

3-D Performance Assessment

Performance Expectation: **HS-LS2-5**

Grade Level: **High School**

Title	Cycling of Carbon in Ecosystems		
Designed by	Cait Stevenson, Meg Perks (AS Madrid) Dorothy Ginnett (AS Barcelona)	Course(s)	Integrated Science 9 Biology 9/10

Performance Expectation	<p>HS-LS2-5: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.</p> <p>Clarification Statement: Examples of models could include simulations and mathematical models.</p> <p>Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.</p>
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Science and Engineering Practice	<p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop a model based on evidence to illustrate the relationships between systems or components of a system
Disciplinary Core Ideas	<p>LS2.B: Cycles of Matter and Energy Transfer in Ecosystems</p> <ul style="list-style-type: none"> Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. <p>PS3.D: Energy in Chemical Processes</p> <ul style="list-style-type: none"> The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary)
Crosscutting Concept	<p>Systems and System Models</p> <ul style="list-style-type: none"> Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions — including energy, matter and information flows — within and between systems at different scales.

Student Performance	<ol style="list-style-type: none"> Components of the model Relationships Connections
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Cycling of Carbon in Ecosystems

PHENOMENON → Watch: <https://www.youtube.com/watch?v=x1SgmFa0r04>

PART ONE: Developing a Model

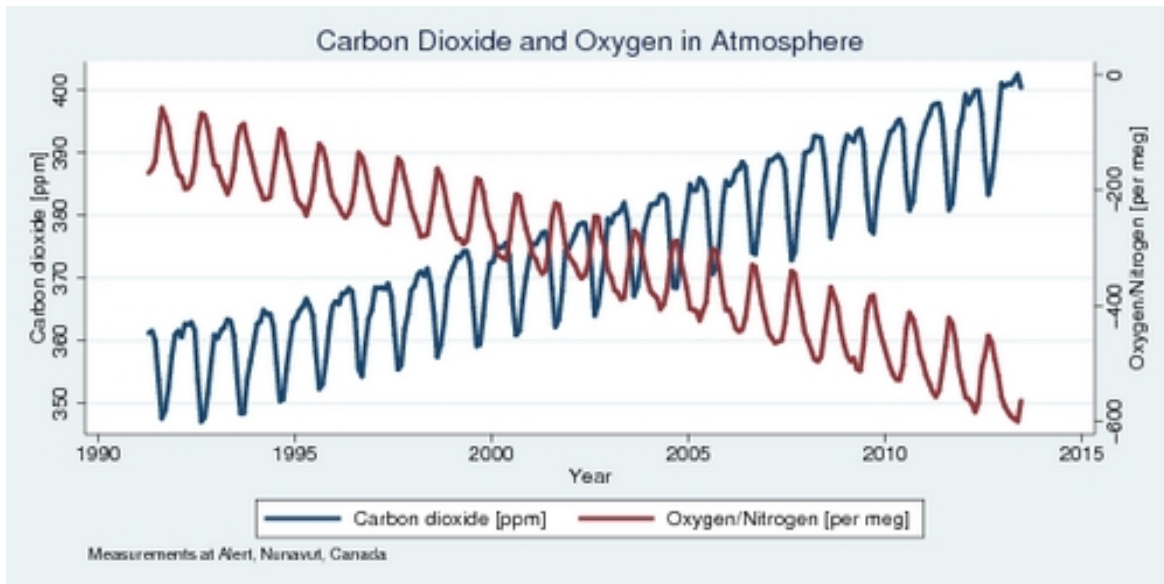


Figure 1: Atmospheric gas levels from 1990-2015 [from: <https://www.ipcc.ch/report/ar5/wg1/>]

- 1) Develop a model to illustrate the role of CO_2 in cellular respiration and photosynthesis, using the evidence presented above.

PART TWO: Identifying Relationships

- 2) Spain is making plans to build a new coal-powered electrical plant to help supply electricity to the growing population. They are considering two sites for the plant. One is in Castille, on open plains, with few large communities nearby. The second option is in Asturias in a forest.

Choose the option which would be best in order to mitigate the effects of the plant on the biosphere, atmosphere, hydrosphere and geosphere. Develop a model to illustrate the impact of CO₂ on each of these spheres for the area you chose.

PART THREE: Making Connections

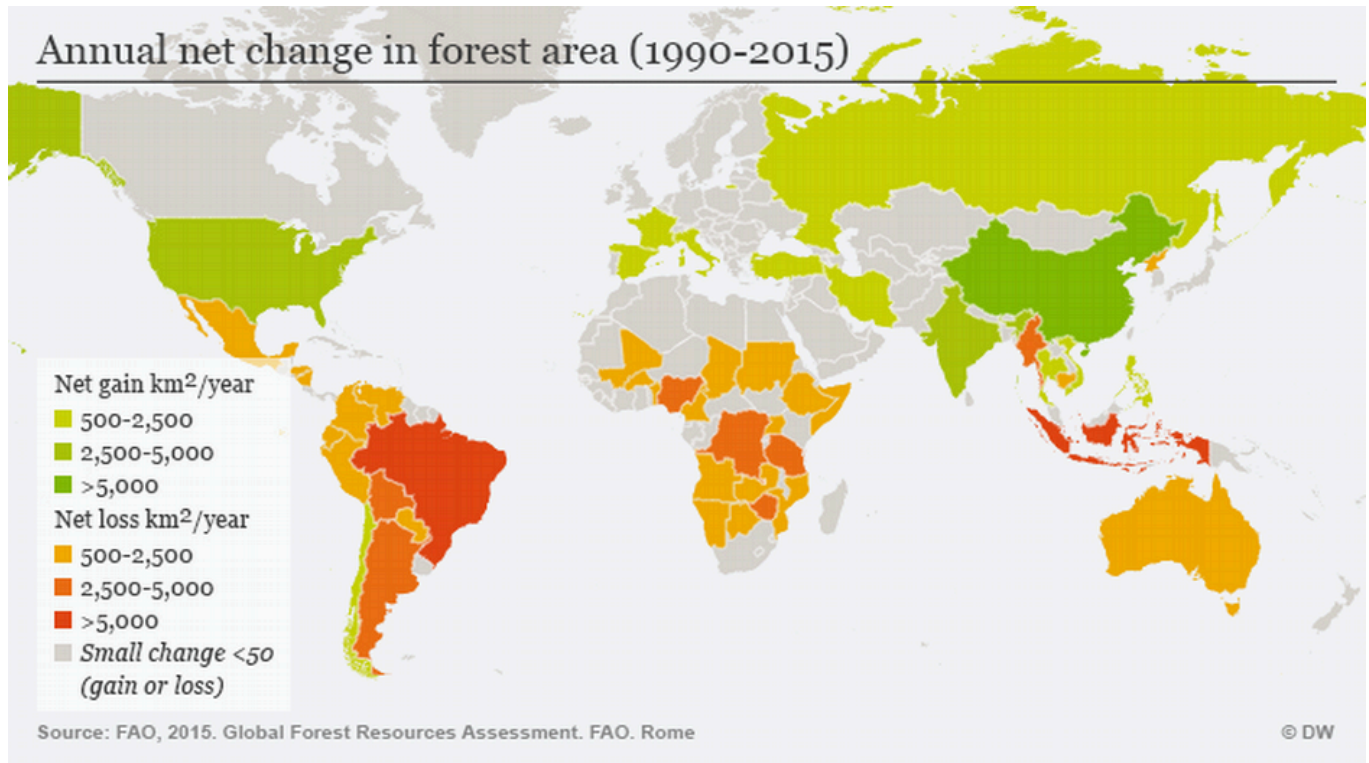


Figure 1: A map showing the annual net change in forest area between 1990-2015

2) Based on the data above, choose one country and explain how the carbon cycling in this region differs from the carbon cycle in your original model.