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DATA Nugget

Do you feel the urban heat?

Featured scientists: Irvin E. Arce (he/him) and Tiffany Troxler (she/her) from Florida International University

Research Background:

Teachers visiting the mangroves in Miami on a record heat day.

Record-breaking temperatures climb higher every year, and Florida is no exception. In Florida, the impact of climate change is felt mostly during the hurricane season. Storms are becoming more violent and show up earlier in the season. These extreme temperatures and weather events affect living organisms of all types, including humans. Outdoor workers, the elderly, and all people who lack adequate housing are susceptible to temperature changes in the environment.

Irvin teaches science at a high school in Miami, Florida. On his way to work, he listens to a local radio station to catch up on the news. One day the radio hosts were talking about an increase in homelessness in Miami and other cities. They also brought up the record heat that the U.S. was experiencing and how this may affect those without homes. This conversation on the radio made Irvin think. He reflected on the impact that such high heat could have on individuals who sleep without air conditioning.

This inspired Irvin to learn more about what could be done to mitigate the impact of climate change in his city. Irvin joined a program that invites teachers to work in scientists' labs in the summer to gain research experience. Irvin was matched with Tiffany, a scientist interested in how urban heat can change based on structures like concrete buildings, urban dwellings, and unshaded places. Irvin took this opportunity to explore how high temperatures in Miami affect the daily lives of people living there.

First, Irvin started looking into how temperatures are reported in Miami. He learned that there was just a single sensor stationed at the nearby airport. The heat and humidity readings from this one sensor are used by local officials to alert the entire city about dangerous heat levels. Alerts are issued when the heat index reaches 108 degrees Fahrenheit or higher. **Heat index** is a value that represents how the body feels

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Heat sensor ready to be put out into the city.

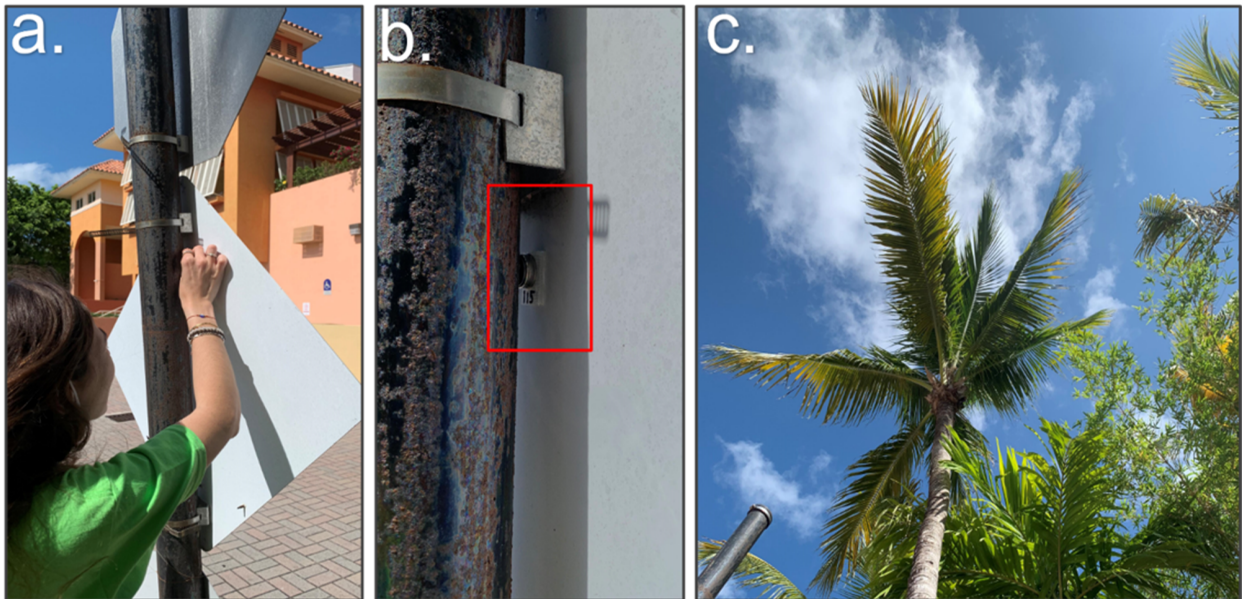
temperature when humidity is factored in. With these alerts, people can take action by spending less time outside.

Irvin realized that no matter how reliable the sensor at the airport is, there is likely a larger range of temperatures within the city. He wanted to know whether the temperatures at the airport were similar to the heat felt at places where people spend time outside.

Tiffany's research team had already started to collect temperature data in urban places where they hadn't been recorded before. Since 2018, her lab placed hundreds of small heat sensors around the city. The sensors go out for 3 months and then the team collects them, records their data, and places them back out into new areas of the city.

Irvin wanted to compare areas that varied in coverage from the sun. He focused on sites where people gathered and spent long periods of time outside – bus stops. Some of the sites he chose had shade from trees, some had a roof providing partial sun cover, and other sites were totally exposed with no shade. Irvin took photos of each bus stop and used them to classify all sites as either full coverage, partial coverage, or no coverage. He used data from the airport as a control comparison to his bus stop sites.

Scientific Questions: How does the amount of cover affect the temperatures at bus stops around Miami? How do bus stops compare to the airport sensor used to issue heat warnings?



a) Attaching a heat sensor in the city b) Heat sensor placed on a street sign c) Example of a photo used to document the environment at each bus stop site.

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Scientific Data:

Complete the table and use the data from three different bus stops on October 1st, 2022, to answer the scientific questions:

	Sensor 4	Sensor 9	Sensor 16	Airport
Time of Day	Full Coverage	Partial Coverage	No Coverage	Baseline
1:00	75.2	77.0	78.4	78.1
2:00	74.8	76.8	78.4	77.0
3:00	74.5	75.9	77.9	77.0
4:00	74.5	75.9	77.5	77.0
5:00	74.5	75.7	77.2	77.0
6:00	75.0	75.9	77.5	75.9
7:00	73.9	74.5	77.0	75.9
8:00	74.3	75.2	76.3	79.0
9:00	76.6	79.0	77.9	81.0
10:00	79.5	81.5	81.3	82.0
11:00	82.4	86.2	84.2	84.9
12:00	84.0	87.4	90.1	84.0
13:00	84.4	85.6	87.1	84.0
14:00	84.7	85.1	92.8	82.9
15:00	85.8	86.9	92.8	82.0
16:00	84.2	85.8	87.4	82.0
17:00	84.2	86.7	85.1	82.0
18:00	82.2	84.4	83.1	82.0
19:00	81.1	81.3	82.4	81.0
20:00	79.9	80.2	81.7	82.0
21:00	79.9	80.6	76.6	80.1
22:00	79.9	80.6	76.6	78.1
23:00	79.0	79.7	77.2	78.1
24:00	75.7	77.5	76.1	78.1

	Sensor 4	Sensor 9	Sensor 16	Airport
	Full Coverage	Partial Coverage	No Coverage	Baseline
Maximum				
Minimum				
Average				

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What data will you graph to answer the questions?

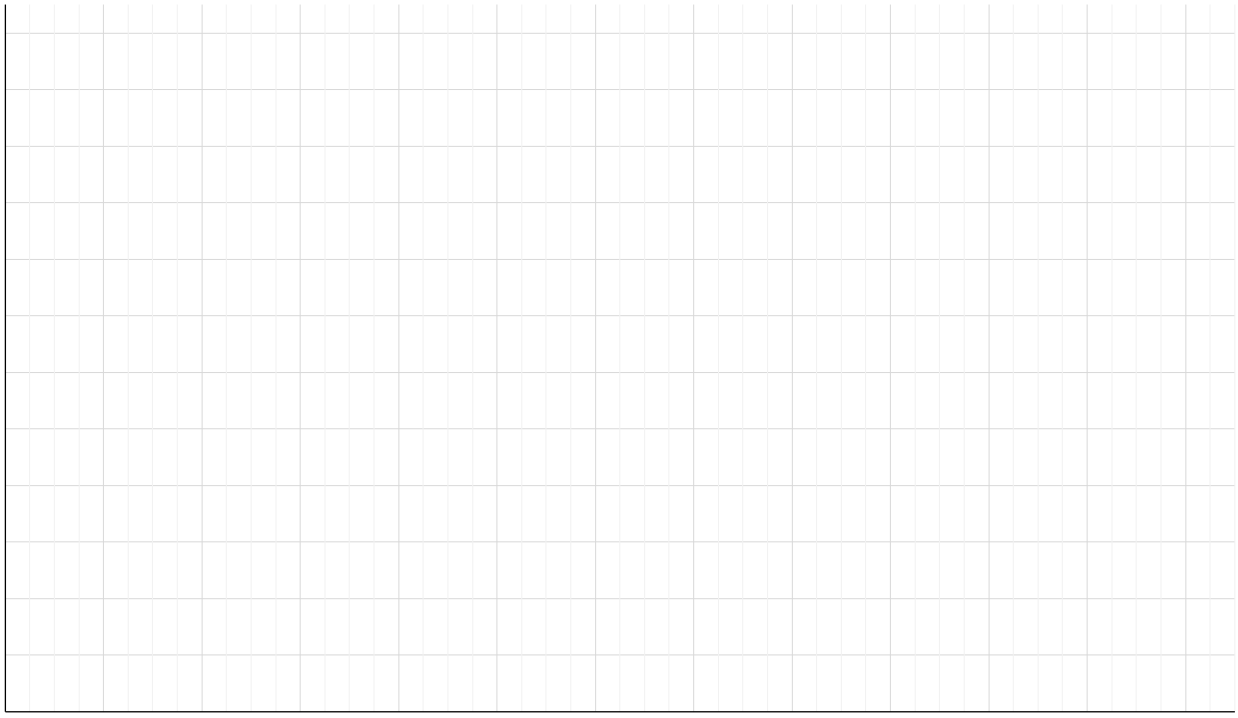
Independent variable(s): _____

_____

Dependent variable: _____

_____

Draw your graph below: Identify any changes, trends, or differences you see in your graph. 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 claims that answer the scientific questions: How does the amount of cover affect the temperatures at bus stops around Miami? How do bus stops compare to the airport sensor used to issue heat warnings?

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

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how sun and shade impacts temperature.

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Apply this research: If you were in charge of issuing heat advisories Miami, how would you use the results of this study? What improvements could be made to better prepare the people of Miami?

Your next steps as a scientist:

Science is an ongoing process. What new question(s) should be investigated to build on Irvin'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.