Value of the Slash of a Tree

Overview: In this lesson students will look at forest ecosystems and determine the estimated slash of the trees. Other forest ecosystem discussions can be implemented as well such as fire ecology.

Keywords: Biomass, biofuel, slash

Age / Grade Range: 8th-12th

Background: Biofuel is defined as “liquid or gaseous fuels produced from biomass” by the Department of Energy (“Energy Basics: Biofuels,” 2011). Biofuels may offer a sustainable solution to domestic energy independence while reducing greenhouse gas (GHG) and fossil carbon emissions (Hoekman, 2009a). Two major types of biofuels include biodiesel and ethanol (Chhetri et al., 2008; Lippke et al., 2012a; Simasatitkul et al., 2012) which can be produced in a variety of different ways by fermenting and processing renewable agricultural, woody, and urban waste products (Hoekman, 2009b; Lippke et al., 2012b; Smith & Searchinger, 2012; Somerville et al., 2010a). Current research is being conducted to increase the efficiency of biofuel production from lignocellulosic feedstocks and to evaluate the feasibility of using different types of biofuels in the transportation industry.

Next Generation Science Standards & Common Core:

MS-LS2.C Ecosystem Dynamics, Functioning, and Resilience
HS-LS2.C Ecosystem Dynamics, Functioning, and Resilience
MS-ESS3.A Natural Resources
HS-ESS3.A Natural Resources
MS-ETS1.B Developing Possible Solutions
HS-ETS1.B Developing Possible Solutions

Goals:

• Students will get a sense of place by investigating and comparing two local forest types, and by familiarizing themselves with several local tree species.
• Students will speculate on the problem of and opportunity resulting from logging waste.
• Students will estimate the mass of potential slash present per acre of each forest type.
• Students will address the different ecological factors that can be affected by forest management strategies.
Objectives:
1. Students will understand that a large quantity of wood ‘waste’ is produced in the logging process, and that the amount of ‘waste’ produced differs between different forest types and structures.
2. Students will be able to identify several tree species in the areas they are sampling.
3. Students will understand that management practices greatly impact the ecology of a forest.

Materials:
- Flags (4 per group)
- Meter tape (1 per group)
- DBH tape (1 per group)
- Calculator (1 per group)
- First aid kit
- Wristwatch (1 per group)
- IPad
- Directions handout for activity (1 per group)
- Forest Service slash estimator handout (1 per group)
- DBH and species table in which to record data (1 per group)
- Writing utensils and paper or notebooks
- Treefinder booklets (1 per group)
- Compass (1 per group)

Set up:
Determine an area in which to conduct the lesson. Ideally, the area would be in close proximity to two different looking forests (e.g., managed vs. unmanaged stands, ponderosa pine vs. grand fir dominated stands, etc.).

Classroom Time:
1.5 hours

Problem: What should we do with leftover slash from logging?

In terms of timber and industries involving wood, what is “waste” and where does it come from? (5 minutes)
- Clearing for fire management
- Waste from paper/lumber manufacturing
- Crop trees
- Slash (previously unmerchantable branches and crown tips) from other forest management activities
- Construction and demolition

How do forests differ, and how can these differences affect a forest’s suitability for responsible biomass harvest? (5 minutes)
- Species composition
- Structural differences (e.g., tree size, age, density)
- Topographical differences (e.g., slope, aspect, elevation, etc.)
How can we measure some of these differences? (1 minute)

- Random sampling
- Forest inventories
- Remote sensing

1. Divide the group into smaller groups. Groups of four would be ideal.
2. Hand out materials, give directions, and send all of the groups to sample area 1 (e.g., either the managed forest or the unmanaged forest). The directions handout will be given to the groups as a reminder of the steps to be followed (provided in Appendix A). Frontload to each group that they will eventually be presenting their results to the rest of the group.
3. Have each group randomly determine a point at which to begin their sample plot. To do this, wander a ways into the plot. Then, to determine an azimuth, look at the watch and prepare to walk in the direction that the second hand points toward at that given moment. Encourage groups to figure out a technique that they could use to randomly generate a value for the number of paces to walk in that direction (e.g., take the tallest person and ask them their birthday, then take the same number of paces as the day they were born). Mark the point with a flag.
4. From that point, have groups measure 6.63 meters north, and place another flag. From there, measure 6.63 meters west and place a flag, then 6.63 meters south and place a flag. The resulting flags will constitute the corners of a square sample plot that is 1/10 of an acre in surface area.
5. For each tree in the sample plot, groups will measure diameter at breast height (DBH) using the DBH tape, and determine species using the tree finder. For trees that lie partially in the plot and partially out (the borderline of the plot transects the bole of a tree) count every other tree.
6. Calculate the estimated slash per tree by referring to the FS Slash Weight Table (appendix C), and record on data table.
7. Estimate and record the total slash per sample plot by taking the sum of the estimated slash per tree values.
8. Estimate and record the total slash per acre by multiplying the total slash per sample plot by 10.
9. Move the groups to sample area 2 and repeat.

Activity (Explore):

Discussion of biomass removal. Elaborate and expand on ideas generated by students in presentations:

A. What ecosystem services do trees provide?
   1. Define ‘ecosystem services’
   2. Oxygen, wildlife habitat, shade, inherent value, water

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storage and use, water purification, nutrient cycling, erosion control, medicinal uses, CO2 sequestration, etc.

B. Impacts of biomass removal on ecosystems
   1. Nutrient loss: how much nutrient loss is not harmful; at what point is it harmful? How do you define what is harmful and not harmful? How does this vary by management perspective and priorities?
   2. Discuss which ecosystem services would or wouldn't be affected by removal of biomass.

C. How biomass removal can affect fire management
   1. Discuss fire management strategies (prescribed and controlled burning, fuel removal) and fire ecology (fire triangle, types of fires, ladder fuel).
   2. Hypothesize about which of the two areas sampled would be more prone to destructive fires.

F. Other than the vegetative structure of a forest, what other factors might come into play when evaluating the suitability of a site for biomass removal? (5 minutes)
   1. Already existing infrastructure
   2. Cultural and societal resources
   3. Etc.

During the activity, move between groups to see that the students understand what they are doing and to answer any questions they might have.
After the data has been collected and the slash per acre has been estimated, have each group present their findings to the rest of the class. Have students reflect on the following questions:
   • Which sample area (per acre) was estimated to contain more slash weight?
   • How did the areas differ in the nature of the slash present (location, size, concentration, etc.)?
   • How might the differences in slash affect the ecology of the sample areas?
   • What were the easiest/most difficult parts of the activity?
   • What flaws did you discover/might you expect from random sampling methods like the one used in this activity?
   • In timber harvest, what might be the benefits and risks associated with extracting more slash than we have been able to in the past?

On the hike back, assess each student’s knowledge by casually asking students to identify trees that were learned during the activity. Ask: what tree is this and how do you know?

Additional resources:
This work was supported by an Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30416 from the USDA National Institute of Food and Agriculture.


Works Cited


Directions for Slash Activity

1. Randomly determine a point at which to begin their sample plot. To do this, wander a ways into the plot. Then, to determine an azimuth, look at the watch and prepare to walk in the direction that the second hand points toward at that given moment. Determine a technique for randomly generating a value for the number of paces to walk in that direction (e.g., take the tallest person and ask them their birthday, then take the same number of paces as the day they were born). Mark the point with a flag.

2. From that point, use the meter tape and the compass to measure 6.63 meters north, and mark that spot with another flag. From there, measure 6.63 meters west and place a flag, then 6.63 meters south and place a flag. The resulting flags mark the corners of a square sample plot that is 1/10 of an acre in surface area.

3. Sample all trees that lie in the sample location and are greater than 1 inch in diameter at breast height (DBH). For trees that lie partially in the plot and partially out (the borderline of the plot transects the bole of a tree) count every other tree.

4. For each tree in the sample plot, measure DBH using the DBH tape, and determine species using the tree finder. Record DBH and species of each tree in the data table provided.

5. Rotate jobs (i.e., species identifier, DBH measurer, recorder of data, and recorder of which trees to include and which were already sampled) amongst group members.

6. Calculate the estimated slash per tree by referring to the FS Slash Weight Table (appendix b), and record on data table.

7. Estimate and record the total slash per sample plot by taking the sum of the estimated slash per tree values.
8. Estimate and record the *total slash per acre* by multiplying the *total slash per sample plot* by 10.

9. Move to sample area 2 and repeat

**Data Recording Table** (1 per sample area)

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*Total Estimated Slash per Sample Plot (sum of Estimated Slash per Tree values)*

*Total Estimated Slash per Acre (Slash per Sample Plot x 10)*
Reflection Questions

1. Which sample area (per acre) was estimated to contain more slash weight?

2. How did the areas differ in the nature of the slash present (location, size, concentration, etc.)?

3. How might the differences in slash affect the ecology of the sample areas?

4. What flaws did you discover/might you expect from random sampling methods like the one used in this activity?

Slash Weight Per Tree Table
This work was supported by an Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30416 from the USDA National Institute of Food and Agriculture.

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/ Numbers within the lined space are within limits of data sampled. 

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