Name_____

DATA Nugget

Trees and the city

Featured scientist: Adrienne Keller (she/her) from the University of Minnesota

Research Background:

Adrienne biking around Minneapolis-St. Paul.

We often imagine nature as being a place outside of cities. But within our cities, we are surrounded by nature – in fact, most human interactions with nature happen within urban areas. Picturing a tree, we might imagine it in a remote forest, yet many trees are planted by residents and local governments within cities. Trees provide important benefits, such as beauty and shade. The number and types of tree species that are planted in a neighborhood can increase the benefits received from trees in urban areas.

When Adrienne first moved to the Twin Cities in Minnesota, she started exploring Minneapolis and St. Paul by bike. Biking is done at a slow enough pace that she can travel long distances but still make observations about neighborhoods in these cities. As an ecologist, she naturally found herself looking for patterns in trees. For example, she noticed some older neighborhoods in St. Paul have a lot of large trees that provide plenty of shade and **tree cover**. In other neighborhoods, Adrienne saw fewer types of trees and noticed that she spent less time shaded by branches and leaves.

Adrienne started conversations with her colleagues about their observations of differences in urban landscapes. They discussed the ways in which laws, policies, and practices ("the way things are done") give advantages to certain groups of people over others. These advantages are woven into our cultural systems.

Adrienne and her fellow researchers expected that neighborhoods with wealthier and more white residents would have benefited from a long history of greater investment. Therefore, these neighborhoods were expected to have greater tree cover from the large old trees that have been growing there for many years. They also expected these neighborhoods would have more types of trees. In contrast, the researchers expected that less wealthy neighborhoods and those with a greater percentage of Black, Indigenous, and other People of Color (**BIPOC**) would have less tree cover and fewer types of trees because of chronic lower investment in these neighborhoods.

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To research these ideas, Adrienne and her colleagues combined three different sources of publicly available data:

1) U.S. Census data, used to estimate **% BIPOC** and **average median household income** per 'Block Group' (similar to a neighborhood).

2) Satellite images, which are often used to estimate **% tree cover**, measure the percent of land area covered by the tree canopy. Adrienne looked at tree cover in the Block Group areas used in the Census.

3) City data that include the location and species for each tree planted along public streets to calculate **tree species richness** in each Block Group. Tree species richness is the number of different tree species in an area and is a measure of tree biodiversity used by many ecologists.

A neighborhood with many tree species and a lot of tree cover.

Scientific Question: How does tree cover and tree species richness differ across neighborhoods with varying income levels and percent of BIPOC residents?

Make Predictions:

The first step Adrienne took to answer her scientific question was to create different maps showing the different neighborhoods in Minneapolis and St. Paul. The maps on the following page helped her visualize the data in a new way. They also let her expand beyond her neighborhood and what she could observe while bike riding.

These maps below show the key variables that Adrienne was interested in: % tree cover, tree species richness, resident household income levels, and % BIPOC residents. White areas on the maps indicate where there are no data available.

Making observations that lead to predictions is an important part of the scientific process. Look closely at the maps and identify any patterns or trends. Draw arrows pointing out important observations and write one sentence describing what you see next to each arrow.

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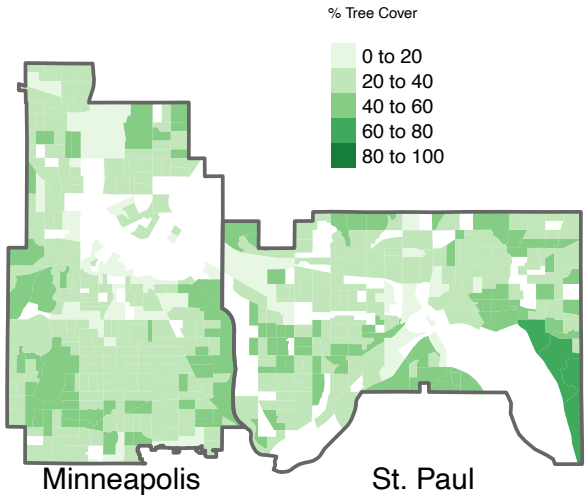
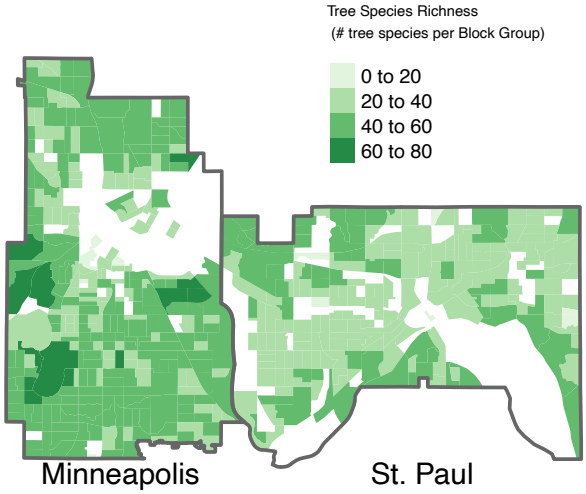
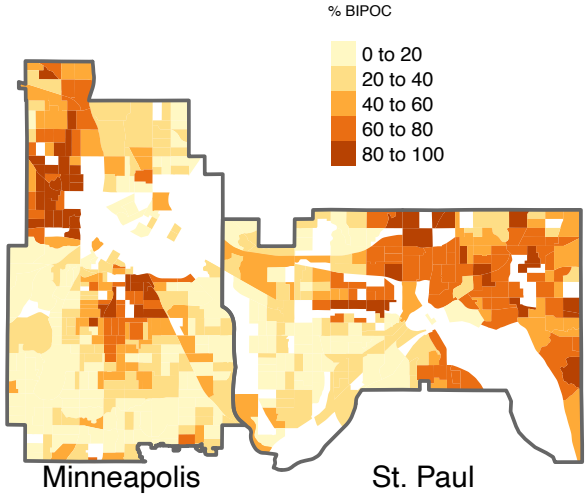
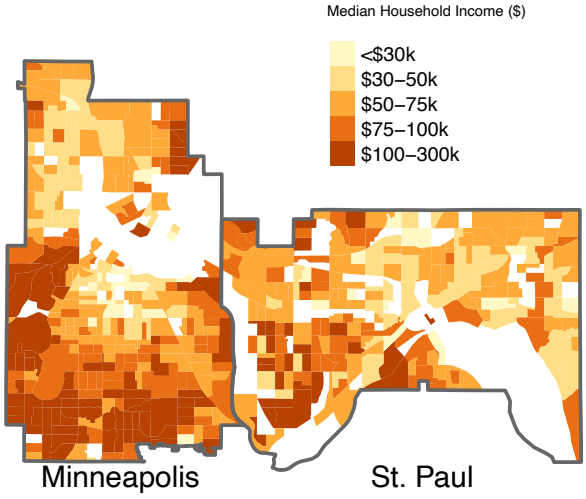
Using your observations from the maps below, make at least two predictions about patterns you see when comparing % BIPOC or median household income and % tree cover or species richness.









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Scientific Data:

Use the data below to answer the scientific question:

Table 1. *Tree cover and species richness for different levels of household income in Minneapolis and St. Paul neighborhoods.*

	Minneapolis			St. Paul		
Median Household Income	**Number of Block Groups**	**Percent Tree Cover**	**Tree Species Richness**	**Number of Block Groups**	**Percent Tree Cover**	**Tree Species Richness**
<30k	20	19.4	32.4	13	32.5	31.1
30-50k	55	26.0	36.4	46	33.1	32.5
50-75k	101	28.7	40.3	82	33.2	34.5
75-100k	71	33.1	43.5	49	39.5	38.5
100-300k	77	38.4	47.3	32	40.7	37.8

Table 2. *Tree cover and species richness for different percentages of BIPOC residents in Minneapolis and St. Paul neighborhoods.*

	Minneapolis			St. Paul		
% BIPOC residents	**Number of Block Groups**	**Percent Tree Cover**	**Tree Species Richness**	**Number of Block Groups**	**Percent Tree Cover**	**Tree Species Richness**
0-10	41	39.0	45.5	21	39.5	34.6
10-20	71	35.4	45.3	35	39.2	36.4
20-30	48	30.5	38.8	42	34.1	37.7
30-40	36	30.2	42.2	11	35.6	36.9
40-50	34	27.1	39.8	12	30.2	31.5
50-60	21	25.7	41.1	20	39.0	35.2
60-70	17	27.8	39.6	25	35.6	37.2
70-80	20	24.0	36.6	34	33.3	32.8
80-90	20	25.0	39.0	14	31.6	31.1
90-100	13	23.9	34.6	6	30.6	30.2

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What data will you graph to answer the question?

Independent variable(s): _____

_____

Dependent variable(s): _____

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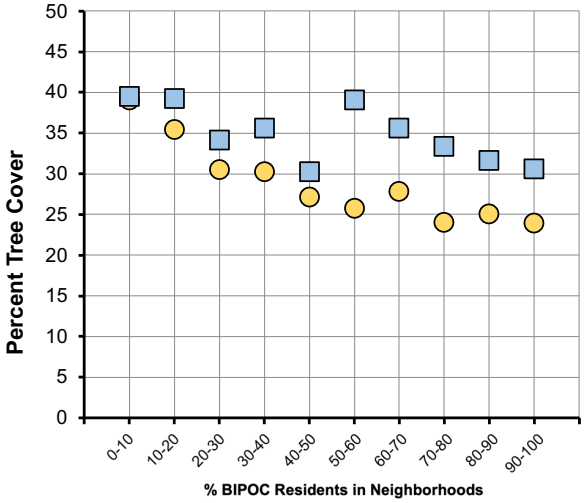
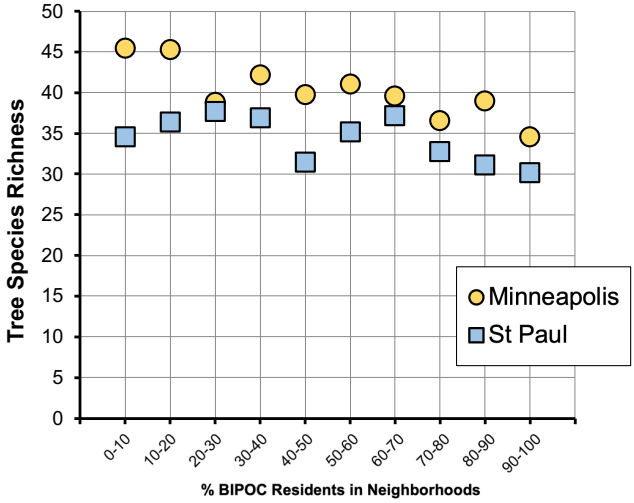
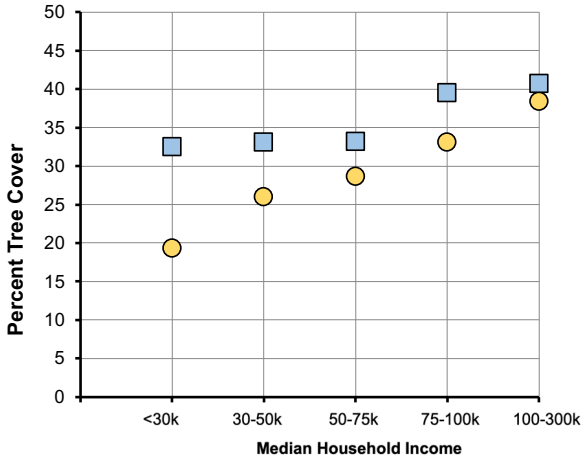
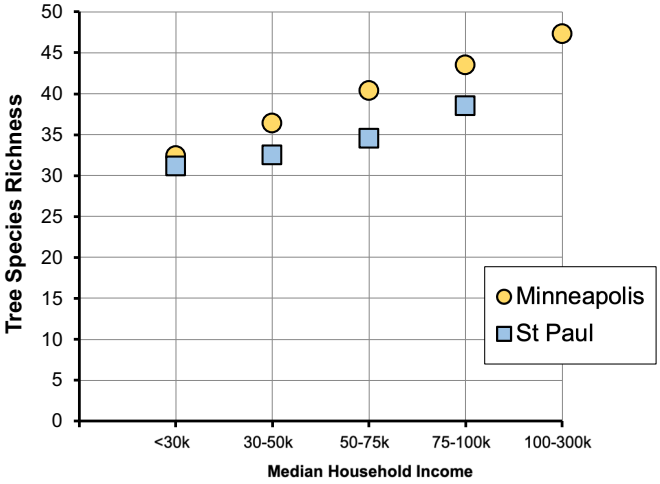
Below are graphs of the data: Identify any changes, trends, or differences you see in your graphs. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.









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Interpret the data:

Make a claim that answers the scientific question, how does tree cover and tree species richness differ across neighborhoods with varying income levels and percent of BIPOC residents?

What evidence was used to write your claim? Reference specific parts of the table or graphs.

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Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how investment from residents and local government can impact trees in neighborhoods.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Adrienne's research? How do your questions build on the research that has already been done?

What future data should be collected to answer your question?

Independent variable(s): _____

Dependent variable(s): _____

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For each variable, explain why you included it and how it could be measured.

What hypothesis are you testing in your experiment? A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.