Geographic Information Systems (GIS) in Planning and Resource Management

ENVS 6189 3.0 – Session VIII

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Session Purpose:

To discuss vector-based GIS processing, analysis and statistical generalization for mapping thematic distributions.
Characteristics of the Raster Data Model:

- forest
- drainage
- highway
- relief

Raster layers
Raster map
Vector map
Actual terrain

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The Vector Data Model –
Spatial Representations:

- forest
- drainage area
- drainage lines
- drainage point
- highway layer

Vector Layers

Vector map

Actual terrain

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The Vector Data Model – Attribute Association:

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Intelligent Structure:
(Arc-Node Topological data model)

Topology: a branch of math that defines spatial relationships between features and their properties in elastic space.

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Topological Relationships:

The most important aspects of topology is its capability to recognize surrounding features. The three most important properties that come with topology are the following:

1) **Connectivity:** Topology keeps track of all connected features - and can be used to derive geometric measurements like length and area.
2) **Containment:** Closed chains of arcs define a polygon and can indicate what is within a polygon.
3) **Contiguity:** Arcs have direction (N2N) and left and right sides. Topology links adjacent feature.
Topological Data Processing
Functions with the Vector Data Model:

**Input functions** – prepare and structure vector data (data entry, resampling/editing and compilation).

**Analysis functions** – explore spatial relationship implicit in the source layers using non-topological, feature-based and layer-based functions. (database query, geometric, reclassification, and overlays operations).

**Output functions** – publishes output to inform decision making (graphs, stats reports and maps).

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Non-Topological Functions:

GeoDatabase Functions

1) Attribute Database Query
2) Statistical Computation
3) Address Geocoding
4) Computation of Area, Perimeter and Distance
Feature-based Topological Functions: Buffering

Used to delineate a specified zone around a vector feature.

Original spatial feature

Buffer zones are generated by each line segment and node of the spatial feature.

Boundaries of individual element buffer are dissolved to form one coherent buffer zone.
Layer-based Topological Functions:

Reclassification

Used to reduce, simplify or reconfigure attribute values to a new measurement scale.

(a) Original soil map

(b) Reclassification criteria

(c) Land suitability map

(d) Land suitability map with boundaries dissolved

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Layer-based Topological Functions:

Overlay

Two feature layers are combined to create a new derived output layer with new attribute combinations, graphic representations and topology.

Easiest to understand in the context of:

1) The types of overlay
2) Topological overlay operators
3) Topological overlay process
Layer-based Topological Functions:

Overlay - UNION

- Maps must be topologically structured
- Performed on one or more layers
- New attribute table contains combined old attributes
- Topology of new map is built automatically

The Topological Overlay Process
UNION Operator

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