Analyzing the Impacts of Humans and Climate on Temperate Forest Plants

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Introduction: Pollen can be used in many ways, such as solving crimes or recreating past landscapes. Through analyzing 46 pollen samples that were extracted from Avery Lake, Illinois, we can see what life was like at different times at this location. This site is situated near Kincaid Mounds, which is the location of the historic Mississippian people. Time periods that were examined include the Little Ice Age (LIA), that took place from about 1300AD-1800AD, and the Medieval Climate Anomaly (MCA), that took place from about 950AD-1250AD.

Study Area: Avery Lake is a swale lake within the Ohio River Valley in southern Illinois. It is situated near Kincaid Mounds, which is where the Mississippian people settled for approximately 300 years. Lakes continually collect debris and sediment that fly in the wind, so the location of Avery Lake is perfect for performing analysis on its contents in order to find out more about the Mississippian people, and their potential impacts on vegetation. Forests and grasslands also surrounded the lake at different periods. The contents of Avery Lake’s sediment can also be used to show the surrounding landscape. The temperate climate of southern Illinois provides the area with an adequate amount of rainfall in order to keep crops alive in the summers.

Methods: A 10-meter sediment core was extracted from Avery Lake in 2014. Within that sediment core, there were thousands of pollen grains. A subsample was taken from every 10 centimeters and put through a series of acetylation techniques in order to get a product that can be easily examined. For each sample, I would prepare a slide. The sample used on the microscope slide is silicone oil based. When being examined under a light microscope, I would look for different pollen grain types. Typically, I would decipher them down to the family or genus taxonomic level. I would mark down every grain I came across, until I reached approximately 300 pollen grains. I performed an analysis of variance (ANOVA) on the abundance of Pinus and Carya pollen found in the 46 samples that were dated within the Medieval Climate Anomaly and Little Ice Age time periods. The ANOVA compared the average Pinus and Carya abundances during the MCA to those during the LIA to determine if they were statistically different from each other. It also compared Pinus and Carya abundances during the Mississippian Era, a time when humans occupied the land directly next to the lake, to times when humans were not present.

Results and Discussion: Through an analysis of variance, I was able to analyze the pollen present at Avery Lake during specific times. Of the 6 different pollen types I tested with ANOVA, Carya and Pinus were the only ones that showed a significant difference.

Results and Discussion Continued: During times where there were humans present at Avery Lake, there was a lower density of Carya pollen compared to when there were no humans present. A similar plant, Quercus, was also analyzed and showed no signs of significant differences. Also proven through running the ANOVA, the density of Pinus pollen correlated to the current climate at that location. During the Little Ice Age (1300-1800AD), Pinus pollen numbers were significantly higher than during the Medieval Climate Anomaly (950-1250AD). During the Little Ice Age, temperatures were lower than normal, and during the Medieval Climate Anomaly temperatures were higher than normal. I presume that the Mississippian people had a purpose for Carya (hickory) trees, whether that is for food, fuel, or structures.

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1. A significant decrease in Carya pollen during human occupations was shown through an analysis of variance. Carya was uninfluenced by the climate. (Above: *P-value = 0.00232)
2. A significant increase in Pinus pollen during the Little Ice Age, a period of cooling, was shown through running ANOVA. Pinus was uninfluenced by human occupations. (Above: *P-value = 0.02876)

* Having a p-value less than 0.05 means there is a significant difference between the two sets of data being examined.