FEBRUARY 2014

The Carbon TIMEs

A newsletter for members of the Carbon TIME environmental literacy project

In This Issue

Andy's Message

Hi Folks--

We're enjoying sharing the fruits of our--and your--labors these days. In addition to the NARST papers described in our article on page 2, Jennifer Doherty and I just completed another NSTA webinar, this one on the Disciplinary Core Idea "Ecosystems: Interactions, Energy, and Dynamics."

We showed the audience a neat little video of the *Carbon TIME* animated carbon fluxes for an ecosystem during the summer and winter. You can check out an archive of the NSTA webinar here: https://learningcenter.nsta.org/products/symposia_seminars/NGSS/webseminar36.aspx.

We also appreciate hearing from you as we revise the units, both through your written feedback and your interviews with Rose Shaw. Thanks for the help in improving the program!

--Andy

Good News

The Ecosystems Unit and Human Energy Systems Unit materials are now available to use on the National Geographic Website. These materials will continue to be available on the MSU zip files website as well (see links to the NGS and MSU sites on page 4). See page 3 for more details.

Congrats!

Congratulations to Tracy Landboe, Jess Moyer, and Cindy Jatul for being the first three Carbon TIME teachers to complete all of their data collection. Bravo, teachers!

Carbon TIME Researchers Prepare for Annual Conference: NARST

The members of the Carbon TIME research team are eagerly preparing their papers and presentations for the annual National Association for Research on Science Teaching (NARST) conference. The NARST conference takes place in Pittsburg, Pennsylvania from March 30-April 2. The team is preparing a four paper set that investigates interconnections among the three strands of scientific literacy identified in the NRC *Framework* and the *NGSS:* science practices, crosscutting concepts, and disciplinary core ideas. The papers report on the analysis of student data that many of you have sent to us over the last year(s).

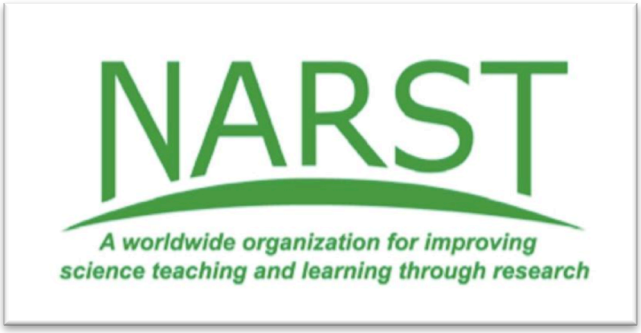


Photo Credit: facebook.com/pages/NARSTorg

Papers 1 and 2 are associated with teaching and learning that follows a general instructional model that joins students in both inquiry and application practices. Paper 1 focuses on the development of principle-based reasoning as a fundamental strategy for explaining common carbon-transforming processes such as photosynthesis, biosynthesis, and cellular respiration. Paper 2 explores the relationship between students' explanation practices with their arguments from evidence practices in both interviews and in classroom contexts. Papers 3 and 4 are focused on students' reasoning and understanding of complex carbon systems in the context of global climate change and agricultural systems. Paper 3 focuses on the development of students' inquiry practices in large-scale contexts including: global carbon cycling and climate change. Paper 4 focuses on students' reasoning about the sustainability of agricultural production systems, including how those systems rely on and affect carbon and nitrogen cycling. The paper titles and authors are listed below.

Paper 1: Learning trajectories of Principle-Oriented Level 3 and Fact-Oriented Level 3 science learners, by Hannah Miller, Allison Freed, Jennifer Doherty, Wendy Johnson, and Charles W. Anderson

Paper 2: Relationships between students' inquiry and application practices for carbon-transforming processes, by Allison Freed, Jenny Dauer, Wendy Johnson, Hannah Miller, and Charles W. Anderson

Paper 3: Connecting macroscopic-scale and large-scale inquiry practices, by Jenny Dauer, Allison Freed, and Charles W. Anderson

Paper 4: Students' ideas about sustainability for agricultural production systems, by Elizabeth Xeng de los Santos, Sarah Riggs Stapleton, and Charles W. Anderson

In addition to our paper set, Jennifer Doherty, Andy Anderson, both from the *Carbon TIME* and Karen Draney from the University of California-Berkley will conduct a pre-conference workshop called *Developing and Validating Learning-Progression-Based Written Assessments*. During the workshop, Jennifer, Andy, and Karen will assist participants in creating written assessment items that align with learning progressions. Participants will also get help with scoring written assessment items using a learning progressions scoring guide. Overall, the participants will use reliability, validity, and efficiency guidelines to evaluate student responses and learning progression frameworks.

By Allison Freed

Ecosystems and Human Energy Systems Unit Materials Available on the NGS Website

We are happy to announce that a first draft of the Ecosystems and Human Energy Systems Units are now on the NGS website! Here are a few reminders about these Units, in case you are interested in teaching them (there is still time!).

These two Units are our "large scale" Units, which means that instead of examining how matter and energy move through organisms (like plants, animals or decomposers), these Units examine how matter and energy cycle through large pools of carbon (like the biomass pool, fossil fuel pool, and the atmosphere pool).

We are in the process of revising the Three Questions for the large scale Units. Instead of the Location Question, the Carbon Question, and the Energy Question, we will turn our attention to the Pools Question, the Fluxes Question, and the Energy Question. These Three Questions are designed to help students think about how carbon and energy move through large pools of carbon, both in local ecosystems and also global carbon pools. Here is an overview of the Lessons in each of the two large scale Units (see a link on page 4):

The Ecosystems Unit

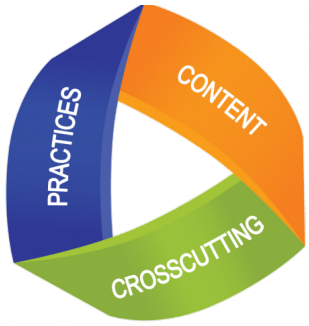
Lesson 1: Carbon in our Ecosystems
Lesson 2: Sunny Meadows Investigation
Lesson 3: Matter Cycles and Energy Flows
Lesson 4: Carbon Pools and Fluxes
Lesson 5: Ecosystems Applications

The Human Energy Systems Unit

Lesson 1: The Keeling Curve Introduction
Lesson 2: Fossil Fuels and Carbon Pools
Lesson 3: Consequences of our Lifestyles
Lesson 4: How Energy Use Creates Carbon Emissions
Lesson 5: Global Implications

NGSS Corner: Notes and News about the Standards

The Next Generation Science Standards (NGSS) are composed of three dimensions: Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts. The 3rd of these dimensions, the Crosscutting Concepts, are a list of seven concepts that are intended to bridge disciplinary boundaries between biology, chemistry, physics, and earth sciences. According to the *Framework for K-12 Science Education,* these concepts will hopefully "become common and familiar touchstones across disciplines and grade levels" (p. 83). We want to draw your attention to the fifth concept: Energy and matter.



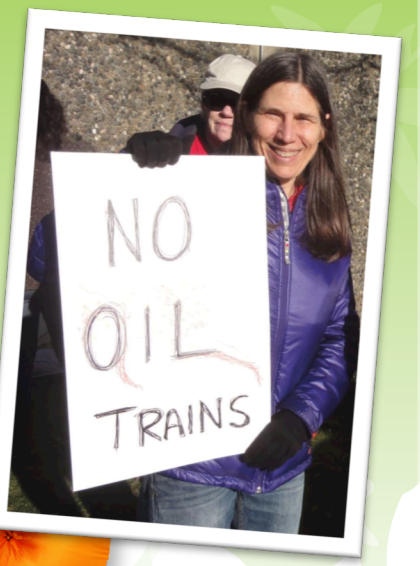
Credit: www.nextgenscience.org

2 Crosscutting Concepts

1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

The inquiry and application sequences in the *Carbon TIME* curriculum use energy and matter as organizing principles for science education, and one of the goals of the *Carbon TIME* curriculum is to help students understand flows, cycles, and conservation of energy and matter. If you are interested in learning more about this crosscutting concept in the NGSS, you can view an archived webinar from NSTA called ***NGSS Crosscutting Concepts: Energy and Matter—Flows, Cycles, and Conservation,*** lead by Andy Anderson and Joyce Parker (both from Michigan State University). You can view the 90 minute archived webinar at the NSTA website here: https://learningcenter.nsta.org/products/symposia_seminars/NGSS/webseminar23.aspx as well as download the presentation used during the webinar.

Spotlight on the science teacher



This month we'd like to highlight the first Carbon TIME teacher to complete data collection: Cindy Jatul! Cindy teaches biology biotechnology at Roosevelt High School in Washington state. Now that Cindy has finished teaching her Units, we asked her if she had any advice for other Carbon TIME teachers. *"I would recommend making the curriculum your own in terms of deciding how best to make the curriculum meet the needs of your students. I like my students to have more control over the design of experiments for example, so I modify the investigations to encourage more student involvement."* Environmental literacy is something Cindy feels is important, both as a teacher and as a citizen: *"I've been interested in environmental literacy for a long time stemming from my belief that students need to understand how the biological world works since we are a part of that world. With the impending climate crisis, citizen understanding of our impact on our ecosystem is even more imperative."* Cindy is a mother of two daughters, 11 and 13, and her partner is a Chinese translator. *"As a family we take advantage of the wonderful outdoor experiences available to us in the Pacific Northwest and are engaged in efforts to reduce reliance on fossil fuels and move to renewables and greater energy efficiency."*

Bravo, Cindy!

Links You Need

Testing Website and Dashboard: http://ibis-live.nrel.colostate.edu/MSP/home.php

- Give feedback
- Order Materials
- Shipping information

Group Spaces Workshops:
www.groupspaces.com/CarbonTIME

Find us on Facebook: Email Staci (sharpst5@msu.edu) to request to join our group.

Follow us on Twitter: @CarbonTIME

National Geographic Website (now with Ecosystems & HES):
http://education.nationalgeographic.com/education/msu/carobontime/staff/?ar_a=1

Videos on the National Geographic website:
http://education.nationalgeographic.com/preview/education/media/growing-plants/?ar_a=1

MSU Teaching Materials:
http://edr1.educ.msu.edu/environmentallit/publicsite/html/CarbonTIME1314_unit_zip_files.html

Carbon Comics