Resource Selection

Eva Strand
CNR Remote Sensing and GIS Lab
Habitat map
Available habitat

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Hectares</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat 1</td>
<td>38079.9</td>
<td>55.1</td>
</tr>
<tr>
<td>Habitat 2</td>
<td>2740.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Habitat 3</td>
<td>2692.8</td>
<td>3.9</td>
</tr>
<tr>
<td>Habitat 4</td>
<td>24533.1</td>
<td>35.5</td>
</tr>
<tr>
<td>Habitat 5</td>
<td>1072.8</td>
<td>1.6</td>
</tr>
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</table>

Habitats
- Green: Habitat 1
- Blue: Habitat 2
- Orange: Habitat 3
- Yellow: Habitat 4
- Brown: Habitat 5
### Expected distribution of 100 points

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**Habitats**
- **Habitat 1** (Green)
- **Habitat 2** (Blue)
- **Habitat 3** (Orange)
- **Habitat 4** (Light Yellow)
- **Habitat 5** (Dark Brown)
Use

100 point – all in habitat 1!

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

Habitats
- Habitat 1
- Habitat 2
- Habitat 3
- Habitat 4
- Habitat 5
Resource selection ratio
(use/available) Manly-Chesson Selectivity Index

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Available</th>
<th>Used</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat 1</td>
<td>55.1</td>
<td>100</td>
<td>1.82</td>
</tr>
<tr>
<td>Habitat 2</td>
<td>4.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Habitat 3</td>
<td>3.9</td>
<td>0</td>
<td>0</td>
</tr>
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<td>Habitat 5</td>
<td>1.6</td>
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<td>0</td>
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Habitats:
- Green: Habitat 1
- Blue: Habitat 2
- Orange: Habitat 3
- Yellow: Habitat 4
- Brown: Habitat 5

Garshelis 2000
### Scenario 1

10 points
2 habitats (only one habitat present)

<table>
<thead>
<tr>
<th>% availability</th>
<th>% use</th>
<th>use/availability</th>
</tr>
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<tbody>
<tr>
<td>Habitat 1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Habitat 2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Conditional probability
Conditional probability
Scenario 2

% availability % use use/availability

Habitat 1
Habitat 2

Scenario 2
10 points
2 habitats
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

Aspen Distribution within study area

North: 23%
North-east: 10%
East: 30%
South-east: 15%
South: 10%
South-west: 15%
West: 5%
North-west: 10%
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
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

<table>
<thead>
<tr>
<th>Overlay type</th>
<th>ArcView 3x</th>
<th>ArcGIS 9x</th>
<th>ArcInfo Workstation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point to Polygon</td>
<td>Geoprocessing Wizard – Spatial Join</td>
<td>Join and Relates: Join – Join data based on spatial location</td>
<td>Arc: identity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point to Grid</td>
<td>Spatial Analyst: Analysis – Tabulate Areas &lt;br&gt; or Script: samplegrids.ave</td>
<td>Spatial Analyst: Raster Calculator &lt;br&gt; Toolbox – Spatial Analyst Tools- Extraction- Extract by Points or Sample</td>
<td>GRID: sample</td>
</tr>
</tbody>
</table>
Polygon Overlays – on polygons or grids

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

Fire perimeters 2000
Region Wide: "Cookie Cutter Approach"

Vector data
• Clip
• Intersect – Union

Raster data
• GRID clip (masking)
• Zonal statistics (GRID)
• Combine
## GIS Overlay Analysis - Polygons

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<th>ArcInfo</th>
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<tr>
<td>Poly to Poly</td>
<td>Geoprocessing Wizard – Intersect or Union</td>
<td>Toolbox – Analysis Tools – Overlay – Union or Intersect</td>
<td>Arc: intersect</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arc: union</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arc: identity</td>
</tr>
<tr>
<td>Poly to Grid</td>
<td>Spatial Analyst: Analysis – Tabulate Areas</td>
<td>Convert the polygon cover to a grid or the grid to a polygon</td>
<td>GRID: zonalstats</td>
</tr>
<tr>
<td></td>
<td>Spatial Analyst – Zonal Statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid to Grid</td>
<td>Spatial Analyst: Analysis – Tabulate Areas or Extension: Grid Transformation Tools – Transform Grids - Combine</td>
<td>Spatial Analyst: Raster Calculator Combine(grid1, grid2)</td>
<td>GRID: combine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Analyst: Analysis – Zonal-Tabulate Areas</td>
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Resource selection Statistical Methods

Expected vs. Observed outcomes

Simple ratio: \( \frac{\% \text{ observed}}{\% \text{ expected}} \) (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 \( \chi^2 \) 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 \( \chi^2 \) 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, 64.91
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
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```
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.

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?
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?