TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE STATE OF OKLAHOMA NATURAL RESOURCES CONSERVATION SERVICE

WOODLAND TECHNICAL NOTE OK-6 (REV) **June 29, 2012**

TO: All Offices

FROM: Steven J. Glasgow
State Resource Conservationist

Re: Zig-Zag Transect as a Planning Tool

The purpose of this technical note is to describe the zig-zag transect as a planning tool. Conservation planners who have been introduced to this system find it ideal for helping a landusers understand and appreciate the makeup and condition of their woodland and the stand treatment which would be applicable.

The zig-zag transect is a simple and rapid inventory system which is based upon the concept of tree spacing. From the transect, several important facts about a woodland can be ascertained. These are:

1. Average tree diameter
2. Range of tree diameters
3. Average tree spacing and spacing by D+X
4. Stocking by numbers of trees per acre
5. Number of trees removable in a thinning
6. Species composition
7. Condition of growing stock

Used by a conservation planner with a landowner, the zig-zag transect becomes a communications device. The landuser participates in identifying the kinds of trees within the woodland and is brought to recognize that some species are more desirable than others. Stocking can be measured by relating tree diameter to tree spacing, and in so doing, the landuser can recognize that trees have spacing needs just as do other crops. The growing stock can be appraised by critically examining a series of trees, one by one, and thus becoming cognizant of differences in condition--an easy concept to master since it is so closely allied to similar judgments commonly made within livestock herds.

Stand Examination by Zig-Zag Transect:

1. Select a stand that is typical of the woodland.

2. Choose a direction of travel which will take you through the stand so that a good cross section can be sampled. You can elect to go in a cardinal direction by using a compass, crossing the drainage ways, using the sun as a marker or using a visible landmark as a direction marker.

3. Select a starter tree. This may be any tree which is a part of the main stand. No measurements are made of the starter tree. It serves only as a point of beginning.

4. At the base of the starter tree, face the chosen direction, place your heels together and position your toes to make a 90-degree angle. A line along the direction of travel bisects the angle formed by your feet (See figure 1, page 2).

5. Locate the closest main stand tree, the center of which is within the angle defined by your feet. This is tree #1 (See figure 2, page 3).

6. Measure the distance from the center of the starter tree to the center of tree #1. Determine the species of the tree and measure its diameter at breast height (4.5 feet). Carefully examine the tree and rate it for condition using the adjectives--good, fair, and poor. A good tree is one that is reasonably straight, not excessively limby, with a sound, full crown and without evidence of scars, wounds, or disease. A poor tree may have a broken top, a bad crotch, excessive limbiness, canker, wounds, scars, disease, or a combination of defects. Use fair as an intermediate rating. Do not confuse species desirability with the condition rating. Rate each tree on its own merits, without regard to species. The condition rating and the other facts (distance, species, and diameter) are recorded as shown on page 4. Show in "notes" the reason for rating a tree as poor.

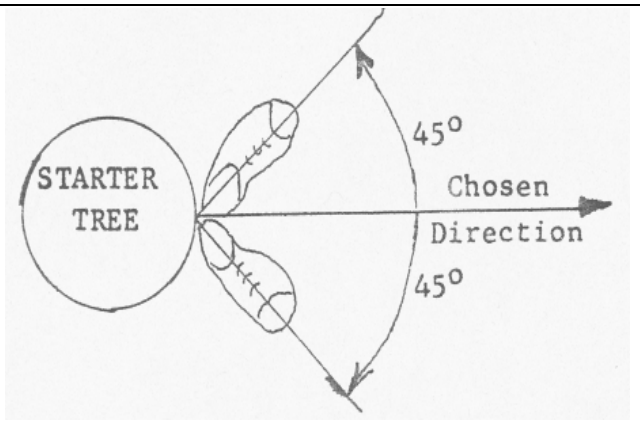
7. Standing at tree #1, repeat steps 5 and 6 to select, measure, and rate tree #2. Continue in this manner until 20 trees have been examined. The line of travel will proceed in a zig-zag fashion. (See figure 2, page 3.)

8. Skip over openings and clumps or patches of trees not part of and decidedly different in kind or size from the main stand. Do not include spacing measurements to or diameter measurements of trees on the edges of openings or clumps. Pass through them on the chosen direction of travel. Commence measurements on the opposite side. (See figure 3, page 3.)

9. In plantations, alternate the direction of travel. Use the direction of the row for the first tree; go at 90^0 to the row for the second; use the direction of the row for the third; and so on.

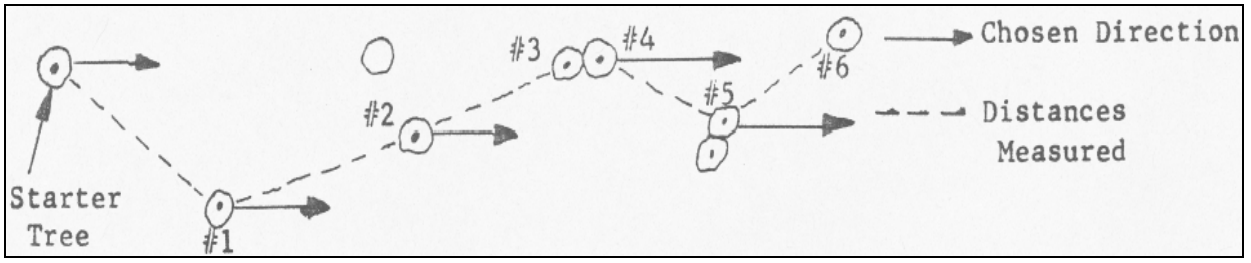
Taking a Zig-Zag Transect

Figure 1. Forming the Angle at the Starter Tree



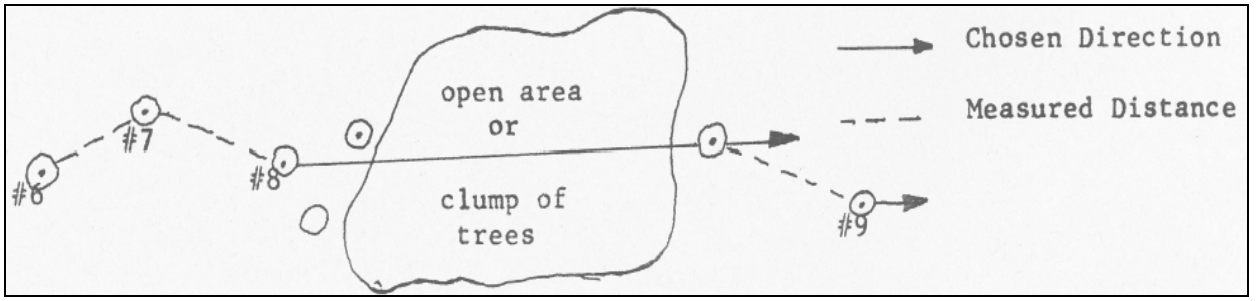
The closest Main Stand tree standing within the 90^0 angle projected by the feet, is selected as tree #1. process is repeated at tree #1 to select tree #2, and so on.

Figure 2. Sequence of Trees and Rules of Tree Selection



a. Measure each distance from tree center to tree center.
b. When two eligible trees are equidistant, select the one closest to the direction of travel as shown at tree #2.
c. Trees joined at base are considered separate and individual. Both may be counted as at #3 and #4. Only one is counted in a situation as shown at #5.

Figure 3. Openings or Clumps of Trees Not Part of the Main Stand



Skip over openings or patches of trees not part of the Main Stand. Stop short of these spots, pass through them on the direction of travel; and commence measurements on the opposite side.

Your field notes will look like the following:

Tree #	Species	Distance (Ft)	Diameter (In)	Condition	Notes:
1	Shortleaf	12	8	Good	
2	Shortleaf	9	7	Good	
3	Shortleaf	15	10	Fair	Scar at base
4	Shortleaf	16	11	Good	
5	Shortleaf	14	11	Good	
6	Shortleaf	5	9	Good	
7	Shortleaf	13	8	Poor	Broken top
8	Shortleaf	14	8	Good	
9	Shortleaf	9	9	Good	
10	Shortleaf	14	6	Good	
11	Shortleaf	9	7	Fair	Cronartium canker
12	Shortleaf	10	7	Good	
13	Shortleaf	11	9	Good	
14	Shortleaf	14	11	Good	
15	Shortleaf	10	11	Good	
16	Shortleaf	17	8	Good	
17	Shortleaf	9	8	Good	
18	Shortleaf	12	9	Poor	Old - mature
19	Shortleaf	10	8	Good	
20	Shortleaf	15	11	Good	
	Totals:	238’	176”		
	Average:	11.9'	8.8"		

Summarizing the Transect Notes:

1. Average stand diameter is obtained by dividing the total of diameters by the number of trees sampled. For example: Average diameter = 176 ÷ 20 = 8.8"; round to 9".
   (A 10-tree sample will give reasonably accurate results.)

2. Range of diameters can be known by noting the smallest and largest of the trees sampled. In the example: 6" - 11".

3. Average tree spacing is found by dividing the total of distances by the number of trees sampled. (Spacing is more erratic than tree diameter. A 20-tree sample is usually preferable to a 10-tree sample.) For example: Spacing = 238 ÷ 20 = 11.9'; round to 12'.

   In NRCS, spacing is usually considered in terms of D+*X*. To get the value, of *X*, subtract the average diameter from the average spacing.

   For the example: 11.9 (spacing) - 8.8 (diameter) = 3.1 (which is *X*). The stand is growing at D+3.1; round to D+3.

4. The number of trees per acre is calculated as follows:

   Number of trees per acre = 43,560 ÷ spacing^2.

   For the example: Number = 43,560 ÷ (12' x 12') = 303 per acre

5. The number of trees which could be removed in a thinning can be determined by using the D+*X* rule. This rule is primarily applicable to even-aged stands. According to the D+*X* rule, the average spacing between trees should equal the average stand diameter (D) plus a constant (*X*), expressed in feet. The constant *X* varies, depending on location and tree type. In Oklahoma, a constant of 6 is most commonly used for southern pines. The approximate number of trees to be removed in a D+*X* thinning is the difference between the number now present and the number that would be present after thinning.

   For the example: There are currently 303 trees per acre. The D+X rule shows the number of 9" trees is calculated to be 194 (9" + 6 = 15'; 43,560 ÷ (15' X 15') = 194). A thinning to D+6 spacing would remove 303 - 194, or 109 trees per acre.

6. An approximation of species composition can be made by determining the percentage of each species. For example: 4 shortleaf pines were sampled out of 20 trees, indicating 20% shortleaf pine and 80% loblolly pine as stand composition.

7. A rough approximation can be made of the percent of trees in fair to poor condition. For the example - Four trees sampled out of 20 trees were in fair to poor condition indicating 20 percent of the stand in fair to poor condition, 80 percent in good condition.

Other Uses

The zig-zag transect described above is a planning tool, primarily for use in commercial woodland. However, this tool can be effective with a landowner or manager of any wooded area, including mixed hardwoods.

Example--Dense post oak-blackjack oak cover on proposed recreation area. The obvious--too many trees. The unknown--which and how many trees should be removed?

By transecting the area and recording what is there, one begins to see individual trees and their merits, undesirable trees and the number of trees per acre. From this information a systematic approach for converting the area to the desired condition can be formulated.