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I teach biology to freshmen at an independent school, **Sayre School**, here in Lexington, KY. Below is a list of the specific topics in our curriculum. I have set in **bold** the section that applies to climate change specifically:

1. A review of the scientific method andexperimental design
2. Characteristics of living things
3. Biological classification
4. Ecology
   [ecosystems/biomes,
   ecological interactions (succession, adaptations, populations),
   environmentalissues,
   photosynthesis and cell respiration]
5. The structure and function of cellsand the use of microscopes
6. Chemical reactions
7. DNA, RNA, and genetics
8. Protein synthesis, mitosis, andmeiosis
9. Human heredity
10. Natural selection and evolution

We are a laptop school (all students are required to have their own laptop). My teaching partner and I designed our labs to be digitally formatted (they all open as pdfs) with attachments, movies, and helpful links.

NOTE ON OPENING LABS: The links to these labs are best used in Adobe Acrobat Reader. If you open the labs in other programs, you may not see all the features, including the links to the documents. Documents in the labs appear as 'thumbtacks' and should be opened in Microsoft Word. These documents are formatted as forms and will not have the same functionality if opened in other programs.

The study of the climate change in my biology class is predicated on the assumption that once students have a solid understanding of how carbon cycles in the natural environment, they can begin to understand how humans cause an imbalance by burning fuels that release carbon sequestered millions of years ago.

Students study the carbon cycle in the context of a specific ecosystem. Some students focus on the desert biome, some the temperate deciduous forest, while other might study the tropical rainforest.

Each group of two to three students creates a drawing of their particular biome and, as they learn about each of the nutrient cycles, incorporates this cycle in the drawing. Here's the lab that explains this process: **Lab 4 Ecosystems**.

Each nutrient cycle studied is associated with at least one lab. The carbon cycle is associated with two: **Lab 5 Carbon Cycle**, a classic study of the cycling of carbon between snails and elodea, and **Lab 6 Cell Respiration**, where students study the difference in carbon dioxide (and oxygen) levels in germinating and non-germinating peas using Vernier probes. These two labs help students understand how carbon cycles in the natural world, focusing on the processes of photosynthesis and respiration. As the students then incorporate the information they've learned about this cycle into their Lab 4 Ecosystem drawing, they are also asked to add other processes - decomposition and combustion, specifically.

As students work, a natural discussion of this process unfolds. Students begin to realize that the interactions of photosynthesis and cell respiration maintain a dynamic equilibrium of carbon in the atmosphere. They learn the reservoirs for carbon - the atmosphere, the ocean, and the ancient reservoirs of fossil fuels. Figurative light bulbs go off as students realize that energy from sunlight was stored millions of years ago in natural gas, petroleum, and coal. This energy is in the form of hydrocarbons that contribute to the overall carbon in the atmosphere, and ocean, when burned. At least once each year, a student laments that we need a machine to remove excess carbon. Of course, one exists - plants! How ironic that at the same time we contribute to excess carbon in the atmosphere we are reducing the very living machines that can remove it. An animated diagram of this process and an explanation is also included on pages 4 and 5 of **Lab 4**.

All of these discussions occur in both small groups and as a class. Students begin to realize that the combination of burning fossil fuels and deforestation are causing excess carbon build up in the atmosphere. This knowledge sets the stage for further study of the results of increasing carbon

dioxide levels in the atmosphere. These discussions begin in Biology class but occur more deeply, with associated labs, during general and AP Environmental Science classes where students review the basic processes that lead to excess carbon levels in the atmosphere and then, more specifically, how those levels cause climate change.