Biol112 | Big Oak Woods Report
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A. Describe the results from the three methods and discuss in a general way the differences in parameter estimates. For example, were our estimates of tree density better or worse than our estimates of dominance?

Trees:

Relative density comparison: ACRU, CAOV, FRAX, LIST, and QURU had the highest relative density values as measured by the point quarter (P-Q) method. CAOV, LIST, QUAL, QUFP, and ULAL were the 5 highest as measured by the quadrat method. Only 2 of the top 5 species match from both methods. From the summary data, CAOV, LIST, NYSY, QUFP, and ULAL were the 5 highest. Appearing in the top 5 from all 3 data sets are CAOV and LIST. The top 5 from the summary data matches the top 5 determined from the quadrat method moreso than the P-Q method, so the quadrat method was slightly better at identifying the trees with greatest relative density.

Relative dominance comparison: CAOV, LIST, QUAL, QUFP, and QURU had the highest relative dominance values as measured by P-Q. CAOV, QUAL, QUFP, QUST, and ULAL were the 5 highest as measured by the quadrat method. Only 2 of these 5 match. From the summary data, CAOV, LIST, QUFP, QUMI, and QUPH were the 5 highest. CAOV and QUFP appear in the top 5 from all 3 data sets. The top 5 species in relative dominance was slightly better described by the P-Q method (3 matches there vs. 2 matches for the quadrat method).

Just judging from the top 5 results for each, it looks like our estimates of tree density were roughly equal to our estimates of dominance.

Saplings:

Relative density comparison: CAOV, FRAX, ILDE, ULAL, and ULAM had the highest relative density values as measured by P-Q. CAOV, CATO, ILDE, LIST, and ULAL were the 5 highest as measured by the quadrat method. Three of the top 5 species match (CATO, ILDE, and ULAL). We had no sapling information in the summary data, so we can’t compare our results to those.

However, there were some interesting points. There were many more ILDE saplings than trees; ILDE has one of the top 5 relative densities for saplings (as well as relative dominance). Thus, the community composition of the forest will likely change as the ILDE saplings mature. CAOV has one of the top 5 relative densities as both trees and saplings, so perhaps CAOV trees are so abundant because their saplings do so well.

Relative dominance comparison: FRAX, ILDE, JUVI, ULAL, and ULAM had the highest relative dominance values as measured by P-Q. CAOV, ILDE, JUVI, LIST, and ULAL were the 5 highest as measured by the quadrat method. Again, 3 of these 5 match (ILDE, JUVI, and ULAL).

JUVI has one of the top 5 relative dominances for saplings, but it does not have one of the top 5 relative densities. However, like ILDE above, it will likely change the forest composition as it matures and becomes well-represented in the forest.

Overall Summary:

For trees, CAOV consistently had one of the highest relative density and dominance values, as measured by both methods, and was one of the 5 highest in our summary data. For saplings, only ILDE and ULAL saplings had both high relative density and relative dominance. These three species were visually well represented in Big Oak Woods (a misnomer, considering how oak wasn’t as abundant as these hickory, holly, and elm species). In the future, these species might make up the majority of mature trees here.

There were some species we did not find: OSVI when we did both the P-Q and quadrat methods, QULY when we did the quadrat, and MORU and NYSY when we did the P-Q. Given that NYSY had one of the top 5 relative densities, missing this species means NYSY must have been more abundant outside the area we sampled. Another possibility (besides not IDing it correctly) is that it was never dense enough in our sampling area to be one of the 4 closest trees or saplings for our P-Q. In both cases, spatial heterogeneity likely played a role (see below).

B. Accuracy of parameter estimates will be influenced by both tree abundance and pattern. Given the amount of sampling we did, how abundant does it appear a randomly distributed species must be for us to obtain an accurate estimate of its density? (+/- 10%)?

A randomly distributed species does not need to be as abundant than a less random species to obtain an accurate density estimate. This is because less random species will tend to have a clumpy distribution, and thus in some areas its density will be very high compared to other areas. If we happen to sample one of the clumps, we might think the species density is very high. (Or, if we sampled outside of a clump, we might miss the species entirely, as we did with NYSY.) With a randomly distributed species, we can sample a smaller area (which we did) and still get an accurate density estimate.

C. What is the likely effect of spatial heterogeneity or pattern in tree distribution? How will these factors affect the accuracy and precision of the parameters calculated? Which species from Big Oak Woods may have parameter estimates influenced by spatial distribution? (Consider species frequency data.)

Spatial heterogeneity should make the distribution of tree species more random (trees of the same species will be less likely to be found clumped together). The less heterogeneous the plot, the greater the relative density and dominance of some trees compared to others (low heterogeneity = low diversity). A plot with little spatial heterogeneity might have a few dominant species, whereas a plot with higher heterogeneity would have many species on it, each with similar values of density and dominance.

Species that would have parameter estimates influenced by spatial distribution include those that colonize forest gaps, which would give those species a naturally patchy distribution. They also include species that have the lowest relative densities, since they are more scarce and it would be easy to overlook them if we didn't sample over a wider area. Another factor to consider is the species' response to disturbance. Since we collected data from plots close to a road, the trees and sapling data we collected might be skewed more toward disturbance-tolerant species. If we had sampled deeper within the forest, we might have obtained better parameter estimates.

3) How do we calculate density for the quadrat data?
FOR QUADRATS WE KNOW THAT EACH QUADRAT IS 100M2.
WE HAVE 14 QUADRATS, SO THAT'S 1400M2 TOTAL.
WE ALSO HAVE THE TOTAL NUMBER OF TREES WE MEASURED IN ALL QUADRATS, SO WE CAN GET #TREES/1400M2 FOR DENSITY.
TO SCALE THAT UP TO HA SO THAT EVERYTHING IS PER HA, DIVIDE 1400 (OUR TOTAL AREA MEASURED) INTO 10000 (THE AREA OF A HA) TO FIGURE OUT HOW MUCH TO MULTIPLY OUR # TREES TO GET #TREES PER HA.

Density = #trees/1400M2

1400M2 out of 10000M2, and 1 ha = 10000 m2. To convert to ha, 1400 m2 * 1ha/10000m2 = # ha.

$$\frac{\text{Trees}}{1400\text{m2}} \times \frac{10000\text{m2}}{1\text{ ha}}$$

4) What does "dominance" refer to? And are spatial heterogeneity and pattern are the same as tree distribution?
IN THIS CASE, DOMINANCE REFERS TO BA. YES, SPATIAL HETEROGENEITY AND PATTERN IN THIS CASE MEAN THE SAME THING.

5) Are those densities and BA given in the summary data relative values?
NO, THEY ARE BOTH PER HA, NOT RELATIVE.

6) The summary data are per hectare and the quadrat data are per 100m2, but what are point-quarter data...per hectare?
THE P-Q IS PER NOTHING, SINCE THERE WAS NO PLOT AREA MEASURED. TO GET THE PER AREA FOR PQ, YOU FIRST NEED TO KNOW HOW MUCH SPACE EACH TREE TAKES UP. TO DO THIS, YOU GET THE AVERAGE OF ALL DISTANCES MEASURED, WHICH TELLS YOU, ON AVERAGE, ABOUT HOW FAR APART THE TREES ARE. THEN YOU SQUARE THAT AVERAGE TO GET Z^2 TO GET THE AVERAGE AREA EACH TREE TAKES UP. THEN YOU DIVIDE THAT INTO 10000 TO CALCULATE HOW MANY TREES WILL FIT INTO A HECTARE (GIVEN THAT EACH ONE TAKES UP X AMOUNT OF AREA), WHICH GIVES YOU #TREES PER HA FOR POINT-QUARTER.

7) Do we need to do calculations with the summary data?
THE ONLY CALCULATION YOU NEED TO DO WITH THE SUMMARY DATA IS TO GET THE IV FOR TREES. YOU CANNOT DO THIS FOR SAPLINGS SINCE WE HAVE NO WAY TO CALCULATE BA FOR SAPLINGS FOR THE SUMMARY DATA.