Analyzing a 20m x 20m Quadrat

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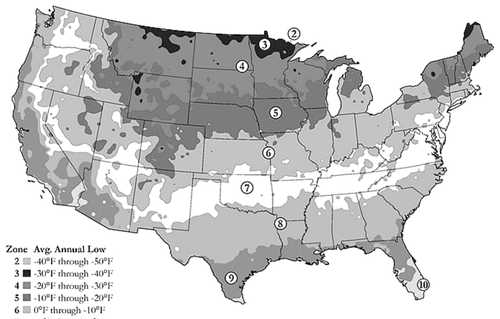
Introduction:

- Purposes
  1. Measure, identify, and map out the trees in the quadrat
  2. Discover which trees are present in the area and their sizes
  3. Calculate population density of the quadrat

- Research
  - Glastonbury is located in zone 6 of the USDA's Tree Hardiness Zones map
  - Zone 6 has an average annual minimum temperature of -17.5°C to -23°C
  - Maple trees, birch trees, hickory trees, and oak trees are most common in this zone

- Questions:
  - What is the population density of the area?
  - What trees are common in Connecticut?
  - What trees will be found in the quadrat?
  - Is there a connection between what trees are most common in Connecticut, and which ones are found in the quadrat?



Procedure:

- **Materials**: measuring tape, chalk or spray paint (to mark trees), 4 flags, compass, paper and pencil (to record data), field guide (to identify trees), 1 piece of cm^2 graph paper, protractor, centimeter ruler

A. Determining pace count:

1. Lay out 20 meters of measuring tape on the ground
2. Starting at the 0 mark on the tape, take a step forward with your right foot
3. Continue walking the full distance, taking normal and even steps
4. While walking, count one pace each time your left foot hits the ground
5. The number of paces it takes to reach the end of the measuring tape is your 20 meter pace count
6. Repeat steps 1-5 for 14 a distance of 14 meters to find your 14 meter pace count
7. Divide your 14 meter pace count by 14 and your 20 meter pace count by 20. Add the two quotients and divide that number by 2. This is how many meters you cover in one pace, and will be used to calculate the distance to each tree from the center

   Example: 10.5/14 = 0.75

   15/20 = 0.75

   (0.75 + 0.75)/2 = 0.75 meters per pace

B. Marking a quadrat:

1. Choose a center point for the quadrat, such as an easily recognizable tree or other landmark. Clearly mark the center point with spray paint or chalk so that it can be easily found again
2. From the center point, walk 14m (using your 14 meter pace count) northeast. Mark where you arrive with a flag as the upper right corner of your quadrat
3. Return to the center point and repeat step 2 a total of 3 additional times, traveling northwest, southeast, and southwest to mark the other 3 corners
4. To check for accuracy, walk directly east from the upper left corner to the upper right corner, counting paces. The distance should match your 20 meter pace count
5. Repeat step 4, walking from the upper right corner directly south to the lower right corner
6. If either of the distances in steps 4 or 5 is inaccurate, repeat the procedure from step 2. Once the distances are accurate, the quadrat has been laid out properly

C. Taking a bearing:

1. Place the compass flat on your hand, directly in front of your chest
2. Rotate the compass so that the direction of travel arrow is facing the object or direction to which you want to take a bearing
3. Turn the azimuth ring until the orienteering arrow lines up with the direction that the magnetic needle is pointing
4. Read off the number on the azimuth ring which is aligned with the direction of travel arrow. This is the bearing

D. Mapping out an area

1. From the center point, take a bearing to a tree within the quadrat
2. Walk from the center point to the tree, counting the number of paces
3. Record both the bearing and distance to the tree
4. Measure and record the circumference of the tree at chest height using a measuring tape
5. Identify the tree using a field guide. Record this information as well
6. Mark the tree with spray paint, or a piece of chalk so you know you have already identified it
7. Repeat steps 1-6 for each tree in the quadrat
8. Multiply the pace count distance to each tree by the number calculated in step 7 of "Determining pace count" above. Record
9. On a piece of centimeter graph paper, draw out the quadrat, making each square centimeter represent one square meter
10. Choose a tree, and use a protractor to draw a light line representing the bearing of the tree, using the center tree as the vertex of the angle
11. Line a centimeter ruler up with the line you have just drawn. Make a small mark at the measurement on the ruler which represents the tree's distance from center

    Example: If a tree is 1.5 meters from center, you will mark 1.5 centimeters on the ruler
12. Repeat steps 10-11 for each tree in the quadrat, numbering them so they can be matched to their type and circumference

E. Calculating Population Density

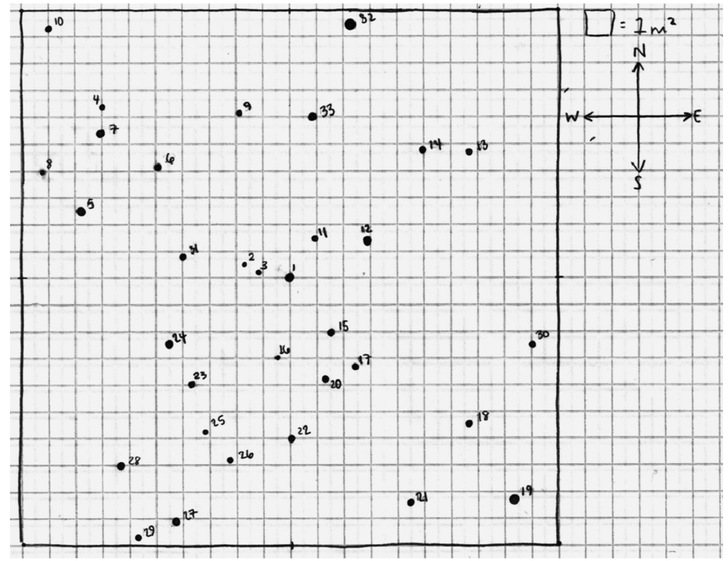
1. Divide the number of trees in the quadrat by $400m^2$. This is the population density per square meter.
2. Multiply this number by 1000 to find the density per square kilometer

Results:

This quadrat included American elm, White Oak, Eastern White Pine, and Norway maple trees. The most common tree in the quadrat was the Norway maple, with 12 trees, followed by the White Oak, with 10 trees, the American elm, with 7 trees, and finally, the Eastern White Pine, with 4 trees. The tree with the largest circumference was a Norway Maple of 127.3 cm. The population density of the area was .0825 trees/m^2 or 82.5 trees/km^2.

Tree Number	Type	Circumference (cm)	Bearing (°)	Paces from Center	Meters from Center
1	Black Oak	104	center	0	0
2	Norway Maple	38.8	290	1.5	1.125
3	Black Oak	46.1	285	1	0.75
4	Norway Maple	49.7	283	3.5	2.625
5	Norway Maple	98.1	287	7	5.25
6	Norway Maple	72.9	311	5.5	4.125
7	American Elm	24.4	307	7.5	5.625
8	Longleaf Pine	16.5	293	9	6.75
9	Norway Maple	35.4	344	5.5	4.125
10	Longleaf Pine	21.4	316	11	8.25
11	American Elm	66	35	1.5	1.125
12	Norway Maple	108	65	2.5	1.875
13	Black Oak	62.6	56	7	5.25
14	Black Oak	67.2	47	6	4.5
15	American Elm	43.7	147	2	1.5
16	Longleaf Pine	13.2	191	2.5	1.875
17	American Elm	81	145	3.5	2.625
18	American Elm	39.4	130	7.5	5.625
19	Black Oak	91.6	135	10	7.5
20	Black Oak	66.5	163	3.5	2.625
21	Black Oak	57	153	8	6
22	Norway Maple	20	180	8	6
23	Norway Maple	75.8	224	4.5	3.375
24	Norway Maple	90.4	243	4	3
25	Norway Maple	17.1	211	5.5	4.125
26	American Elm	12.9	199	6	4.5
27	American Elm	89.9	206	8.5	6.375
28	Norway Maple	46.9	222	8	6
29	Black Oak	61.3	211	9.5	7.125
30	Longleaf Pine	30	106	8	6
31	Black Oak	64.5	312	8	6
32	Norway Maple	127.3	13	8.5	6.375
33	Black Oak	84.4	10	5.5	4.125

Results (continued):



Conclusion:

This experiment shows the population density and tree species found in a quadrat in Glastonbury, CT. Although it is only a model for a small area at one point in time, if the experiment was extended over several months, or even years, the growth of the trees could be monitored. This would be useful in determining if the trees were growing properly, as well as measuring their rate of growth. In addition, a larger area could be measured, or several small areas could be analyzed, and the data averaged to reach more general conclusions. Changes in population density could also be monitored. All in all, this data would become more useful as time passed and it could be compared to discover changes and the reasons behind them.

In the process of this experiment, using pace count was not the most accurate way to lie out a quadrat, nor to measure the distance from the center point to each tree. To increase accuracy, a measuring wheel could be used. In addition, trees with a circumference less than 10 cm were not taken into account. If those saplings were measured, identified, and included, they would add more depth to the experiment, and more accuracy to the map. However, the data was collected as precisely as possible with the provided equipment, and is a fairly accurate representation of the quadrat.

References and Further Information:

Arbor Day Foundation. What Tree Is That?: Tree Identification Guide. Online Edition. http://www.arborday.org/trees/whatTree/

Benvie, Sam. 2000. *The Encyclopedia of North American Trees*. First Edition. Firefly Books (U.S.) Inc, Buffalo, New York.

Nebraska Forest Service. 2011. Norway maple (*Acer platanoides*). Online. Nebraska Forest Service, Lincoln, Nebraska. http://www.nfs.unl.edu/CommunityForestry/Trees/NorwayMaple.pdf

Petrides, George A. 1958. *Peterson Field Guides: A Field Guide to Trees and Shrubs*. Second Edition. Houghton Mifflin Company, Boston.

Wang, Paula. 2008. Classroom Earth: Assessing an Ecosystem's Biodiversity. Online. National Environmental Education Foundation, Washington, D.C. http://www.classroomearth.org/node/177