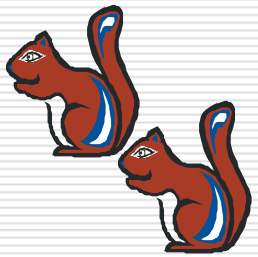


What we will cover today

GIS and homeranges

1. **Hardcopy and Digital Maps**
2. **What's a GIS, Databases**
3. **Vectors, Grids, Operations**
4. **Home ranges and Analysis**

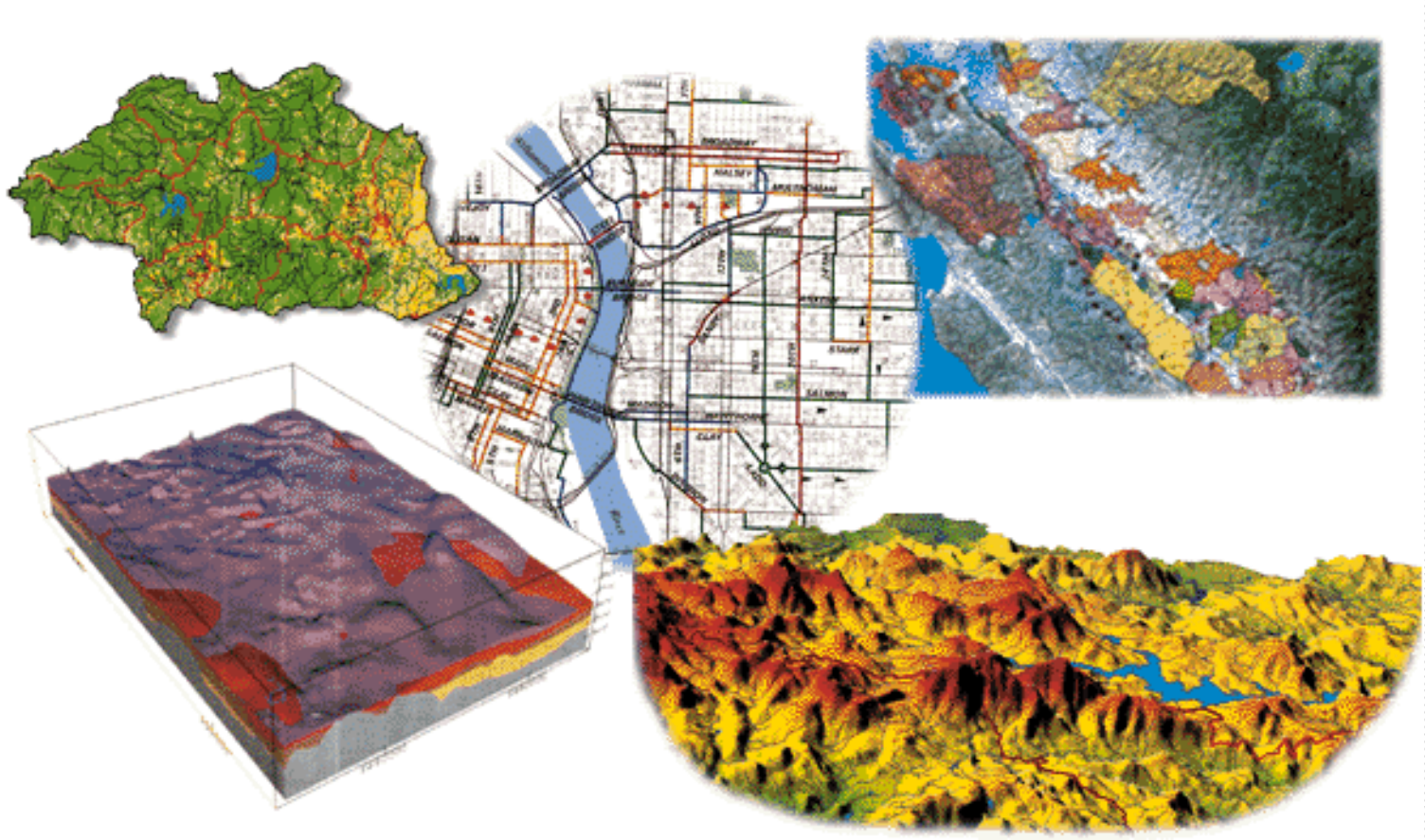
What's a GIS

GEOGRAPHIC INFORMATION SYSTEM (GIS

Geography + Information = A Map & a Database in a Computer

A GIS delivers spatial information in a digital format

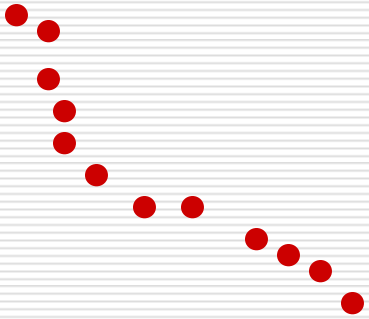
GIS and Habitats



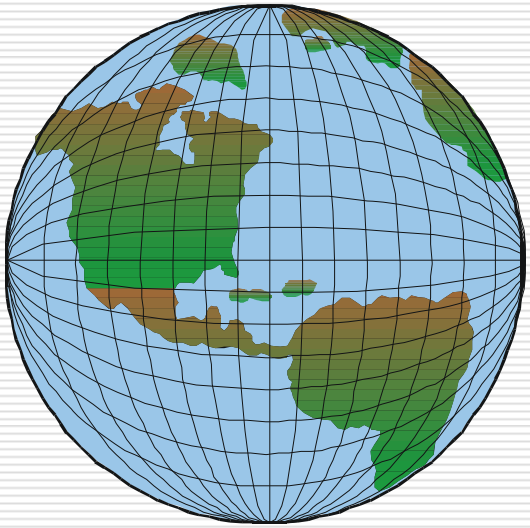
Source: T. Gottschalk

What's a GIS: Example for a Real World Wildlife application

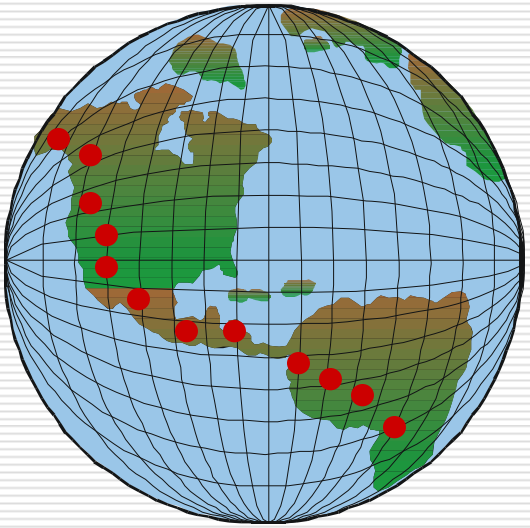
Telemetry



Habitat



Map + Analysis



What's needed:

Fieldwork, Wildlife Data, Habitat Data, Software, Hardware, Statistics, Interdisciplinary Expertise, Funding, Motivation

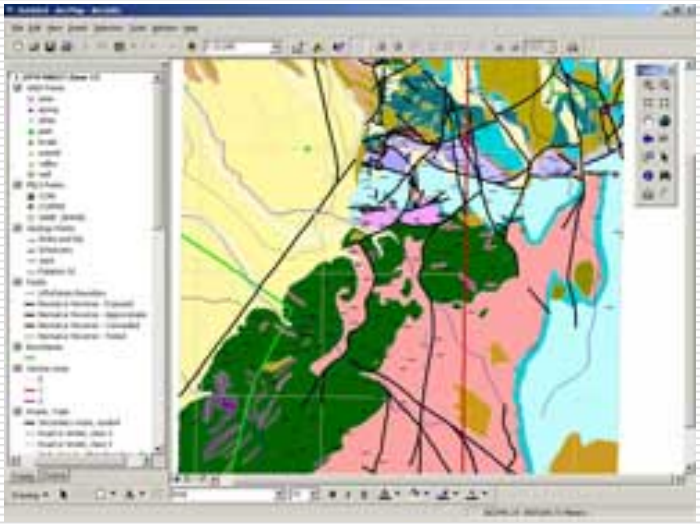
Components of a GIS

-database
-visual display
-computer
-software

-plotter/printer
-data storage
-data back-up

-maintenance

-internet



Hardcopies

‘Hardcopy Map Culture’:

-on paper
-governmental agency and approval
-can be transported and rolled up
-in libraries, collections, or privately owned
-updated

Information presented: Usually topography

Digital Maps

‘GIS Map Culture’:

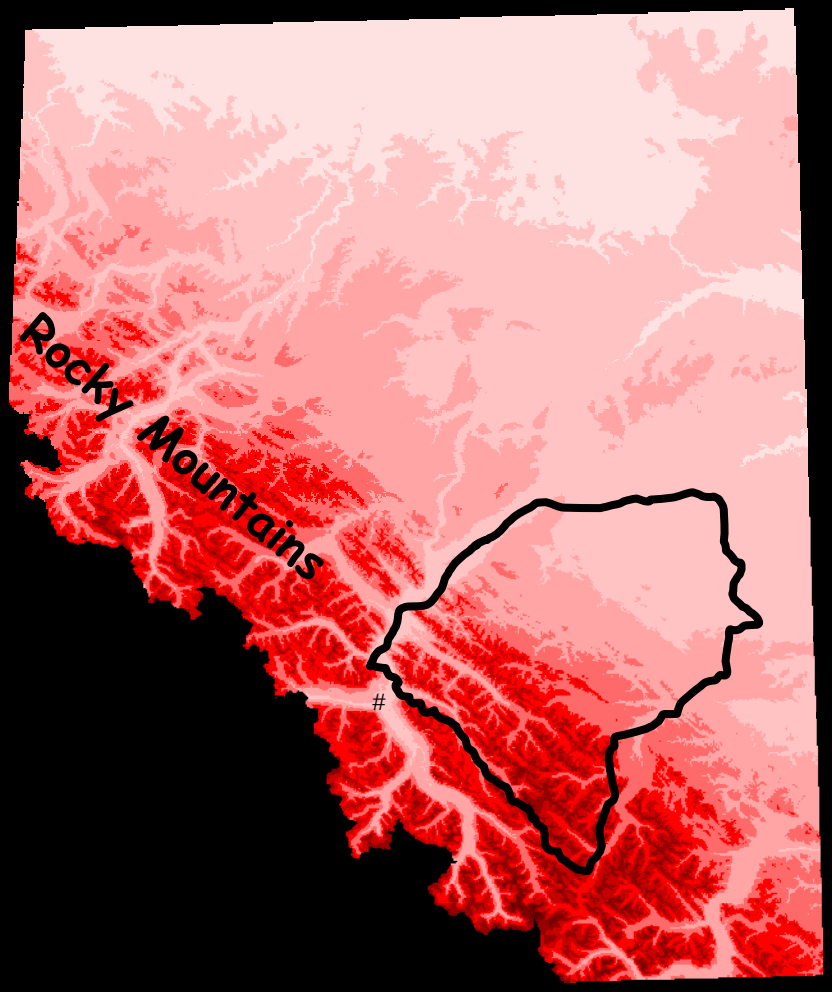
1. huge information content

2. not always presented by government institutions

3. different/untraditional information presented,
   e.g. DEM, Slope, Aspect, Watersheds, Rivers,
   sun incidence...

=> hard to relate to, and to evaluate

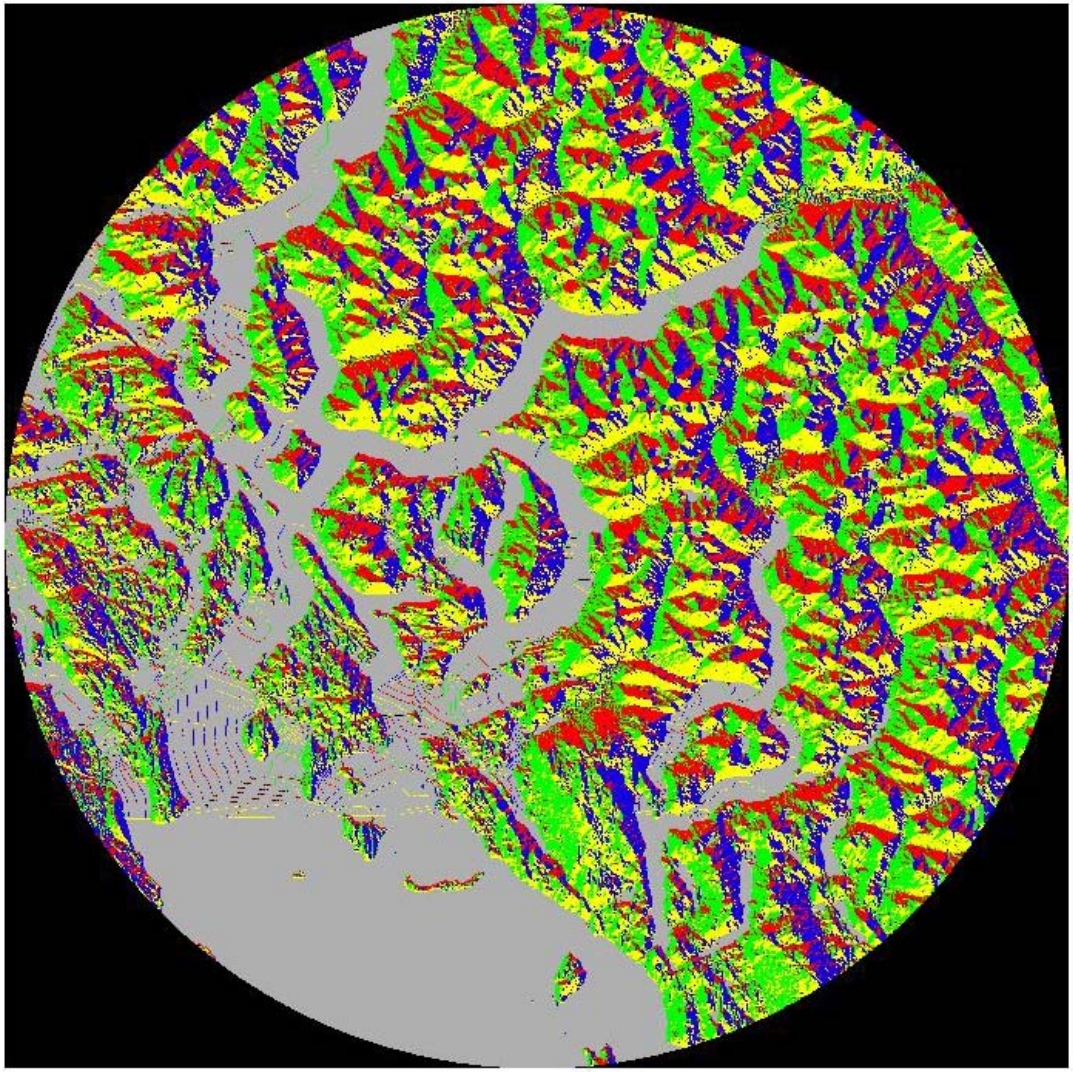
A GIS Example...



Elevation (m)

- 496 - 843
- 844 - 1190
- 1191 - 1537
- 1538 - 1884
- 1885 - 2231
- 2232 - 2578
- 2579 - 2925
- 2926 - 3272
- 3273 - 3619
- No Data

A GIS Example...



Coastal
British Columbia
(TRIM1 data)

Aspect
- Flat (-1)
- North
- East
- South
- West
- No Data

0 10 20 30 40 50 60 70 80 90 100 Kilometers

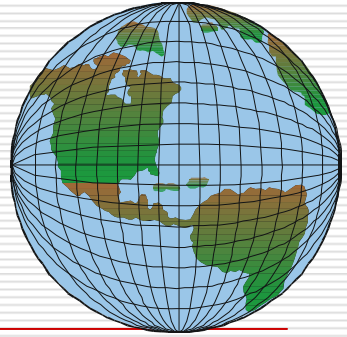
N
W E
S

Digital Culture Clash

GIS vs ‘Hardcopy Map Culture’:

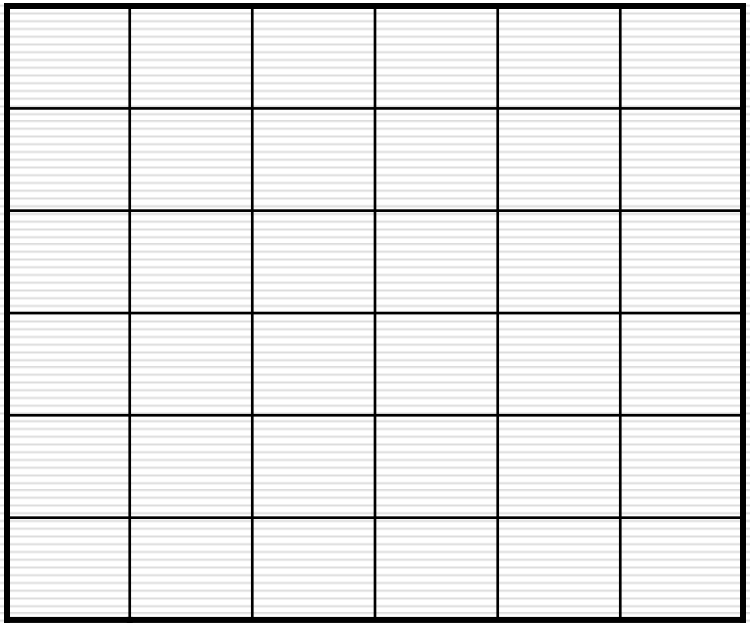
-database
-computer needed
-computer skills needed
-interpolations
-accuracy issue
-projection issue
-difficult production process

=> different skill set required



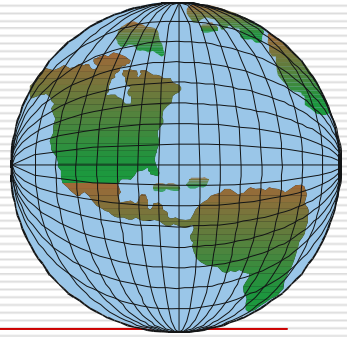
Coordinate Systems a)

Y coordinate



plain, unprojected

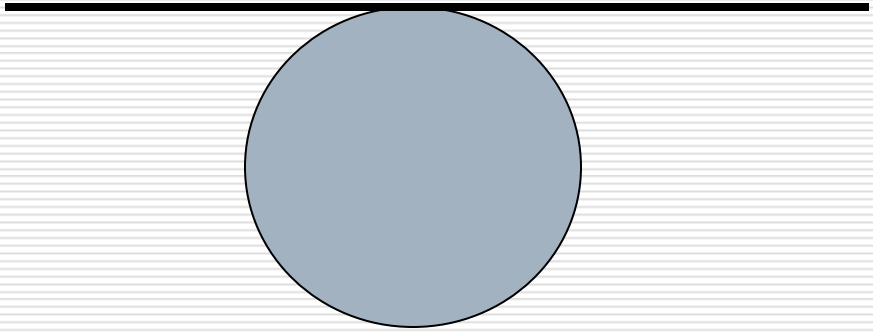
X coordinate



Coordinate Systems b)

earth curvature,
projected

Y coordinate



X coordinate

GIS Software

ArcView, ArcGIS (ESRI)

IDRISI

GRASS

MapInfo

SPANS-GIS

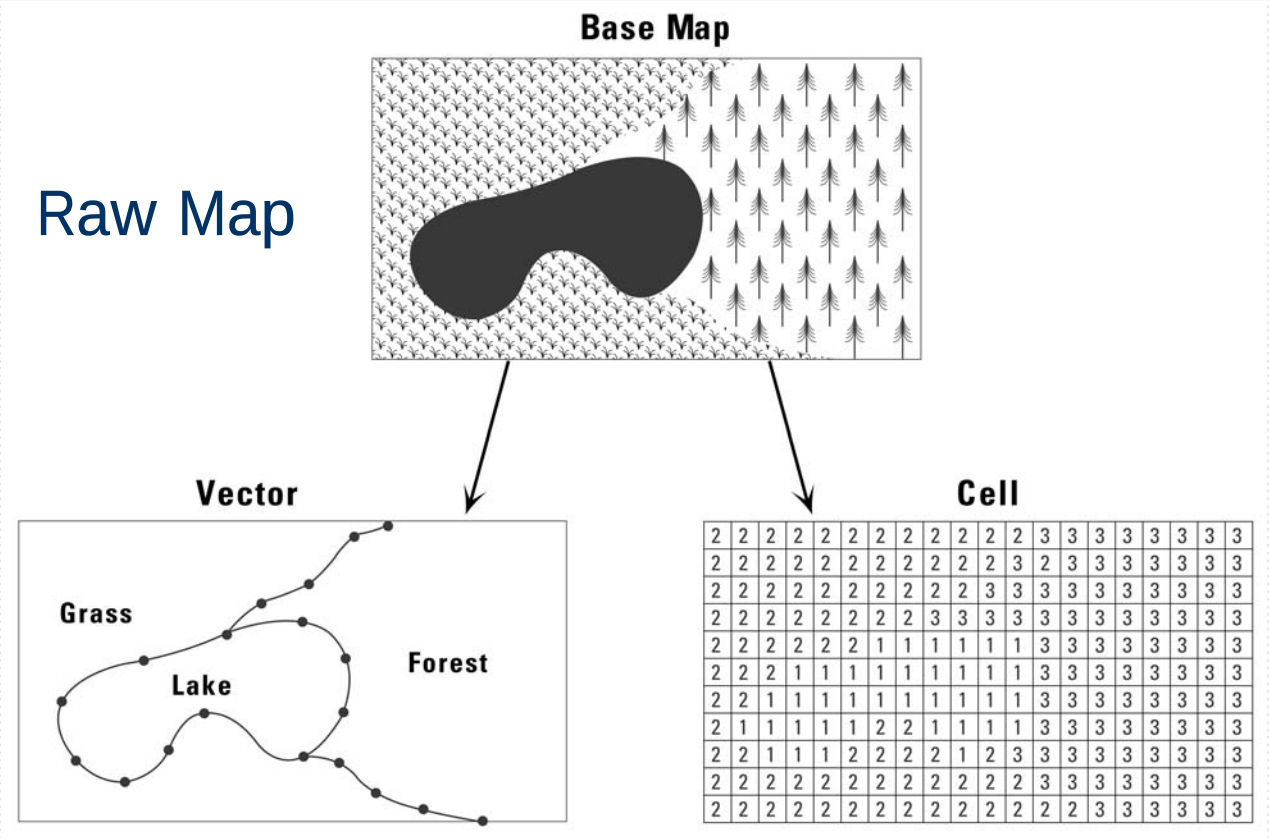
CARIS

...

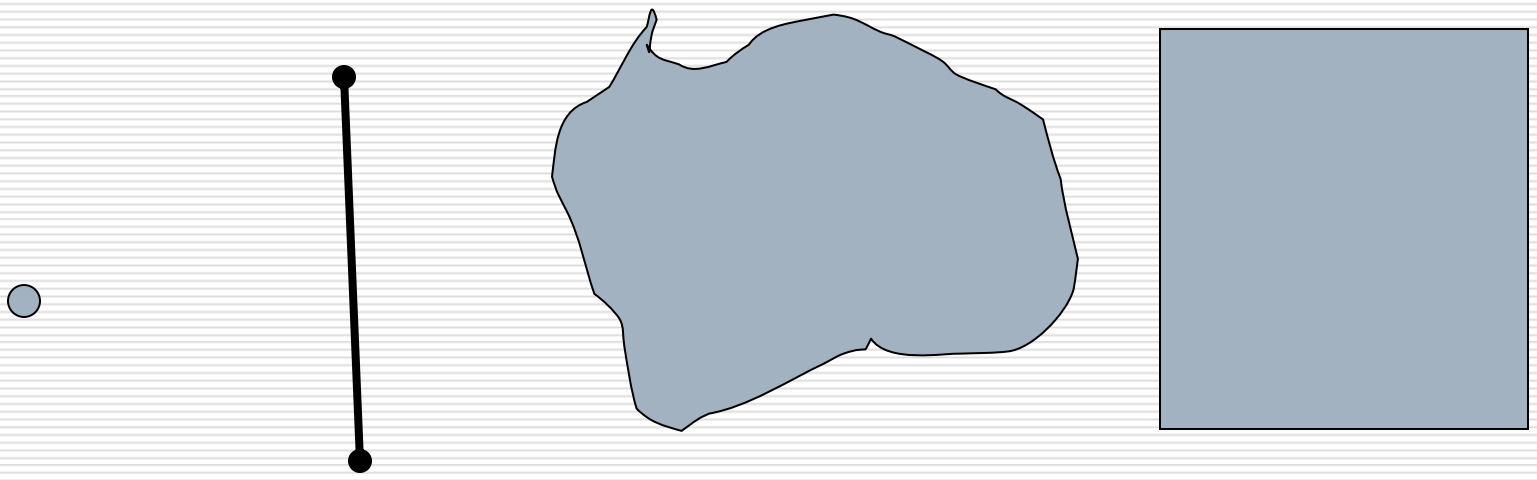
PS. Compatibilities among data, applications, GPS...

GIS Concepts: Vectors vs. GRIDs

Raw Map

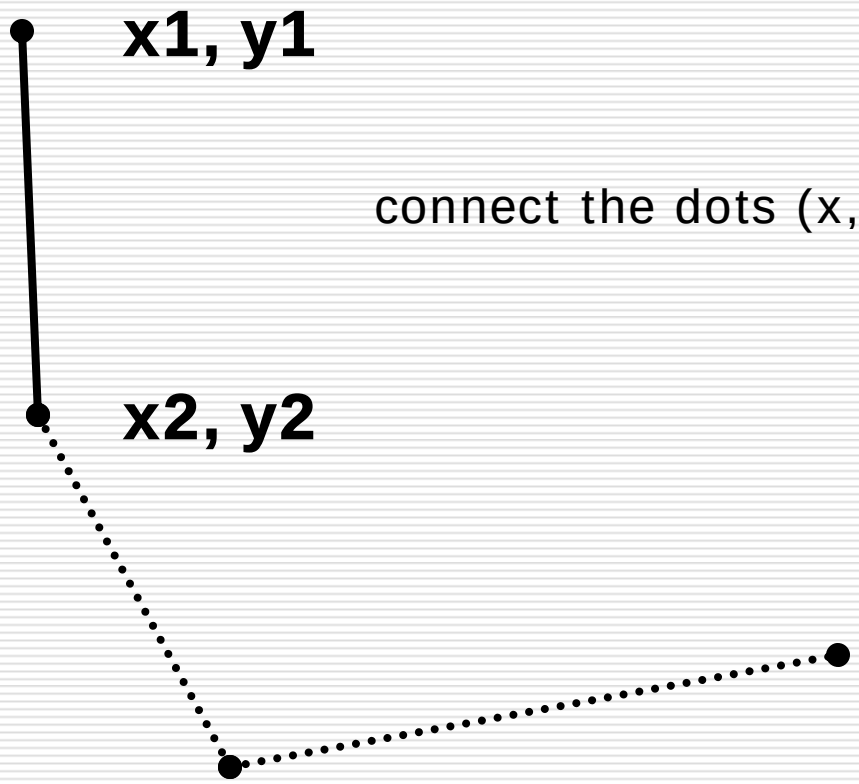


GIS Concepts: Vectors



Point Line Polygon

GIS Concepts: Vector Data



=>Vector GIS Database consists of x,y corner coordinates

GIS Concepts: GRIDs

columns

rows

1,1	2,1	3,1	...
2,1			
3,1			
...			

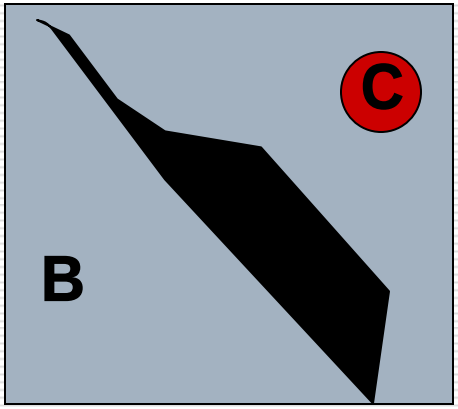
grid cell (pixel) size

e.g.40,000 * 30,000

=>GRID GIS Database consists of x,y pixel coordinates + z values

GIS Concepts: Attribute Data

Map



Attributes

Polygon	Class	Area
A	Water	3
B	Forest	8
C	Urban	1

GIS Concepts: Digitalisation

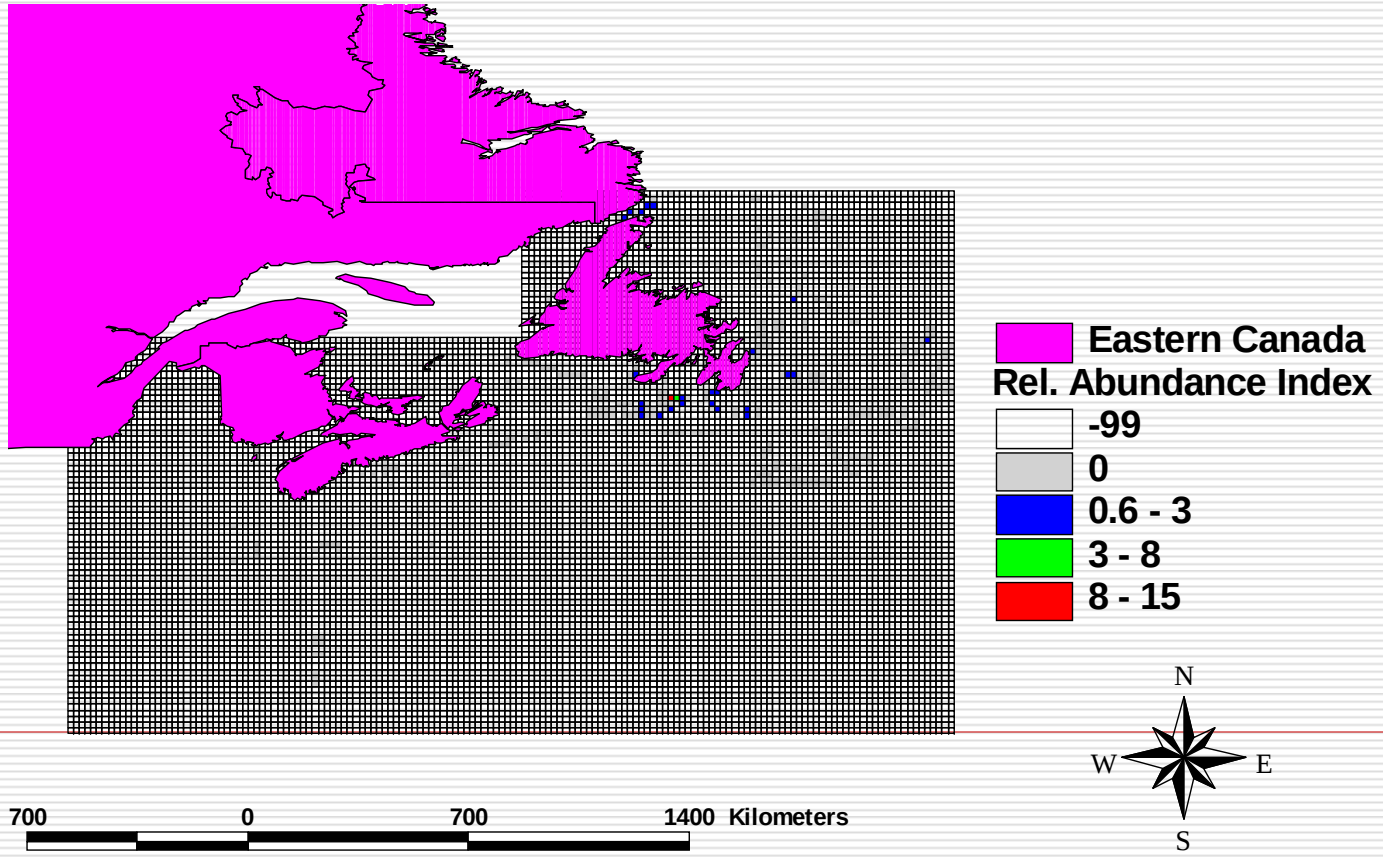
Hardcopy (analogue) => GIS (digital)

Manual Digitizing
Scan Digitizing
Digital Products, e.g. Video, Remote Sensing

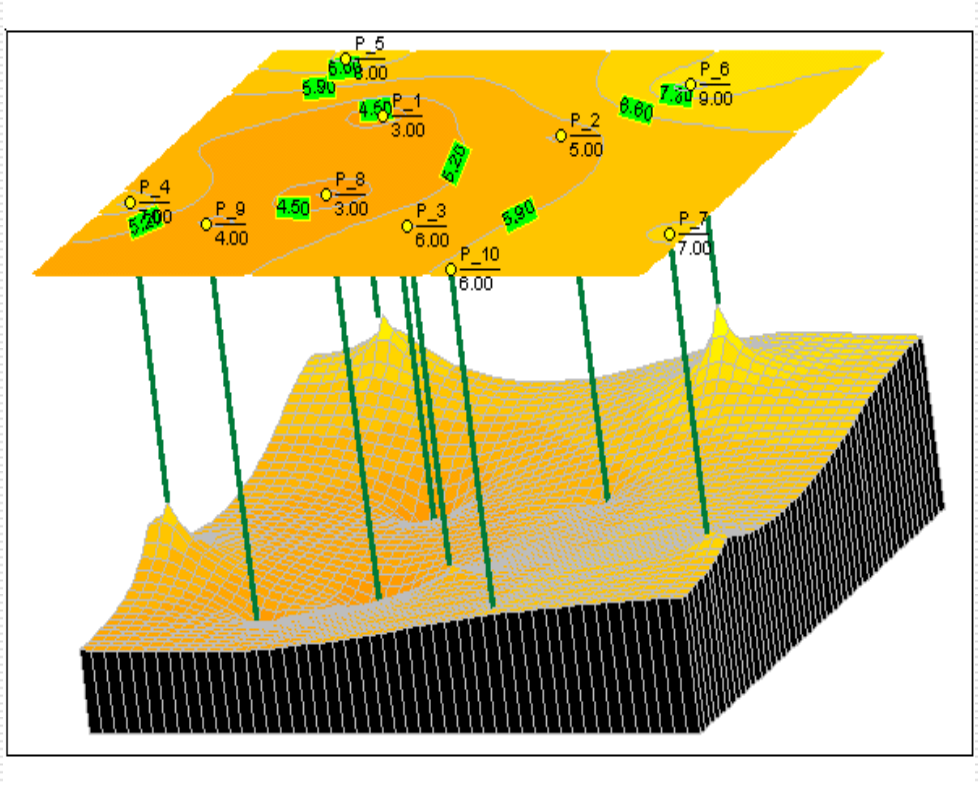
=>GPS

Example: Wildlife Map

Northern Gannet in August from PIROP (Standardised Counts)

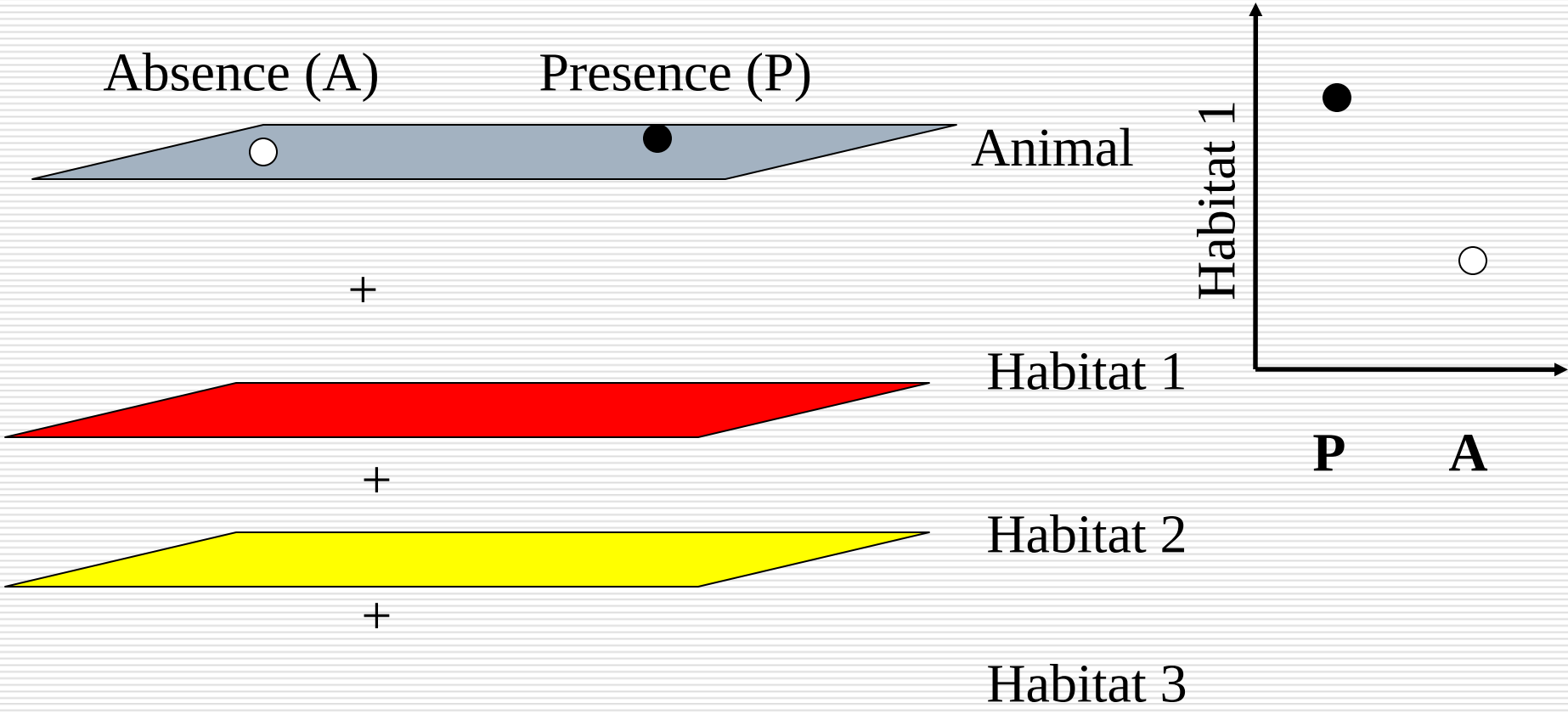


GIS Concepts: Data Layer Overlays

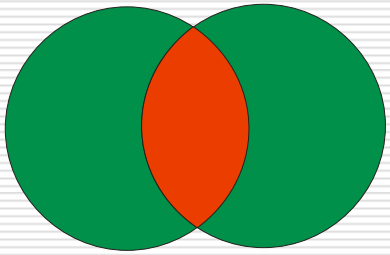


Source
T. Gottschalk

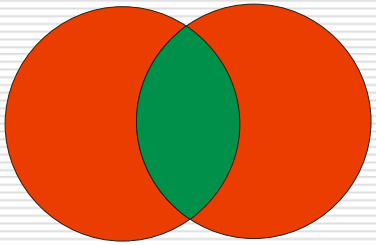
GIS Concepts: Data Layer Overlays



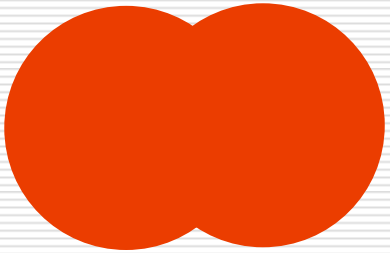
GIS Concepts: Boolean Logic
(applies to polygons and to grids)



A and B

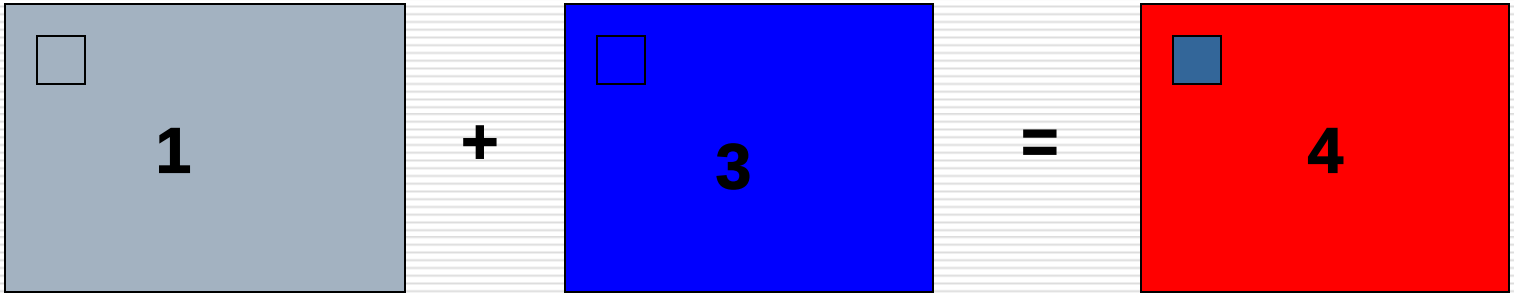


A not B



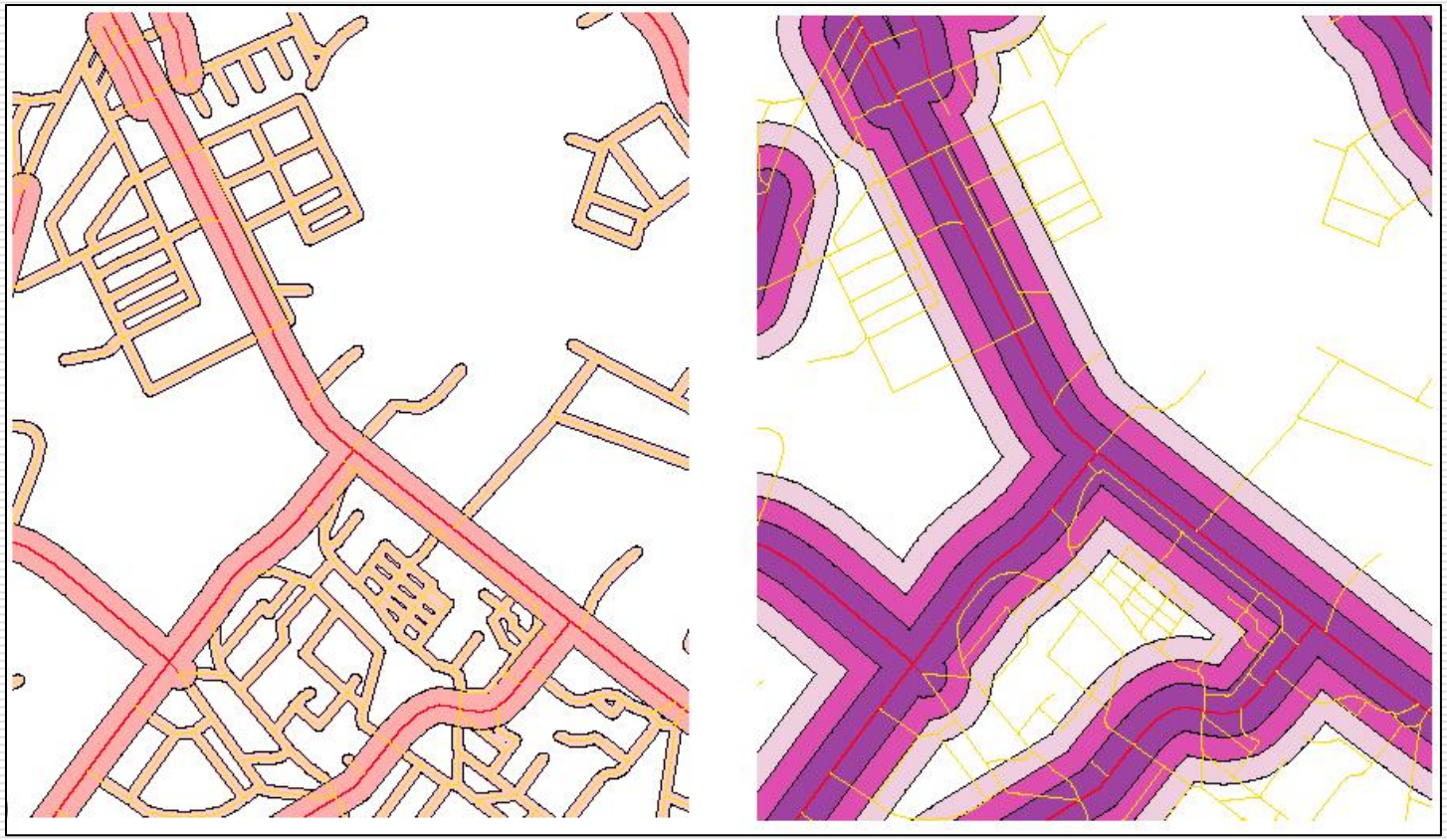
A or B

GIS Concepts: Computations, e.g. for grids



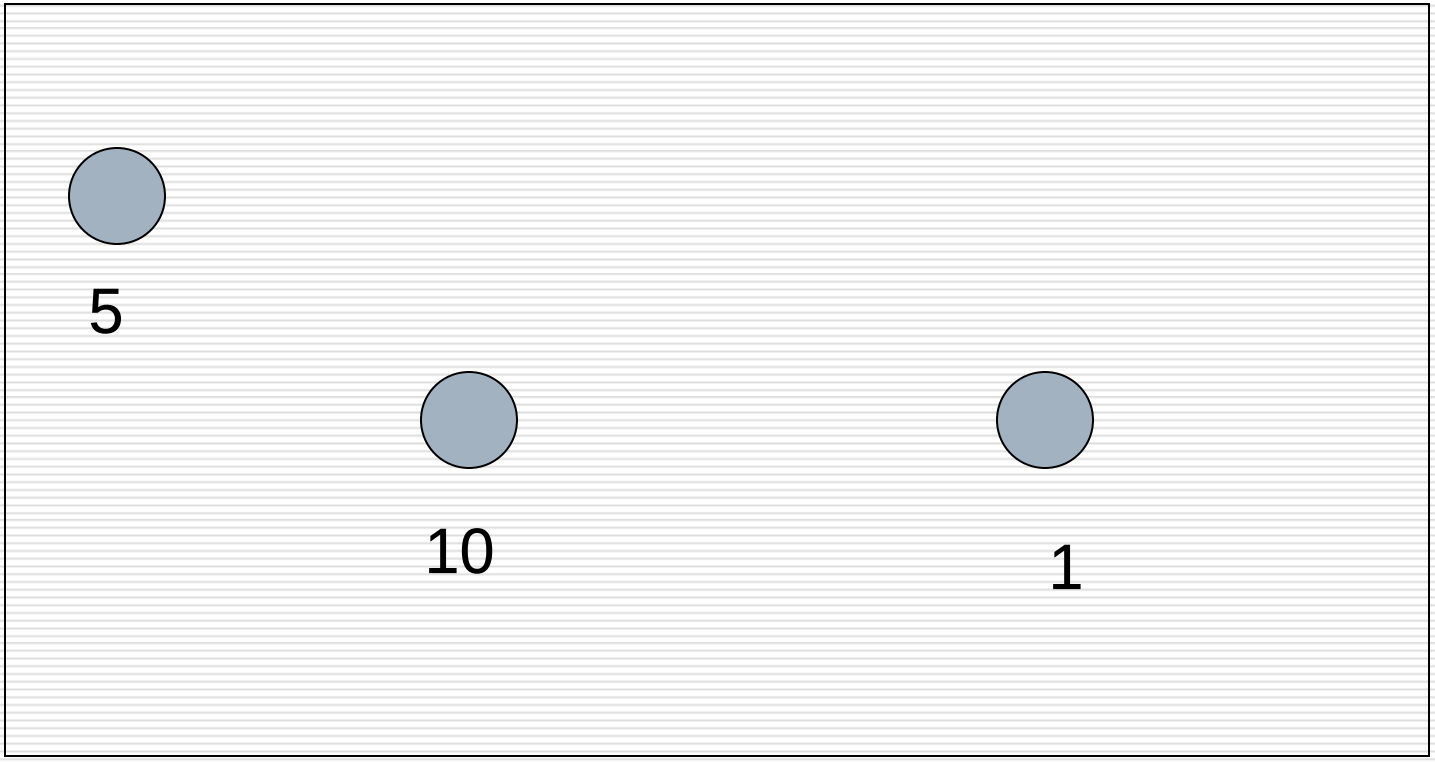
(subtraction, multiplication, division…)

GIS Concepts: Buffering

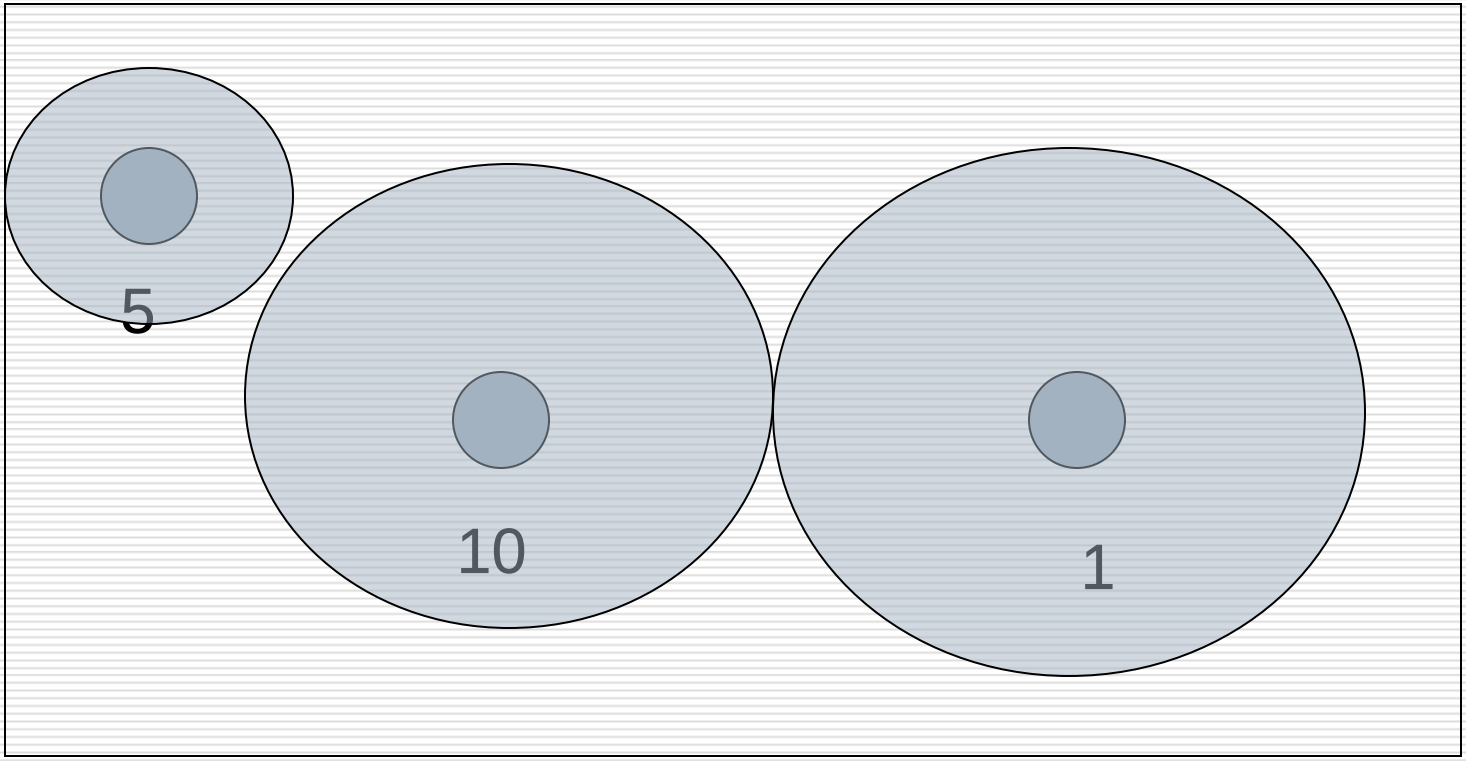


Source
T. Gottschalk

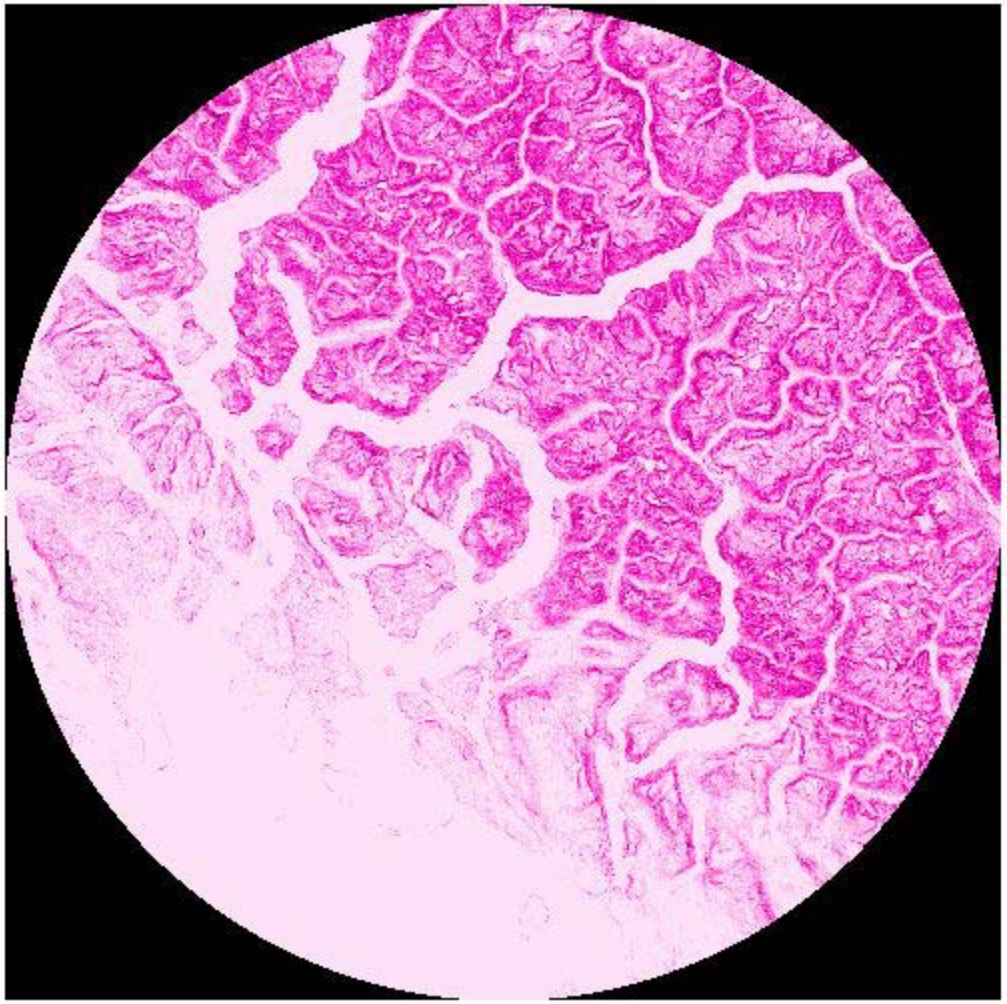
GIS Concepts: Interpolations a)



GIS Concepts: Interpolations b)



Slope Interpolation



Coastal
British Columbia
(TRIM1 data)

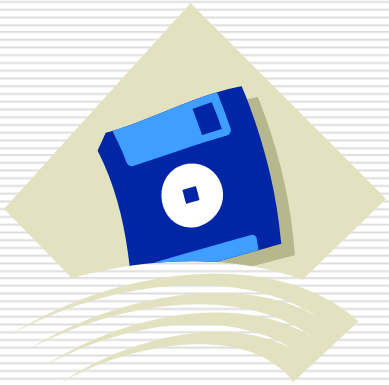
Slope in degree

- 0 - 9.99
- 10 - 19.99
- 20 - 29.99
- 30 - 39.99
- 40 - 49.99
- 50 - 59.99
- 60 - 69.99
- 70 - 79.99
- 80 - 90
- No Data

N
W
E

0 20 40 60 80 100 Kilometers

GIS and Metadata



Metadata: “Description of Data”

Metadata Standards:
USGS, FGDC (NBII Biological Profile)

>400 fields required to describe a dataset

http://www.fgdc.gov/index.html

GIS and WWW

www use:
-data description
-data provision
-distributed mapping/data
-interactive mapping
-interactive download

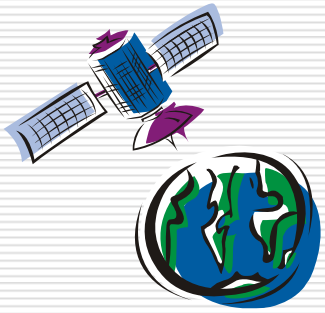
e.g. ArcIMS

Sources of Error in GIS Data

Age of data
Aerial coverage
Map scale
Administrative units
Coordinate Systems
Positional accuracy
Content accuracy
Variation in data sources

Numerical computation
Topological analysis
Classification

The Remote Sensing Link



Data

Image Processing Software, e.g PCI, ERMAPPER

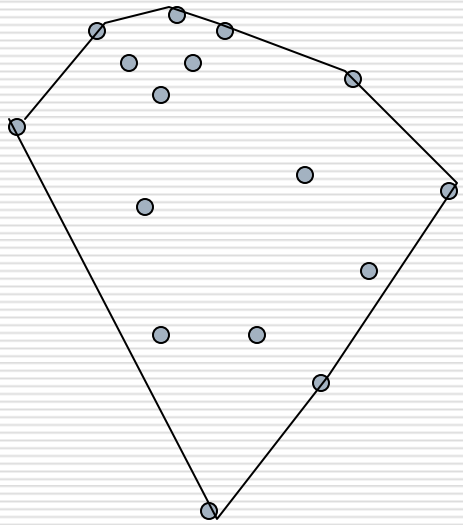
GIS

The Remote Sensing Link: An Example in GIS

Great Slave Lake: Credit Mike Suitor and Jana Fenske

What's a Home range

"*A home range satisfies all life needs of an animal*"



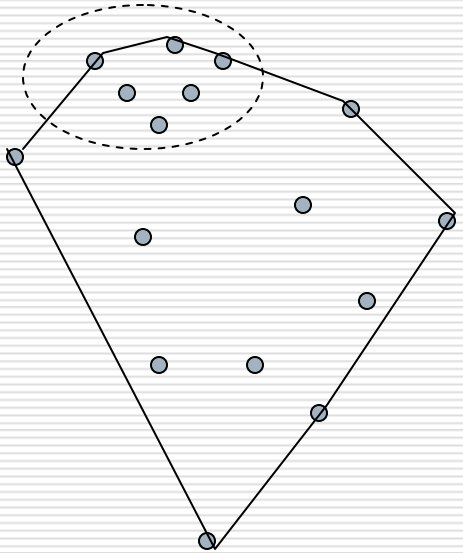
Biological Home range

vs

Telemetry Home range

Types of Home ranges

MCP
90% Kernel
80% Kernel
70% Kernel
...
Geometric Means
...



Minimum convex polygon

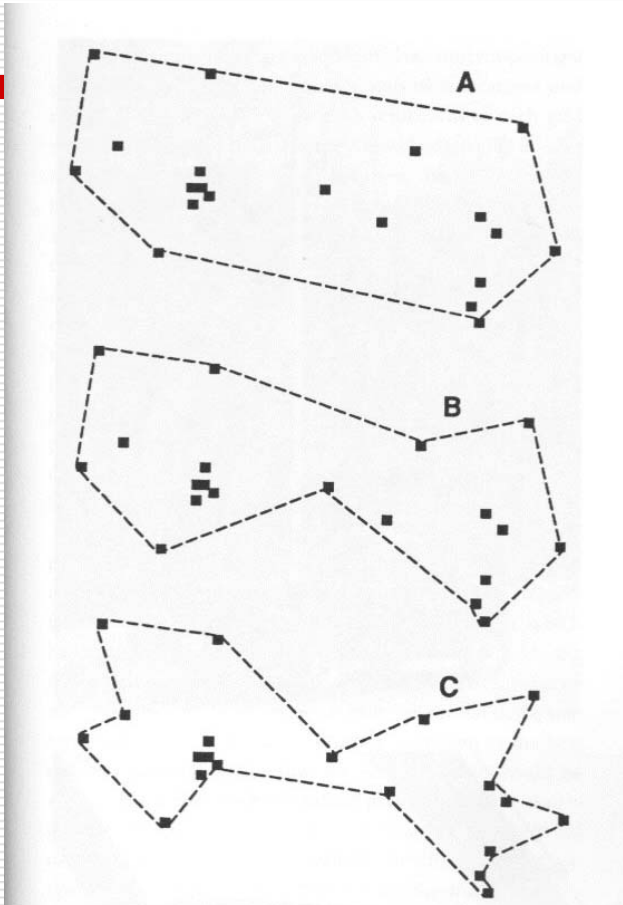


Figure 119. The minimum polygon estimator of home range (Mohr 1947) applied to simulated relocations of a single animal. (A) The standard use of this technique, in which all angles are convex; (B and C) examples of polygons with at least one concave angle that can be constructed from the same data.

- Easy, repeatable
- Sensitive to outliers
- Can incorporates large areas of unused habitat
- Does not indicate how animals use their home range

Probabilistic models of home range

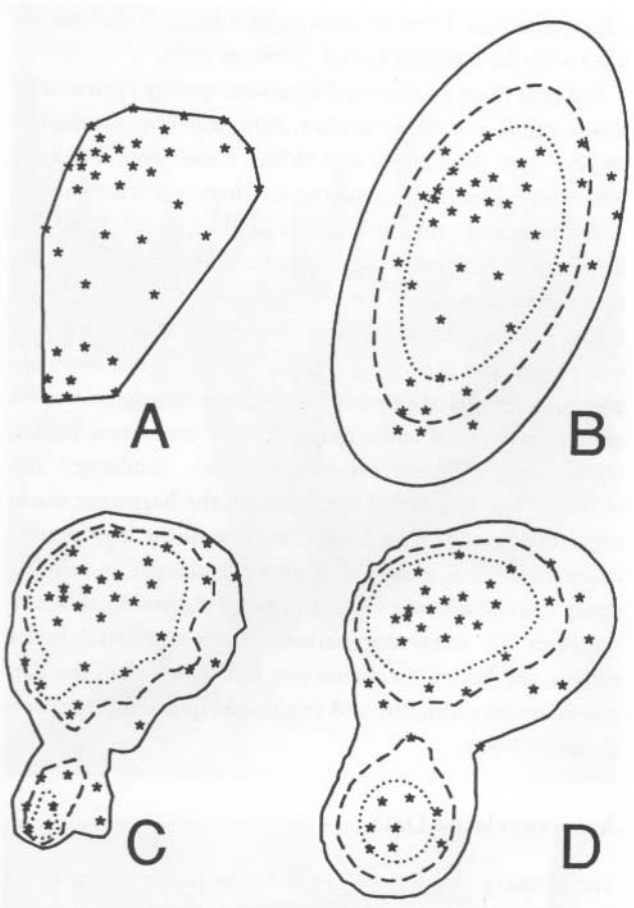
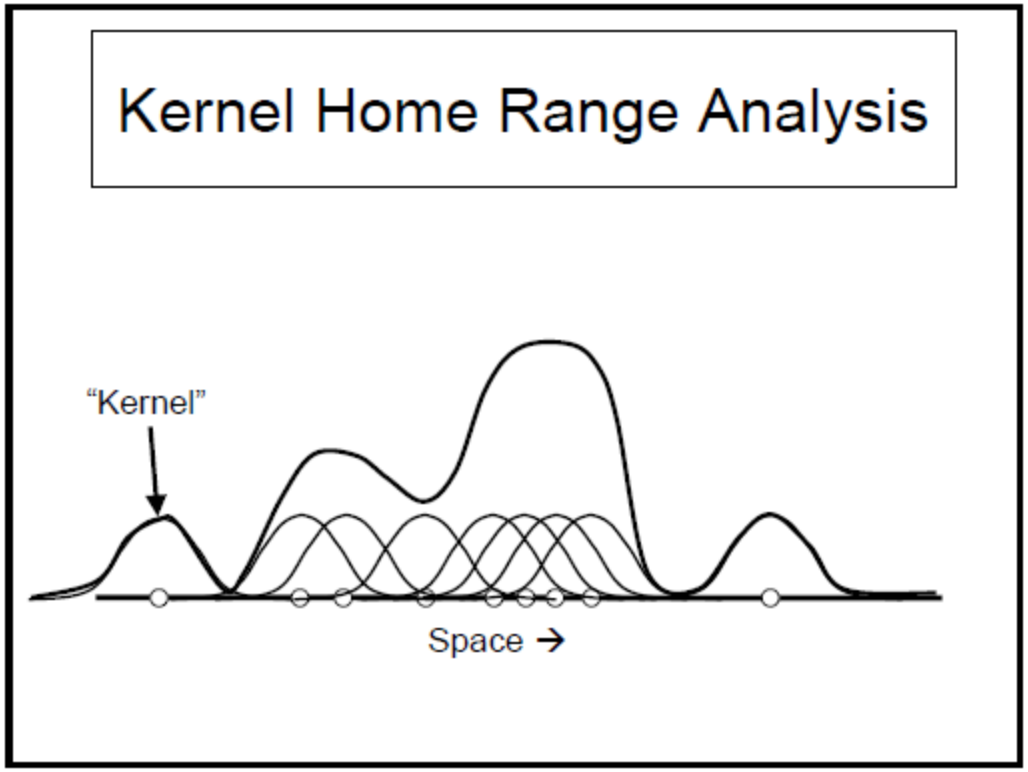


Figure 120. Estimated shape and size of a home range depends on the technique used to define the boundary. A simulated home range was analyzed with four different techniques using program CALHOME (Kie et al. 1996). Home range A represents a minimum convex polygon (Mohr 1947), and has an area of 12.3 square miles (31.8 km²). Home ranges B, C and D represent 95 percent bivariate normal ellipse (Jennrich and Turner 1969), harmonic mean (Dixon and Chapman 1980) and adaptive kernel (Worton 1989) estimates of the same home range, respectively. Estimates of home range size are: B = 27.5 square miles (71.3 km²); C = 14.4 square miles (37.2 km²); and D = 19.2 square miles (49.6 km²). Inner contours within B, C and D represent 60 percent (dot) and 80 percent (dash) use.

- Give better indication of how home range is used
- Exclude unused areas


Kernel Home Range Analysis
"Kernel"
Space →

Home range Analysis

Home range Characteristics:

Size
Extent
Diameter
Area
Shape

Underlying Habitat
=>Predictive Modeling

Applications of Home range

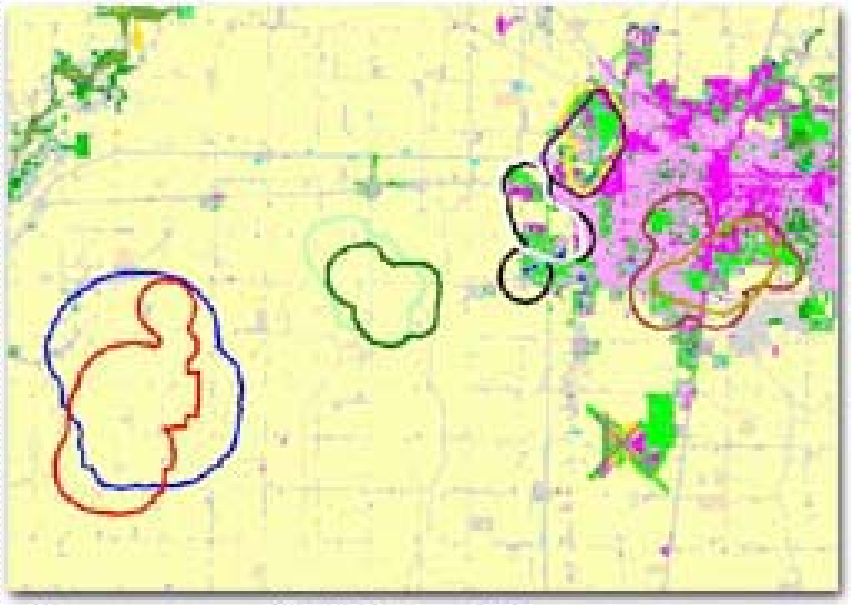
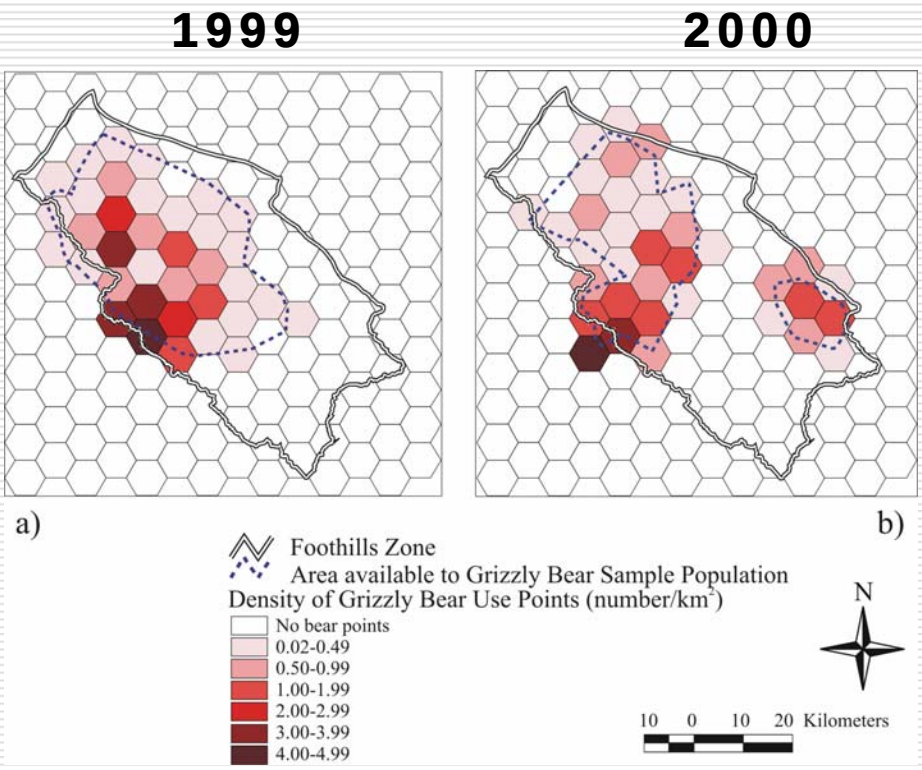


Figure courtesy of Todd E. Gosselink



Potential Shortcomings of Home range Analysis

Data dependent

Scale dependent (space and time)

Survey effort dependent

Individual dependent

Tools for Home range analysis

Animal Movement Extension in ArcView

TRIANGULATE software

various others…

e.g. see at http://nhsbig.inhs.uiuc.edu/wes/home_range.html

Alternative indices

Mean distance between successive locations

Home range length

Distance between seasonal range centers

Movement rate

End of Session

Any Questions ?