Habitat Suitability
Teacher Instructions

Introduction:

This activity asks students to use prior knowledge to decide on the suitability of an area for a particular species. The most practical way to do this is to use the photographs from the aerial photographs protocol. The students can also take data on their own using any of the forest ecology protocols. Previous to doing this activity, students should have selected and marked their team's study sub-plot. The species used in the protocol are endangered species, but any species would work well.

Objectives:

1) Obtain data on a particular site.
2) Obtain habitat data on a particular species.
3) Assess the site for suitability with the species.

Students Required: Groups of two - four

Estimated Time: One class period

Overview of Tasks:

1) Assign species for the students to work with.
2) Allow students to research the species.
3) Allow students to run student instructions.

Questions:

1) Does the habitat suit the needs of the species?
2) What makes the habitat suitable/unsuitable for the species?
3) What are the pros and cons of keeping this habitat in its current condition?

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Student Instructions

Introduction:

A myriad of animals can be found living in the forest. Unlike plants, animal wildlife doesn't stay put for convenient human observation. Luckily, careful examination of forest structure can provide important information regarding the animal component of the forest ecosystem. Scientists can study forest structure and make predictions about the wildlife inhabitants of a study site. Not only is it interesting to identify species of wildlife you might encounter in a given area, these predictions can also be used to anticipate and hopefully mitigate the loss of biodiversity. One of the most common limitations to the success of endangered or sensitive species is the loss of, or the fragmentation of habitat. This is the link connecting habitat loss with the loss of biodiversity.

Forest fragmentation occurs when forest habitat gets divided into smaller and smaller units. Some species cannot survive without an adequate area of uninterrupted habitat. For example, a suitable habitat for red tree vole (Arborimuslongicaudus) must include at least 10 acres of continuous old-growth forest. The requirements of the northern spotted owl (*Strix occidentalis*) are even greater since the home range of individual owl pairs can be as large as 5,000 acres. The fragmentation of habitat not only decreases the total area of forest, it also produces more isolated patches of habitat. Remnants of populations in fragmented habitats are more susceptible to extinction since they are more vulnerable to invasions of exotic and non-forest-dwelling species.

Habitat fragmentation increases the contrast between adjacent habitat islands and their mutual influence, which results in a so called the **edge effect**. The greater the extent of forest fragmentation, the greater the length of habitat edges, which can serve as entry gateways for harmful organisms. For example, the brown-headed cowbird (*Molothrus ater*) parasites nests of other forest bird species along forest edges. A simple mathematical fact that shows that the smaller a habitat fragment gets, the greater its perimeter length becomes relative to its surface area, increasing its vulnerability to outside invaders. For example, the perimeter-to-surface area ratio of forest stand A is 224 m /acre. This means that each acre of this forest stand can be "invaded" through 224 m of edge habitat. In the case of the smaller stand B, however, the situation is even more concerning since its small size produces a perimeter-to-surface ratio of as much as 371 m per acre.

It is important to distinguish between a forest that is fragmented by human development and a forested landscape composed of a mosaic of mature and younger stands that results from timber harvesting. The first may represent permanent habitat loss, but the second may only cause a temporary reduction in habitat for forest-interior species that rely on mature forests. Early successional forests do provide habitat for many bird species, including some migrating birds that are declining. Forest-interior species that require mature forests are affected by both types of fragmentation. Much more time is needed to develop a mature forest. Adequate amounts of mature forest at any point in time are needed.

One way to understand the connection between forest structure, habitat fragmentation, and the loss of biodiversity is to assess whether or not your study site can support wildlife species listed

as sensitive, or endangered. The term "habitat suitability" is used to describe the complex set of environmental factors that affect the ability of organisms to establish and maintain a population. In order to assess habitat suitability you must consider the biotic as well as the abiotic conditions of the site. For example, some important characteristics to consider are: suitable plant- or landscape features for nesting, shelter from temperature extremes; food source availability, and access to water. Other factors include competition or cooperation with other species, predation, and location along a migration path.

Materials:

Data from previous experiments or Aerial Photographs

Procedures:
Previous to doing this activity, students should have selected and marked their team's study sub-plot.

1) Chose a species listed in table 1 or use a species assigned to you. Research the habitat that the species prefers.
2) List the favored conditions and elements of the species.
3) Make sure your class has set out the transect, and your team has set out its sub-plot before proceeding. Using the aerial photos of your sub-plot, determine the size of the forest stand that contains your sub-plot. Using the photo of the watershed, count up the total number of forest patches, and estimate or calculate the average size of the patches. You can either approximate this or, use the formula below.

Alternative: Calculating average patch size: Total number of patches (*N*), Mean Patch Si, ($\hat{s}$) and Area Weighted Average Patch Size ($\hat{s}_w$). Total number of patches and average patch size are the total number of forest patches and their average size within a watershed. Average patch size is sensitive to the number of small patches in the landscape. Weighted average patch size is calculated as:

$$\hat{S}_w = \frac{\sum S_k^2}{\sum S_k}$$

where ***Sk*** is the size of the ***k****th* patch

4) Although remaining forest areas may not be joined as one or a few large patches, movement of animals and seeds among patches will be greater if the remaining forest patches are in close proximity to one another. Estimate the number of forest patches that are close and number that are isolated.
5) Compose a two-five page report outlining the assessment of habitat suitability on your sub-plot. Find out some of the means by which people are trying to restore your chosen endangered species. What are habitat improvements required by the Endangered Species Act? What are the primary reasons your species is threatened or endangered? How has habitat fragmentation contributed to the species decline?

Table 1. Habitat preferences of important wildlife species in Oregon

Species	Favored habitat conditions and elements	Protection Status
Marbled murrelet (*Brachyramphus marmoratus)*	• Coastal forests • Tree DBH more than 30 inches • Less canopy closure • Vertical canopy structure • Presence of Mistletoe • Forest edge makes poor nesting sites • Fewer trees per acre	Threatened species
Bald eagle (Heliaeetus leucocephalus)	• Large dominant trees in older forests for nesting • Optimum DBH of nesting trees > 20 inches • Presence of water (lakes, rivers) within 1-5 miles of the nesting tree • Avoids clearcuts, logging roads and developed areas	Threatened species
Northern spotted owl (*Strix occidentalis*)	• Late successional mixed conifers • Tree DBH more than 30 inches • Live trees with broken tops for nesting • High canopy closure • Rich understory • High density of well-decayed course woody debris • More than 1,200 continuous acres of habitat	Threatened species
Northern goshawk (*Accipiter gentilis*)	• Tree DBH more than 20 inches • Canopy cover more than 60% • Sparse ground cover and under-story • Access to water • Several hundred acres of habitat	Species of concern
Peregrine falcon (Falco peregrinus)	• Cliffs and rock walls taller than 98 feet, overlooking open areas	Endangered species in Oregon

Pileated woodpecker (*Dryocopus pileatus*)	• Snags and trees with DBH more than 28 inches • Fallen logs with DBH more than 15 inches	Oregon sensitive species
Olive-sided flycatcher (Contopus borealis)	• Forest openings and edges • Presence of snags and residual trees from forest fire • Canopy cover less than 40%	Oregon sensitive species
Oregon red tree vole *(*Arborimus longicaudus*)*	• large live Douglas-fir trees of DBH > 30 inches. At least 5 per acre (12 per ha) of these trees to create optimum habitats • average height of dominant trees > 160 feet • high canopy closure and multistory forest structure	Species of concern
Western pond turtle *(Clemmys marmorata)*	• forest aquatic habitats such as ponds, marshes and riparian areas • little or no canopy closure and sparse ground vegetation at nesting sites	Species of concern
Oregon megomphix – mollusk (Megomphix hemphilli)	• Tree DBH more than 20 inches • Multiple canopy layers • Presence of hardwood species such as red alder or big leaf maple • Canopy cover more than 60% • Deep layers of litter • High volume of course woody debris	Survey and manage species of the US Forest Service and the Bureau of Land Management.

Resources:

- You can learn more about the habitat preferences of other species in *Wildlife-habitat relationships in Oregon and Washington* by Johnson and O'Neil. 2001. This is an excellent resource that among other things describes individual forest types in Oregon and Washington and lists all wildlife species that occur in this region. The book includes numerous data tables and wildlife habitat distribution maps.
- GAP CDs for the state of Oregon are available free to teachers (while supplies last). Contact: Annie Weiland annie.weiland.oregonstate.edu.
- Oregon Department of Fish and Wildlife. http://www.dfw.state.or.us/. Contact a wildlife biologist and invite them to do a class presentation about some of the species your class has investigated.
- Wade, T. G., K. H. Riitters, J. D. Wickham, and K. B. Jones. 2003. Distribution and causes of global forest fragmentation. Conservation Ecology **7**(2): 7. [online] URL: http://www.consecol.org/vol7/iss2/art7/
- Birds in the Forested Landscape: What is ForestFragmentation and Why is it Important? http://www.birds.cornell.edu/