Foundations of Forest Wildlife Habitat Management

*Habitat through Disturbance and Silviculture*

**Guest Lecturer:** Dr. Brenda McComb, Oregon State University.

**Series Description** The Forest Ecology Working Group (FEWG) and NCTC are pleased to offer this 5-part focused lecture series to introduce fundamental principles of forest habitat management. Please contact Jeff_horan@fws.gov if you want more information about FEWG or this webinar series.

**July 14** - Habitat Selection by Forest-Associated Species: Abiotic factors

**July 28** - Saving all the Pieces: Forest structure and Composition

**August 11** - Forest Disturbance and Stand Dynamics

**August 25** - Silviculture as a Forest Disturbance

**September 15** - Habitat Considerations: Dead wood and Riparian Areas
Foundations of Forest Wildlife Habitat Management: Habitat Through Disturbance and Silviculture

Week 1: Introduction and Habitat Selection by Forest Associated Species: Abiotic Factors

Photo by Hankyu Kim
Objectives of this Lecture Series

• Provide foundational information to find a **common ground** when approaching management of forests for multiple values.

• Use disturbance ecology as a foundational framework for active stand management

• Introduce management stands to achieve desired habitat conditions for selected species or conservation of biological diversity

Information provided is a component of:

NCTC Course: “Forest Ecology and Management”

FW/FES 552: “Forest Wildlife Habitat Management” (OSU)
Lecture Schedule

**Background**

Principles of forest habitat ecology, habitat function, and habitat selection; introduce abiotic & biotic factors (Lectures 1 & 2)

**Disturbance Ecology and Stand dynamics**

Disturbances and stressors that influence forest structure, composition, and function as habitat for selected species (Lecture 3)

**Management Of Stands**

Applying silvicultural approaches to achieve habitat objectives (Lectures 4 & 5)
Conceptual Framework

Active management with a forest products focus

Active management with habitat or multiple products focus

Passive management to allow natural disturbances to achieve goals
Value of Forests

- Forests managed primarily for forest products provide habitat for many species.
- Forests managed to consider habitat structure and function can support a wide variety of species with forest products as one outcome.
Saving all the pieces

• “The first rule of intelligent tinkering is to save all the pieces” (Aldo Leopold)
• What are the pieces?

Habitat elements:
Those parts of the environment important to a species when present in the correct sizes, amounts and distributions
Defining Goals: Species, wildlife, biodiversity?

• Manage for a species such as deer, woodpeckers, owls, snakes, wood ducks, etc. – which of the 1.7 million described species would you like?

• Manage for a group of species such as game, songbirds, native fish, etc.

• Manage to conserve biodiversity (both known and unknown): genetic representation, populations, ecosystems
We have information to manage forests

• We understand plant dynamics, disturbance ecology, habitat selection, and population dynamics.

• We can develop reasonable stand and forest management plans

• Need to monitor the effectiveness of the plans
The Biggest Challenge

Meeting habitat goals with increasing demands on natural resources on a decreasing available land base.

https://www.nasa.gov/sites/default/files/forest-cover-global.png?itok=SzC6ccIf
Questions?

Photo by Hankyu Kim
Habitat Selection by Vertebrates

Habitat is defined as the resources necessary to support a population over space and through time.
Learning outcomes for this lecture

• Identify levels of selection for a species of vertebrate

• Understand limitations of studies designed to detect habitat selection

• Recognize the importance of fitness as a response variable when detecting habitat selection
Food – Energy input

- Solar Energy
- Photosynthesis
  - Food: Energy Inputs
  - Digestible Energy
    - Net Energy
    - Heat Loss
      - Cover: Energy Conservation
    - Excreta and Urine
  - Available Energy
    - Fitness: Reproduction
    - Movement
    - Basal Metabolism
Cover provides a mechanism for conserving energy

Energy Conservation = closer to the TNZ for endotherms

Question: how does this concept relate to ectotherms?
Cover

• And escape from predators
• And a place to nest or den
Water

• Essential but highly variable from species to species
Habitat Selection

**Levels of Habitat Selection**

- **First order selection** = occurrence within a geographic range “where in the world the species occurs”
  - Establishment of subpopulations within the geographic range

- **Second-order selection** = establishment of a home range “the area used to acquire resources”

- **Third order selection** = use of resource patches within the home range where resources are found

- **Fourth order selection** = use of specific food and cover resources acquired in the resource patches.

**Scales of Habitat Selection**

**Space**

**Time**

Define the levels within scales of disturbance?


Hierarchical Levels of Habitat Selection

Metapopulation Structure

https://seaspout.files.wordpress.com/2011/08/source_sink.gif

Habitat Structure and Composition

- Animals often use proximal cues to select habitat that can provide ultimate resources
  
- Ultimate resources = food, cover, water

We tend to think of structure and composition as visual proximate cues to ultimate resources, but is that too anthropocentric?

**Aural social cues** – Betts et al. & black-throated blue warblers

**Olfactory cues** – Scent marking by mammals

**Tactile?** – Soil compaction?

Other?


https://www.fs.usda.gov/detail/okawen/landmanagement/?cid=STELPRDB5319349
Assessing habitat use

An example of classic habitat selection research using radio telemetry:

- “…Regenerating stands (<20 years), mostly 1992–1994 clearcuts, are white.”

What does this tell us about selection?
What level of selection is addressed?
What spatial scale is addressed?
What information is needed to assess habitat preference?
What information is needed to assess habitat quality?
Habitat Quality = Animal fitness

Ideal Free Distribution

More animals in better habitat

Ideal Despotic Distribution

Is density a useful index of habitat quality?

Territoriality influences distribution and fitness

What demographic parameters do we need to know to understand fitness?

- Survival
- Reproduction
- Movement
Questions?

Photo by Mike Jones
Abiotic factors influencing habitat elements

• Geology
• Topography
• Soils
• Climate

• Limits on habitat elements and organism physiology
• Drives distribution of potential vegetation
• Provides the template for biotic interactions
• Influences tree occurrence and tree growth

Abiotic factors influencing production of habitat elements

Learning Outcomes

• Identify the key abiotic factors influencing forest species composition and structure on a site

• Understand how the site can limit the ability to achieve habitat goals
Areas of the United States with potential for karst features

- Areas underlain by soluble bedrock
- Humid areas (>30 inches average annual precipitation)
- Dry areas (<30 inches average annual precipitation)

http://geology.er.usgs.gov/egpsc/graphics/06_karst_studies_weary.jpg
Soils

- Texture
- Depth
- pH
- Micronutrients (e.g., Serpentine)
- Moisture (hydric, xeric, mesic)

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054167
Site quality

• Site index=Height of the dominant and co-dominant trees at a specified age

• Tree presence, and growth rates are a function of available sunlight, moisture, nutrients, in addition to competition

• Why tree height?

https://www.nrs.fs.fed.us/fmg/nfmg/rp/silv/sitequality/p2_siteindex.html
Soils

Find a soil survey for your area
https://websoilsurvey.scegov.usda.gov/App/HomePage.htm
Changes over Space: Topography

Elevation and Latitude Effects

Holdridge Life Zones

https://commons.wikimedia.org/wiki/File:Lifezones_Pengo_FAO.svg
Moisture gradients

Silvics of North America

Climate Effects

Temperature and precipitation can limit the distribution of some species.

Source: WikiMedia Common: from Farm Services Administration (1942) Public Domain

http://www.fsl.orst.edu/clams/map_index.html#climate

Long term trends in temperature, precipitation and vapor pressure deficit

https://en.wikipedia.org/wiki/Benton_County,_Oregon

https://prism.oregonstate.edu/
Below canopy trends in temperature and birds


Photos by Hankyu Kim
Projecting climate change effects forward in time (G. Reeves Presentation to the Oregon Board of Forestry, June 3, 2020).
Vegetation patterns will likely continue to change

“...many invasive species share traits that will allow them to capitalize on the various elements of global change. Increases in the prevalence of some of these biological invaders would alter basic ecosystem properties in ways that feed back to affect many components of global change...”(Dukes and Mooney 2000)
Forest Types

https://data.fs.usda.gov/geodata/rastergateway/forest_type/conus_forest_type_metadata.php

Climates will disappear and new ones will develop

“There is a close correspondence between regions with globally disappearing climates and previously identified biodiversity hotspots; for these regions, standard conservation solutions (e.g., assisted migration and networked reserves) may be insufficient to preserve biodiversity.”
(Williams et al. 2007)
http://www.pnas.org/content/104/14/5738.abstract
Site limitations to providing habitat elements

• Is the site capable of meeting your objectives for a stand?
  • What is the capability of the soil to grow trees of desired species? Shrubs? Herbaceous plants?
  • Is soil moisture adequate during the growing season?
  • How might slope or aspect influence growth and survival of desired species?
  • What are the climatic limits to growth and survival of the desired species?
  • How might climate change influence growth and survival of the desired species?
Questions?

For questions, comments and ongoing discussions to the group for all 5 Forest Wildlife Habitat Management webinars:

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