

Carbon TIME Professional Development Module 3

Professional Development Module 3 highlights key elements of other *Carbon TIME* units, outside of *Systems and Scale*. The table below illustrates how Module 3 contributes to each of the four [Carbon TIME Professional Development Course of Study](#) Goals.

Professional Development Module 3 Goals

	Carbon TIME Professional Development Course of Study Goals			
	Goal 1: Understanding Three-Dimensional Learning and Carbon TIME Curriculum	Goal 2: Preparing to Teach Carbon TIME Units	Goal 3: Learning from Classroom Experiences and Student Work	Goal 4: Creating and Sustaining Supportive Professional Communities
Module 3	Models key tools for assessing and scaffolding students' three-dimensional engagement with phenomena.	Models the use of key tools for other Carbon TIME units.	Identifies questions for teachers to ask themselves about indicators of students' success in other Carbon TIME units.	Provides an opportunity for teachers to work together as a supportive, professional community to plan and enact Carbon TIME units.

Module 3 Introduction and Overview



This module provides brief introductions to the other *Carbon TIME* units: *Animals*, *Plants*, *Decomposers*, *Ecosystems*, and *Human Energy Systems*. The focus of the sessions in this module is primarily on how each unit enacts the key parts of the Instructional Model and on the tools and resources included in the unit, in addition to supporting advance planning around materials and instructional decisions that teachers make before starting the unit.

Activities for Module 3, Preparing to Teach other Carbon TIME Units

One of the goals of this module is to support teachers in preparing to teach new *Carbon TIME* units after deep exploration and teaching of the foundational unit, *Systems and Scale*. The *Carbon TIME* website is designed to provide this support through unit-, lesson-, and activity-level teacher-facing information. This section briefly outlines these resources and their organization on the website. We recommend teachers spend time individually or together locating, reviewing, and discussing these resources.

Unit front matter is linked in its entirety as a PDF file from each Unit Home page. The same content is also easily viewable in sections by using each of the unit homepage tabs. These tabs are organized into steps involved in planning and preparing to teach a Carbon TIME unit, and are outlined below.

1. **Unit Home tab:** Review the brief unit introduction.
2. **Unit Overview tab:** Read the Unit Overview.
 - a. Unit Overviews are short (2-3 page) readings available for each unit that orient teachers to the Unit Driving Question, students' roles and science practices, using the Three (or Four) Questions to explain the unit's natural phenomena, and addressing how much detail is appropriate for meeting three-dimensional student performance goals.
3. **Unit Sequence tab:** Review the Unit Sequence and make teaching decisions.
 - a. *Carbon TIME* units are designed to support diverse learners and classrooms, and not all activities may be appropriate for your students. Review the Unit Sequence to make

- decisions about optional activities or lessons; orange text and the the word (Optional) in parentheses indicate decisions to make.
- b. Some units have repeating activities (marked with circular arrows ) , indicating these activities are available (and identical) in multiple units. You will likely want to omit these activities once students have completed them in one unit.
 - c. Some units have 2-turtle activities (marked with stacked turtles ) , which place a higher demand on students. The [Carbon TIME Turtle Trails Document](#) provides further information about choices for making units more or less demanding, depending on your students' needs.
4. **IM & Storyline tab:** Review the unit instructional model and storyline chart.
 - a. Each unit has a unit-specific version of the *Carbon TIME* Instructional Model, including key observations, patterns, and models addressed in the unit.
 - b. Each unit has a Unit Storyline Chart organized to easily view each Lesson (or related group of activities). This Chart provides a summary of the question addressed in that section of the unit, what students do, and what students figure out.
 5. **Unit Goals tab:** Review unit goals.
 - a. Each unit includes goals in two forms. First, there is a list of *Next Generation Science Standards* (NGSS) Performance Expectations addressed in the unit. Then, there is a table with the specific target performances for each activity.
 6. **Unit Materials tab:** Review resources you need to provide; resources provided through the *Carbon TIME* website; and recurring resources.
 - a. *Carbon TIME* units were designed to require materials that are easily purchased or already available in most schools. This [Materials to Purchase List](#) – linked in each unit and also available in the *Carbon TIME* Library General Resources section – compiles materials needed across all units.
 - b. For units using molecular modeling kits (*Animals, Decomposers, and Plants*), many kinds of kits will work. Our suggestions are available in the *Carbon TIME* Library Cross-Unit Teaching Tools section titled, "[Materials for molecular modeling](#)".
 7. **Students' Learning Progressions Readings:** available through the the Unit-Specific Resources section of the *Carbon TIME* Library
 - a. Students' Learning Progressions readings provide a unit-specific overview of the *Carbon TIME* learning progression research on which the curriculum is based. Learning progressions are descriptions of the informal and then successively more sophisticated (scientific) ways that students reason about phenomena.

Lesson-level teacher guides are also available in their entirety as a PDF file from each Lesson page. As with unit-level front matter, the same content is also easily viewable in sections by using the lesson-level tabs, outlined below.

1. **Lesson Overview tab:** Review the lesson-level introduction, guiding question, and activity list with timing, and locate the lesson in the unit's Instructional Model.
2. **Lesson Learning Goals tab:** Read the activity-specific student target performances for each activity in the lesson, as well as the NGSS Performance Expectations addressed.
3. **Lesson Background Information tab:** Read background information on how the lesson supports students' progress toward achieving three-dimensional performances described in *Carbon TIME* learning progression research, as well as the key ideas and pactices addressed in each activity.
4. **Lesson Talk & Writing tab:** Talk and Writing tables provide specific talk and writing goals as well as strategies teachers can use in talk and writing to support these goals. Talk and writing goals differ across the unit, so the lesson-level tables provide suggestions specific to that part of the unit. Talk and writing prompts are also available in the notes section of each Activity PowerPoint. The [Talk and Writing Educator Resource](#) provides additional information.

Activity-level information is located after the lesson-level information in the Lesson teacher guides. This information is also easily viewable in sections by using the activity-level tabs, outlined below.

1. **Overview and Prep tab:** Review the target student performance for the activity.
 - a. Review a list of resources teachers need to provide; resources provided through the website (worksheets, assessing/grading documents, and other student-facing electronic or print-based materials); and recurring resources that are used across multiple activities or lessons in the unit.
 - b. Review the brief setup information.
2. **Directions tab:** Activity directions are outlined in a step-by-step fashion coordinating with slides in the Activity PowerPoint.
 - a. Directions are written with brevity and clarity in mind; realize that *Carbon TIME* is designed as a toolkit (not a script).
 - b. Directions are also copied into the notes section of each Activity PowerPoint.
3. **Assessment tab:** Review suggestions for listening and making sense of students' ideas, including links to relevant assessment and grading documents. Tips here focus on supporting student ideas, as well as helpful notes for classroom engagement.
4. **Differentiation and Extending the Learning tab:** When available, this tab provides ideas for differentiation, for managing materials across multiple sections of the same course, for modifying lessons to meet the needs of specific groups of learners, as well as suggestions and links for extending learning for interested students and classes.

Activities for Module 3, Session 1: Animals and Decomposers

The *Animals* and *Decomposers* units follow the same path through the Instructional Model. They both focus on the same processes: cellular respiration, digestion, and biosynthesis; the notable difference is that digestion occurs outside the body of decomposers.

In this module, participants dig deeply into explanation practices at the end of the units, during which students are asked to integrate and explain carbon-transforming processes in organisms.

1. Use a [Teacher Target Performance Tool](#) to engage teachers in a reflective discussion of the unit, including activity chunks; student target performances; assessing tools and strategies; and scaffolding tools and strategies.
2. Choose one of the **Carbon TIME Big Idea Probes** to engage teachers as learners: the *Animals* unit [Big Idea Probe: What Happens to the Fat?](#) or the *Decomposers* unit [Big Idea Probe: Leaf Pack Experiment](#).
 - a. See the [Using Big Idea Probes Educator Resource](#) for support in engaging teachers as learners.
 - i. *Carbon TIME* Big Idea Probes are formative assessment tools designed to be used multiple times across a unit to stimulate student-to-student discussion about specific scientific and informal ideas related to a real world question.
3. Choose one of the **Carbon TIME Lesson 6 Functions of All Organisms activities** to engage teachers as learners: *Animals* Activity 6.3: Functions of All Animals or *Decomposers* Activity 6.4: Functions of All Decomposers.
 - a. Engage in a complete [Discourse Routine](#) around the Activity worksheet.
 - b. Use either the [Animals Activity 6.3: Functions of All Animals Worksheet](#) or the [Decomposers Activity 6.4: Functions of All Decomposers Worksheet](#).
 - c. As you engage teachers (or your colleagues) in these activities, we suggest using the teacher-facing directions available in the Activity-level "Directions" tabs ([Animals](#)

- [Activity 6.3](#) or [Decomposers Activity 6.4](#)) to guide you as a facilitator of learners. The directions are also copied into the notes section of each Activity PowerPoint.
- d. Use the Grading documents through the *Carbon TIME* [Assessment site](#) for support and discussion around goal student responses.
4. **Choose one of the *Carbon TIME* Lesson 6 Comparing activities** to engage teachers as learners: *Animals* Activity 6.2: Comparing Animals and Flames or *Decomposers* Activity 6.3: Comparing Decomposers, Plants, and Animals.
 - a. Use either the [Animals Activity 6.2: Comparing Animals and Flames Worksheet](#) or the [Decomposers Activity 6.3: Comparing Decomposers, Plants, and Animals Worksheet](#).
 - b. As you engage teachers (or your colleagues) in these activities, we suggest using the teacher-facing directions available in the Activity-level “Directions” tabs ([Animals Activity 6.2](#) or [Decomposers Activity 6.3](#)) to guide you as a facilitator of learners. The directions are also copied into the notes section of each Activity PowerPoint.
 - c. Use the Grading documents through the *Carbon TIME* [Assessment site](#) for support and discussion around goal student responses.
 5. **Return to the *Carbon TIME* Big Idea Probe.**
 - a. Engage in a discussion of how participants’ ideas have changed over the session, and how student ideas may change over the course of the unit.
 - b. Use the Assessing the Big Idea Probe documents in the *Carbon TIME* [Assessment site](#) for support and discussion around common student responses.
 6. Note that similar lessons exist in the *Plants* unit Lesson 6: [Plants Activity 6.3: Comparing Plants and Animals](#) and [Plants Activity 6.2: Functions of All Plants](#).

Activities for Module 3, Session 2: Plants

The *Plants* unit includes two investigations of plants and involves three carbon-transforming processes: photosynthesis, cellular respiration, and biosynthesis.

In this module, participants dig deeply into inquiry practices, focusing on planning for investigations, identifying important patterns in data, and developing evidence-based arguments. These experiences are best when teachers engage as learners with the actual investigation materials (growing plants), which means preparing for this professional learning experience (as well as planning ahead for students) by planting seeds **about 4 weeks before** they are needed.

1. Use a [Teacher Target Performance Tool](#) to engage teachers in a reflective discussion of the unit, including activity chunks; student target performances; assessing tools and strategies; and scaffolding tools and strategies.
2. **About 4 weeks in advance:** Review the [Plants Pre-Lesson – Investigation Setup](#) – and prepare plants for future professional learning experiences.
 - a. There are two recommended protocols – paper towel (abbreviated PT) as the substrate, the 1-turtle recommendation; or gel (abbreviated GL) as the substrate, the 2-turtle (more advanced) investigation setup.
 - b. Use the Pre-Lesson and Pre-Activity teacher’s guides (0.1GL; 0.2GL; 02.PT) to prepare materials in advance or – more ideally – to engage teachers as learners.
3. Use **Plants Lesson 3: Investigating Plants**: As you engage teachers (or your colleagues) in the activities in this lesson, we suggest using the teacher-facing directions and background information available in the Lesson-level tabs ([Plants Lesson 3](#)) as well as the Activity-level “Directions” tabs to guide you as a facilitator of learners. The directions are also copied into the notes section of each Activity PowerPoint.
 - a. Use [Plants Activity 3.1: Predictions and Planning about Radish Plants Growing](#).
 - b. Use *Plants* Activity [3.2PT](#) or [3.2GL](#) (or both): Observing Plants’ Mass Changes, Part 1.
 - c. Use [Plants Activity 3.3: Observing Plants in the Light and Dark](#).
 - d. Use *Plants* Activity [3.4PT](#) or [3.4GL](#) (or both): Observing Plants’ Mass Changes, Part 2.

- e. Use [Plants Activity 3.5: Evidence-Based Arguments about Plants](#).
 - i. Be sure to engage in a complete [Discourse Routine](#) around the Evidence-Based Arguments Tool.
 - f. Use the Assessing and Grading documents through the *Carbon TIME* [Assessment site](#) for support and discussion around goal student responses
4. Use **Plants Activity 6.1: Explaining Other Examples of Plants Growing, Moving, and Functioning** to engage teachers as learners.
- a. This activity provides three readings with coordinating worksheets focusing on how other plants – Lodgepole pine, Smooth cordgrass, and Prickly Pear Cactus – grow, move and function. These examples include an Investigating section (part A. on the worksheets) that provides additional practice around investigation design, patterns in data, and evidence-based conclusions.
 - b. As you engage teachers (or your colleagues) in these activities, we suggest using the teacher-facing directions available in the Activity-level “Directions” tabs ([Plants Activity 6.1](#)) to guide you as a facilitator of learners. The directions are also copied into the notes section of each Activity PowerPoint.
 - c. Use the Grading documents through the *Carbon TIME* [Assessment site](#) for support and discussion around goal student responses.

Activities for Module 3, Session 3: Ecosystems & Human Energy Systems

1. Use a [Teacher Target Performance Tool](#) to engage teachers in a reflective discussion of the unit, including activity chunks; student target performances; assessing tools and strategies; and scaffolding tools and strategies.
2. **Choose one of the *Carbon TIME* Big Idea Probes** to engage teachers as learners: the *Ecosystems* unit [Big Idea Probe: Wolves and Deer](#) or the *Human Energy Systems* unit [Big Idea Probe: What Would Happen if We Cut Fossil Fuel Use in Half?](#)
 - a. See the [Using Big Idea Probes Educator Resource](#) for support in engaging teachers as learners.
3. **Read, review and discuss teacher-facing materials in preparation to teach the units.** Few teachers have experiences teaching carbon pool and flux models or using large-scale systems-thinking to trace matter and energy in an effort to explain natural phenomena.
 - a. Students’ Learning Progression Readings: available through the the [Unit-Specific Resources section](#) of the *Carbon TIME* Library
 - b. Unit Front Matter: available through the unit homepage tabs, or downloadable as a PDF file.
 - c. Lesson-level front matter: available through the lesson-level tabs, or downloadable as a PDF file.
 - d. Other suggestions in the Module 3 section above, “Preparing to Teach other Carbon TIME Units,” may also be helpful.
4. **Return to the *Carbon TIME* Big Idea Probe.**
 - a. Engage in a discussion of how participants’ ideas have changed over the session, and how student ideas may change over the course of the unit.
 - b. Use the Assessing the Big Idea Probe documents in the *Carbon TIME* [Assessment site](#) for support and discussion around common student responses.

Returning to Module 1

As described in the [Carbon TIME Professional Development Module 1](#), we recommend regularly revisiting the PD Course of Study’s Driving Question: *How do I support my students in three-dimensional engagement with natural phenomena, in order for them to achieve environmental science literacy?*

- Have teachers review and update their ideas and questions.
- See the [Using a Driving Question Board Educator Resource](#) for support.

Additionally, using or revisiting suggestions listed in [Carbon TIME Professional Development Module 1](#), “Activities for Teachers’ Foundational Knowledge about *Carbon TIME* website and unit design” may be helpful.