

Lesson 13

Carbon Cycles through Ecosystems



Unit Title: Carbon Cycles through Ecosystems	
Theme: Ecosystems & Cycles	Grade Level: 7
# of sessions for the unit: 3	Session #13: How can climate-change endanger fauna? An introduction
Date created: Summer 2017	Author: B. Allia, C. McWilliams

Unit Description

Focusing on systems and cycles, students use their understanding of climate-change and how carbon and thermal energy interact with Earth's land and atmosphere. Students practice skills such as argumentation and collecting and analyzing data. Students gain experience with the interactions of humans and Earth processes with ecosystem dynamics, and with developing solutions to complex climate-change issues. The lessons generally follow this order:

- Introduce unit and culminating event: climate-change's effect upon fauna
- analyze global temperature and carbon dioxide trends
- understand personal climate-change experiences, such as weather, matter and energy uses
- collect wetland and upland forest soil carbon-stores
- sample atmospheric carbon-store
- analyze land and atmospheric carbon-stores
- understand the carbon cycle, pre-human and human era
- describe personal experiences with solid forms of carbon changing into atmospheric carbon
- develop and present solutions to save a fauna from climate-change issues

Standard(s)

Based upon the 2016 MA Science & Technology/Engineering Curriculum Framework

MA LS2 Ecosystems: Interactions, Energy, and Dynamics

MA 7.MS-LS2-3 Develop a model to demonstrate how matter and energy are transferred among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes

Unit Goals

1. Create an action plan to decrease carbon in the atmosphere, increase carbon stored by the land, and preserve natural carbon-stores in the ground
2. Build background knowledge of how carbon cycles within a local ecosystem
3. Understand relevant climate-change issues in order to make informed decisions
4. Identify authentic scientific processes, such as sampling, gathering, and analyzing land and atmospheric carbon-content data, in order to validate evidence regarding climate-change

Unit Objectives

■ Students will be able to

understand that:

1. Carbon cycles through the atmosphere and land
2. Human activities increases atmospheric carbon by burning fossil fuel
3. Atmospheric carbon is a “greenhouse gas”
4. Greenhouse gases increase global temperatures
5. Wetlands and uplands store different amounts of carbon above and below ground

and to:

1. Sample, collect, and analyze primary-source data
2. Collect and analyze secondary data as a means to validate causes of climate-change

Lesson Objectives

1. Students research evidence and reasoning to argue that Human activities increases atmospheric carbon by burning fossil fuel
2. Students develop their argument that increased atmospheric carbon has harmed fauna
3. Students present their argument that increased atmospheric carbon has harmed fauna

Note any potential barriers to the lesson — consider variability

■ Student challenges

- physical challenges when collecting samples
- anxiety about preparing and presenting this project
- Vocabulary, reading, written expression

■ Teacher challenges

- computer availability for research
- website resources
- access to a wetland and upland forest

Evaluation/Assessment

(directly linked to the goals, i.e., Formative/Ongoing Assessment or Summative/End of Lesson Assessment)

■ Summative Assessment: Fauna Climate-change Research Project

1. Visual
2. Presentation
3. See rubric at end of this lesson

Formative Assessment

1. As students develop and practice presentation during class, teacher monitors for understanding and accuracy

Vocabulary

- fauna
- ecosystem
- argument
- evidence
- reasoning
- tipping point
- carbon footprint

NOTE: Consider the [UDL Guidelines](#) in selecting methods and materials to ensure that you provide options for engagement, representation, and action and expression.

Methods

(e.g., Anticipatory Set, Introduce and Model New Knowledge, Provide Guided Practice, Provide



Independent Practice)

Day 1 + Day 2

Hook Why is this tree so special? (It helps to reforest the tropics) A 4-year-old cedar in a Reforest the Tropics (RTT) mixture, shaded on the sides to form a clean stem, 3-4 logs <https://reforestthetropics.org/rtt-updates/>

Day 1 + Day 2

1. Students review unit notes to select information to include in slide show
2. In small groups with internet access, students create a Noodle Tool or a research tool project to create presentation's bibliography
3. Teacher introduces students to Reforest the Tropics website
 - A. Show 3-minute video clip

- B. Klinki Forestry Project = Klinki trees grow exceptionally fast and sequester massive amounts of carbon
- C. United Nations Framework Convention on Climate-change http://unfccc.int/kyoto_mechanisms/aij/activities_implemented_jointly/items/1727.php
- D. The Klinki Forestry Project will convert pastures and marginal farmland to commercial tree plantations by promoting the planting of 6,000 hectares of private farms with mixtures of selected fast-growing tree species in a matrix, with the Klinki tree as a major component. The trees will be harvested periodically for use in long-lived lumber products (such as utility poles) or left standing. The project will include small, medium, and large farms, educational pilot projects, and investor farms. Farmers will be given incentives for plantings in return for the rights to the sequestered carbon. The objective of the project is to develop a demonstration of the involvement of the farmer in carbon sequestration as an economic activity using the latest tree farming technology while providing greenhouse gas (GHG), wood production, and conservation benefits.

47 year old Klinkii tree in Costa Rica forest

- E. Carbon Extraction: <https://reforestthetropics.org/forests/the-rtt-product/> A potential donor may look towards purchasing carbon RECs or engage in emissions reduction efforts to balance their carbon output. At RTT, we applaud any effort to go green, however we also recognize the need to pull carbon dioxide from the atmosphere. There are three methods to extract CO₂ from the atmosphere: fertilizing the oceans, a risky method that will exacerbate the problem of an already too acidic ocean; smokestack “scrubbers,” which are estimated to remove and store CO₂ for a price of approximately \$200 per metric ton (*The Economist*; Mar. 5, 2009); and reforestation; which under the RTT model is safe, sustainable and far more cost effective.
 - F. Creating Habitat <https://reforestthetropics.org/creating-habitat/>
 - G. Three proven ways to extract carbon dioxide from atmosphere “Excess CO₂: The Elephant in the Room” <https://reforestthetropics.org/rtt-updates/>
4. Teacher guides groups
- A. In their claims, evidence, reasoning, action slideshow format, for their chosen animal
 1. Have they reached the tipping point?
 2. Will they be able to survive?
 3. What needs to change to bring back the animal’s original environment?
5. Remind students to
- A. include information learned over the next few weeks’ discussions of climate-change
 - B. additional class time can be used to ensure students make the connections with the lessons and how they can do their final products for this project
 - C. Students will present during class time — allow at least 10 minutes for each presentation
 - D. Suggest students use graphic organizers, included in materials section below
 - E. Assignment sheet to be distributed to students 1st day of unit and post on teacher webpage (*next page*)
 - F. Grading: Each section of the presentation is worth xx points based on how completely each section is explained.

Lab Report

Carbon Cycles through Ecosystems

Looking for Evidence:

How is Climate-change Affecting the World Around Us?

This project is worth xx points

You will pick one geographic area/animal/thing that is changing due to climate-change.

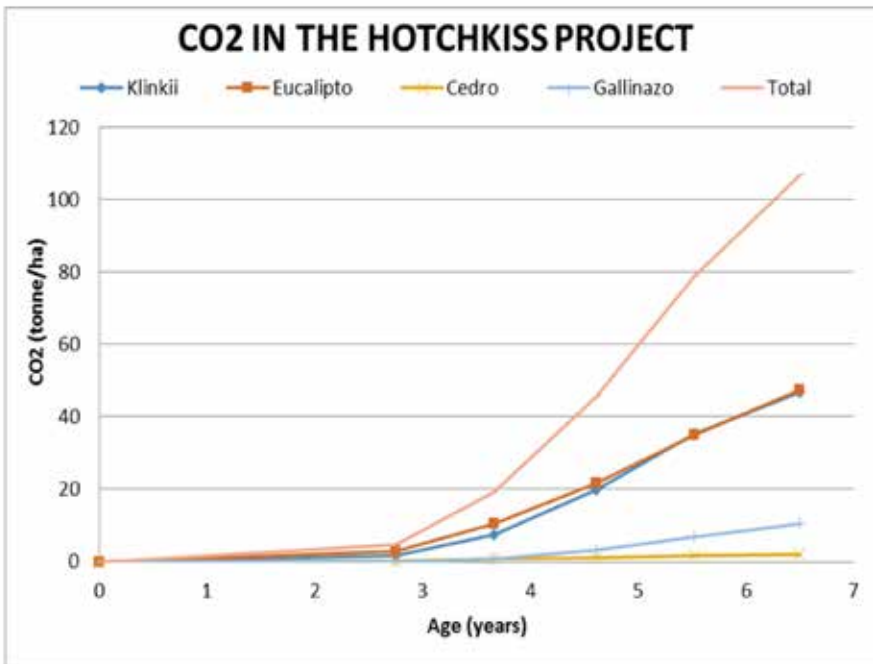
Inform the teacher what your topic is to have it approved.

Research this area and prepare a report to present to the class. Must create a poster for understanding and OK to make a Powerpoint or Google slides or other method approved by the teacher for the presentation (with little to no transitions) that clearly includes the following information in detail (5 points for each):

1. The topic being researched — include details; describe it and where it is found.
2. Describe your topic's 'normal' environment when it was doing well.
3. What evidence is there that the environment has changed? (Describe how your topic's 'normal' environment has changed).
4. Using reasoning, how has this change in the environment affected the topic? Be specific — can your topic adapt? Has your topic reached its tipping point? How close are they to the tipping point?
5. Create an action plan for how you can help slow down/stop the climate-changes occurring? Include some ways we can reduce the amount of carbon dioxide in the atmosphere and ways we can increase the amount of carbon stored by the land. This must include some ways you personally can reduce your carbon footprint by reducing electricity use and transportation needs.
6. Presentation: You and/or your team will present your report to the class. (Poster or PP)

Homework Day 2:

Students analyze this graph and read about RTT's Hotchkiss School reforestation project: <https://reforestthetropics.org/rtt-updates/page/3/> (scroll down to middle of this webpage to find the Hotchkiss School)



Day 3: Students present

1. Students present
2. Homework: Google Forms self-evaluation survey upon project
3. Grading Rubric: (*next page*)

Grading Guide

Carbon Cycles through Ecosystems

Grading: Each section of the presentation is worth xx/6 points based on how completely each section is explained.

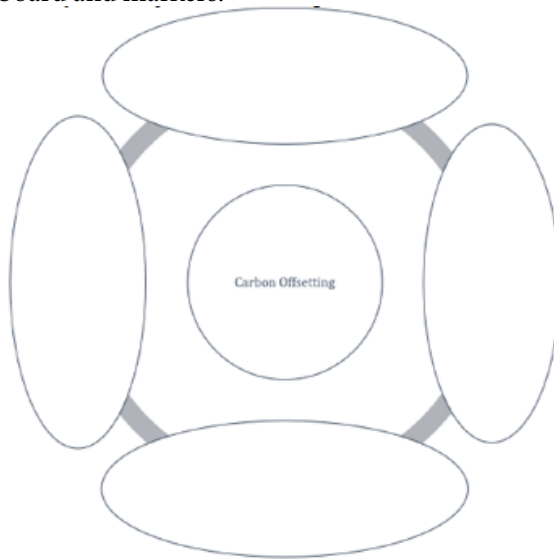
	Deficient: Poor 0-10	Needs Improvement: Fair 11-19	Proficient: Good 20-22	Advanced: Excellent 23-25	Points
Evidence			Provides valid evidence that the environment has changed <ul style="list-style-type: none"> • before industrial revolution • post industrial revolution • accurate evidence • accurate scientific vocabulary 		
Reasoning			Using an evidence-reasoning chain <ul style="list-style-type: none"> • links evidence: reasons of why a change in your animal's environment • negatively affected it • links evidence: reasons of how your animal tried to adapt • links evidence: reasons to your animal's tipping point — have they reached it? how close? • reasoning supported with valid evidence and details • addresses possible counterclaims (misconceptions) 		
Action Plan			The Action plan includes action strategies to <ul style="list-style-type: none"> • slow down or stop the climate-change from occurring • reduce the atmospheric carbon dioxide • increase land-based carbon-stores • personally reduce your carbon footprint by reducing • electricity use and transportation needs 		
Presentation			During your class presentation, your group <ul style="list-style-type: none"> • integrated your hand-drawn poster into presentation • included detailed graphs supporting your evidence-reasoning chain • presented in a logical order, clear and easy to follow helpful visuals • attractive appearance, uncluttered and clear 		
				Total Points	

Materials

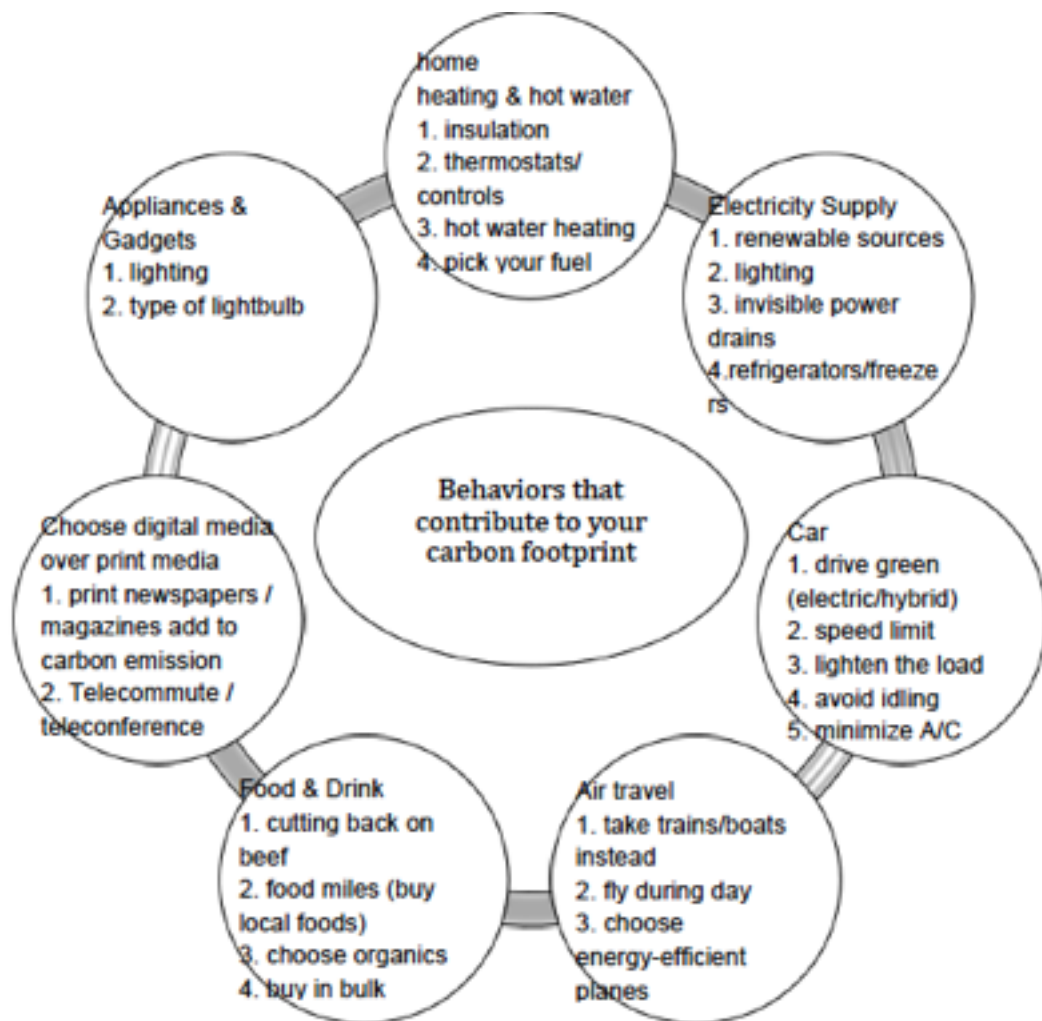
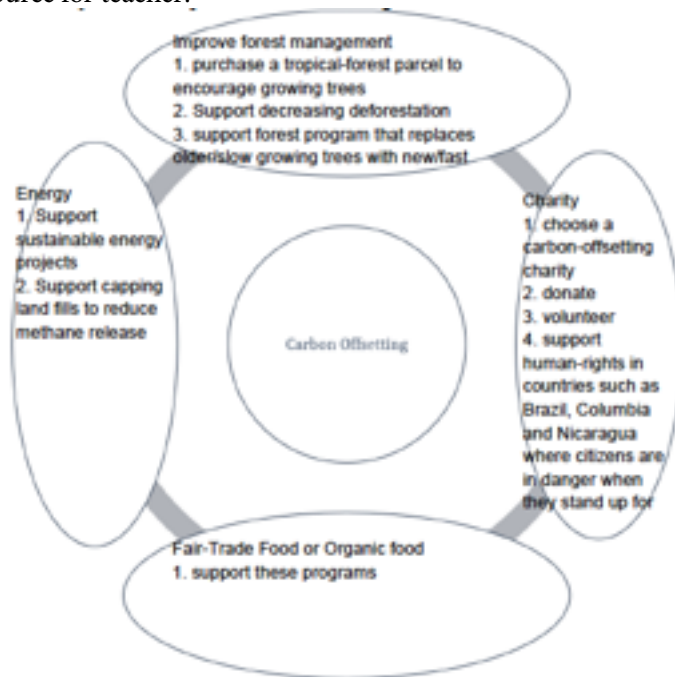
■ Access to computers, Powerpoint or Google slides

■ Suggested technology tools

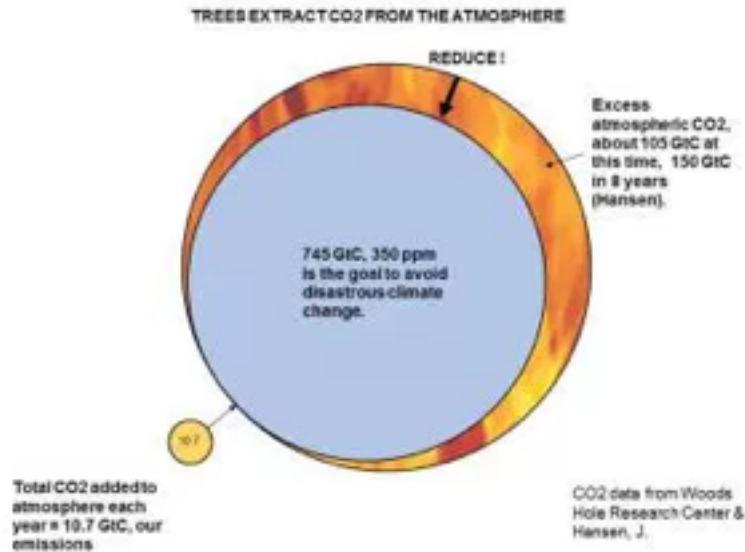
1. Noodle Tool group research tool www.noodletool.com
2. Actively Learn guided reading homework www.activelylearn.com
3. Brain Pop video and guiding questions www.brainpop.com as homework resource
4. Students create slideshow within Google Classroom
5. Posterboard and markers.



6. Resource for teacher:



From Reforest the Tropics:



Notes and Comments

Examples of websites that will help with this project from a google search for 'animals affected by climate-change'

<https://www.worldwildlife.org/magazine/issues/fall-2015/articles/animals-affected-by-climate-change>

<http://news.nationalgeographic.com/news/2014/03/140331-global-warming-climate-change-ipcc-animals-science-environment/>

<https://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/Effects-on-Wildlife-and-Habitat.aspx>

Examples: Fauna and Flora affected by climate-change

- mountain yellow-tail frogs
- Panamanian golden frog
- golden frogs (and many other types of frogs)
- Pika
- Sea turtles: Green, leatherback, plus more
- Eastern Hemlock Forests
- tiger
- emperor penguins, adelic penguin (plus several other penguins)
- snow fox
- snowshoe hare
- puffins
- cod
- krill
- different types of whales
- different types of birds
- coral reefs
- shellfish/fish due to ocean acidification
- panda bears
- koalas
- mosquitoes
- nutrition of leafy greens
- increased temperatures in an environment/drought
- French wine grapes
- permafrost