Goal of the Lecture

To familiarize students with HSI models commonly used by government agencies and NGOs to assess habitat quality for a species.

Reading Assignments:
- Chap 18: 495-497
  - See Marsh Wren Example

HSI Website: http://www.nwrc.usgs.gov/wdb/pub/hsi/hsiindex.htm

Lecture Structure

I. Habitat Evaluation Procedures (HEP)

II. HSI Models

III. Eastern Newt Model
Habitat Evaluation Procedures

**History & Goal**

In 1974, U.S. Fish and Wildlife Service began developing a habitat assessment methodology called the “Habitat Evaluation Procedures” (HEP).

In 1980, HEP was formalized with the “Habitat Evaluation Procedures Handbook” available at [http://policy.fws.gov/ESMindex.html](http://policy.fws.gov/ESMindex.html).

Methodology was developed to provide an objective and consistent way for government employees to assess fish & wildlife habitat quality.

Moreover, HEP provides a means to:

- Compare existing habitat quality between different sites.
- Examine (or predict) changes in habitat quality over time in response to succession, management, or human disturbance.

**Species-specific**

- Monitoring ecological assessment

Simplify!!

**Concept**

It is assumed:

1. Habitat quality can be measured.
   
   Best measure of quality is demographic parameters
   
   High = high reproduction, survival, and recruitment resulting in populations near maximum carrying capacity.

2. Abiotic and biotic variables exist that are strongly correlated with habitat quality.
   
   e.g., vertical cover in grasslands is positively related w/ quail survival
   
   (and these can be measured?)

3. The relationships in #2 can be quantified with a model.
   
   e.g., Habitat Quality = 0.0025 + 0.09(VC) (commonly graphed for use)

4. Predictions of habitat quality by #3 will be an index of species-specific carrying capacity.

Habitat Suitability Index (HSI) Models

SpatialAlso!

Scale

0 - Non-habitat
1 - Optimum habitat
K - N = 0

**Background**

Quantify the relationship between habitat quality (SI) and easily measured abiotic and biotic factors important for reproduction, survival, and recruitment of a species.

Development of an HSI Model:

- Exhaustive literature review for a species
- Identification of key “habitat” variables
- Construction of a model that represents optimum habitat quality

Words: description

Graphs: relates existing habitat quality to optimum quality

Mathematically: (regression models)

- Calculate habitat quality for each variable
- Calculate total habitat quality for an entire habitat patch (sum of variables)

Many assumptions!

Site-specificity

Is your site typical or unique?

Models not verified with demographics before publication.

157 Models Created
### Habitat Suitability Index Models

**Steps to Use**

**Words:** Based on existing literature, a description of habitat variables most strongly correlated with demographic variables.

**Graphs:**
- Conceptually:
  - Suitability Index (SI) = Existing Habitat Quality / Optimum Habitat Quality
- Graph of Equation:
  - SIV1 = Index for Variable 1
  - SIV2 = Index for Variable 2
  - HSI = MIN[SIV1, SIV2] (for "0" exists)
  - HSI = (SIV1 + SIV2)/2 (for "0" exists)

**Mathematical:**
- By Variable
  - SIV1 = 0.0025 + 0.09(V1)
  - SIV2 = [75 - 0.5(V2)]/50
- Overall
  - HSI = MIN[SIV1, SIV2]
  - HSI = (SIV1 + SIV2)/2

### Habitat Evaluation Procedures

**Habitat Units**

A total index of habitat quality for a habitat patch.

**Management Area**

<table>
<thead>
<tr>
<th>Patch</th>
<th>HSI</th>
<th>Area</th>
<th>HUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>0.64</td>
<td>10.0</td>
<td>6.40</td>
</tr>
<tr>
<td>b</td>
<td>0.65</td>
<td>10.0</td>
<td>6.50</td>
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<tr>
<td>c</td>
<td>0.61</td>
<td>10.0</td>
<td>6.10</td>
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<tr>
<td>d</td>
<td>0.68</td>
<td>10.0</td>
<td>6.80</td>
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<td>0.67</td>
<td>10.0</td>
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</table>

**Use all Metric or all English Units**

HUs can be summed across habitat patches on a management area but NOT summed across species!!

**Management Area Averages**

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**Good for Relative Comparisons**

### Habitat Evaluation Procedures

**Eastern Newt Example**

[Sousa (1985)]

**Words:**
- Lentic Water Bodies (juvenile, adult)
- Moist Woodlands (subadult [eft])

**Variables:**
- Permanent Lentic Water Body w/ Littoral Zone (<2 m deep)
- Distance to Available Forest Cover
- Percent Horizontal Cover of Vegetation in Littoral Zone
- Distance to Available Forest Cover

**Calculate Total Average**

**Assumptions:**
1) Water >2m is non-habitat or unimportant
2) Permanent water is necessary
3) Water quality does not affect habitat quality
4) Vegetative cover is a reasonable estimate of habitat quality (food, cover, reproduction)
5) Quality of forest cover unimportant <150 m

**Determine Variables via Correlation Analyses**
Habitat Evaluation Procedures

Eastern Newt Example

- **Graphs:**
  - Horizontal Cover
  - Distance to Forest

- **Math:**
  - Variable Equations:
    - \( SIV_1 = \frac{0.015(V_1)}{1.125} \)
    - \( SIV_2 = \frac{75 - 0.5(V_2)}{50} \)
  - HSI Equation:
    - \( HSI = SIV_1 \times SIV_2 \)
  - HU Equation:
    - \( HU = HSI \times \text{Surface Area of Littoral Zone} \)

Suppose: We have a permanent water body with 5 ha in littoral zone, and HC of aquatic vegetation = 60%; Distance of Forest = 75 m.

Calculate Habitat Units:

- \( SIV_1 = \frac{0.015(60)}{1.125} = 0.80 \)
- \( SIV_2 = \frac{75 - 0.5(75)}{50} = 0.75 \)
- \( HSI = (0.80) \times (0.75) = 0.60 \)
- \( HU = 0.60 \times 5 = 3 \) HUs

Interpret!