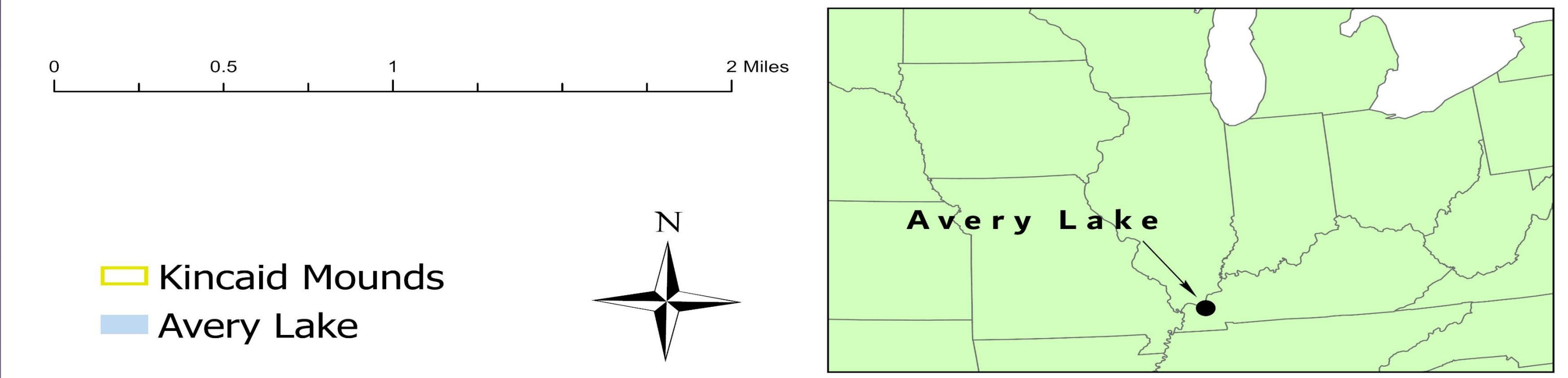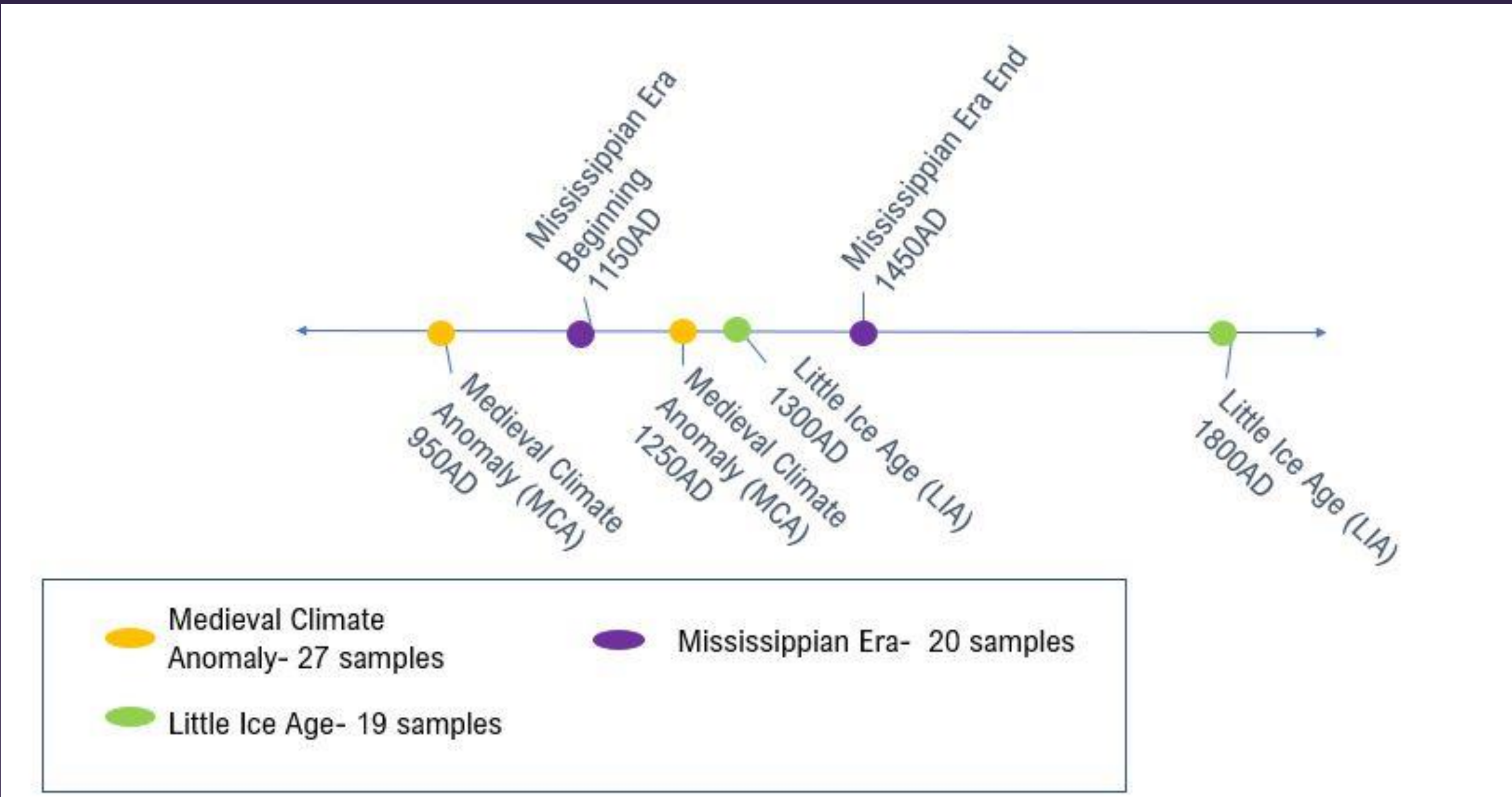# Analyzing the Impacts of Humans and Climate on Temperate Forest Plants

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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 acetolysis 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.

	Latin Name	Common Name
Non-Arboreal	Asteraceae	Sunflower Family
	Ambrosia	Ragwood
	Artemisia	Mugwart
	Cephalanthus	Buttonbush
	Chenopodiaceae	Goosefoot
	Circaea	Enchanter's Nightshade
	Cyperaceae	Sedge
	Dalea	Prairie Clover
	Ephedra	Ephedra
	Equisetum	Horsetail
	Fabaceae	Legumes
	Gallium	Bedstraw
	Iva	Marsh Elder
	Malvaceae	Mallows
	Parthenocissus	Virginia Creeper
	Poaceae	Grass
	Polygonum	Knotweed
	Rumex	Buckwheat
	Sagittaria	Aquatic Flower
	Thalictrum	Meadow-rues
	Urtica	Stinging Nettle
	Verbenaceae	Verbena
	Vitis	Grape Vine
	Xanthium	Daisy Family
	Zea Mays	Corn
Arboreal	Abies	Fir
	Acer	Maple
	Alnus	Alder
	Betula	Birch
	Carya	Hickory
	Castanea	Chestnut
	Celtis	Hackberry
	Cornus	Dogwood
	Corylus	Hazel
	Fagus	Beech
	Fraxinus	Ash
	Juglans	Walnut
	Juniperus	Juniper
	Larix	Larch
	Liriodendron	Tulip Tree
	Liquidambar	Sweetgum
	Morus	Mulberry
	Ostrya	Hornbeam
	Picea	Spruce
	Pinus	Pine
	Platanus	Sycamore
	Populus	Cottonwood
	Quercus	Oak

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.

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.

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