Measuring Habitat Use
Overview

- Become the animal
- Silly nulls
- What to measure
- How to measure
- Variability
- Benefits of pilot studies
- Applications to the real world

Become the animal

- Exercise in pattern seeking
  Try to envision/determine what the animal would need/use in its' environment

Habitat

"the resources and conditions present in an area that affect occupancy by a species" (Morrison 2002)

Silly nulls

- We can always develop a hypothesis but is it useful?
  - Example 1: No difference between habitat used by an organism and that not used (randomly selected)
  - Example 2: No difference between habitat used by Species A and Species B

- Why are these silly?

Silly nulls

- Why are these silly?
  - Example 1:
  - Example 2:

- Avoid _____

- Determine which resources affect fitness
  - Focus on resources_____
  - What are constraints on use?
  - Generate a model

- Resources can be abundant but used differently in different areas

- Focus on WHY animals use habitat
- Gain knowledge that is applicable outside your study area
- Ask big questions
- Conduct long-term studies

Are these silly nulls?

- Nest success of greater sage grouse is positively correlated with herbaceous cover and grass height (Holloran et al. 2005. JWM 69:638-649)

Y N why?

- Ocelots will select large patches of closed canopy habitat and avoid large patches of unsuitable open habitat (Jackson et al. 2005. JWM 69:733-738)

Y N why?

What to measure

Vegetation

- Composition _____
- Structure _____
- Landscape pattern: _____

At what spatial scale?

- Ecosystem
- Community
- Population
- Organism

- Landscape level
- Between sites
- Within-Site
- Site-level

At what spatial scale?

Within-Site
Structure & Composition

- Vertical structure (graph)

Horizontal structure (patchiness)

- Patches of different plant species across the ground increase the complexity of habitat

(Pictures)

Special features

- riparian areas, breeding sites, den sites, burrows

others:

Site Level

- Shape – affects the amount of core or interior habitat in a stand
- Topographic position – slope, aspect, and elevation affect stand microclimate and plant development
- Size – is the size of the stand large enough to include a home range or territory? of one or more individuals?
- Site quality – influences vegetation production and structure
- History – past disturbances

Between Sites

- Edges: interface between two or more plant communities or stand conditions, may be gradual or abrupt
- Types of edge – (review)

Landscape Level

- Corridors and connectivity – Use is variable among species (some use corridors, some do not)

- Patch _____
- Patch _____
- Patch _____
- Juxtaposition
- Isolation - distance between like similar patches
- Patch boundaries (contrast, permeability)
- Diversity of landscape elements (age structure)

Question for discussion

- Two basic aspects of vegetation can be distinguished:
  structure (physiognomy)
  taxa of plants (floristics).

What are trade-offs to using either of these levels of measurement?

Think of how these measurements of vegetation fit with Johnson's (1980) hierarchy, and how this influences data analysis.

1st Geographic
2nd Home range
3rd Vegetative types
4th Food items

Can models adapted for one location be applied to another?

What should be measured?

Criteria for selecting a system and variables for study

- _____
- _____
- Relevant to impact effects and sensitive in response
- _____

Precision and accuracy

Relevant to impact effects and sensitive in response

- Many studies _____and variables that were painstakingly measured aren't used in any analyses
- When should you measure 100 habitat variables and when should you stick to 50 or 25?
  -
  - _____
  - Should you measure ground cover if you're looking at habitat for brown creepers?

Spatial scale

- Match scale of analysis with scale targeted for management
- Hierarchical approach to studying habitat relationships

Jackson et al. 2005 Landscape metrics associated with habitat use by ocelots in south Texas. JWM 69:733-738

- Ocelots are listed as endangered
- Previous work shows they prefer closed canopy habitat
- This study: What patch size do they prefer?
- Used GIS and satellite imagery in south Texas to compare habitat with areas used by 11 ocelots
- Hypothesis: ocelots prefer large patches of closed canopy habitat and avoid large patches of unsuitable habitat
- Used areas had higher fragmentation than not used
- Ocelots preferred patches of closed canopy over other land cover types
- Results of this study can be used to designate conservation areas for ocelots and applied to management of other T&E wildlife

What scale is this study _____

Where does your project fit in?

Biogeographic scale
Regional scale
Local, between-plot scale
Local, within-plot scale

Temporal variation

- Temporal changes in habitat availability
  - Seasonal
    - When is most critical survival time: winter, summer? Why?
  - Daily
  - Behavioral variations
    - Breeding / non-breeding seasons
    - Presence / absence of predators, competitors
    - Age class / density (ex. fall high numbers of rodents since lots of juveniles + adults, spring low with low winter survival)

Short- vs Long-Term Studies

- Short-term studies
  - Retrospective
  - Substitute space for time
  - Use systems with fast dynamics
  - Model
- Long-term studies
  - As long as generation time of dominant organism
  - Longer than most studies

When are long-term studies particularly important

- Slow processes
  - forest succession, exotic species invasions
- Rare events
  - El Nino, catastrophic natural events
- Subtle events
  - Processes change yearly, but variance is high year to year (BBS shows decline / increase in some bird species over time)
- Complex phenomena

How to measure

Measurements of the Animal

- Presence/absence? _____
- Index of abundance? _____
- Density estimate? _____
- Complete enumeration (census)?_____
- Location, movements, survival? _____

Measuring Factors

- Match measurements to question
- Relate species richness (coarse measure) to gross structure of vegetation, not to composition

Examples:

Qualities of useful variables

- Influences distribution of study animal
- Biologically meaningful
- Can be measured _____ and at the desired _____
- Should have small _____variation relative to _____ variation
- Should describe environment immediately around the animal

Indirect measures?

- Sometimes no alternative but to measure habitat features indirectly
- Example: Insects that serve as forage base
  - May measure amount of foliage or live crown ratio instead of insects themselves
  - May measure insects themselves but not know specific species being consumed
- One of the greatest weaknesses in habitat analysis

Questions for discussion

- When measuring habitat, MMM point out that you need to chose variables that are relevant to the question at hand. How do you know what is relevant?
- In a focal animal approach, habitat is sampled in which an animal of interest has been found. An animal's location may serve as the center of a a sampling plot, or a series of observations may be used to delineate the sampling area. The major assumption is that the measurements indicate habitat preferences of the animal. Why might this not be a good assumption?

Benefits of pilot studies

- Can _____ methods
  (if no specific method already in general use)
- Can determine _____
  - Based on variance in population, *avoiding Type I and II errors*, effect size
- Evaluate data as you get it before "the big study", make adjustments as necessary
  - Can determine how much vegetation data you need to collect (may vary by the measure being taken)
  - Potential for observer bias

Statistical hypothesis testing

- Type I error: finding a difference when there isn't one
  - null hypothesis is rejected when it is really true
- Type II error: not finding a difference when there is one
  - a false hypothesis is accepted

	Reject	Do not reject
Hypothesis true	Type I	Correct
Hypothesis false	Correct	Type II

When is it bad to make a
Type I error?
Type II error?

Give an example of each

When to skip doing the study

- If you can't accurately count or index animals
- If there is too much variation in the system to measure accurately
- If you can't (or don't) correct for observer bias
- If you mismatch scale to organism
  - Don't try to count bears in a 5 square mile area if one bear uses ≥200 sq miles or count woodpeckers in a 20 ha area if they have a 10 ha home range