The Value of a Dead Tree

Overview: Students will perform basic forestry measurements of trees to evaluate the suitability of an area for cavity excavating birds in order to make a value and attitude based decision about the best use for dead trees in the context of energy needs in a changing climate and ecosystem integrity.

Keywords: Cavity nester, DBH

Age / Grade Range: 10-12

Background: With adaptations such as strong, chisel-shaped bills and stiff tail feathers to brace against trees, woodpeckers are able to excavate trees both to forage and create nest cavities. Nest cavities are chambers hollowed out of a tree created by removing bark and hollowing out a rounded space in a tree trunk. Weaker cavity excavating birds such as nuthatches and chickadees modify woodpecker cavities or excavate in snags, weakened from decomposition, as they lack the specific adaptations necessary for independent excavation of live trees (Bull, 2002; Podulka, Rohrbaugh, & Bonney, 2004). Other cavity utilizing animals such as small mammals, amphibians, and other birds that do not have cavity excavating abilities rely on old woodpecker cavities for shelter and breeding, especially those that are enlarged by decay (Aubry & Raley, 2002).

Scientists hypothesize that woodpecker nest cavities may play an integral role in winter survival by providing a favorable microclimate and protection from predators to other animals unable to make their own cavities (Cooper, 1999; Loeb, 1993; McComb & Noble, 1981).
Humans and nature are in conflict over the management of snags at both the timber industry and visually aesthetic levels. For example, forests that are managed for commercial harvest minimize the risk of tree death and increase monoculture to maximize profits which creates large stands of forest without the ecological component of dead trees as possible nest cavity sites (Block & Finch, 1997).

Reconciling anthropocentric and ecocentric values and attitudes in favor of snag conservation is a complex issue still being explored.

Field Instructor Unit Conversion Notes:

A chain is a commonly used measurement in forestry that equals 66 feet. Students may estimate this with paces or use a meter tape. A square chain (66'X66' area) is 4356 square feet which is approximately 1/10 of an acre. This information will be useful in scaling down the habitat preference chart for cavity excavators to make the exploration area a more manageable size for the activity.

Next Generation Science Standards & Common Core:

LS2.A: Interdependent Relationships in Ecosystems
LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
LS2.C: Ecosystem Dynamics, Functioning, and Resilience
LS4.C: Adaptation

Goals:

Students will perform basic forestry measurements of trees to evaluate the suitability of an area for cavity excavating birds in order to make a value and attitude based decision about the best use for dead trees in the context of energy needs in a changing climate and ecosystem integrity.

Essential Questions:

- What are cavity excavators and which common species can we find in Ponderosa State Park?
- What is a secondary cavity nester and what ecosystem components do they depend on and why?
- What values and attitudes influence the value of a dead tree and what do the data suggest to you?

Objectives:

- Students identify common species of cavity excavating birds and secondary cavity users through pictures and field observation.
- Students observe evidence of cavity excavation in PSP.
- Students recognize the role of strong cavity excavators as ecosystem engineers.
- Students relate the presence of snags to winter survival of secondary cavity users.
- Students define and visualize the distance of a "chain."
- Students measure canopy density, dbh, and the height of trees.
- Students record and plot different stages of tree decomposition as they relate to wildlife habitat.
- Students analyze their data for habitat suitability for different species of wildlife preferences.
- Students relate their findings to the Value of a Tree lesson and assess the ecocentric versus anthropocentric uses of dead trees.
- Students justify their own opinions about the value of a dead tree based on their data and predict the interpretations of this data by other industry stakeholders (wildlife biologist, paper mill owner, airline, biofuel manufacturer, harvestable forest manager, etc.)

Materials:

- Laminated cavity nester and cavity pictures
- Wildlife tree stage chart
- Cavity excavator habitat preference chart
- Orange flags from grad kit

- Meter tape
- Clinometer
- Densiometer
- Optional- flagging

Set up:

Students should have completed the Value of a Tree lesson and have a basic understanding of tree decomposition. Field instructor may want to make sure that students are familiar with basic forestry measurements such as canopy density, DBH, and using a clinometer.

Field instructors may be interested in adapting this to be a comparison between the managed and unmanaged forest or unmanaged and campground/MOSS campus to apply concepts to the influence of human presence and recreation to forest management practices that affect wildlife.

Classroom Time:

1.5 hours of a field day

Think back to calculating the value of a tree. What question were we trying to answer? (what is the value of dead woody material that is considered waste as an alternative biofuel energy) Do you think woody debris is always considered waste? In this activity we will try to evaluate the importance of woody biomass. In other words, we'll act as foresters to answer the question, "What is the value of a dead tree?" How might it have value other than monetary value or value to people? (ecological value) I will show you some of the organisms that need woody biomass, such as snags, for habitat.

Introduction (Engage):

Show students pictures of cavity excavating and using animals. Hand a picture to each student. How do you think your animal uses nest cavities? (hold up pictures of nest cavities for students to see) Encourage discussion among students to notice that some animals are woodpeckers and able to excavate their own cavities with their beaks. Are any of you confused about your animal? Why? (doesn't seem to have adaptations for excavation) Explain that some of these animals are ecosystem engineers and some of them depend on ecosystem engineers like the woodpeckers. What do you think this means? (some animals make habitat for others) Challenge students to make the connection that woodpeckers modify habitats and other animals depend on the cavities they make. Sort the animals accordingly (primary excavators, strong primary excavators, weak excavators, non excavators). Point out that weak excavators (nuthatch, chickadee) are dependent on soft decaying wood of snags and non excavators (woodrat, squirrel, frog, owl) depend on abandoned nest cavities. The small woodpeckers (downy, hairy, flicker) are strong enough to excavate in live trees, but not really hard ones like Ponderosa Pine. The Pileated Woodpecker is the only strong primary excavator in this area. Why do you think this is so? (it is bigger and stronger than the other woodpeckers, pure mechanical size advantage) These animals are non-migratory in some areas so they depend on cavities year round for breeding and shelter during the winter. What winter challenges might these nest cavities protect the animals from? (Cold, wind, snow, energy loss- especially important for small animals due to high surface area to volume ratio) Show the pictures of nest cavities again pointing out that there are ranges of cavity entrance sizes depending on the excavator. (small woodpeckers- hairy and downy, medium- flicker, large- pileated)

Activity (Explore):

We are going to mark out a study area to look for evidence of nest cavities. We want to answer the question "What is the value of a dead tree to the cavity nesters and ecosystem as a whole?" A forest manager or conservation biologist might do this kind of investigation in an area where energy developers are interested in harvesting woody biomass. In energy development, impacts to the environment and community are considered before making a decision. Foresters use a unit called a "chain" which is about 66 feet. We will mark off a square chain of area. Sometimes foresters estimate this by knowing their pace. Would you like to pace your chain or use a meter tape? Define the study area by measuring out a square chain by student directed method and marking corners with flags. Now that the study area is defined, what do you think a scientist might want to know first? (general habitat characteristics) Encourage students to free explore the area for evidence of cavity excavation and observe cavity excavators in action. Students may want to take pictures with them as a "field guide."

Explanation

Regroup students from free exploration and ask them to report some of their findings. Scientists often need to communicate their interesting observations in some sort of quantifiable or standard qualitative way. How do you think this helps scientists collaborate? (communicate information in a way everyone understands) Give students a classification chart of wildlife trees and ask them to survey the area for wildlife trees based on their preliminary observation of snags and nest cavities. Provide students with flagging and a marker. How will you keep from counting a tree more than once or forgetting a tree? (transects, plots, flagging labels, etc.) How will you record the data? (take turns, one central data sheet, all travel as a group from tree to tree) Record the stages for each tree located and make sure you can identify each tree on the list by labeling or mapping.

Elaboration:

Ask students to make some generalizations about their data so far. Does the presence of wildlife habitat (wildlife trees) make it good wildlife habitat? (possibly, not necessarily because there are generalists and specialists in the animal world) Give students a chart of habitat minimum standards and ideals. Why do you think it is important to count these specific types of trees? (nutrient cycling- living trees are future snags, snags are future downed wood, downed wood is future soil to nourish future trees) Can you use this chart to evaluate the quality of habitat assuming that our square chain is a representative sample? Ask students to describe methods together. (remind about math extrapolation, multiply by 10 if only surveying 1 square chain) Provide students with measurement tools (meter tape, clinometer, densitometer- if doing ponderosa pine specific eval). Challenge students to take relevant measurements and relate their findings to the preferences in order to synthesize the information. What does this information mean for wildlife? Evaluate the quality of this habitat for cavity using animals.

Imagine that this forest plot is on a timber harvest area. Many of the wildlife trees may be seen as waste because they are not merchantable and interfere with the uniform shape and size of an easily harvestable area. What ecosystem impacts do you predict if all this wood were removed to be used as jet fuel? Use the Value of a Tree worksheets to get an idea of the numerical value of this unmerchantable woody biomass.

Evaluation:

Take the opinion of a stakeholder who may be interested in using dead trees (paper mill owner, woody biomass converter, timber harvest manager, wildlife biologist). Evaluate the data and suggest what they may conclude as the value of a dead tree.

Use the data collected to justify your opinion of the value of a dead tree explaining your own values and attitudes.

Additional resources:

http://www.abcbirds.org/newsandreports/special_reports/ppine_landowner.pdf
http://www.abcbirds.org/abcprograms/domestic/CavityNesting.html
http://www.abcbirds.org/newsandreports/special_reports/Cavity-nester%20booklet.pdf

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