

TECHNICAL NOTES

STATE OFFICE

STILLWATER, OKLAHOMA 74074

ECOLOGICAL SCIENCES TECHNICAL REFERENCES

FOR IN-SERVICE USE ONLY

Range OK-14, REV.

December 19, 2008

RE: Guidance for Determining Brush Infestation Levels

When planning Brush Management (314), it is necessary to determine infestation levels (density) and areas (acreage) of infestation. The inventory methods outlined in this technical note are used to determine the extent of brush problems (infestation level and acreage) for conservation planning, program rankings, monitoring and providing treatment alternatives that are economically feasible and according to the Oklahoma NRCS Brush Management (314) standard.

Further guidance on planning brush management can be found in the Oklahoma NRCS Brush Management (314) standard and Range Technical Note OK-17, Brush Management Options for Grazing Lands.

/s/ Ronald L. Hilliard
Ronald L. Hilliard
State Conservationist

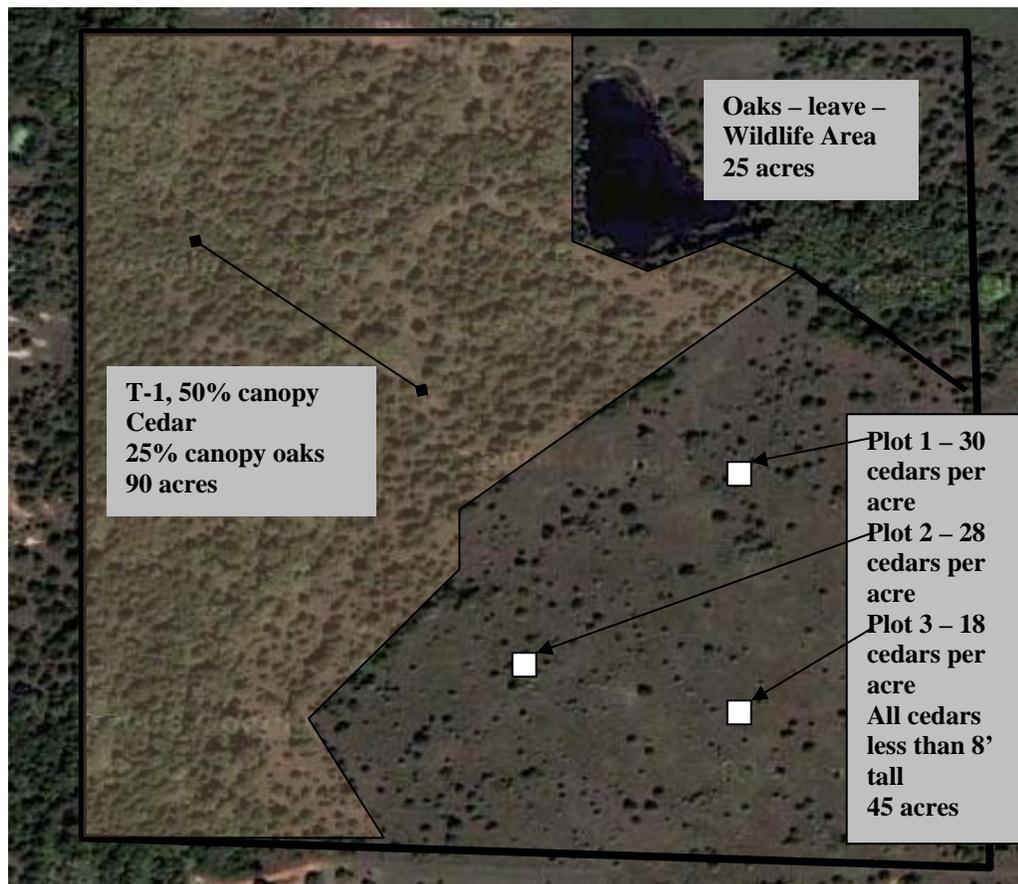
Enclosures

DIST: AO

Guidance for Determining Infestation Levels and Extent

Inventory methods can include either percent canopy or number of plants per acre. Canopy percent works best for larger brush, multi stem plants (i.e. salt cedar), plants growing in thickets / vines (i.e. blackberry, buckbrush) and for larger trees with canopies that grow close to the ground (i.e. junipers). Number of plants per acre works best for single stem plants and/or plants that are smaller (<8 ft) or when making a determination for using individual plant treatment (IPT). The canopy diameter method is a simplified inventory method that combines both the canopy and the number of plants methods. This works best in the same situations as using canopy methods.

Brush management is planned for a primary target species which has been identified to be of the most concern. All brush may need to be inventoried in order to determine the target species. As a minimum, the target species along with acres of different infestation levels will be identified through these inventory procedures.



Define areas needing treatment, along with infestation determinations, on the conservation plan map, overlay or other methods that document and clearly show areas needing treatment. Use of GPS to outline areas during inventory provides a quick and easy method for delineation. Locations of transects and/or plots will be in areas that best represent the infestation levels being inventoried. Multiple methods for inventory may be needed. Use of aerial photography prior to field visit can be beneficial in selecting locations. Actual locations of where inventories were conducted will be noted on the map. The number of transects / plots will be sufficient enough to determine an average for the field or site in concern and to delineate areas which may have different infestation levels. In the example above, it is clear that there are two levels of infestation. These two areas will be separated and delineated accordingly. Acres of infestation for each infestation level can then be determined. In this example, the ecological sites are oak savannahs,

so the target brush species would be the cedar and brush management would be planned to leave the oaks (i.e. IPT planned to selectively remove the cedars, prescribed burning, etc.) Multiple methods could be used to determine infestation levels.

% Canopy Cover Method - Canopy is the area of ground covered by the vertical projection of the outmost perimeter of the natural spread of plant foliage. Two methods may be used, both will require 100 readings.

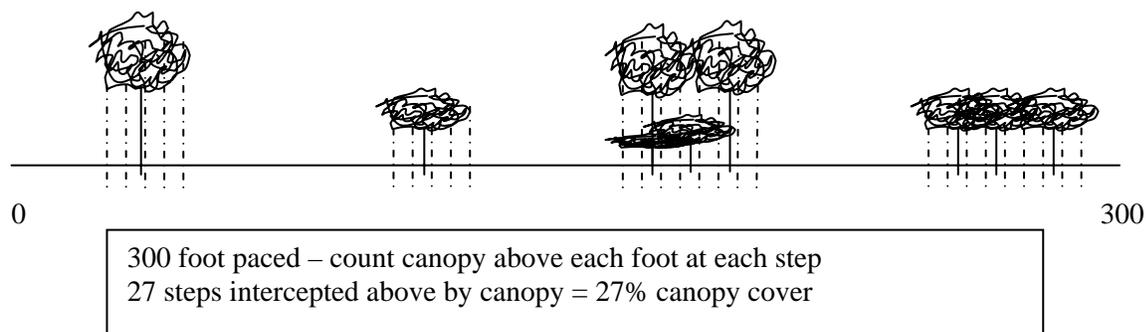
1. % canopy will be determined by taking 100 readings along a 100 – 300 foot transect line. The line can be paced or a tape of sufficient length used.
2. If using tape method (100-200 ft. tape)
 - Lay out tape along a line through area where canopy is to be determined.
 - Count the number of foot markers (every 2 feet for 200 ft. tapes) that have canopy above them.
 - The number of points counted is the % canopy

Example: Line established using 100 ft. tape. Brush canopy is counted over 35 of the 1 foot markers. Brush canopy is 35%.

3. If using paced method.
 - Determine a line to pace by selecting a point in the distance to walk toward.
 - Begin pacing toward the selected point.
 - With each step, determine if there is canopy cover directly above the tip of the foot. This will require 100 steps.
 - Count the number of steps that were under canopy and this will be % canopy.

Example: (see diagram 1) 100 paces are made along the predetermined line. 27 steps are intercepted with brush canopy above tip of foot. Brush canopy is 27 %.

Diagram 1. Determining Canopy Cover



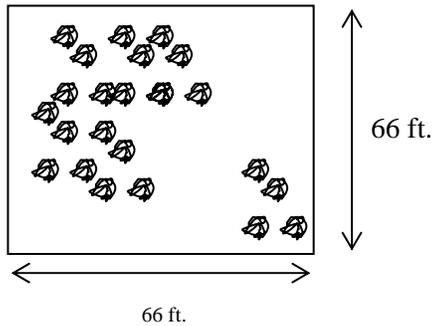
Plants per Acre Method – Two methods may be used.

1. Mark off area 66 feet by 66 feet (1/10 of an acre) or 21 feet by 21 feet (1/100 of an acre).
 - Count number of plants in marked off area and multiply by 10 (66x66) or 100 (21x21)

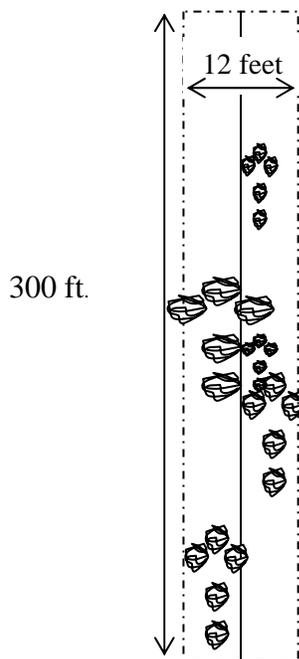
Example: (diagram 2) 23 trees counted in the marked off area (66 x 66). Plants per acre are 230 (23 trees x 10).
2. Transect Method (Belt Transect)
 - Determine transect line as for canopy determinations
 - Tape or pace 300 feet (approx. 100 paces)
 - Count the number of plants within 6 feet on both sides of tape (total of 12 feet wide strip along path)
 - Multiply number of plants counted by 12 to get number of plants per acre.

Example: (diagram 2) Number of trees counted along the line, 6 feet on both sides is 25. Number of plants per acre is (25x12) 300.

Diagram 2. Determining Plants per Acre



Mark off area 66 x 66 ft (1 tenth of an acre) or 21 x 21 ft (1/100 of an acre).
 Count 23 plants
 66×66 plot = $23 \times 10 = 230$ plants per acre
 (Multiply by 100 when using the 21 x 21 plot)



Lay out Belt Transect – 300 feet long
 Walk along transect line and count plants rooted within 6 ft. on both sides (12 foot wide strip)
 Total counted = 25.
 $25 \times 12 = 300$ plants per acre

Canopy Diameter Method

1. Select inventory area. Use a plot to conduct inventory, either the 66'x66' or 21'x21'. Use the larger plot size with larger trees and small plot with small trees. The belt transect can also be used.
2. Determine the average canopy diameter of the trees or shrubs of concern inside the plot area and count the number of trees represented by that canopy within the plot.
 - Canopy is the area of ground covered by the vertical projection of the outmost perimeter of the natural spread of plant foliage (edge of drip line to edge of drip line).
 - A quick and easy way to do this is to measure the diameter of shaded circle on the ground below the tree or shrub in question at mid-day (assuming leaves are present).
3. Multiply the number of trees counted by the appropriate conversion factor (conversion factor of 10 for a 66'x 66' plot; or 100 for a 21'x21' plot) to determine the number of trees per acre.
4. After measuring the canopy diameter, refer to the first column in the chart and find the diameter value that is the same as the one you determined. If multiple sizes or diameters exist, it will be necessary to evaluate or count numbers of plants with different canopy areas (i.e. 10 plants at 10 ft. diameter, 5 plants at 20 ft. diameter, etc.)

5. Follow the row across to the column value that most closely represents the number of trees per acre. The percentage at the top of that column is the percent canopy cover.
6. The value that is present is the number of trees that would need to be counted in an acre to be considered infested at that canopy percentage.

Example: a 66' x 66' plot is used. 10 plants counted with average canopy diameter of 15 feet. Total trees per acre would be 100 (10 x 10.) Looking down the first column, find the average Tree Diameter (ft) of 15 ft. Follow row to the right and find the number closest to the number of trees counted. In this case it would be 99. Looking to the top of that column, it indicates a %canopy of 40%. Some interpolation may be needed in some cases then values fall between those shown.

Average Tree Diameter (ft)	Area (ft ²) per tree	% Canopy										
		1.0%	5.0%	10.0%	15.0%	20.0%	25.0%	30.0%	35.0%	40.0%	45.0%	50.0%
1	0.79	555	2775	5549	8324	11098	13873	16647	19422	22196	24971	27745
2	3.14	139	694	1387	2081	2775	3468	4162	4855	5549	6243	6936
3	7.07	62	308	617	925	1233	1541	1850	2158	2466	2775	3083
4	12.56	35	173	347	520	694	867	1040	1214	1387	1561	1734
5	19.63	22	111	222	333	444	555	666	777	888	999	1110
6	28.26	15	77	154	231	308	385	462	539	617	694	771
7	38.47	11	57	113	170	226	283	340	396	453	510	566
8	50.24	9	43	87	130	173	217	260	303	347	390	434
9	63.59	7	34	69	103	137	171	206	240	274	308	343
10	78.50	6	28	55	83	111	139	166	194	222	250	277
15	176.63	2	12	25	37	49	62	74	86	99	111	123
20	314.00	1	7	14	21	28	35	42	49	55	62	69
25	490.63	1	4	9	13	18	22	27	31	36	40	44
30	706.50	1	3	6	9	12	15	18	22	25	28	31
35	961.63	0	2	5	7	9	11	14	16	18	20	23
40	1256.00	0	2	3	5	7	9	10	12	14	16	17
45	1589.63	0	1	3	4	5	7	8	10	11	12	14
50	1962.50	0	1	2	3	4	6	7	8	9	10	11

Three worksheets are available for conducting and documenting brush inventories. These are OK-ECS-WORKSHEETS 10A, 10B and 10C (attached) and are posted on the Oklahoma NRCS website under Technical Resources, ECS - Planning tools and Worksheets.

Client Name	EXAMPLE										Planner	
Field / Site											Date	
Determining Percent Canopy Cover											Total Average % Canopy for Field / Site	27
Species	Step or Point Number											Sub Totals
	0	20	40	60	80	100						
Transect # 1 W. Elm	x	x	x	x	x		x	x	x	x	x	13
Blackberry			x	x	x	x				x	x	14
Buckbrush					x	x	x	x	x			6
Total Canopy	x	x	x	x	x		x	x	x	x	x	27
Transect #												
Total Canopy												
Transect #												
Total Canopy												
Transect #												
Total Canopy												
Transect #												
Total Canopy												

EXAMPLE Determining Number of Plants per Acre											
Species	Transect or Plot#	Subtotal	Transect or Plot #	Subtotal	Transect or Plot#	Subtotal	Transect or Plot#	Subtotal	Transect or Plot#	Subtotal	TOTAL
Sumac		23		15							38
Blackberry				10							10
Total Plant Count		23	Total Plant Count	25	Total Plant Count		Total Plant Count		Total Plant Count		Average
Plants per Acre		230	Plants per Acre	250	Plants per Acre		Plants per Acre		Plants per Acre		240
Size of Plot Used	66 x 66 (conversion factor 10)			21 x 21 (conversion factor 100)			Belt transect - 12 ft. wide (conversions factor 12)				

Since the two plots are very similar in counted plants, we would average these two plots to get the infestation level for the field.
 48 total plant count x 10 - 480 divided by 2 plots = 240 average

EXAMPLE

Species	cedar											
Average Canopy Dia.(ft)	6	20										
# Trees Counted	30	5										
# plants per acre	300	50										
% Canopy	20	35										
Total Canopy	55%				Total Canopy				Total Canopy			
Plot Size Used (circle):	66' x 66'		21' x 21'									

Average Tree Diameter (ft)	Area (ft2) per tree	% Canopy										
		1%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
1	0.79	555	2775	5549	8324	11098	13873	16647	19422	22196	24971	27745
2	3.14	139	694	1387	2081	2775	3468	4162	4855	5549	6243	6936
3	7.07	62	308	617	925	1233	1541	1850	2158	2466	2775	3083
4	12.56	35	173	347	520	694	867	1040	1214	1387	1561	1734
5	19.63	22	111	222	333	444	555	666	777	888	999	1110
6	28.26	15	77	154	231	308	385	462	539	617	694	771
7	38.47	11	57	113	170	226	283	340	396	453	510	566
8	50.24	9	43	87	130	173	217	260	303	347	390	434
9	63.59	7	34	69	103	137	171	206	240	274	308	343
10	78.5	6	28	55	83	111	139	166	194	222	250	277
15	176.63	2	12	25	37	49	62	74	86	99	111	123
20	314	1	7	14	21	28	35	42	49	55	62	69
25	490.63	1	4	9	13	18	22	27	31	36	40	44
30	706.5	1	3	6	9	12	15	18	22	25	28	31
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40	1256	0	2	3	5	7	9	10	12	14	16	17
45	1589.63	0	1	3	4	5	7	8	10	11	12	14
50	1962.5	0	1	2	3	4	6	7	8	9	10	11

Example: Cedar inventoried, two distinct sizes. 66ft x 66ft plot laid out and trees counted for each diameter size found. 30, 6 ft trees were counted. Multiple the 30 by 10 (conversion factor to convert to trees per acre) equals 300 trees per acre. Find the diameter size (6ft) in left column, look across the row to find 300. The closest number is 308, representing 20% canopy. Next are the 20 ft. diameter trees which we count 5 of these in our plot or 50 per acre. Looking at the table we find the closest number is 49, representing 35% canopy. We now add these together to determine we have a total of 55% canopy cover of cedar.

Client Name						Planner					
Field / Site						Date					
Plot Size Used (circle):	66' x 66'					21' x 21'					
Species											
Average Canopy Dia.(ft)											
# Trees Counted in the plot											
# plants per acre											
% Canopy (from table)											
Total Canopy											
(# plants per acre = # trees counted x conversion factor (based on plot size)) Total canopy = Total % canopy for each species.											

Average Tree Diameter (ft)	Area (ft ²) per tree	% Canopy										
		1%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
1	0.79	555	2775	5549	8324	11098	13873	16647	19422	22196	24971	27745
2	3.14	139	694	1387	2081	2775	3468	4162	4855	5549	6243	6936
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10	78.5	6	28	55	83	111	139	166	194	222	250	277
15	176.63	2	12	25	37	49	62	74	86	99	111	123
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40	1256	0	2	3	5	7	9	10	12	14	16	17
45	1589.63	0	1	3	4	5	7	8	10	11	12	14
50	1962.5	0	1	2	3	4	6	7	8	9	10	11

Enter each species inventoried. For each species, determine an average diameter for those found within the plot. Count the number of trees found in the plot that have the diameter indicated. If multiple diameter sizes exist, then inventory separately.

The number of trees per acre for each diameter size is determined by multiplying the number counted in the plot by appropriate conversion factor (66' x 66' = 10; 21' x 21' = 100)

Using the table, find the diameter on left side, go across the row to the number of trees counted per acre (make sure to use the per acre value, not plot value)

The percentage at the top of the column represents % canopy

Add up all % canopy for each species to determine that species canopy %.

Client Name		Planner										
Field / Site		Date										
Determining Percent Canopy Cover												
Species	Step or Point Number										Sub Totals	
	0	20	40	60	80	100						
Transect #												
Total Canopy												
Transect #												
Total Canopy												
Transect #												
Total Canopy												
Transect #												
Total Canopy												

Enter each species inventoried

Indicate transect number which should correspond with any labeling on maps

The step or point numbers represent each step, or point, along the transect. Mark each time where the toe (if stepped) or mark on tape lands under a canopy. Only count canopy of species of concern. It is possible to have a canopy of multiple species.

The total marks for each species can be sub-totaled at the right. This provides data as to extent of each species.

Tally the marks for total canopy at bottom of each transect space and total on the right. This will be one mark for each point with canopy, regardless of the number of species. This total will not exceed 100.

The subtotals by species may not equal the total canopy and may exceed 100 due to layering of multiple species.