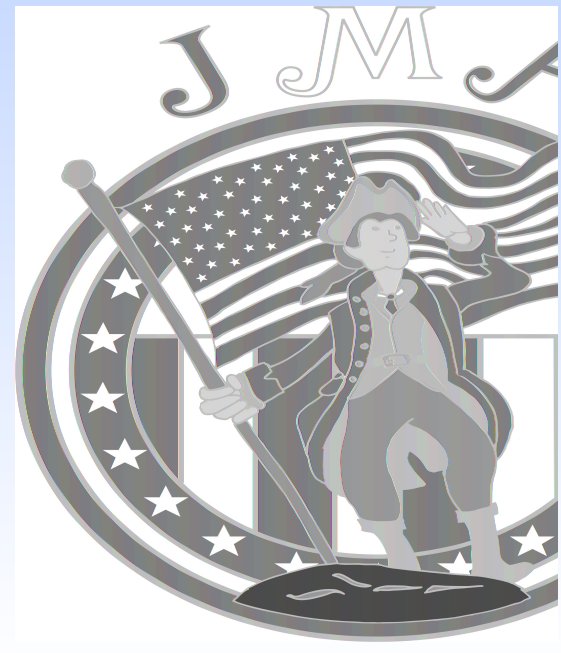


# Is there a relationship between Carbon Dioxide and Aerosols in the air?

## Cadence and Eirene Campbell

Jefferson Montessori Academy



### Abstract

- Our research is about carbon dioxide and aerosols because we wanted to learn about pollution.
- Our research question is “Is there a relationship between carbon dioxide and aerosols in the air?”
- The GLOBE protocols we used were Aerosol Protocol to test AOT.
- The results of our research are that there is no correlation between AOT and CO2.
- We conclude that there is no relationship between AOT and CO2 at the atmosphere level tested.

### Question/Hypothesis Asking Questions

- Is there a relationship between carbon dioxide and aerosols in the air?
- Our hypotheses is: “If the CO2 rises it will have no effect on the AOT.”
- If there is no relationship between carbon dioxide and aerosols in the air then there will be no trend in our data.
- We are interested in researching this topic because we want to learn more about pollution.
- Our research question can be answered with GLOBE data by collecting AOT with a Calitoo and collecting the amount of carbon dioxide with a Pocketlab.
  - This subject interests us because we want to learn more about climate change.
  - Climate change is important to everyone. It impacts local and global communities.
    - We have a lot of oil drilling in the area. Does that affect the AOT and Carbon emissions?
    - Is the Carbon and AOT higher in high traffic areas?
  - We can expand on this project next time by testing other cities and comparing the data.

### Introduction Content Knowledge

- Researching this topic is important because we wanted to learn about carbon and climate change. We learned that Carbon Dioxide is one of the greenhouse gasses and that greenhouse gasses cause a greenhouse effect. When there too many greenhouse gasses the Earth's temperature will continue to rise causing global warming.
- This ties into our project last year because we studied cloud covers effect on air temperature. We found that the more clouds there were the ground stayed warm longer.
- This topic addresses climate issue because it studies the connection between AOT and CO2.
- For our research we used Aerosol GLOBE protocols or data to understand how AOT and CO2 are connected.



Field Photos

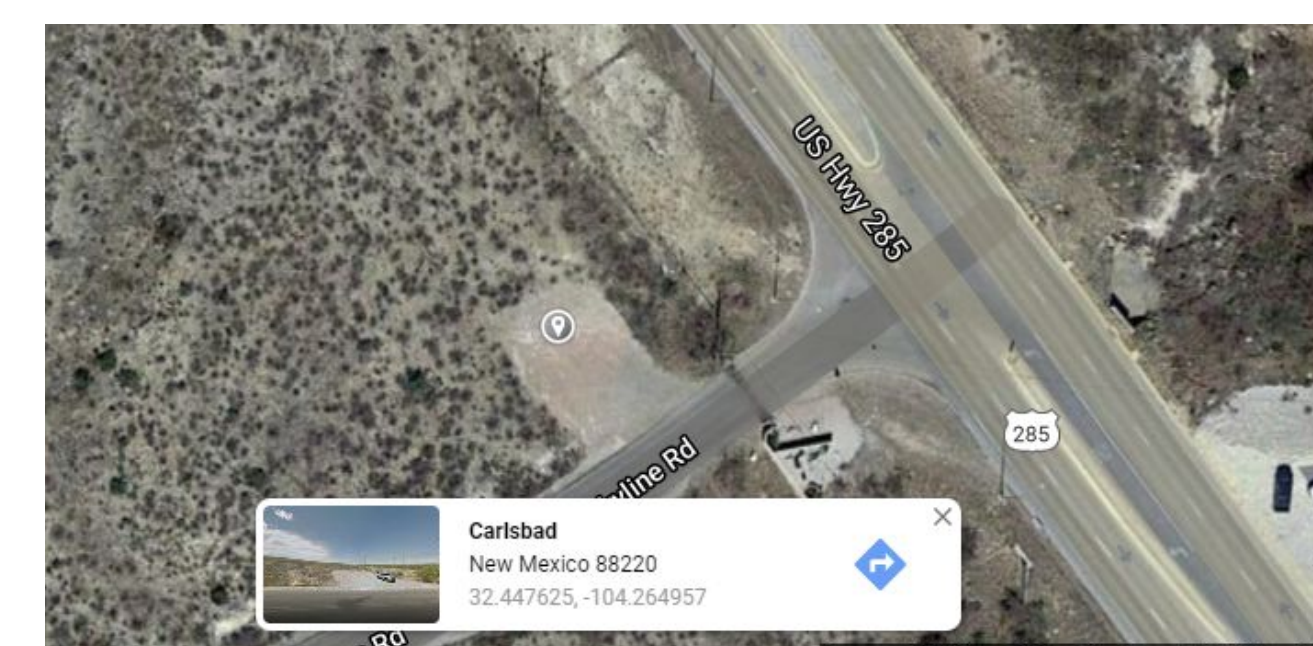
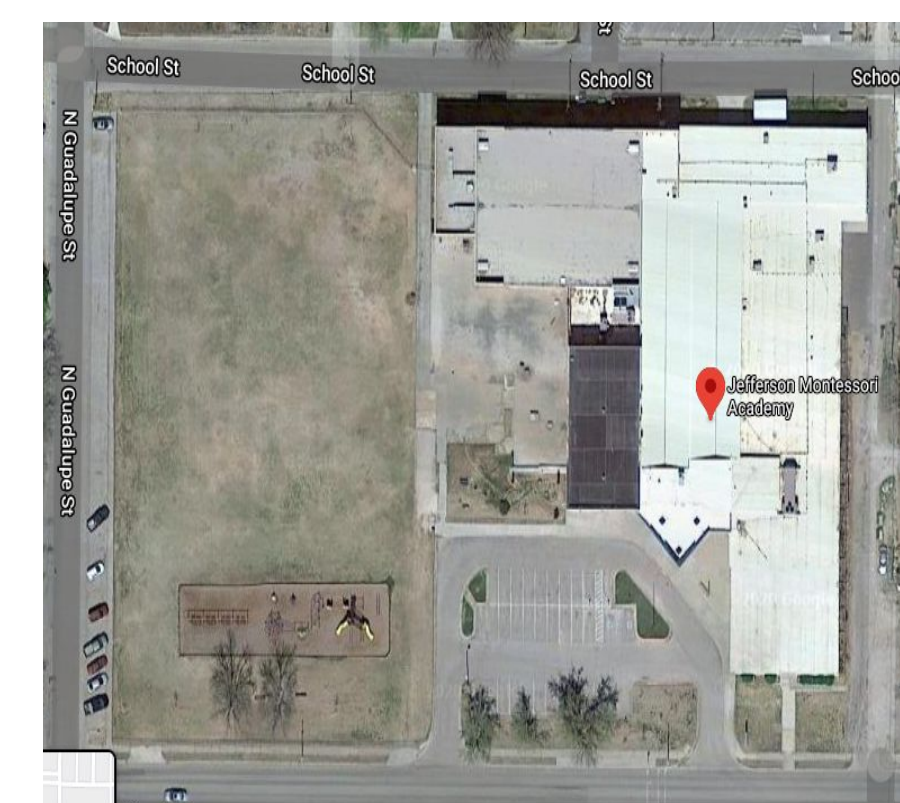
### Research Methods

- Our plan for the investigation is to use special equipment, the Calitoo and the Pocket Lab, to test how much carbon is in the air.
- Our plan will produce data to test the amount of carbon and AOT at JMA and the Living Desert to see the differences between levels of CO2 and AOT.
- The study sites are located at our school and right outside of town on the main road.
- Our study site at JMA is a school. We took our data from the GLOBE weather Station and we made sure to stay out of the shade. There are very few plants or vegetation around this site and it is very flat terrain. The Living Desert has a lot of cacti and has a flat terrain where we took our measurements.
- The GLOBE protocols we plan to use are the GLOBE aerosols protocols as follows:
  1. Connect a digital voltmeter to the output jacks of your sun photometer. (Skip this step if your sun photometer has a built-in digital voltmeter.)
  2. Turn the digital voltmeter and sun photometer on.
  3. If your sun photometer has a rotary switch on the top of the case, select the “T” setting and record 100 times this voltage.
  4. Select the green channel.
  5. Face the sun and point the sun photometer at the sun. (Do not look directly at the sun!)
  6. Adjust the pointing until you see the maximum voltage in your digital voltmeter. Record this value on your Data Sheet.
  7. Record the time at which you observed the maximum voltage as accurately as possible, to the nearest 15 seconds.
  8. While still pointing your sun photometer at the sun, cover the aperture with your finger to block all light from entering the case. Take a voltage reading and record this dark voltage reading on your Data Sheet.
  9. Select the red channel (assuming you have started with the green channel) and repeat steps 6-8.
  10. Repeat steps 3-9 at least twice and not more than four times.
  11. If your sun photometer has a rotary switch on the top of the case, select the “T” setting and record 100 times this voltage.
  12. Turn off both the sun photometer and the voltmeter.
  13. Note any clouds in the vicinity of the sun in the comments (metadata) section. Be sure to note the types of clouds by using the GLOBE Cloud Chart.
  14. Do the Cloud Protocols and record your observations on the Aerosols Data Sheet.
  15. Do the Relative Humidity Protocol and record your observations on the Aerosols Data Sheet.
  16. Do the Barometric Pressure Protocol and record your observations on the Aerosols Data Sheet.
  17. Read and record the current temperature to the nearest 0.5 °C following one of the air temperature protocols.
  18. Complete the rest of the Aerosols Data Sheet.
- We plan to collect aerosol and carbon dioxide data, once a week of Fridays
- We plan to collect data at 3:30 pm each day.

#### Carrying Out Investigations

- The GLOBE protocols we used were GLOBE Aerosol Protocol.
- When we collected data we used both the Calitoo and the Pocket lab per the directions of each device and wrote down the data in our notebook.
- We collected data a total of 7 different days at JMA, however due to weather conditions these days varied.
- We collected data a total of 7 different days at Living Desert
- We analyzed the data using charting and analyzing several different graphs
- Our methods help to answer the research questions because it creates a visual tool to see the data.

### Map of Study Site(s)



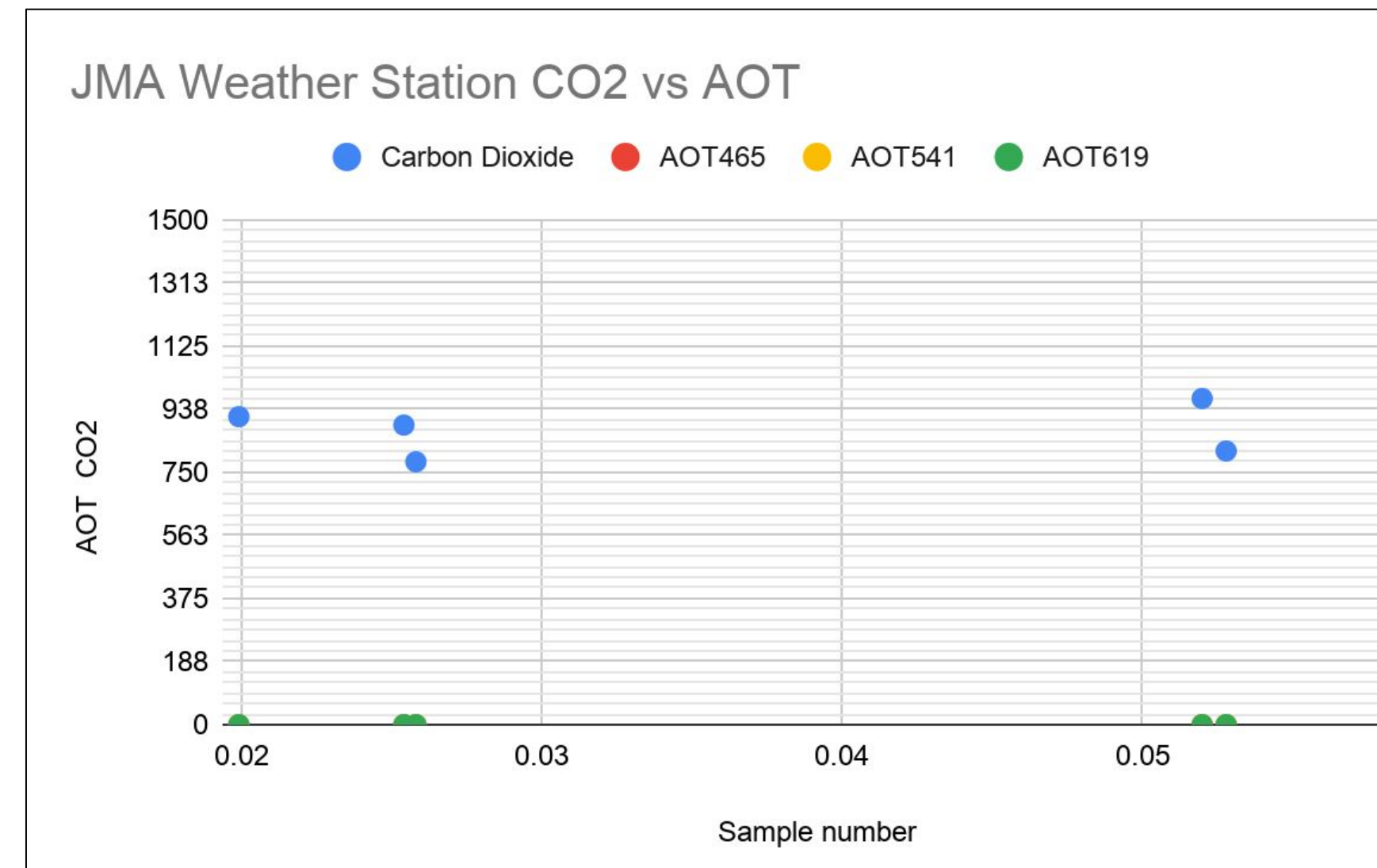
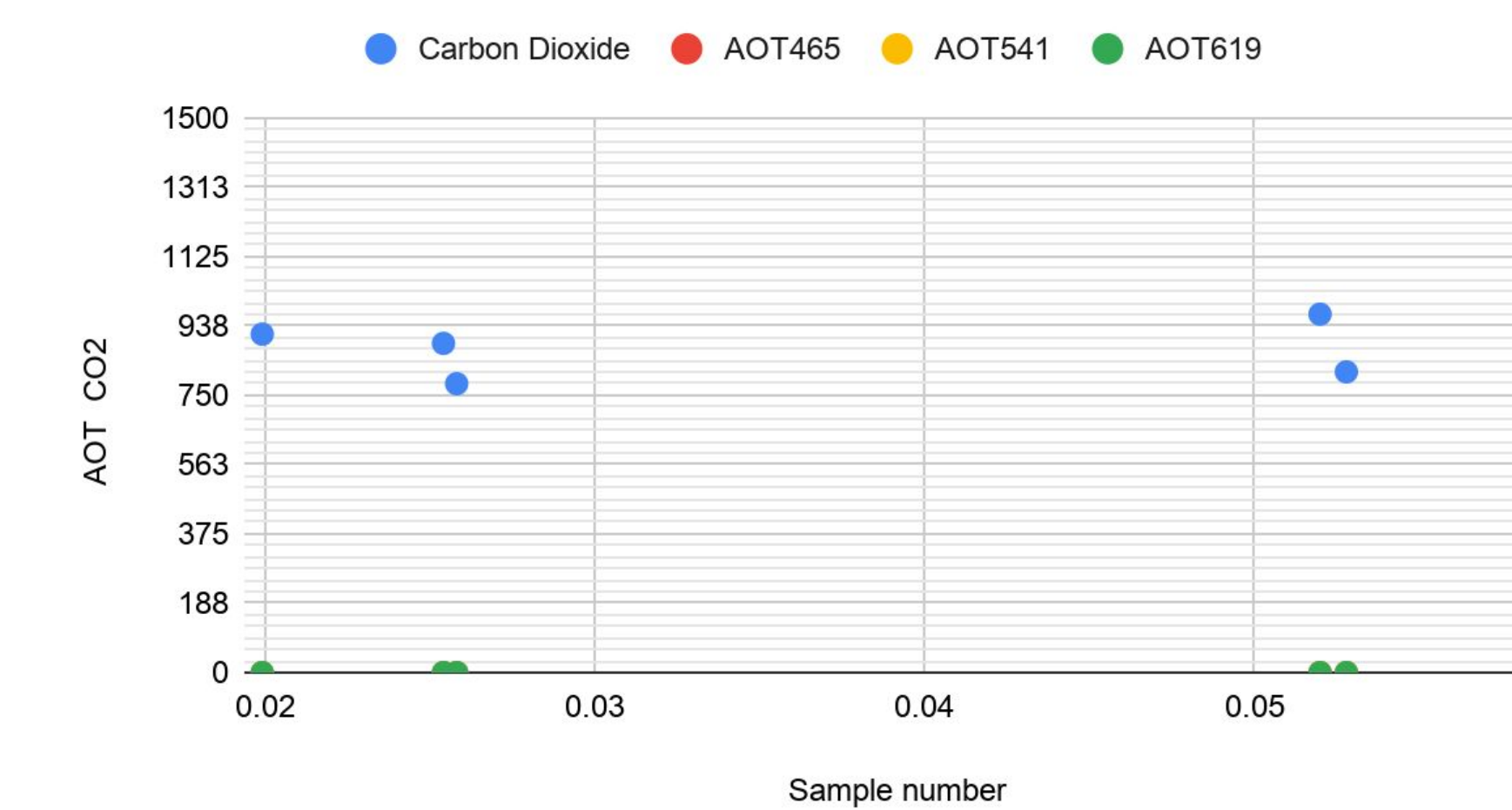
### Results

#### Analyzing Data

- Our results show that there is not a trend or relationship between carbon dioxide and AOT.
- The analysis we conducted addressed the research question because we collected carbon dioxide and AOT at the same time at each location and then graphed our data to see if there was a trend between them.
- As shown in our data table, data was collected and data points were entered into the GLOBE database. (See data table and graph)
- According to our data, there is not a relationship or trend between carbon dioxide and aerosols.

	JMA	Living Desert	JMA	AOT465	AOT541	AOT619	
	12-6	1373	754	12-6	0.0522	0.0556	0.0584
	12-13	760	765	12-13	1.7682	1.8286	1.7993
	1-17	890	820	1-17	0.0784	0.0221	0.0254
	1-18	915	1000	1-18	0.0683	0.0188	0.0199
	1-23	969	736	1-23	0.072	0.061	0.052
	1-24	813	768	1-24	0.0641	0.0551	0.0528
	1-25	781	833	1-25	0.0297	0.0259	0.0258
			Living Desert	AOT465	AOT541	AOT619	
				12-13	1.0911	1.1014	1.0883
				1-17	0.0693	0.0596	0.0548
				1-18	0.0228	0.0284	0.0278
				1-23	0.026	0.0285	0.0286
				1-24	0.0505	0.0457	0.0432
				1-25	0.0353	0.0311	0.0312

JMA Weather Station CO2 vs AOT



### Discussion

#### Interpreting Data

- The most important results are that according to the data there is no connection between AOT and CO2.
- The results mean that CO2 in the atmosphere does not affect the aerosols.
- The data are important to science and our community because it will help with studies on Global warming.
- Comparing our results to similar studies by other researchers reveals other researchers have found a connection between the two at higher elevations. (<http://www.co2science.org/articles/V10/N24/EDIT.ph>)
- The results do help answer the research question because there is no connection at the elevation we studied, only higher elevations.
- The results do support our hypothesis at our elevation because we saw no connection.
- Next time we could take data from different elevations to see if we could get different results higher up.

### Conclusions

#### Drawing Conclusions & Next Steps

- Our conclusion is supported by the results because we did not think there would be a connection between AOT and CO2.
- Improvements to our research can be taking data in different cities and at different elevations.
- We appreciated doing this research for GLOBE and NASA because it helped us learn about pollution and Greenhouse Gasses.

### Bibliography

#### References

- <http://www.co2science.org/articles/V10/N24/EDIT.ph>
- GLOBE Aerosol Protocol sheet
- NASA Cloud Identification Guide
- D. Dakers. (2015). The Carbon Cycle. New York, NY. Crabtree Publishing
- Smithsonian. (2007). Earth. New York NY. DK Publishing