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DATA Nugget

Breathing in: Part 2

Featured scientists: Susan C. Cook-Patton, the Nature Conservancy &
Kristina J. Anderson-Teixeira, Smithsonian Conservation Biology Institute.
Written by Ryan Helcoski

In Part 1, you learned how trees "breathe in" and accumulate carbon dioxide within their tissues during photosynthesis. You also examined data from ForC, the Global Forest Carbon Database. Using this dataset, you studied how "breathing in" differed in regrowing forests around the world. Now it's time to go a step further and see how Susan and Kristina used the ForC database to take action!

Research Background:

Susan (left) and Kristina (right), the scientist team leading the ForC project.

Like many other scientists, Susan and Kristina are concerned about global warming. **Global warming** is the well-documented rise of the temperature of Earth's surface, oceans, and atmosphere. As of 2020, global temperatures are now warmer by about 1 °C (1.8 °F) than they were before people started burning a lot of fossil fuels in the late 1700's. While this may seem like a small increase, it has already caused major changes on Earth.

To ease global warming, humanity needs to not only reduce their greenhouse gas emissions, but also to capture the excess greenhouse gases in the atmosphere. This is a huge motivating factor for Kristina and Susan's investigation into regrowing forests in Part 1 and part of the reason they created the **ForC** database.

Thankfully, Susan and Kristina are not alone. People from all around the world share their concern. That's one of the reasons the **Intergovernmental Panel on Climate Change** (**IPCC**) was established in 1988 by the United Nations. The IPCC is dedicated to providing the world with reliable scientific information on the risks, impacts, and response options of climate change. So, it makes sense that the IPCC is also interested in data on carbon accumulation due to forest regrowth.

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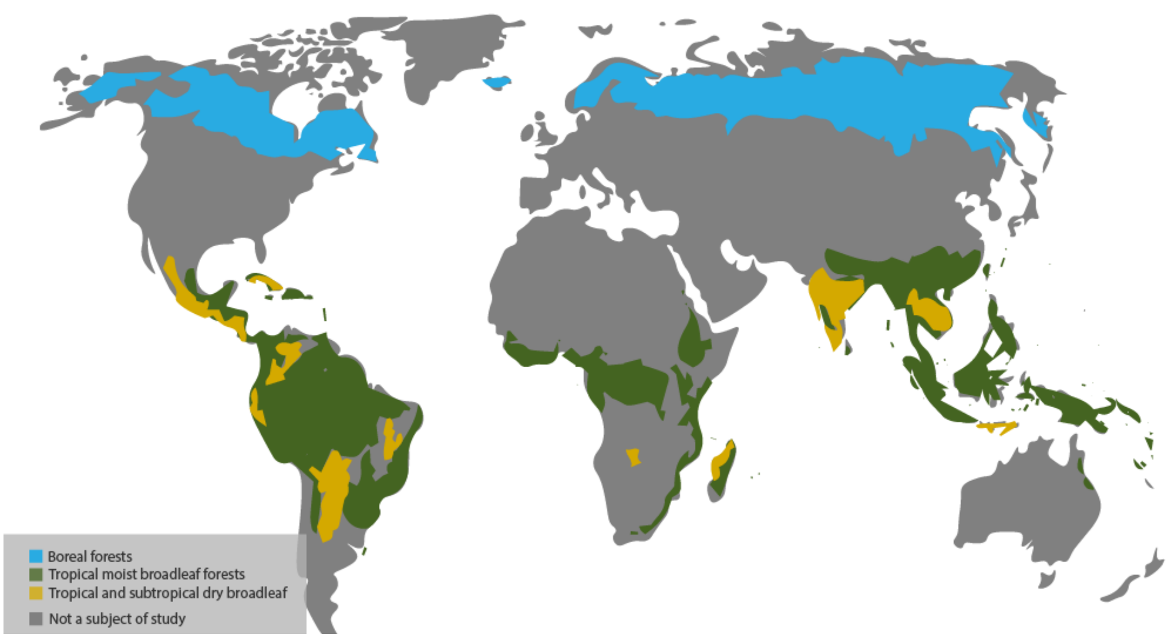
Susan and Kristina wanted to make sure that the IPCC has the most precise data available in order to better inform policy decisions. They were confident their dataset would improve upon what the IPCC had available when they calculated their estimates. They hoped their work would be incorporated into the IPCC's next update.

Susan and Kristina thought that the forest carbon accumulation values calculated by ForC would be different than those provided by the IPCC. They anticipated their values would be more precise because of the additional variables they had compiled. In the end, they and their colleagues combined field measurements with 66 environmental variables that could affect carbon accumulation in young regrowing forests. This fine-tuned model was used to create a global map that predicts the potential aboveground carbon accumulation for the first 30 years of forest regrowth. They were able to look at the varying forest types at a finer scale, zooming in to a resolution of one kilometer!

However, before Susan and Kristina would present their map model to IPCC, they needed to first compare their values with the IPCC's current model. They chose to focus on three forest types: boreal, tropical dry broadleaf, tropical moist dryleaf. They looked at each forest type on three different continents and compared the estimated values from the IPCC model to the ForC model. If the ForC model is more precise, they expected to see very different values for different locations of the same forest type. If ForC did not increase precision, the values for each continent would be similar to the IPCC values in each forest type.



Map showing the distribution of boreal, tropical moist broadleaf, and tropical/subtropical dry broadleaf forests across the globe. Illustrated by Habib Aina.

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Scientific Question: How does the ForC database compare to the IPCC database for each forest type (boreal, tropical dry broadleaf, tropical moist dryleaf)?

Scientific Data:

Use the data below to answer the scientific question.

Location	Forest Type	Average IPCC MgC/ha/yr	Average ForC MgC/ha/yr	% difference
Asia conifer	Boreal	0.517	1.080	
Europe conifer	Boreal	0.517	0.940	
North America conifer	Boreal	0.517	0.890	
Africa tropical dry	Tropical Dry Broadleaf	1.833	1.710	
Asia tropical dry	Tropical Dry Broadleaf	1.833	2.400	
North America tropical dry	Tropical Dry Broadleaf	1.833	2.000	
Asia rainforest	Tropical Moist Broadleaf	1.598	3.640	
South America rainforest	Tropical Moist Broadleaf	2.773	4.640	
Africa rainforest	Tropical Moist Broadleaf	3.572	4.550	

What data will you graph to answer the question?

Independent variable(s):____

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Dependent variable(s): ____

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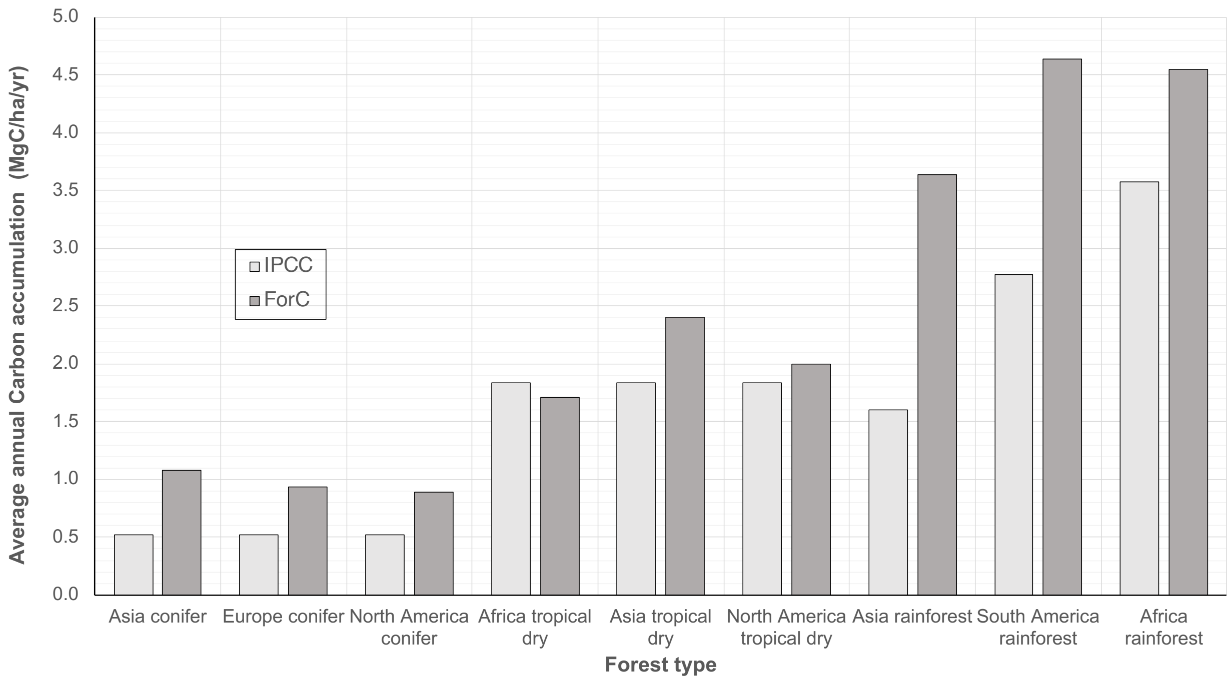
<u>Below is a graph of the data</u>: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see and write one sentence describing what you see next to each arrow.



<u>Interpret the data:</u>

Make a claim that answers the scientific question. Make sure to discuss the differences within the three forest types mentioned in the scientific question

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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 trees sequester carbon and the differences between the two models.

Your next steps as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer your question? What do you think should come next?