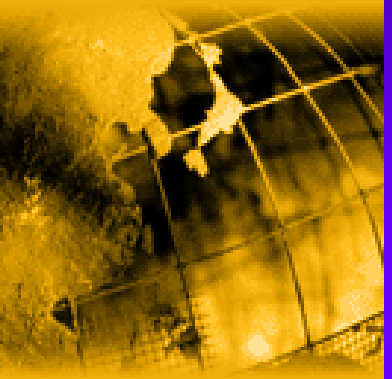

Geographic Information Systems (GIS) in Planning and Resource Management

ENVS 6189 3.0 – Session VIII

John Sorrell

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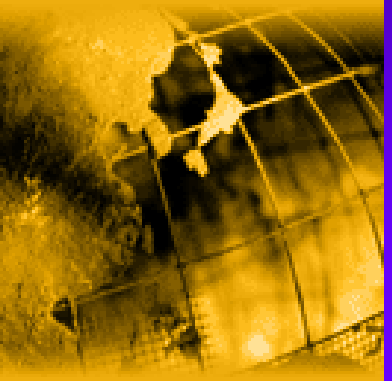
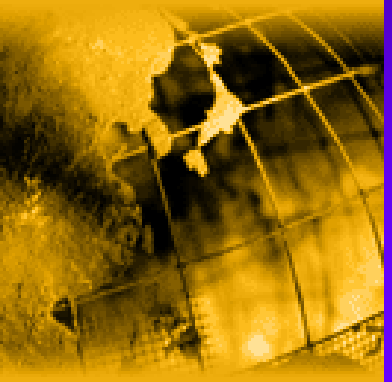
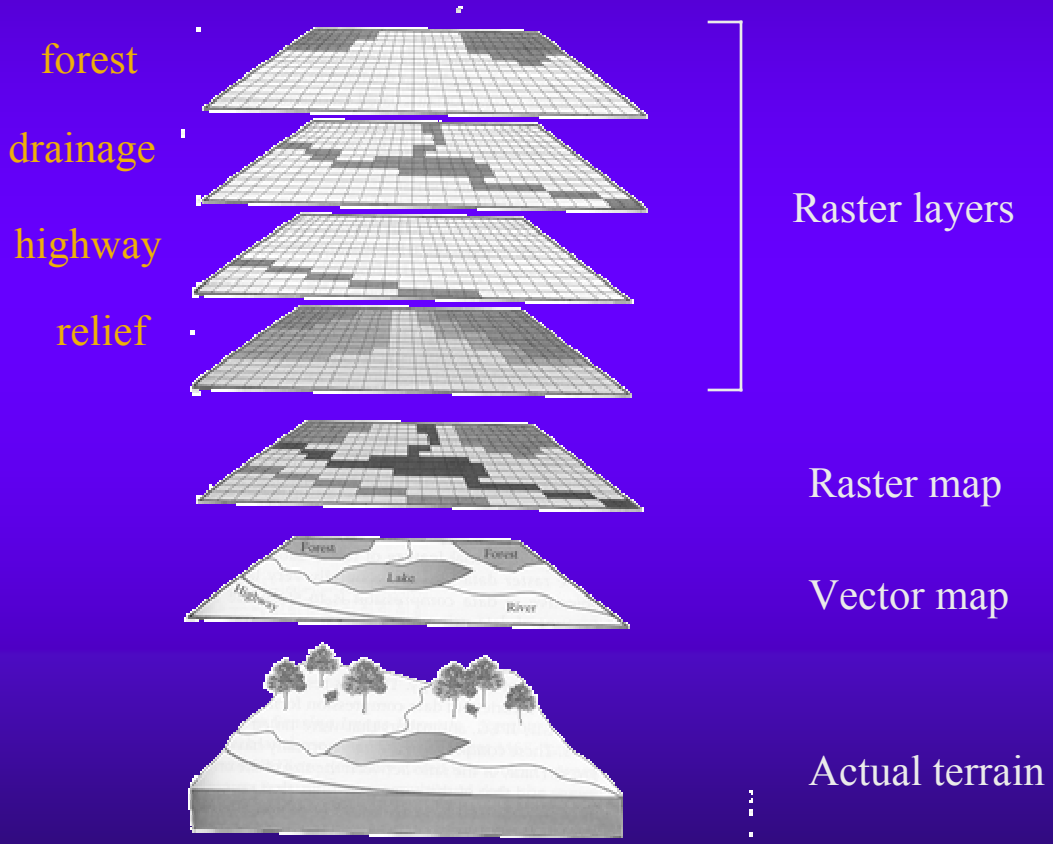
Session Purpose:

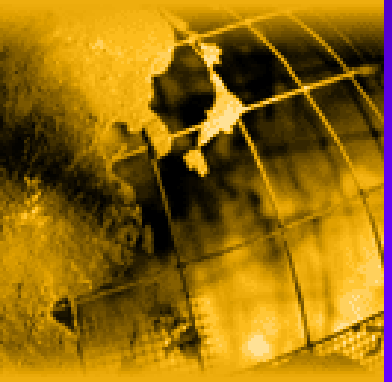


To discuss vector-based GIS processing, analysis and statistical generalization for mapping thematic distributions.

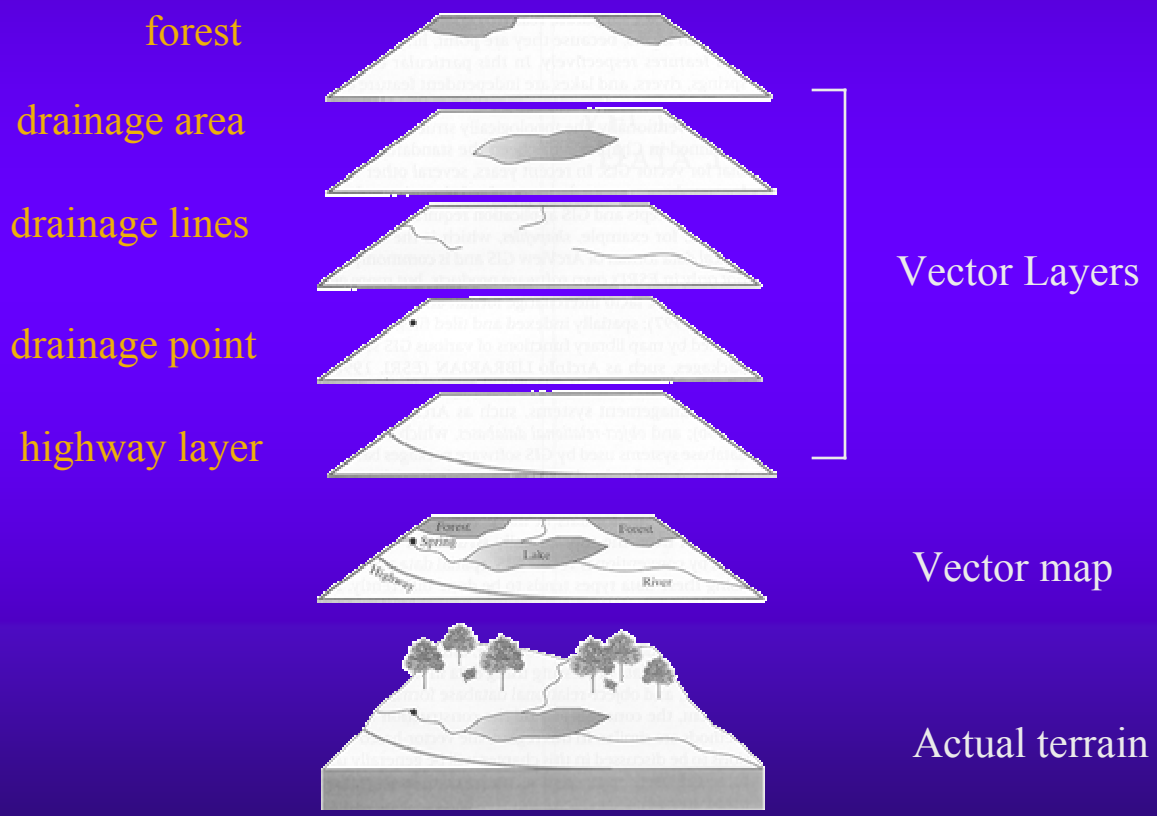


Characteristics of the Raster Data Model:

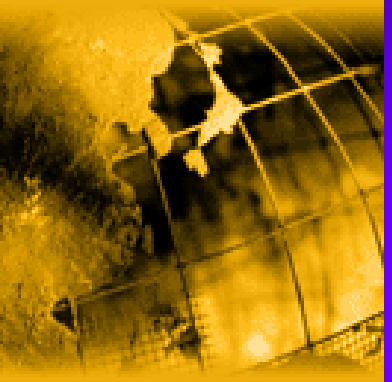


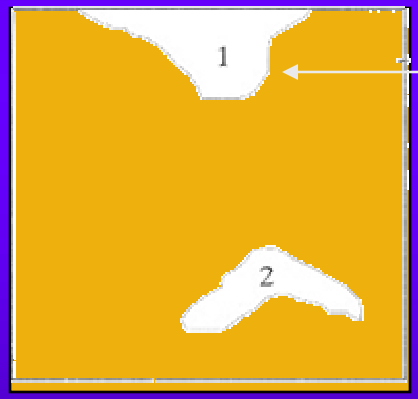


The Vector Data Model – Spatial Representations:



The Vector Data Model – Attribute Association:

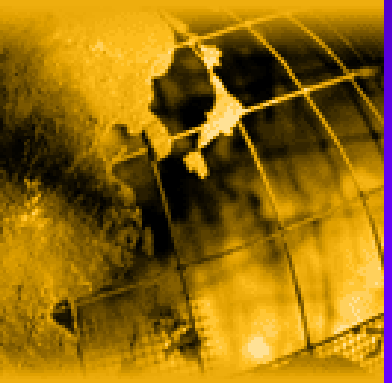




Poly ID	Feat code
1	45001
2	45020

Feat Code	Symbol
45001	G
45030	B
45020	R

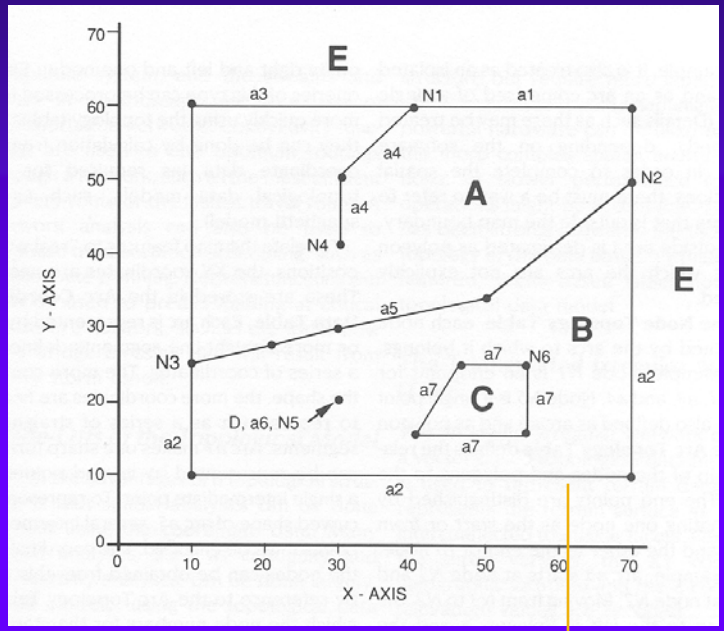
Poly ID	Area	Owner
1	300	K Jones
2	250	J Doe



Intelligent Structure:

(Arc-Node Topological data model)

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

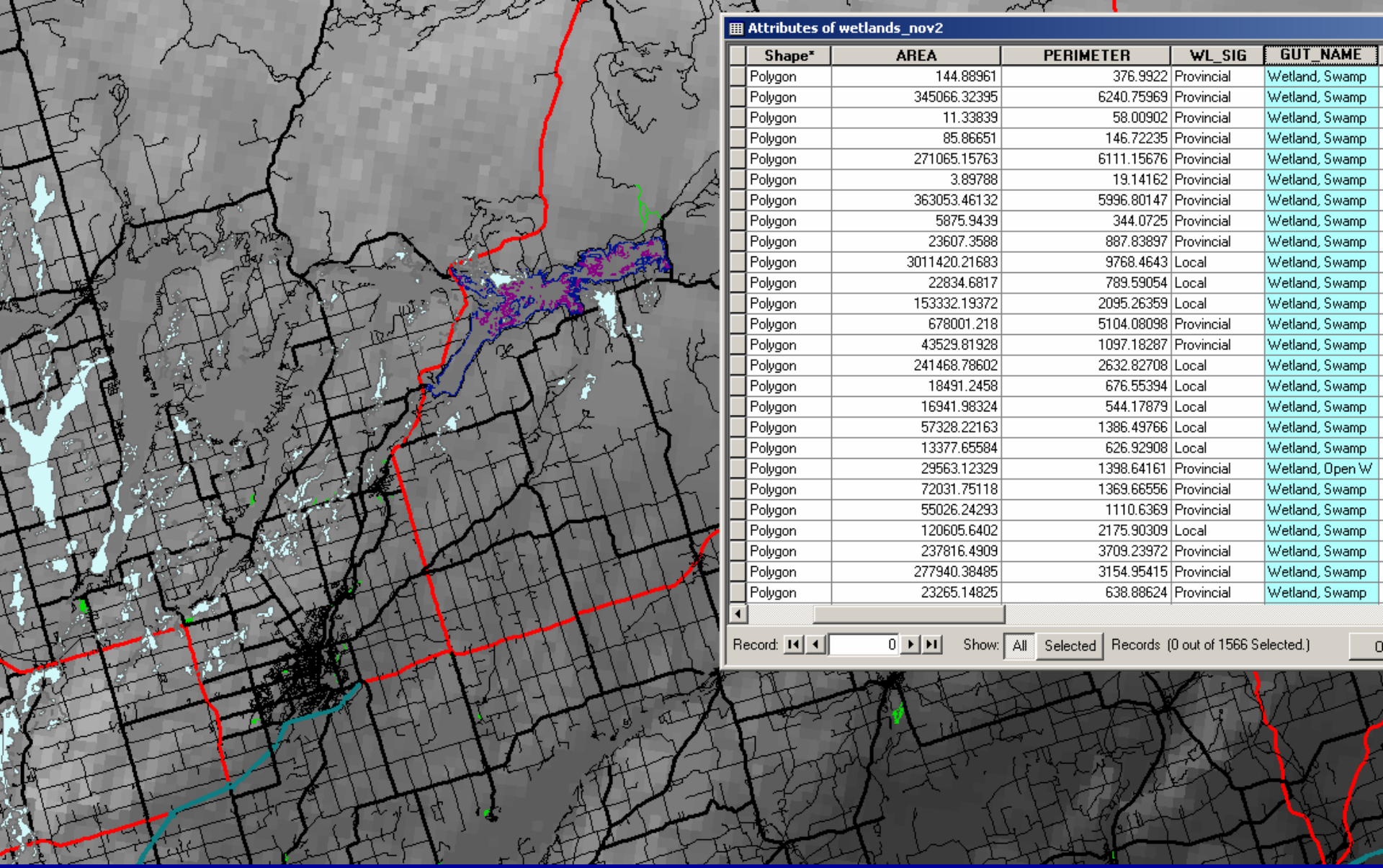


POLYGON TOPOLOGY	
POLYGON	ARCS
A	a1, a5, a3
B	a2, a5, 0, a6, 0, a7
C	a7
D	a6
E	area outside map coverage

NODE TOPOLOGY	
NODE	ARCS
N1	a1, a3, a4
N2	a1, a2, a5
N3	a2, a3, a5
N4	a4
N5	a6
N6	a7

ARC TOPOLOGY				
ARC	START NODE	END NODE	LEFT POLYGON	RIGHT POLYGON
a1	N1	N2	E	A
a2	N2	N3	E	B
a3	N3	N1	E	A
a4	N4	N1	A	A
a5	N3	N2	A	B
a6	N5	N5	B	B
a7	N6	N6	B	C

ARC COORDINATE DATA			
ARC	START X, Y	INTERMEDIATE X, Y	END X, Y
a1	40, 60	70, 60	70, 50
a2	70, 50	70,10; 10,10	10, 25
a3	10, 25	10,60	40, 60
a4	40, 60	30,50	30, 40
a5	10, 25	20,27; 30,30; 50,32	70, 50
a6	30, 20		30, 20
a7	55, 27	55,15; 40,15; 45,27	55, 27

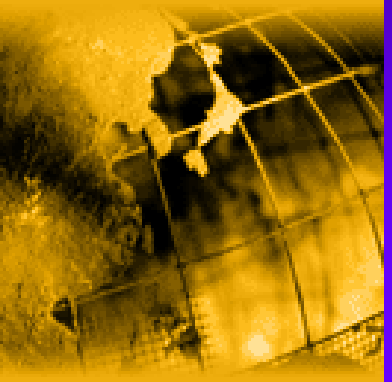


Attributes of wetlands_nov2

Shape*	AREA	PERIMETER	WL_SIG	GUT_NAME
Polygon	144.88961	376.9922	Provincial	Wetland, Swamp
Polygon	345066.32395	6240.75969	Provincial	Wetland, Swamp
Polygon	11.33839	58.00902	Provincial	Wetland, Swamp
Polygon	85.86651	146.72235	Provincial	Wetland, Swamp
Polygon	271065.15763	6111.15676	Provincial	Wetland, Swamp
Polygon	3.89788	19.14162	Provincial	Wetland, Swamp
Polygon	363053.46132	5996.80147	Provincial	Wetland, Swamp
Polygon	5875.9439	344.0725	Provincial	Wetland, Swamp
Polygon	23607.3588	887.83897	Provincial	Wetland, Swamp
Polygon	3011420.21683	9768.4643	Local	Wetland, Swamp
Polygon	22834.6817	789.59054	Local	Wetland, Swamp
Polygon	153332.19372	2095.26359	Local	Wetland, Swamp
Polygon	678001.218	5104.08098	Provincial	Wetland, Swamp
Polygon	43529.81928	1097.18287	Provincial	Wetland, Swamp
Polygon	241468.78602	2632.82708	Local	Wetland, Swamp
Polygon	18491.2458	676.55394	Local	Wetland, Swamp
Polygon	16941.98324	544.17879	Local	Wetland, Swamp
Polygon	57328.22163	1386.49766	Local	Wetland, Swamp
Polygon	13377.65584	626.92908	Local	Wetland, Swamp
Polygon	29563.12329	1398.64161	Provincial	Wetland, Open W
Polygon	72031.75118	1369.66556	Provincial	Wetland, Swamp
Polygon	55026.24293	1110.6369	Provincial	Wetland, Swamp
Polygon	120605.6402	2175.90309	Local	Wetland, Swamp
Polygon	237816.4909	3709.23972	Provincial	Wetland, Swamp
Polygon	277940.38485	3154.95415	Provincial	Wetland, Swamp
Polygon	23265.14825	638.88624	Provincial	Wetland, Swamp

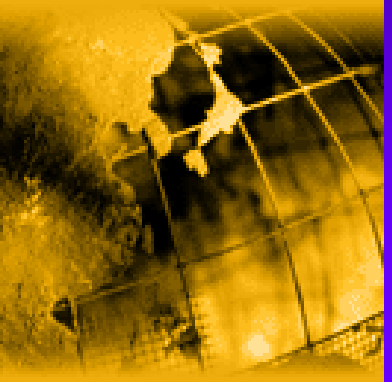
Record: 0 Show: All Selected Records (0 out of 1566 Selected.)

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.

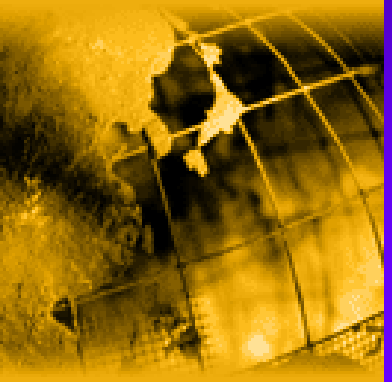


Topological Data Processing Functions with the Vector Data Model:

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).

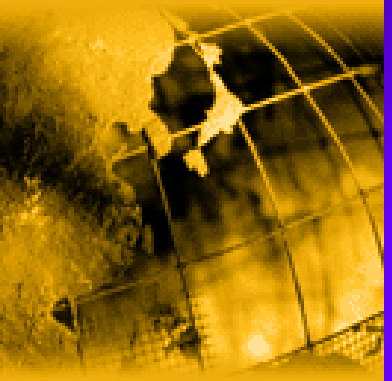
Output functions – publishes output to inform decision making (graphs, stats reports and maps).



Non-Topological Functions:

GeoDatabase Functions

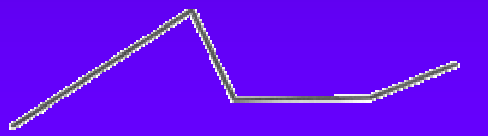
1) Attribute Database Query
2) Statistical Computation
3) Address Geocoding
4) Computation of Area, Perimeter and Distance



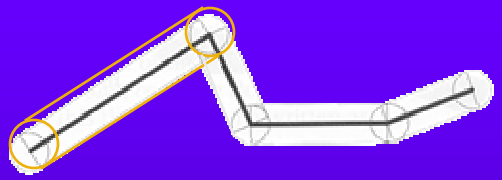
Feature-based Topological Functions :

Buffering

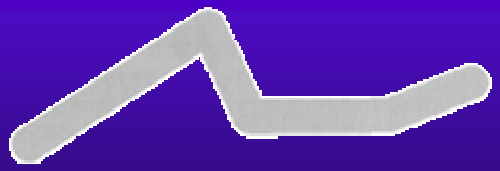
Used to delineate a specified zone around a vector feature.



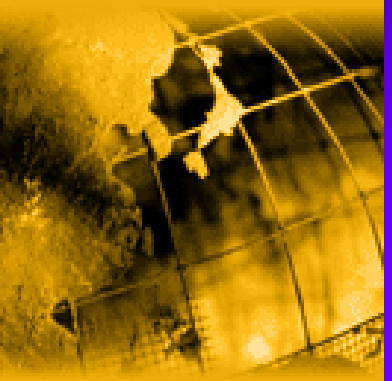
Original spatial feature



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



Boundaries of individual element buffer a re 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.

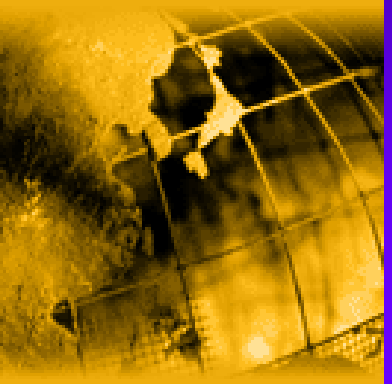
(a) Original soil map

Clay	Unsuitable (U)
Gravel	
Loam	Suitable (S)
Sandy loam	
Sand	Moderately suitable (M)

(b) Reclassification criteria

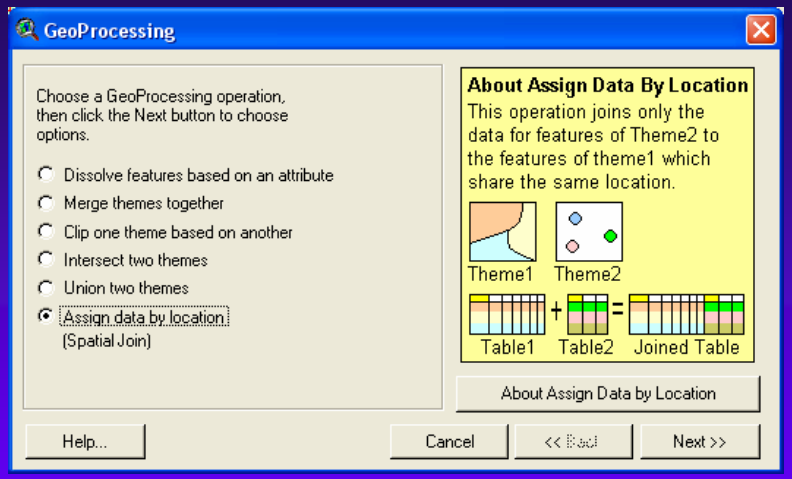
(c) Land suitability map

(d) Land suitability map with boundaries dissolved



Layer-based Topological Functions:

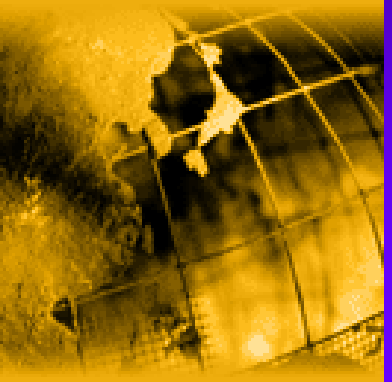
Overlay



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

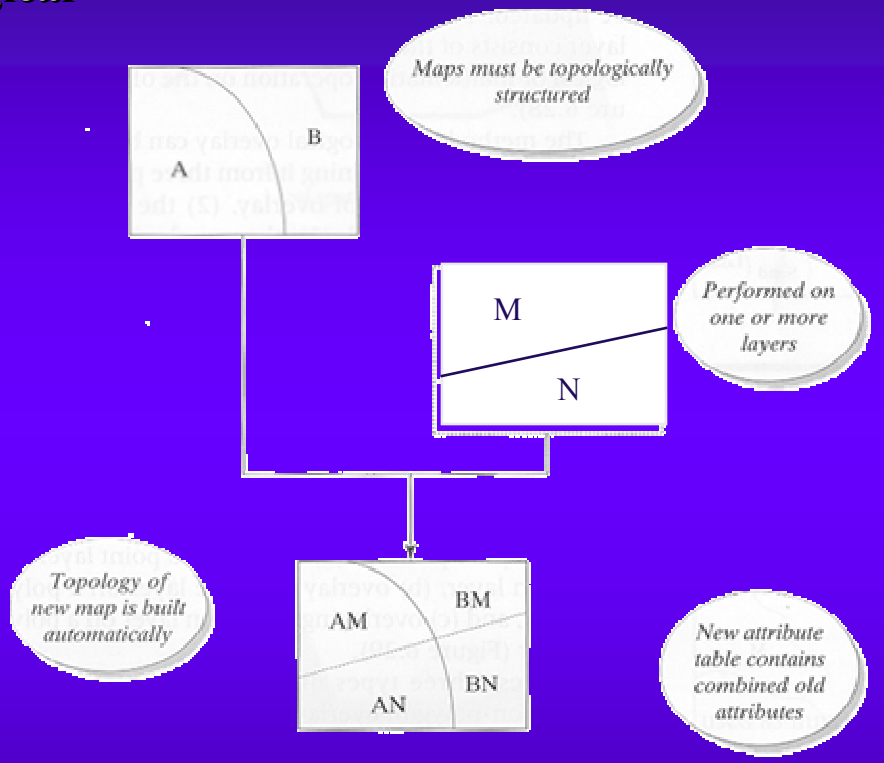
Easiest to understand in the context of :

1) The types of overlay
2) Topological overlay operators
3) Topological overlay process



Layer-based Topological Functions:

Overlay - UNION



The Topological Overlay Process
UNION Operator

#	Attrib
1	A
2	B

#	Attrib
1	M
2	N

#	Attrib 1	Attrib 2
1	A	M
2	B	M
3	A	N
4	B	N