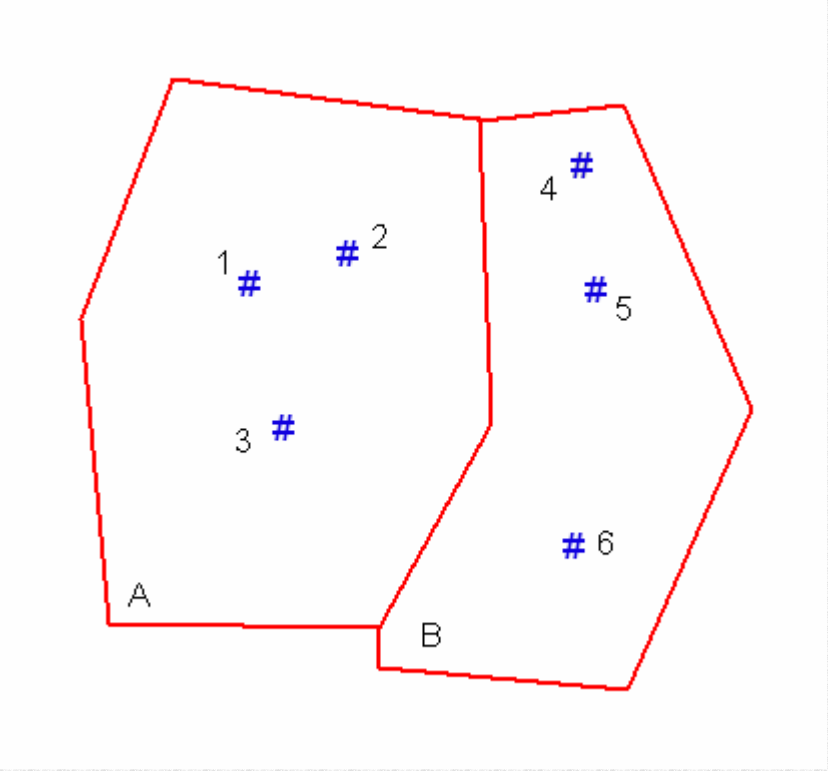
Spatial Reference Systems – Map Projections

- Conversion of data locations from spherical coordinates (latitude and longitude) to Cartesian coordinates for ease of calculations
- Maximizes benefits or minimizes costs of the conversion
  - Area
  - Distance
  - Direction
  - shape

Spatial Analysis

- Compare different layers of spatial data
- Combine elements of diverse data

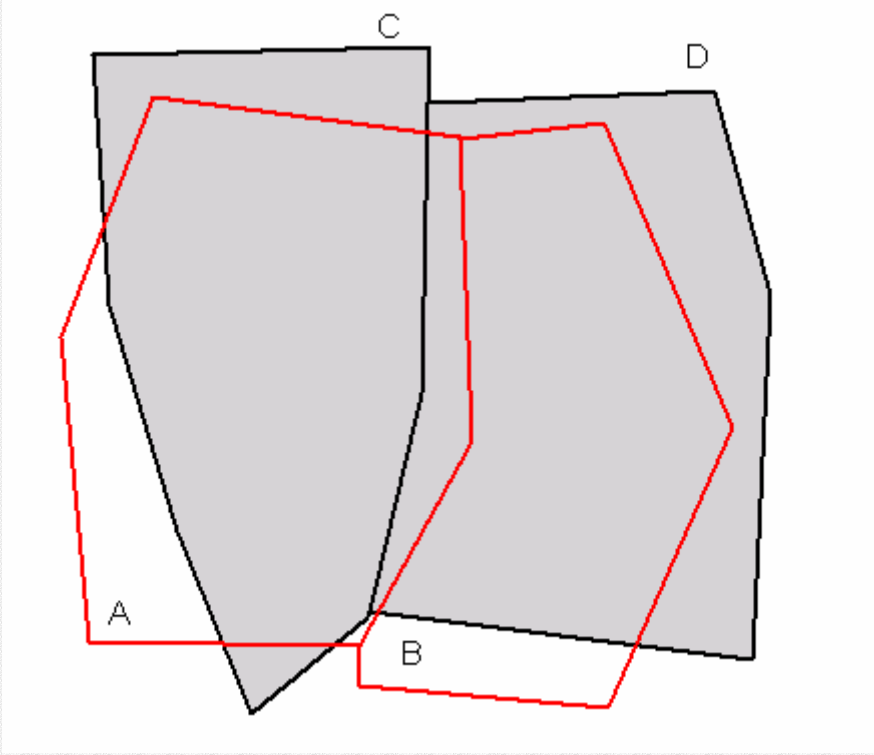
Points in Polygon



Vector processing

Which land use is well #1 sited in?

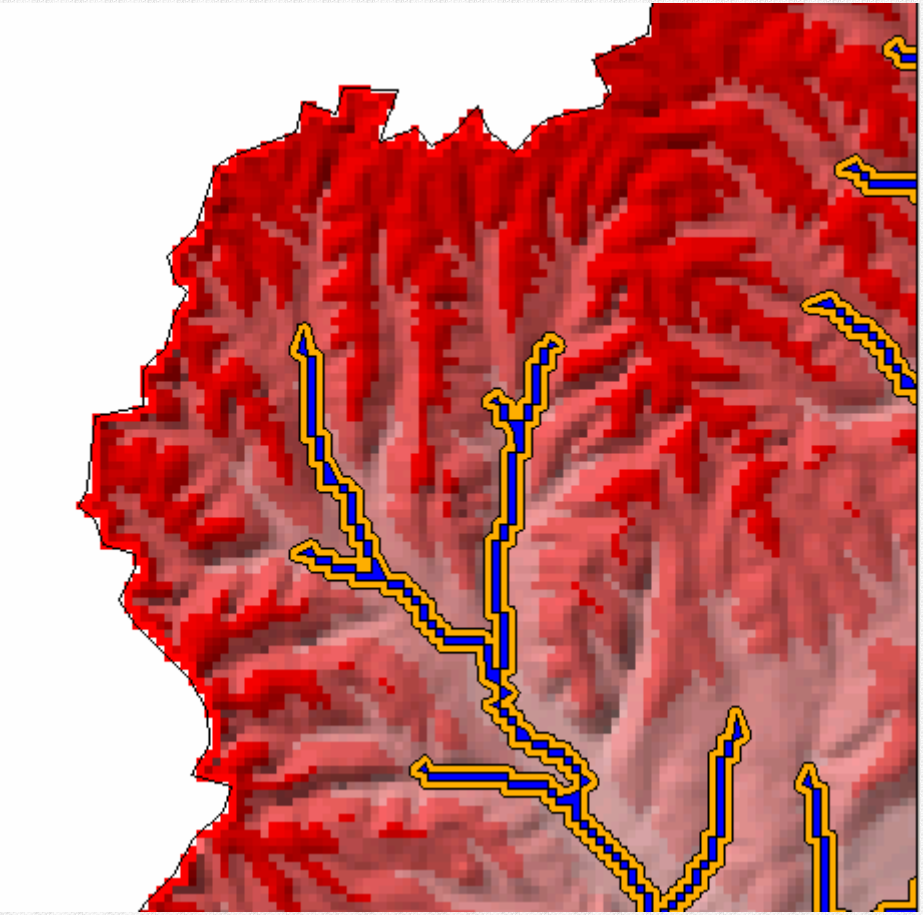
Polygon on polygon overlay



Vector processing

Which parts of land use polygon A fall inside of soil Polygon C.

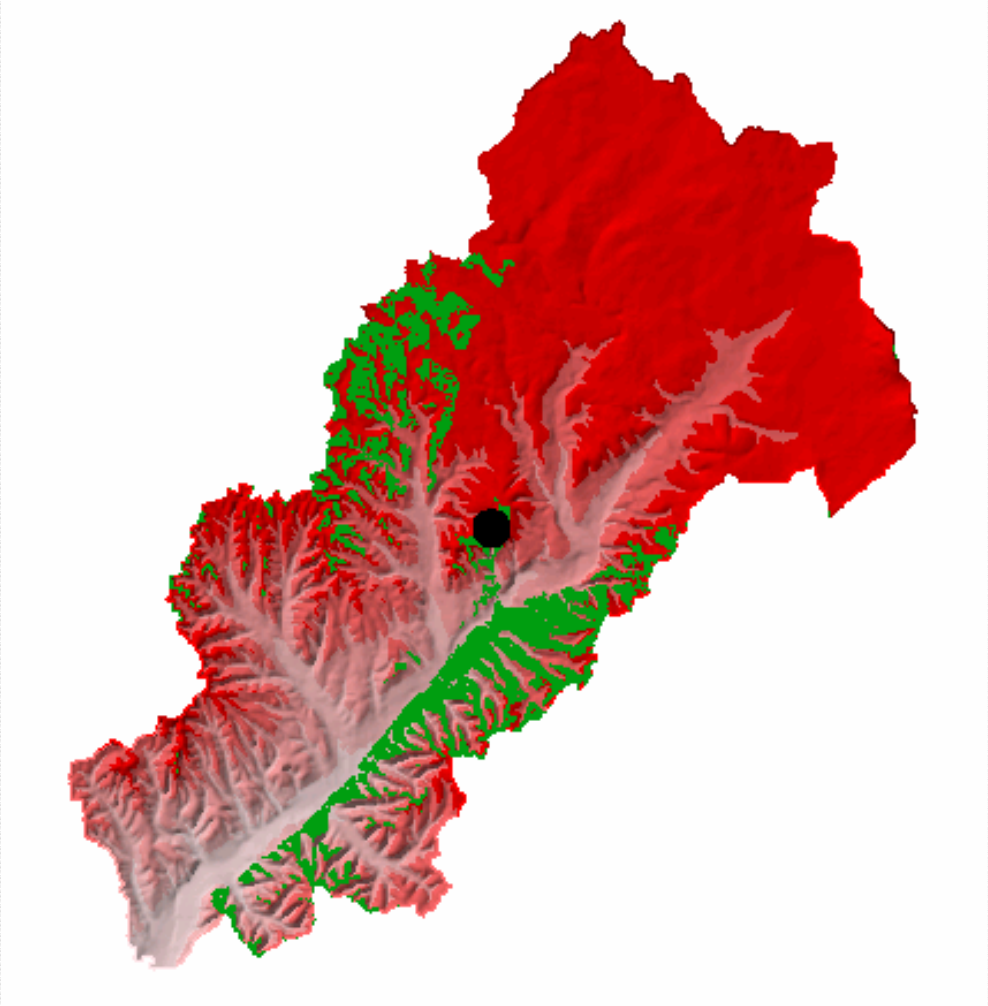
Buffers



What are the characteristics of land within 50 meters of a stream?

Vector processing

Visibility



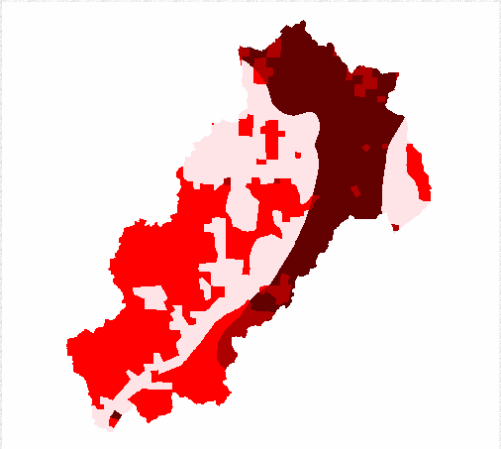
What land is visible from the selected location?

Raster processing

Modeling

How much precipitation contributes to runoff?

Runoff Curve Number



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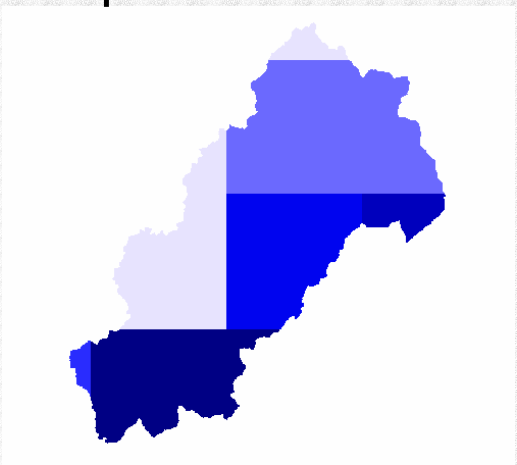
Precipitation



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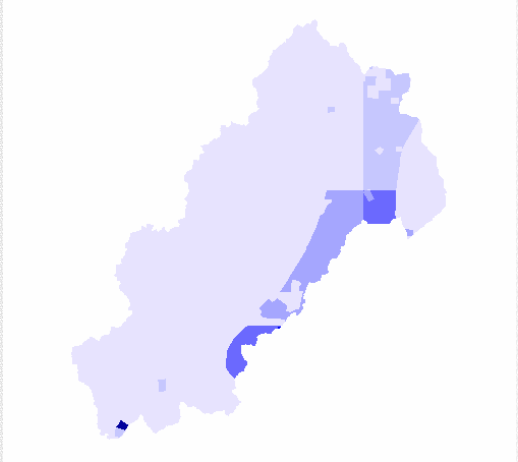
Runoff



Raster processing