Assessing Lower Canopy, LOD Attributes

OFFICE WORK
Using the data collected by the entire class, develop responses to the following questions.

1. What is the mean cover for the vegetation species named in lab using each of the two lower canopy assessment methods (transect vs. fixed-area plot)? How do they compare? If different, why do you think they differ?

**Point transect** method
Cover (COV) in percent of species “j” for a single transect is estimated by the formula:

\[
COV_j(\%) = \frac{j}{p} (100) , \text{ where}
\]

\( j = \) the # points intersecting just species “j”,
\( p = \) total number of points sampled along transect

**Fixed-Area plot** method
Cover (COV) in percent of species “j” for a single plot is estimated by eye in the field.

**Mean Cover** (either method)

\[
\bar{C} = \frac{1}{n} \sum_{i=1}^{n} COV_i , \text{ where}
\]

\( n = \) the # transects or plots

2. Which vegetation method produces more variable observations? Why do you think that is? Which method would you recommend to your colleagues for use? Why? Would you change anything about that method to improve it? Why or why not?

**Variance of Cover** (either method)

\[
\text{Var}(C_{\text{COV}}) = \frac{\sum_{i=1}^{n} COV_i^2 - \frac{1}{n} \left( \sum_{i=1}^{n} COV_i \right)^2}{(n-1)}
\]
3. What is the **mean volume per acre of LOD** using each of the two LOD assessment methods? How do they compare? If different, why do you think they differ?

**Line intersect** method

Analysis of LOD Data collected with Line Intersect Method

In general, for any attribute of interest we use an “attribute-to-length ratio” to estimate the total amount of the attribute per unit area.

Total amount, \( T_x \), of attribute \( x \) per unit area, is estimated using this fundamental equation:

\[
T_x = \frac{\pi}{2L} \sum_i \frac{x_i}{l_i}
\]

where \( L = \) length of transect, \( x_i = \) attribute of interest, and \( l_i = \) length of intersecting piece.

If \( l, L \) are measured in feet, then units of \( T \) are “amount of attribute \( x \) per sq. ft.” (Units of \( l \) and \( L \) must match to make any sense.)

When the attribute of interest, \( x \), is VOLUME (cubic feet), we typically assume fallen logs are shaped like cylinders.

\[
x = v_{cyl} = \pi r^2 l = \pi \left( \frac{d_i}{2} \right)^2 l
\]

\[
T_V = \frac{\pi}{2L} \sum_i \frac{\pi (d_i^2 / 2) l_i}{l_i} = \frac{\pi^2}{8L} \sum_i d_i^2 \Rightarrow \text{ft}^3 / \text{sq. ft}
\]

The volume of woody debris per acre is obtained by multiplying \( T_V \) by 43,560 (1 acre = 43,560 ft²):

\[
\hat{V} = 43,560 \cdot T_V = 43,560 \frac{\pi^2}{8L} \sum_i d_i^2 = \frac{5445\pi^2}{L} \sum_i d_i^2 \Rightarrow \text{ft}^3 / \text{acre}
\]

Now, if \( d \) is measured in inches and \( L \) in feet, the volume of woody debris per acre (ft³ / acre) becomes:

\[
\hat{V} = \frac{5445\pi^2}{L} \sum_{i=1}^{k} \left( \frac{d_i}{12} \right)^2 = \frac{5445\pi^2}{144L} \sum_{i=1}^{k} d_i^2 = \frac{373.2}{L} \sum_{i=1}^{k} d_i^2
\]
**Fixed-Area plot** method

Volume of an individual piece:

\[ v = 0.005454 \cdot d_a^2 \cdot l \], where

\( v \) is piece volume in cu.ft,

\( d_a \) is average of end diameters (in.) on the LOD,

\( l \) is the piece length (ft).

Total volume, \( T_V \) on a single plot (sum up all the individual pieces):

\[ T_V = \sum_i v_i \]

The volume of woody debris per acre is obtained by multiplying \( T_V \) by the plot expansion factor, which is the inverse of the plot size, \( a \):

\[ \hat{V} = \left( \frac{1}{a} \right) T_V \]

**Mean LOD volume per acre** (either method)

\[ \bar{V} = \frac{1}{n} \sum_{i=1}^{n} \hat{V}_i \]

4. Which LOD assessment method produces more variable observations? Why do you think that is? Which method would you recommend to your colleagues for use? Why? Would you change anything about that method? Why or why not?

**Variance of LOD volume per acre** (either method)

\[ s^2 = \frac{\sum_{i=1}^{n} \hat{V}_i^2 - \frac{1}{n} \left( \sum_{i=1}^{n} \hat{V}_i \right)^2}{n-1} \]