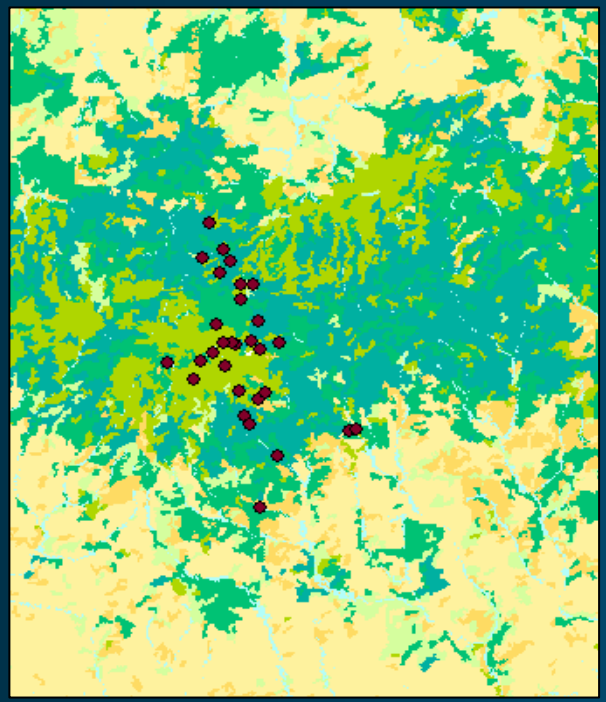
Resource Selection

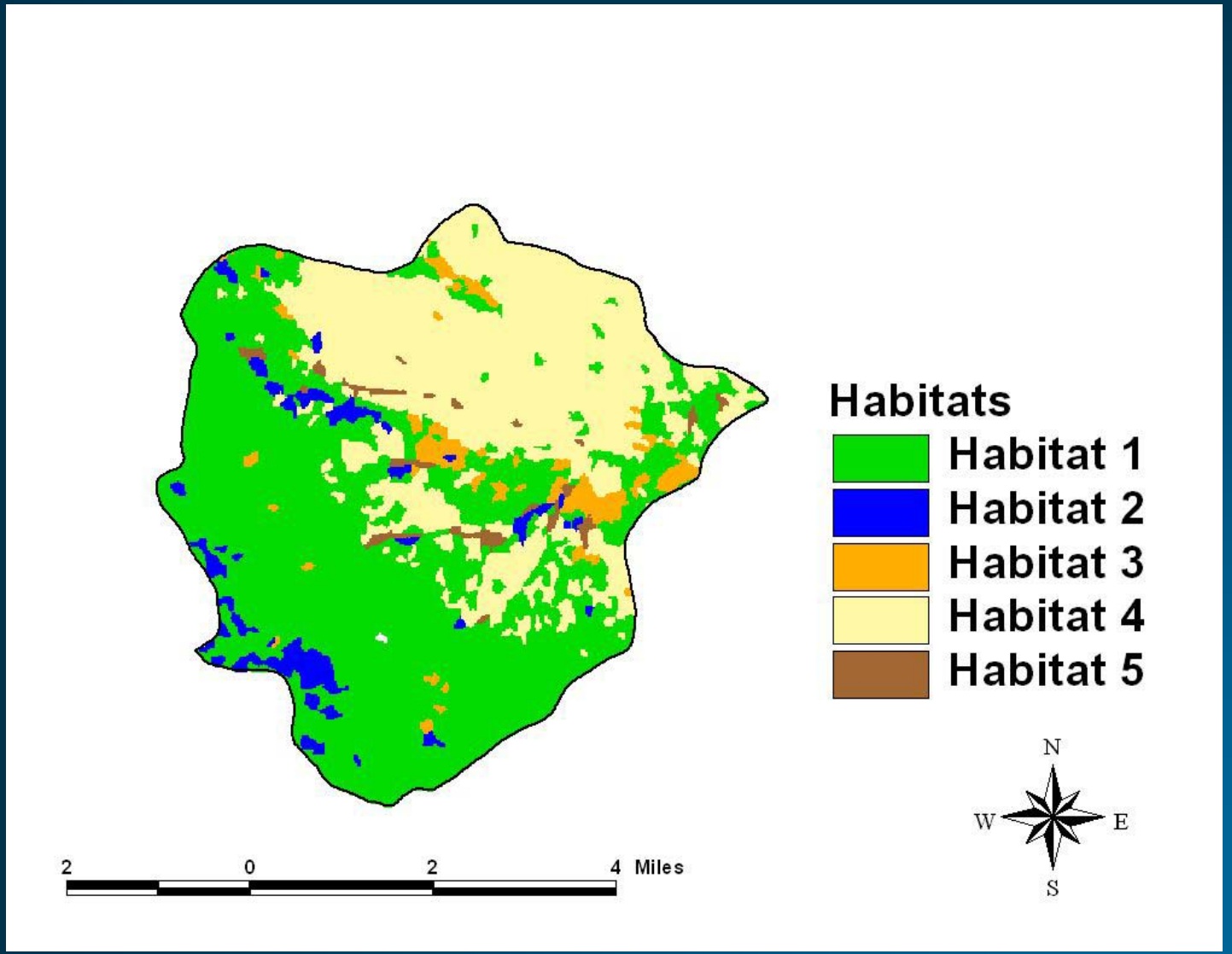


Eva Strand

CNR Remote Sensing and GIS Lab

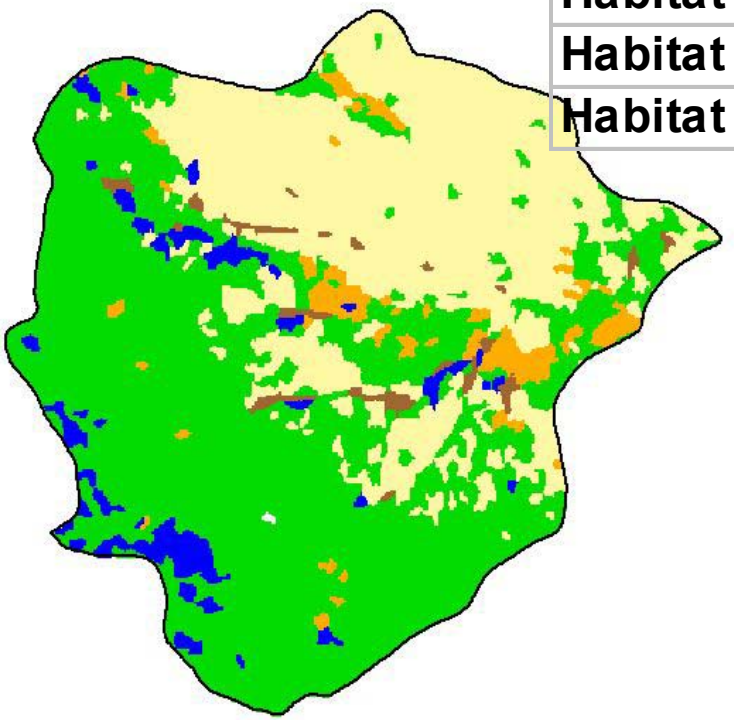
University of Idaho

Habitat map


Habitats
Habitat 1
Habitat 2
Habitat 3
Habitat 4
Habitat 5
N
W
E
S
2
0
2
4 Miles

Available habitat

Habitat	Hectares	Percent
Habitat 1	38079.9	55.1
Habitat 2	2740.5	4.0
Habitat 3	2692.8	3.9
Habitat 4	24533.1	35.5
Habitat 5	1072.8	1.6



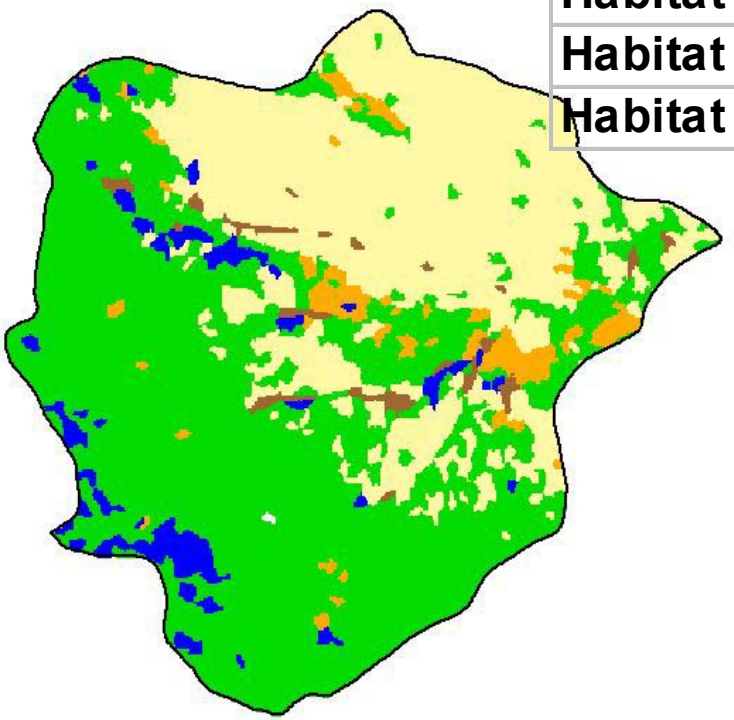
Habitats
- Habitat 1
- Habitat 2
- Habitat 3
- Habitat 4
- Habitat 5

2 0 2 4 Miles

N
W E
S

Expected distribution of 100 points??

Habitat	Hectares	Percent
Habitat 1	38079.9	55.1
Habitat 2	2740.5	4.0
Habitat 3	2692.8	3.9
Habitat 4	24533.1	35.5
Habitat 5	1072.8	1.6



Habitats
Habitat 1
Habitat 2
Habitat 3
Habitat 4
Habitat 5

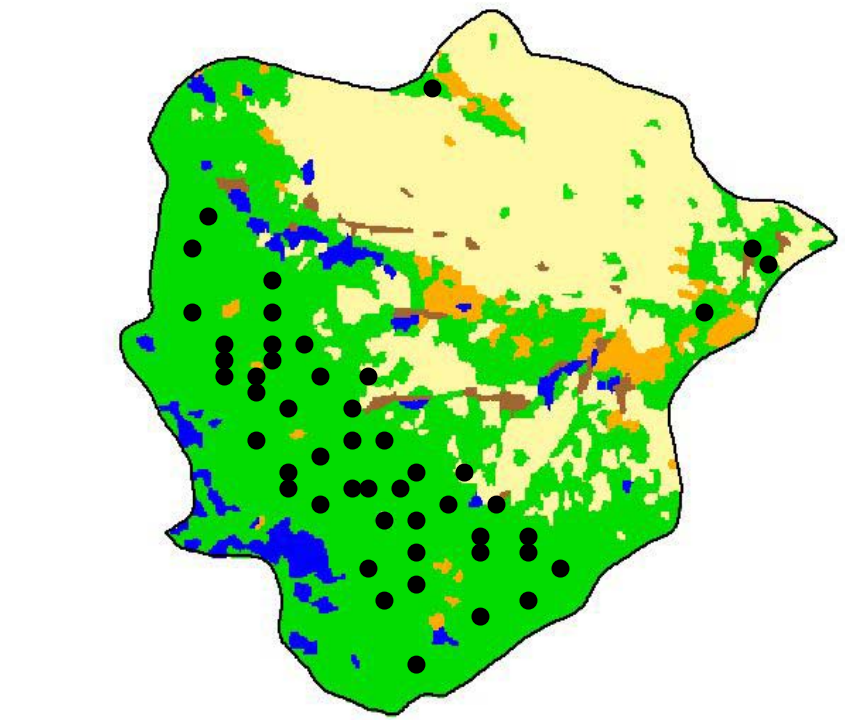
2 0 2 4 Miles

N
W E
S

Use

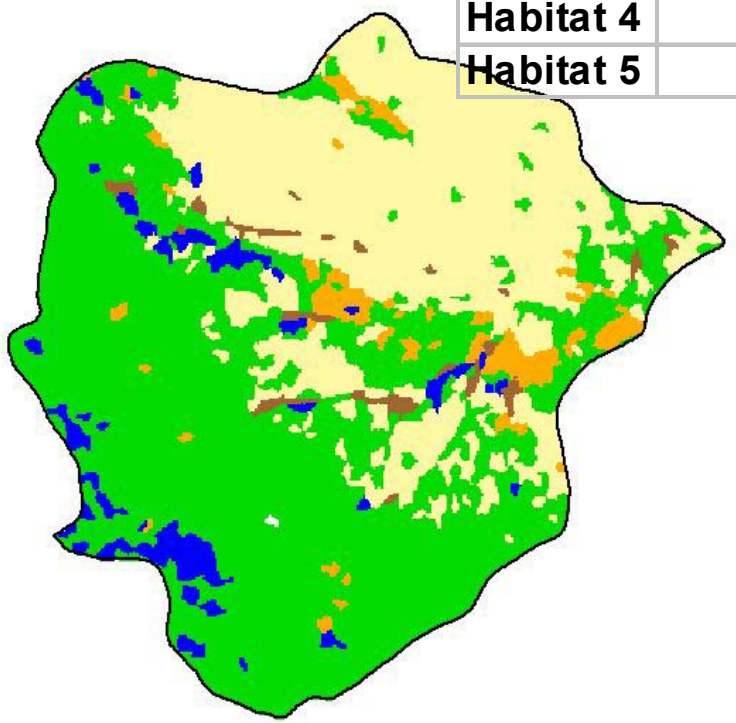
100 point – all in habitat 1!

Habitat 1	100%
Habitat 2	0
Habitat 3	0
Habitat 4	0
Habitat 5	0



Resource selection ratio (use/available) Manly-Chesson Selectivity Index

Habitat	Available	Used	Ratio
Habitat 1	55.1	100	1.82
Habitat 2	4.0	0	0
Habitat 3	3.9	0	0
Habitat 4	35.5	0	0
Habitat 5	1.6	0	0



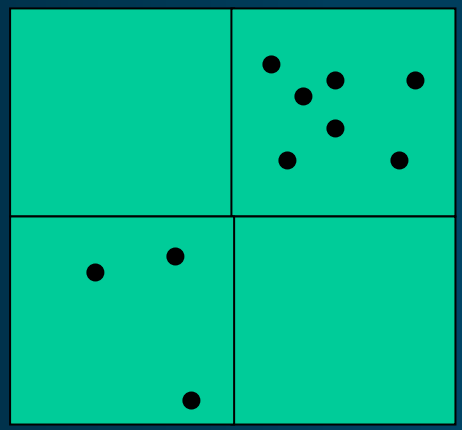
Habitats
Habitat 1
Habitat 2
Habitat 3
Habitat 4
Habitat 5

N
W
E
S

2 0 2 4 Miles

Garshelis 2000

Conditional probability
Scenario 1

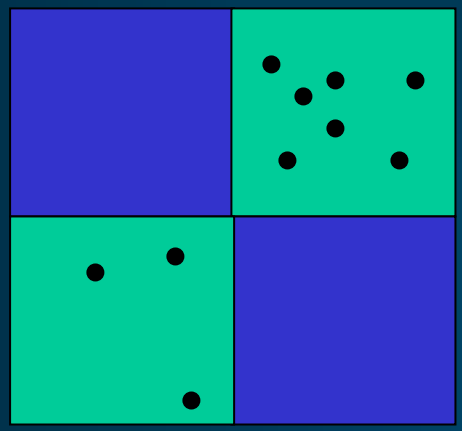


Scenario 1

10 points
2 habitats (only one habitat present)

	% availability	% use	use/availability
Habitat 1	100	100	1
Habitat 2	0	0	

Conditional probability
Scenario 2



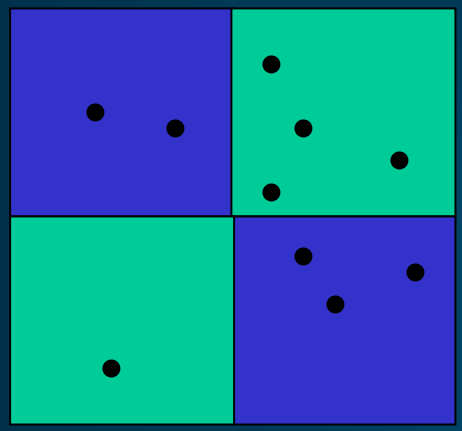
Scenario 2

10 points
2 habitats

% availability % use use/availability

Habitat 1
Habitat 2

Conditional probability: Scenario 3



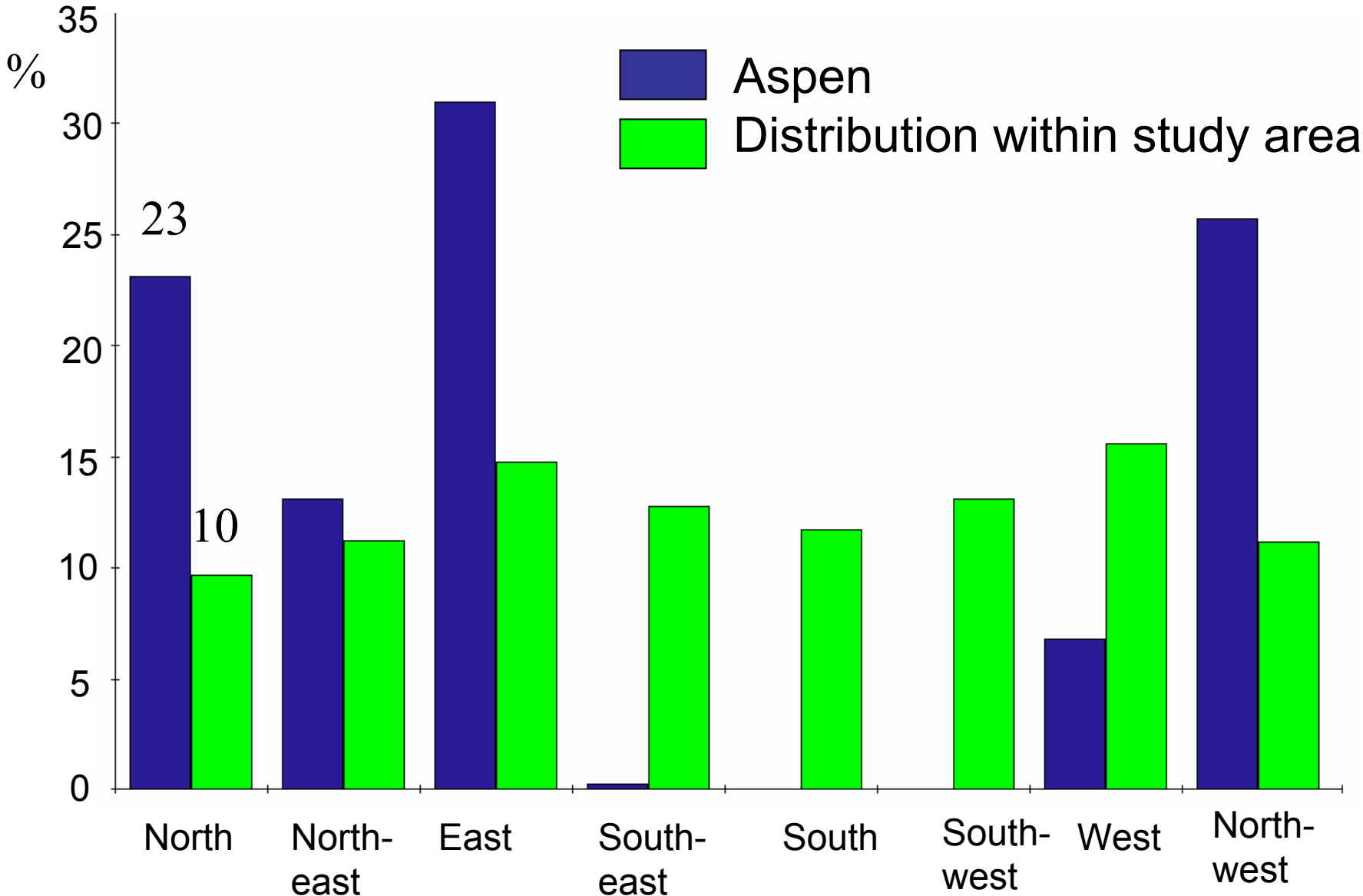
Scenario 3

10 points
2 habitats

	% availability	% use	use/availability
Habitat 1			
Habitat 2			

Does this mean that the animal uses the two habitats at random?

Conditional probability: Aspen distribution



Fatal Flaws in Habitat Selection Analysis

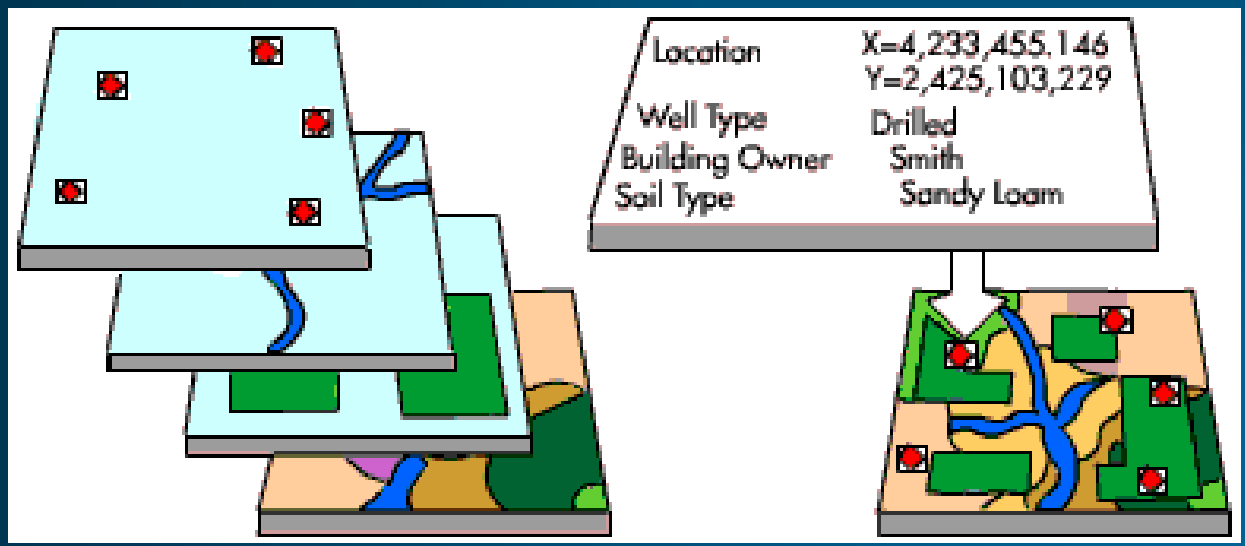
according to Garshelis 2000

1) The assumption that the more available a resource is the more likely an animal is to use it.

2) The assumption that selection is related to each habitat's potential contribution to individual fitness and population growth.

Overlay Analysis in GIS

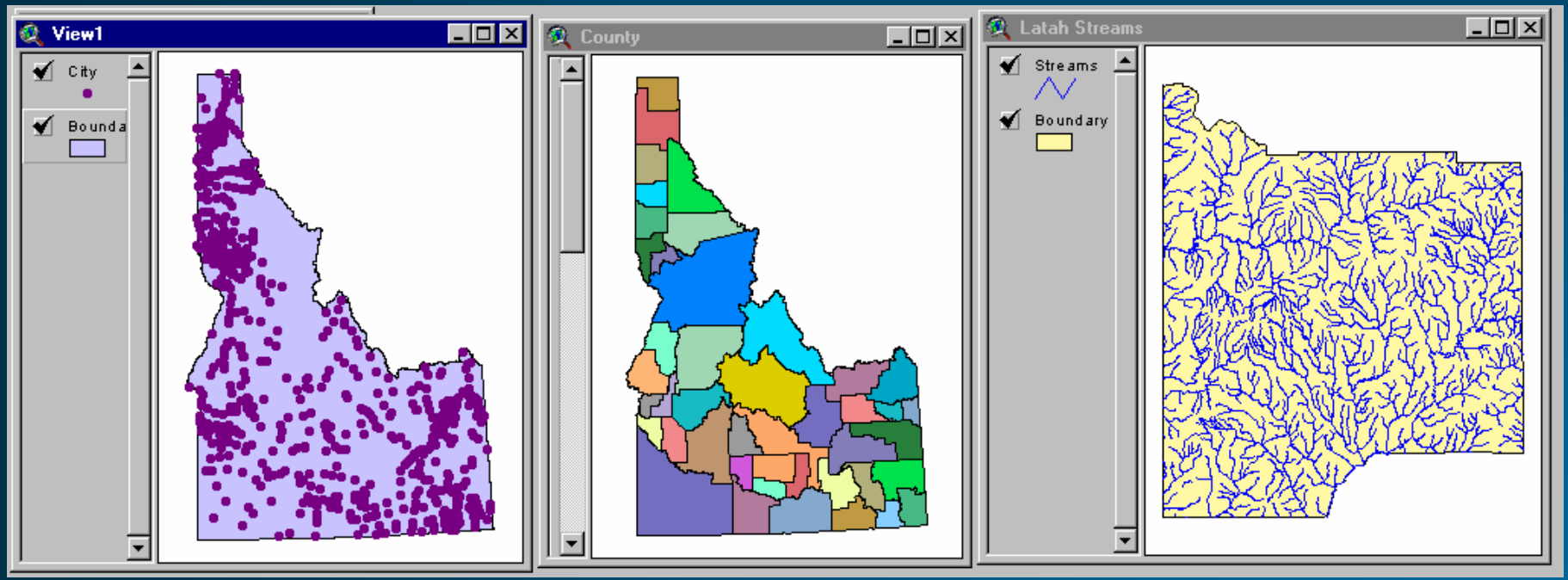
Gathering information from multiple data layers



Vector Data

Coordinate-based data structures commonly used to represent map objects. Each object is represented as a list of X,Y coordinates

Examples - tree, poles, roads, housing developments, zoning districts

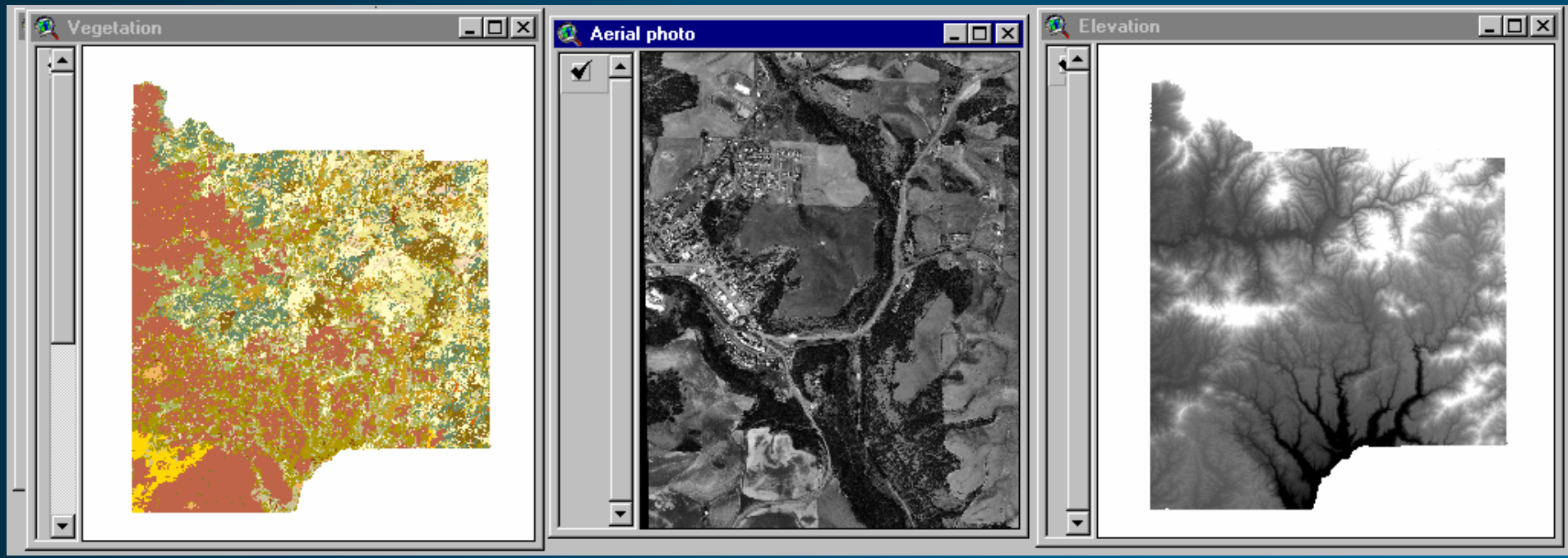


Points Polygons Lines

Raster Data

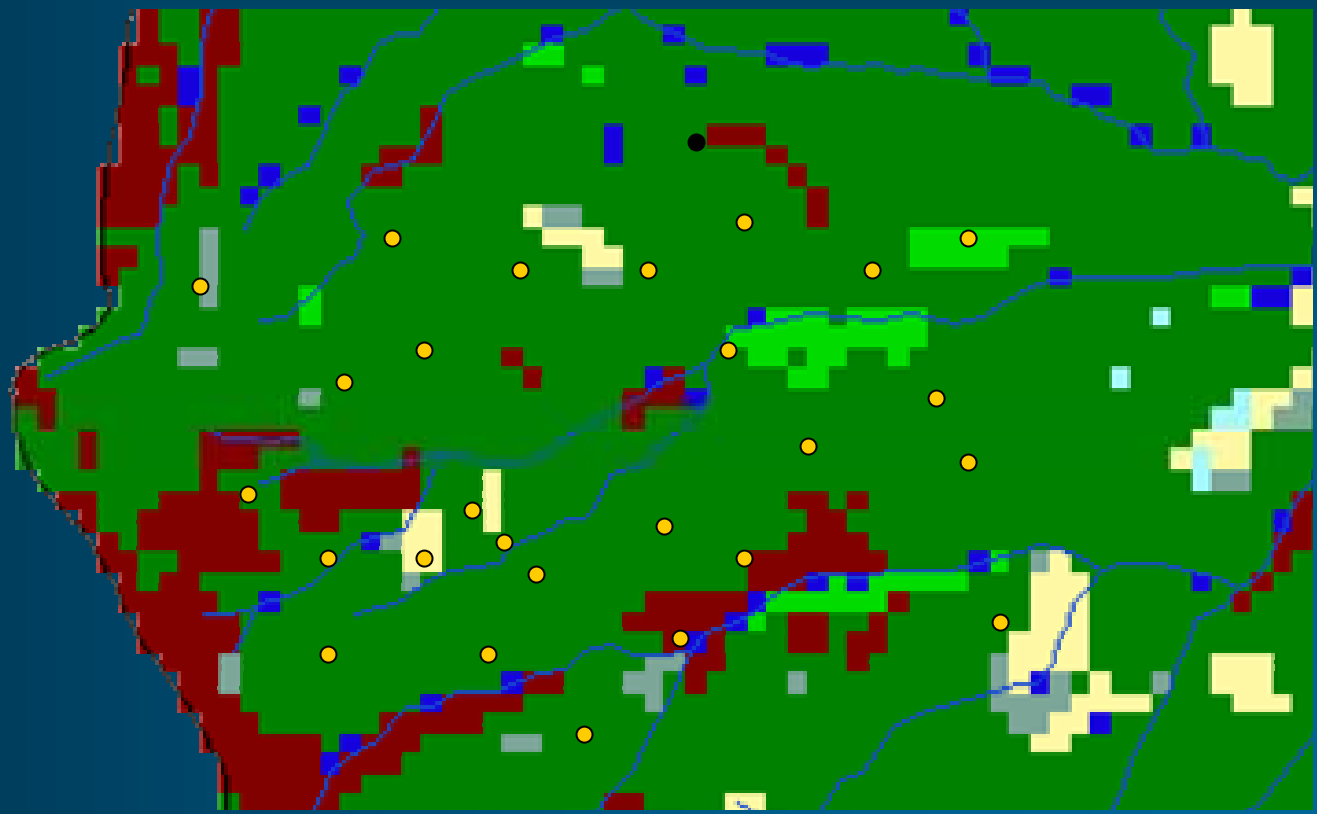
Cell-based representation of map features. Each cell has a value. A group of cells with the same value represent a feature.

Examples - satellite imagery, aerial photography and some come from software packages like GRID and ERDAS.



Point / Polygon overlay

Point / GRID overlay

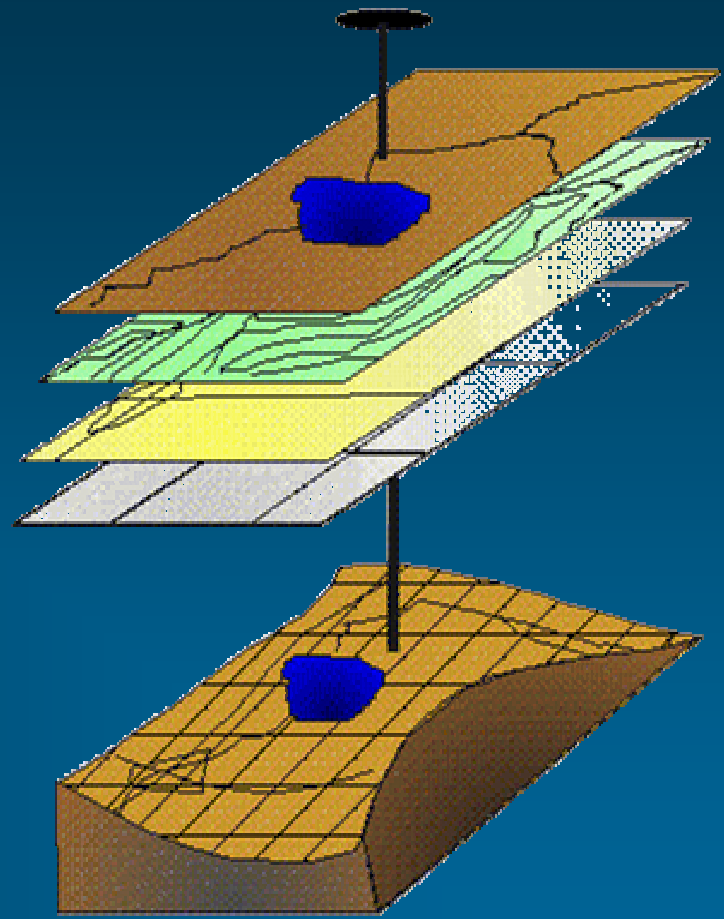


“Piercing Needle” Approach

Multiple layers of data are in relative position with one another - inserting a "digital pin" through the stack of overlayed data.

This allows questions to be answered concerning *everything* occurring at a particular location.

This view of the world limits focus to a particular point and precludes wide-area landscape analysis.

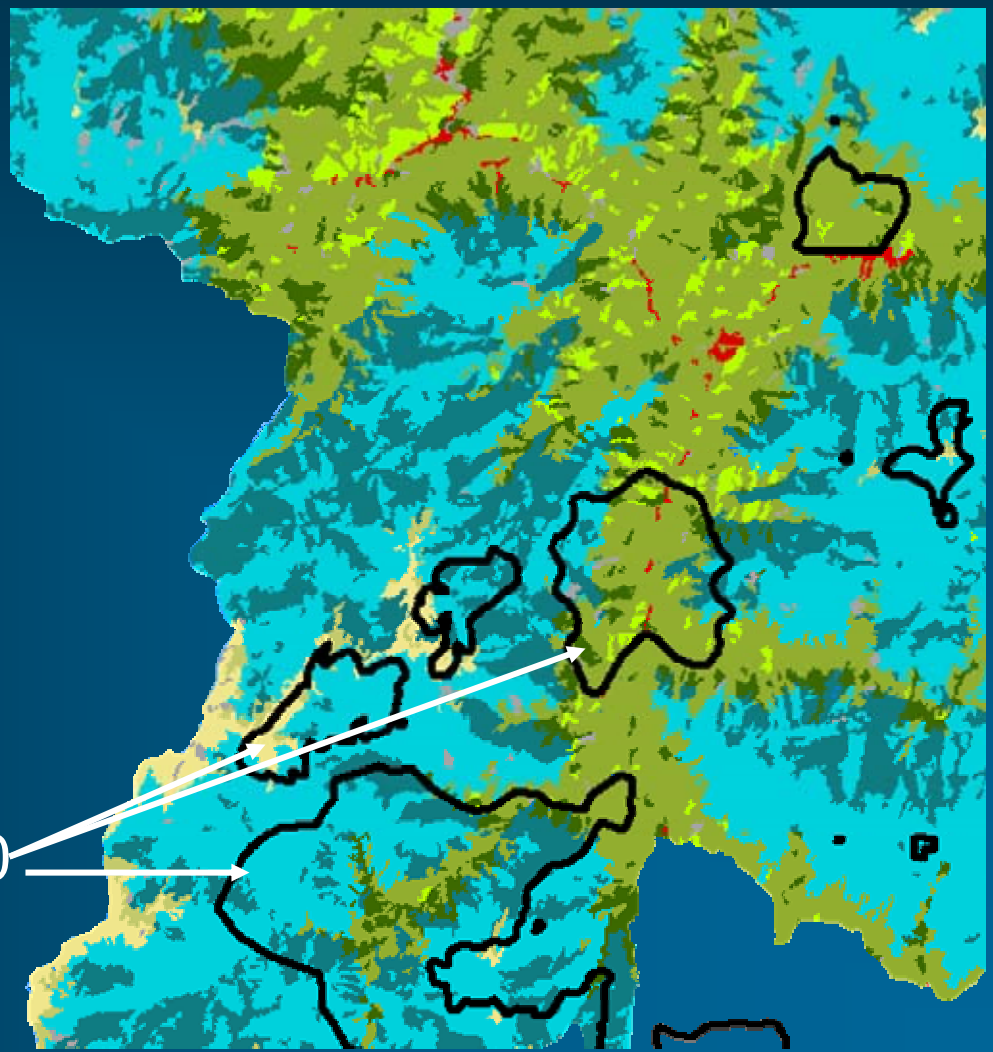


GIS Overlay Analysis - Points

Overlay type	ArcView 3x	ArcGIS 9x	ArcInfo Workstation
Point to Polygon	**Geoprocessing Wizard – Spatial Join**	**Join and Relates: Join – Join data based on spatial location**	**Arc: identity**
Point to Grid	**Spatial Analyst: Analysis – Tabulate Areas** **or** **Script: samplegrids.ave**	**Spatial Analyst: Raster Calculator** **Toolbox – Spatial Analyst Tools-Extraction-** ***Extract by Points or Sample***	**GRID: sample**

Polygon Overlays – on polygons or grids

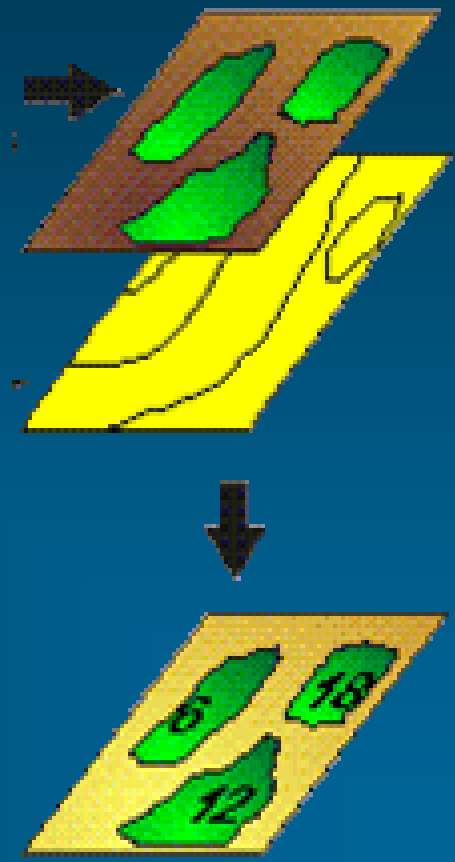
What covertypes burned in the Selway-Bitterrot Wilderness in year 2000?



Region Wide: "Cookie Cutter Approach"

Vector data
- Clip
- Intersect – Union

Raster data
- GRID clip (masking)
- Zonal statistics (GRID)
- Combine



GIS Overlay Analysis - Polygons

Overlay type	ArcView 3x	ArcGIS 9x	ArcInfo
Poly to Poly	Geoprocessing Wizard – Intersect or Union	Toolbox – Analysis Tools – Overlay – Union or Intersect	Arc: intersect Arc: union Arc: identity
Poly to Grid	Spatial Analyst: Analysis – Tabulate Areas Spatial Analyst – Zonal Statistics	Convert the polygon cover to a grid or the grid to a polygon Spatial Analyst – Zonal Statistics	GRID: zonalstats
Grid to Grid	Spatial Analyst: Analysis – Tabulate Areas or Extension: Grid Transformation Tools – Transform Grids - Combine	Spatial Analyst: Raster Calculator Combine(grid1, grid2) Spatial Analyst: Analysis – Zonal-Tabulate Areas	GRID: combine

Resource selection Statistical Methods

Expected vs. Observed outcomes

Simple ratio: % observed / % expected (Manly-Chesson Selectivity Index)

Chi-square

Example 1: Neu et al. 1974 used chi-squared analysis with a Bonferroni confidence interval to assess habitat selection for moose in burned areas.

Example 2: Young *et al*. (1987) used χ^2 analysis to demonstrate that the Northern Spotted Owl use old-growth habitats more than would be expected based on its proportion of the landscape

Example 3: Agee *et al*. (1989) used χ^2 analysis to evaluate habitat preference of grizzly bears

Resource selection Statistical Methods

Expected vs. Observed outcomes

Resource selection software by Garton et al.

Methods

1) Neu et al. Chi-square analysis with Bonferroni Confidence Intervals
2) Friedman's method
3) Johnson's method
4) Quade's method
5) Aebischer's compositional analysis

Input to Resource selection software

- Number of animals
- Number of habitats
- % use for animals within habitats
- % available of habitats

Scales of selection

- Points within home range
- Home range within study area

```
; Number of blocks (animals)
Blocks = 13, 'pheasants'
; Number of treatments (habitats)
Treatments = 5, habitats
; Label for each habitat type
Labels = Scrub, Broad, Conifer, Grass, Crop

[Resources]
; resource use data (entered by animal on each line)
Use =  1, 19.60,  1.97,  0.00,  0.00, 78.40
Use =  2, 20.58, 14.70,  0.00,  0.40, 64.31
Use =  3,  8.32,  5.73,  0.00, 58.90, 27.03
Use =  4,  8.78, 23.86,  0.00, 12.24, 55.10
Use =  5,  4.41, 30.29, 10.32, 54.98,  0.00
Use =  6,  5.43, 30.52, 10.11, 53.94,  0.00
Use =  7,  4.34, 31.24, 11.02, 53.39,  0.00
Use =  8,  8.66, 38.71,  0.00, 52.61,  0.00
Use =  9,  9.64, 53.16,  0.00, 37.17,  0.00
Use = 10, 11.72,  8.82,  0.00, 79.44,  0.00
Use = 11, 14.36, 32.56,  0.00, 53.05,  0.00
Use = 12,  9.70, 10.95,  0.00, 79.33,  0.00
Use = 13,  5.53, 20.08,  4.11, 70.28,  0.00

; available resource
Available =  1, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  2, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  3, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  4, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  5, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  6, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  7, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  8, 3.22, 9.23, 0.75, 52.83, 33.98
Available =  9, 3.22, 9.23, 0.75, 52.83, 33.98
Available = 10, 3.22, 9.23, 0.75, 52.83, 33.98
Available = 11, 3.22, 9.23, 0.75, 52.83, 33.98
Available = 12, 3.22, 9.23, 0.75, 52.83, 33.98
Available = 13, 3.22, 9.23, 0.75, 52.83, 33.98
```

Resource selection Statistical Methods

Expected vs. Observed outcomes

Logistic Regression
In a logistic regression analysis you would compare the locations where the phenomenon is present to those locations where it is absent (or to a random set).

Example 1 : Pereira and Itami (1991) used logistic regression to model effects on Red Squirrel habitat

Example 2: Beck et al. 2006 used logistic regression to model resource selection of elk in the Jarbidge Mountains, Nevada.

Statistical analysis: Manly BFJ, LL McDonald, DL Thomas, TL McDonald, and WP Erickson, 2002. Resource Selection by Animals pp.83-117, chapter 5, Kluwer Academic Publisher, Dordrecht/Boston/London.

Some considerations…

How is availability defined?

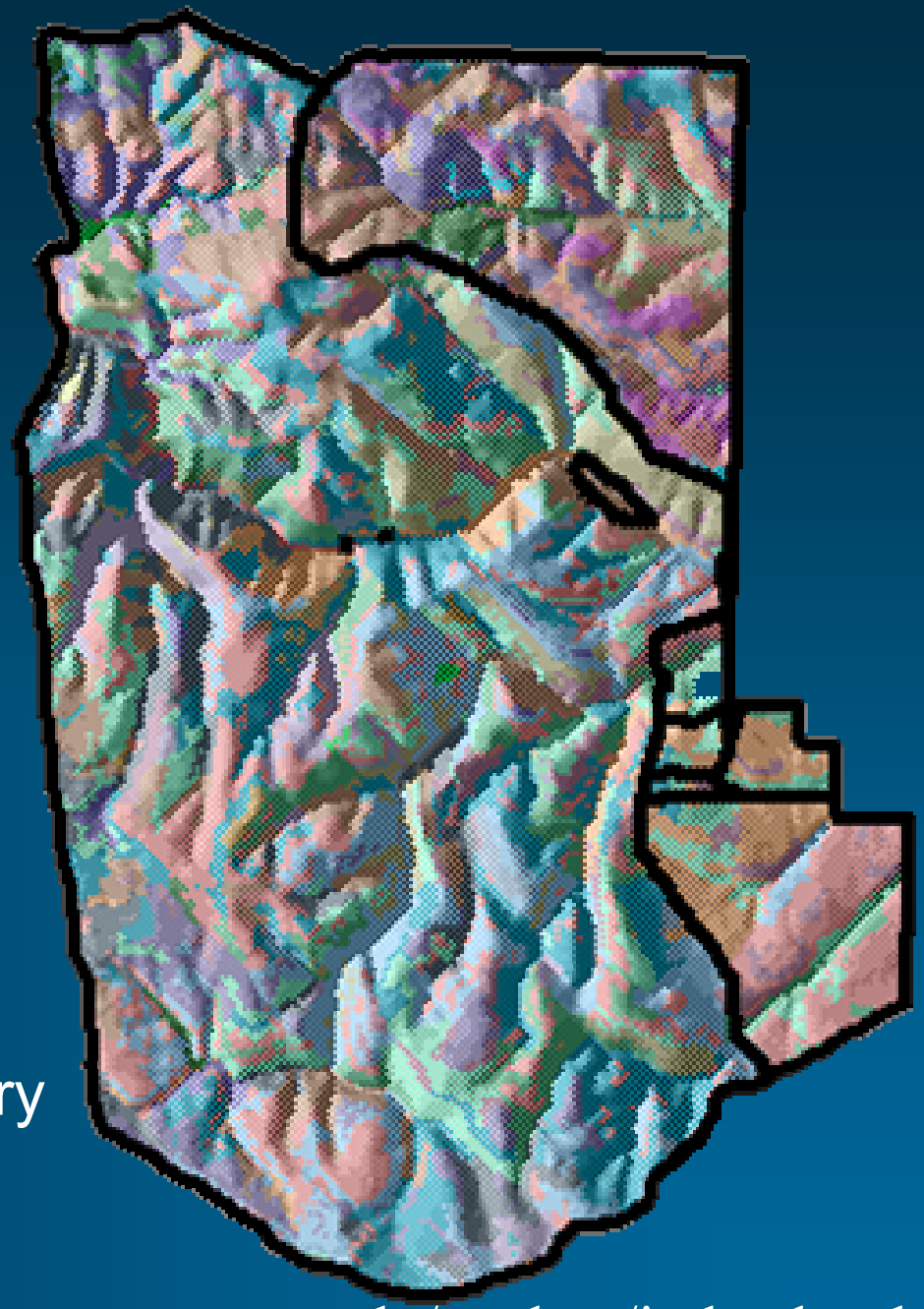
What is the accuracy of the point locations?

What is the spatial and thematic accuracy of the habitat layer?

Is the sample size large enough?

Are the data locations independent in time?

Starkey Project



The Fence:

- 27 miles of 8 foot high fence
- About 40 square miles

The Animals:

- 450 elk, 250 deer, 550 cow-calf pairs
- Approx. 180 collared

The System:

- Loran-C Automated Telemetry System
- Positions every 15 seconds
- Accurate within 50 meters

www.eou.edu/starkey/index.html

Exercise outline

1. Create a home range for one Starkey elk .

2. Determine what habitat types are located within the home range (Availability)

3. Determine how many elk points fall within each habitat type (Use) .

4. Through calculation of the 'Simple Ratio' determine if the elk (represented by GPS locations) selects certain habitat types over others within the home range.

5. Using the resource selection software, determine if pheasants are selecting for certain habitats using the method by Neu et al. and Compositional Analysis. How would you set up a similar study for the Starkey elk data?