# EQuIP Rubric for Science Unit
# Peer Review Panel Feedback

**Overall Rating:**

**E/I**

Example of high-quality NGSS design if improved

**Unit Name:** Disruptions in Ecosystems
**Grade Level:** 6, 7, 8

## Category I. NGSS 3D Design

| Unit Criteria | None | Inadequate | Adequate | Extensive |
|---|---|---|---|---|
| A. Explaining Phenomena/Designing Solutions: Making sense of phenomena and/or designing solutions to a problem drive student learning. | | | X | |
| B. Three Dimensions: Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) *that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions*. | | | | X |
| i. *Provides opportunities to develop and use specific elements of the SEP(s).* | | | | *X* |
| ii. *Provides opportunities to develop and use specific elements of the DCI(s).* | | | | *X* |
| iii. *Provides opportunities to develop and use specific elements of the CCC(s).* | | | | *X* |
| C. Integrating the Three Dimensions: Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs. | | | X | |
| D. Unit Coherence: Lessons fit together to target a set of performance expectations. | | | X | |
| E. Multiple Science Domains: *When appropriate*, links are made across the science domains of life science, physical science and Earth and space science. | | | | X |
| F. Math and ELA: Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects. | | | X | |

## Category I Rating: 2

At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C

### Criterion A.

**Specific evidence from materials and review team consensus reasoning:**

Student Questions and Prior Experiences:

- Activity 1.1 Engage - Teacher questions students about their prior knowledge of living and nonliving parts of their local environment before being presented the chapter phenomenon of wolves in Yellowstone video.
- Activity 2.1 Engage - Students observe a bag of compostable plant material for several days as the chapter phenomenon as well as continued focus on a disruption in the Yellowstone ecosystem.
- Activity 3.1 Engage - Students read a story about a girl who is shopping for fish. She noticed that the fish have different colored labels and wondered what that means.
- Activity 4.1 Engage - Students watch a video on the invasive zebra mussel.
- Activity 5.1 Engage - Students examine a fictitious scenario of an insect infestation at a farm. "This chapter engages students with a phenomenon that is woven throughout this unit, that of humans using more and more resources which causes environmental problems and thus creates the need for the development of solutions." 5.1 In the KWL, the W develops student questions related to the chapter 5 phenomena.

The above evidence is what it seems the writers intend as the phenomena for each chapter in the unit. The phenomena as identified above, are not clearly identified in the teacher's guide and it is unclear how student questions are explicitly used to propel instruction outside of the use of KWLs.

Lesson Focus:

- Chapter 1: All of the activities in Chapter 1 provide information for students to answer the question of whether or not wolves should be introduced into an environment to control the deer population.
- Chapter 2: Students continue to model ecosystems and explore the changes that would occur in an ecosystem if a disruption occurs.
- Chapter 3: Students explore aquatic ecosystems and specifically look at the effect humans have on the health of ecosystems that provide fish for consumption.
- Chapter 4: Students again explore an aquatic ecosystem, but look at the effect of an invasive species on the ecosystem
- Chapter 5: Students design solutions to several disruptions to ecosystems as a culminating activity.

Each lesson centers around a driving question, but it may or may not be directly related to phenomena that students have experienced.

Engineering as a Learning Focus:
Lesson 5.5 asks students to design a solution to a coral reef problem. In addition to being an engineering problem, students also need to use aspects of LS2 in considering biodiversity and the flow of energy/matter through the ecosystem. Additionally, students consider ESS3.C regarding the positive and negative effects of human impact in the situation. Engineering is appropriately integrated with the life science DCIs in Chapter 5.

**Suggestions for improvement:**

Consider clearly identifying the phenomena for each chapter and the anticipated student questions that would be generated as a result of the phenomena. Provide guidance to teachers on how to use those student-generated questions to drive instruction.

Consider selecting an overall anchoring phenomenon to be used throughout the unit for overall sense-making and unit cohesiveness.

If the final lesson of each chapter was used as the frame for that chapter, being introduced at the beginning and serving as the impetus for the necessary learning in the other lessons, it might make the unit more explicitly phenomena-based. For example, if chapter 1 started with a phenomenon centered on the question "Should wolves be reintroduced to the Northeast?" The rest of the chapter would then hinge on students needing to figure out food webs and they would need to know what happened with the wolves in Yellowstone.

**Criterion B.**

**Specific evidence from materials and review team consensus reasoning:**

Science and Engineering Practices:
Activity 1.2 Explore (Teacher' Guide, p. 32): "Introduce the scientific practice of developing and using models. Explain that a scientific model is a representation that can be used to explain and predict what happens in the natural world. This part of the activity is an example of the predictive value of a model."

- Develop and/or use a model to predict and/or describe phenomena.

Activity 2.6 Elaborate: Students create a 2- or 3-D model of the movement of matter and energy in a local ecosystem.

- Develop and/or use a model to predict and/or describe phenomena.

- Develop a model to describe unobservable mechanisms.

Activity 3.5 Evaluate: Students analyze and interpret data about the nitrogen run-off, dead zone size, and oyster harvests to develop an argument about the effect of the human population on the Chesapeake Bay Oysters.

- Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Activity 5.4 and 5.5: Students are presented with a disruption to an ecosystem and are tasked with developing a solution to the problem.

- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

Disciplinary Core Ideas:

- In activity 1.3, students develop a model of energy flow and matter cycling in Yellowstone. This addresses LS2.B: "Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers. . ."
- In activity 2.2, students analyze the effects of ecosystem disruptions on a food web. This highlights LS2.C: "Ecosystems are dynamic in nature. . . Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations."
- In activity 3.3, students analyze the effects of humans on fish populations. This leads to an understanding of ESS3.C: "Typically as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise." They continue to address this as they look at fishing regulations.
- In activity 5.4, students systematically evaluate design solutions. This addresses ETS1.B: "There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem."

Crosscutting Concepts:

Activity 1.2 Explore (Teacher's Guide, p. 32): "Analysis questions 2 and 4 can be used to introduce the crosscutting concept of patterns and cause and effect. Patterns, such as those observed in the predator-prey interactions of organisms, can be used to identify cause-and-effect relationships. These cause-and-effect relationships can then be used to predict outcomes of an event, such as a change in organisms in an environment."

- Graphs, charts, and images can be used to identify patterns in data.

"Explain that the patterns and cause and effect are two examples of Crosscutting Concepts. Point out that Crosscutting Concepts are concepts that are found across all disciplines of science and engineering. Explain that they can be a lens or touchstone through which students make sense of phenomena and deepen their understanding of disciplinary core ideas."

- Patterns can be used to identify cause and effect relationships.

Activity 4.1 Engage (Teacher's Guide, p. 221): "The crosscutting concept of stability and change is helpful for thinking about the phenomena described in this activity, particularly in Analysis 2. Students will likely suggest that the zebra mussel and the Hudson is an example of stability and change because the ecosystem was stable, but with the introduction of the zebra mussel it may be changing."

- Small changes in one part of a system might cause large changes in another part.

In Lesson 5.2 AQ, Students are asked in question 2: Describe an example of a cause and effect relationship that occurred during the game.

- Q2 is bullet point 2 from the K-2 CC Cause and effect statement "events have causes that generate observable patterns."

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| | Lesson 5.2 Question 3: Describe any patterns that you saw in the way that the environmental, economic, and social points changed.<br>• Patterns can be used to identify cause and effect relationships. |
| | **Suggestions for improvement:** |
| **Criterion C.** | **Specific evidence from materials and review team consensus reasoning:**<br>In Chapter 1: Lesson 1.6, students apply the DCI of LS2.A with the idea of the reintroduction of a predator into an ecosystem to apply impact on ecosystem. Students must look through the lens of patterns when examining the data in order to construct their explanation. The three dimensions are integrated during student sense-making of the phenomena.<br><br>In Chapter 2: Lesson 2.3, students create an ecosystem model and then use an explanation tool to explain where plants get the matter they need to grow. Students address LS2.B while tracking the transfer of energy in the ecosystem using a model. All 3 dimensions are integrated in this lesson.<br><br>In Chapter 5: Lesson 5.2, during the follow-up, students revisit the guiding question: “how difficult was it to balance the needs of humans with protecting the environment?” The teacher is instructed to use the language of both the DCI ESS3.C and the CCCs of stability and change and cause and effect while facilitating the discussion. The students then look at AQ 4: Explain how an event in one area could affect another area. Students can apply their understanding of the CCCs stability and change and cause and effect in connection with ESS3.C. Though this is explicitly only an integration of 2 of the dimensions, students must use the science and engineering practice of engaging in argument from evidence to articulate their thoughts. Calling out the use of this practice would document the use of a 3-dimensional sense-making approach.<br><br>In addition, shaded assessment boxes located in the teacher’s guide provide guidance on assessing and guiding student performances in all 3 dimensions.<br><br>In every lesson, at least 2 of the 3 dimensions are evident and integrated seamlessly. The lessons explicitly containing only 2 dimensions, have the third dimension implied. |
| | **Suggestions for improvement:**<br>This category could easily be rated as extensive by examining each chapter to explicitly identify which student sense-making incorporates a crosscutting concept, science and engineering practice, and disciplinary core idea to ensure that 3-Dimensional learning is evident in all lessons. |
| **Criterion D.** | **Specific evidence from materials and review team consensus reasoning:**<br>Builds on Prior Learning:<br>The Food Web model used in Chapter 1 is revised in Chapter 2 with additional organisms and movement of matter and energy. In Chapters 3 and 4, students examine aquatic ecosystems and in chapter 4, the topic of invasive species is introduced. In Chapter 5, students use their combined knowledge from the previous chapters to design a solution to a specific ecosystem disruption.<br><br>The unit explores ecosystems and disruptions to ecosystems. The chapters seem to stand alone, rather than build or connect seamlessly. Various lessons and chapters connect to ideas from previous lessons, but one chapter could be explored in isolation from the others. |

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| | Students create their own questions in several KWL charts throughout the unit, but it is unclear how student questions are used to build on the next lesson.<br><br>Helps Students Develop Toward Proficiency:<br>Each chapter identifies the PEs targeted in the sequence of the lessons. The chapter overview, 5E's chart, and assessment overview clearly articulate the student progression toward demonstrating the performance expectation. |
| | **Suggestions for improvement:**<br>An overarching, anchoring phenomena that is used in all chapters could strengthen the unit coherence, as well as emphasizing connecting what students figured out across lessons. |
| **Criterion E.** | **Specific evidence from materials and review team consensus reasoning:**<br>Disciplinary Core Ideas from Different Disciplines:<br>Chapter 2 uses DCIs from Life Science (2.PS.1B), Earth/Space Science (ESS2.A) and Physical Science (PS1.B) together for students to create a final scientific explanation. Chapter 3 uses DCIs from Life Science (LS2.A) and Earth/Space Science (ESS3.C.2) to investigate human impact on aquatic ecosystems. Chapter 5 uses DCIs from Life Science (LS2.C, LS2.D), Earth/Space Science (ESS3.C) and Engineering (ETS1.B). Appropriate DCIs are combined throughout this unit to make sense of the phenomena and guiding chapter questions. The connections are natural and authentic.<br><br>Crosscutting Concepts Used to Make Sense of Phenomena:<br>In the Teacher's guide, each activity starts with a Rationale and NGSS Integration section. This section explicitly describes how to use the CCCs to make sense of the phenomena/lesson focus question. The crosscutting concepts deepen meaning and authenticity of both the DCI and SEPs The Rationale section provides very clear guidance to use the CCCs across the appropriate science domains. |
| | **Suggestions for improvement:** |
| **Criterion F.** | **Specific evidence from materials and review team consensus reasoning:**<br>Activity 1.3 Explain (Teacher's Guide, p. 43): "There are numerous opportunities in this activity in which to assess ELA CCSS SL8.1, specifically Steps 1, 2, 3, and 5." Students use the DART strategy to define and provide examples of interactions between organisms.<br><br>Activity 1.6 Evaluate (Teacher's Guide, p. 77): "This activity provides several opportunities to assess multiple ELA Common Core State Standards, including RST.6-8.1, WHST.6-8.2, WHST.6-8.9, and SL.8.1. Use the assessment chart to locate the steps which are the best opportunities for assessment of these standards before choosing which ELA standard(s) to assess."<br><br>Each Chapter overview in the Teacher's guide clearly identifies the intended CC math and CC ELA standards addressed in each chapter. |
| | **Suggestions for improvement:**<br>Consider adding more explicit directions in the Teacher's Guide for assessing math and ELA standards. This is evident in Chapter 1, but not in the following chapters. It might be helpful to shade/color the ELA/math connections in the Teacher's guide to emphasize the rich connections already evident. |

## Category II. NGSS Instructional Supports:

| | | None | Inadequate | Adequate | Extensive |
|---|---|---|---|---|---|
| Unit Criteria | A. **Relevance and Authenticity**: Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world. | | | X | |
| | B. **Student Ideas:** Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate. | | | X | |
| | C. **Building Progressions**: Identifies and builds on students' prior learning in all three dimensions, including providing support to teachers. | | X | | |
| | D. **Scientific Accuracy**: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning. | | | | X |
| | E. **Differentiated Instruction**: Provides guidance for teachers to support differentiated instruction. | | | X | |
| | F. **Teacher Support for Unit Coherence:** Supports teachers in facilitating coherent student learning experiences over time. | | | X | |
| | G. **Scaffolded differentiation over time:** Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems. | | | | X |

(Evidence of Quality?)

## Category II Rating: **2** Adequate evidence for at least three criteria in the category

**Criterion A.**

**Specific evidence from materials and review team consensus reasoning:**

Directly Experience Phenomena:

- Activity 1.1 Engage: Students watch a video of wolf reintroduction to Yellowstone National Park as the chapter phenomenon.
- Activity 2.1 Engage: The teacher creates a compost bag for students to make observations of for the duration of the chapter.

Each activity uses video clips for students to experience the phenomena.

Connect Instruction to Students' Home:

- Activity 1.1 - Engage: "Students begin by discussing a familiar local environment."
- Activity 2.6 Evaluate (Teacher's Guide, p. 155): "You might also consider taking the class outside to take pictures of common organisms that the students can use in their models."
- Activity 4.2 Explore (Teacher's Guide, p. 231): "Discuss the definition of dynamic ecosystem and have students suggest other examples, such as Yellowstone or a local ecosystem they are familiar with, and why they think those ecosystems are dynamic."

Opportunities for Students to Connect their Explanation to Own Experiences:
Students design solutions and figure out phenomena as provided by the teacher with the common experience of watching a video clip, but not as directly connected to their own experience. In 4.2, students do develop questions that they investigate in 4.3, but these are still related to the Hudson River ecosystem which may not be of particular interest to students and may not be relevant to their own experiences.

By viewing various video clips of ecosystems, students are presented with a relevant and authentic learning experience. It would be difficult to include ecosystems that are representative of every possible classroom. The approach of using multiple ecosystems across the world, provides entry points for a wide variety of student experiences.

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**Suggestions for improvement:**

Activity 2.1: Each set of students could create their own compost bag for a firsthand experience.

Is there a way to provide some extensions that are specific to the location of the student? Text could provide some regional examples that teachers could adjust/supplement to meet their specific needs. Could you provide suggestions for teachers to contact their local Department of Fish and Wildlife to determine what problems exist locally with the wildlife populations? Students could use food webs and energy pyramids to determine what might be causing those problems.

The following links are no longer live or available:

- Chapter 1: Lesson 1.3: Competition: Grizzlies and Wolves Compete
- Chapter 5.1: Lesson 5.1: Animal Planet video clip on cane toads.

Consider alternative clips or what to do in the future should video resources be taken down. Because videos are the entry way for most of the lessons it is imperative that all links are live and available. The provided hints for downloading or how to use the other sources were very helpful.
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<tr><td rowspan="2">**Criterion B.**</td><td>

**Specific evidence from materials and review team consensus reasoning:**

Opportunities abound for students to express, clarify, justify, interpret, and represent their ideas. Teacher feedback, using the provided scoring tools, is easily provided. The unit could include more opportunities for students to give each other feedback.

- Chapter 1.1 KWL Chart allows students to express prior knowledge, ask questions, and interpret their learning.
- Activity 1.3 Explain: Students watch 3 videos and create definitions for types of interactions. After, they read passages and revise their definitions and create additional examples. This activity is completed using a graphic organizer.
- Activity 1.4 Explain: “Compare your prediction to the ecological model of predator-prey interactions. If your ideas changed, explain how they changed. If your ideas stayed the same, explain what you understand about predator-prey relationships.”
- Activity 2.3 Explain: Students complete an anticipation guide. The guide allows students to initially express their ideas, and then after reading, clarify and refine their thinking.
- Activity 2.5 Elaborate: Students are given 4 different models for the flow of energy in an ecosystem. They must make an initial decision for which model is the correct model. Then students read a series of scientific findings and clarify their initial decision. The class then holds a discussion to represent their ideas and eventually come to a consensus.
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**Suggestions for improvement:**

Provide more opportunities for students to give one another formal feedback. Perhaps peer editing of scientific explanations and arguments. Provide some guidance on productive group talk at the beginning of the first lesson, other than the Group Work More Information. This will help the teacher frame discussions so that students are talking to each other (asking for and offering clarification and evidence). The teacher could take time to have students compare their answers to the rubrics provided and give them opportunities to revise.
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<tr><td>**Criterion C.**</td><td>

**Specific evidence from materials and review team consensus reasoning:**

Identifying Prior Student Learning Expected:
Lessons x.1 seek to elicit student prior understanding of the phenomenon/DCI components in the chapter. However, there are no other places that address expected prior learning in the other two dimensions.
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Explaining how the Prior Learning will be Built:
Each Activity begins with a Rationale and NGSS section. In this section, the connections to prior activities are made explicit. For example, (Teacher’s Guide, p. 130): “This Explain activity builds on students’ prior learning about the cycling of matter among the biotic and abiotic components in ecosystems, and formally builds the concept of energy flow in ecosystems. This activity introduces representations that can be used to model energy flow into, through, and out of an ecosystem, between living and nonliving parts of the ecosystem. Students formalize their understanding of the crosscutting concept of the cycling of matter and the flow of energy.”

While there is evidence of a progression of learning for the DCIs, the progression of learning about the CCC and SEPs is not clearly evident.

**Suggestions for improvement:**

If the Rationale and NGSS Integration section were taken one step further where it identifies expected levels of prior learning and explains how that prior learning would be build upon, this could easily move to adequate.

Consider calling out specific elements of the SEPs or CCCs that students need to already be proficient in to succeed in the chapter/lesson.

**Criterion D.**

**Specific evidence from materials and review team consensus reasoning:**

All science information is accurate and grade level appropriate based on the DCIs used in this unit.

**Suggestions for improvement:**

**Criterion E.**

**Specific evidence from materials and review team consensus reasoning:**

Appropriate Reading, Writing, Listening, and/or Speaking Alternatives:

- Activity 1.1 Engage (Teacher’s Guide, p. 16): “Note that the language used in the segment may be challenging for some learners, and it may be helpful to review some of these terms prior to viewing the segment.”
- Activity 1.1 Engage (Teacher’s Guide, p. 16): “Discussing the roots of some of these words may help students to understand and remember these terms and may also help them recognize other words they may encounter. Some of these roots are the same as or similar to the equivalents in Spanish, which may be especially helpful for students whose native language is Spanish.”
- Activity 1.1 Engage (Teacher’s Guide, p. 24): Teacher’s guide provides suggestions for adjustment to instruction for English Language Learners.
- Activity 1.1 Engage (Teacher’s Guide, p. 18): Creation of a word wall to assist with vocabulary acquisition.
- Activity 1.2 Explore (Teacher’s Guide, p. 30): “Note that the suffix —vore is Latin for “devour” and is used to indicate what type of diet an animal has. The root “carni-” means meat, “herbi-” refers to plants, and “omni-” means all. Some of these roots sound similar to the equivalents in Spanish.”
- Activity 2.3 Explain (Teacher’s Guide, p. 119): “If this is too difficult for students, or if you have a significant number of students who struggle with English, you can instead provide some or all of the sample captions to get students started. Students could match some or all of the sample captions to the diagrams, rather than writing their own captions. “
- Activity 4.1 Engage (Teacher’s Guide, p. 220): “Model the strategy for the students using the first paragraph and/or the map from the reading. As you read aloud, stop periodically and tell the students what you are thinking as you read. Write your thoughts on the reading, using a document camera or other system to show students what you are doing. For

example, while modeling looking at the map you might note the thought “Lake Ontario and Lake Erie both border New York.” This strategy makes transparent for students the thoughts going through their heads as they read, which is particularly important for struggling readers.”

Extra Support:

- Activity 1.2 Explore (Teacher’s Guide, p. 31): Extra Support - “If they are unable to begin Step 5, refer to the Yellowstone food web begun by the class or the food web on the first page of the activity and demonstrate how to begin drawing part of the web with one or more plants at the bottom of the web.”
- Activity 1.3 Explain (Teacher’s Guide, p. 43): “Review examples from the reading. If students are having difficulty understanding any of the interactions, brainstorm additional examples in a familiar ecosystem (either a local one, such as a forest, or one that has been studied often, such as the African savannah).”
- Activity 1.4 Explain (Teacher’s Guide, p. 60): “You are likely to have a few students who are able to work independently to analyze provided graphs and to create their own graphs. However, most will need support. Begin by providing as much support as needed, and then fade support over time. Because it is difficult for students to determine appropriate numbering scales for axes, these are generally provided or started on the handouts in this activity.”
- Activity 2.2 Explore (Teacher’s Guide, p. 105): “If your students are having difficulty describing the cards and order, you might wish to copy, cut apart, and provide the simple captions on the optional Forest Change Descriptions Captions. You can provide a few of the captions to get them started, or have them match all of the captions to the cards if they are struggling. The captions are provided in the handout section for this activity.”
- Activity 3.3 Explain (Teacher’s Guide, p. 187): “Depending on their level of comfort with analyzing line graphs, students may need support to analyze the data. Remind students to look for patterns in the data, to look at when the line changes direction, and if it goes up, down, or stays relatively flat. You may also want to point out that while the x-axes (year) are all the same, the y-axes (total catch) have different scales.”
- Activity 3.4 Elaborate (Teacher’s Guide, p. 197): “Note that for Analysis question 3, students may need some scaffolding to construct their answers. You may wish to draw a template on the board for students, with four numbered panels.”

Extensions:
Not Evident.

This unit provides extensive guidance on differentiated instruction for every learner group except gifted learners. Typically, not addressing one of the sub-bullets of a criterion would drop a rating to “inadequate,” but the quality of the support for the other bullets was such that an exception was made.

**Suggestions for improvement:**

By including additional extensions for students above grade level this category could easily be marked extensive. The supports for students requiring extra support are thoughtful, relevant, and ready to use.

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| **Criterion F.** | **Specific evidence from materials and review team consensus reasoning:**<br><br>Strategies for Linking Student Engagement Across Lessons:<br>The chapters in this unit are all related, and their ideas build upon each other. However, there is only one pair of chapters where questions developed by students at the end of one chapter are directly used in the next chapter. The unit "feels" very teacher driven as opposed to being student and phenomena driven. Many Engage (x.1) lessons provide an opportunity for developing KWL charts. However, there is little instruction for the teacher in using these charts to guide the flow of the unit or to influence student learning. (e.g. pages 219-221 in chapter 4).<br><br>Strategies for Ensuring Student Sense-Making:<br>While CCCs are included, in many instances, their use is not explicit in the sense-making process. The scoring guide for chapter 2 assessment does require students to include information about the cycling of matter and the flow of energy. The other chapter assessment scoring guides lack explicit reference to crosscutting concepts. Without this explicit reference, it is possible for the students to engage in 2-dimensional sense-making without reference to the CCCs.<br><br>Lacking an overarching anchoring phenomenon makes it difficult for ultimate unit coherence. Individually, each chapter has strong connections and teacher support for connecting back to the guiding questions. Connections between chapters are not as well developed in the Teacher's Guide. |
| | **Suggestions for improvement:**<br><br>Creating a guiding document for the entire unit (ex. unit map) that explicitly provides strategies for teachers to highlight connections for students from chapter to chapter would support teachers in facilitating unit coherence.<br><br>By tweaking the scoring guides for the chapter assessments, the expectation that sense-making should be 3-dimensional can be clearly indicated. |
| **Criterion G.** | **Specific evidence from materials and review team consensus reasoning:**<br><br>• Activity 3.4 Elaborate (Teacher's Guide, p. 196): Depending on the class, you may wish to encourage students to try constructing their explanations without the scaffolding of the Explanation Tool, or to give individual students that option.<br>• Activity 3.5 Evaluate (Teacher's Guide, p. 206): "As this is an Evaluate activity, students should construct their arguments independently, not in pairs or groups. Their arguments can also be used to assess the performance expectation 'Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations in an ecosystem' and 'Construct an argument supported by evidence for how increases in human population...impact Earth's systems.'"<br>• Activity 5.2 Explore (Teacher's Guide, p. 288): The teacher facilitates a conversation using the DCI and CCC to support students developing ideas that will be used in subsequent lessons. This type of scaffolded discussion sets students up for sense-making success.<br><br>Students begin the unit investigating disruptions to ecosystems. By the end of the unit, they are able to evaluate disruptions and design solutions to minimize the disruptions. |
| | **Suggestions for improvement:** |

# Category III. Monitoring NGSS Student Progress

| Unit Criteria | None | Inadequate | Adequate | Extensive |
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| A. **Monitoring 3D student performances**: Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions. | | | | X |
| B. **Formative:** Embeds formative assessment processes throughout that evaluate student learning to inform instruction. | | | X | |
| C. **Scoring guidance**: Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students. | | | X | |
| D. **Unbiased tasks/items**: Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students. | | | X | |
| E. **Coherent Assessment system:** Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning. | | | X | |
| F. **Opportunity to learn**: Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback | | | X | |

Evidence of Quality?

## Category III Rating: **3**

At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion

**Criterion A.**

**Specific evidence from materials and review team consensus reasoning:**

There is extensive guidance provided in the Teacher's Guide to monitor 3-D student performances. The tasks provide multiple, ongoing opportunities for teachers to monitor three-dimensional learning.

- Activity 1.2 Explore Analysis Question 1 (Teacher's Guide, p. 33): "DCI - MS LS2.A, CCC - Patterns: Use this question to check whether students can identify the various patterns of interaction in their food webs."
- Activity 1.2 Explore Analysis Question 4 (Teacher's Guide, p. 35): "DCI - MS LS2.A, CCC - Patterns: Question 4a can be used to determine whether students can apply what they have learned about patterns of interaction to another ecosystem. Use question 4b to add to the third column, What We Learned, of the KWL chart. Help students begin to note similarities in the patterns of interaction between the two environments."
- Activity 1.4 Explain (Teacher's Guide, p. 57): "Analysis questions 1 and 2 can be used to check whether students recognize patterns of interaction and are using crosscutting concepts such as patterns and cause and effect to explain their ideas."
- Chapter 1 Assessment elicits evidence of learning in the DCI MS LS2.A, the CCCs of Patterns, Cause and Effects, and the SEPs of Engaging in Argument from Evidence and Developing and Using Models.
- Activity 2.1 Engage Analysis Question 1 (Teacher's Guide, p. 97): "How do you think the disruption you investigated would affect the ability of organisms to get the matter they need to live?" DCI MS.LS2.B and CCC Matter and Energy.
- Activity 2.3 Explain (Teacher's Guide, p. 119): "DCI-MS LS2.B, SEP-Developing and Using Models, CCC-Energy and Matter. Students' changes to their models can be used to assess their growing understanding and help you to decide what support they need to further understand the cycling of matter in ecosystems."
- Activity 3.2 Explore (Teacher's Guide, p. 190): "Use the students' answers to the questions at the end of each game (Steps 4, 5, and 7) to informally assess their analysis and interpretation of the data from the games, their initial understanding of the core idea of the

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<tr><td></td><td>dependence of populations on environmental interactions, and cause and effect relationships.”<br>• Activity 3.4 Elaborate (Teacher’s Guide, p. 197): Analysis Question - What are the biotic and abiotic factors that are affected in a dead zone? How do they differ from a healthy ecosystem? “Use this question to assess students’ understanding of the core idea of population dependence on environmental interactions (DCI – MS LS2.A.1) and cause and effect (CCC).”</td></tr>
<tr><td></td><td>Suggestions for improvement:<br><br>One possible improvement would be to Include explicit references to CCCs in the scoring rubrics for chapter assessments.</td></tr>
<tr><td rowspan="2">Criterion B.</td><td>Specific evidence from materials and review team consensus reasoning:<br><br>Throughout the guide, teachers are encouraged by the following, “Analysis questions marked with Assessment are suggested opportunities to check for student understanding. Hints for using the questions are included with the suggested answers.”<br>• Activity 1.1 Engage Teacher’s Guide provides selected analysis questions to check for student understanding of DCI MS LS2.A and SEP Engaging in Argumentation.<br>• Activity 1.3 Explain (Teacher’s Guide, p. 45): “Analysis questions 1–3 can be used to check whether students are able to identify (questions 1 and 2) and describe (question 3) examples of the five patterns of interaction.”<br>• Activity 1.5 Elaborate (Teacher’s Guide, p. 68): “Use students’ work with the Explanation Tool as a formative assessment, and provide feedback.”<br>• Activity 2.5 Elaborate (Teacher’s Guide, p. 148): “Check students’ before and after responses to assess their initial ideas, what they have learned from the reading, and where they are still struggling. Review and clarify any persistent ideas that are non-scientific.”<br>• Activity 4.2 Explore (Teacher’s Guide, p. 233): “Have students write an if-then-because statement as their prediction for each factor. For example, ‘I predict that IF the zebra mussel population increases THEN the phytoplankton population will decrease BECAUSE zebra mussels eat plankton.’ This step can be used to check for students’ understanding of developing and asking questions, as well as cause and effect relationships.”<br><br>A variety of opportunities for multiple types of formative assessment are called out in the Teacher Guide. However, there is no guidance provided for teachers to use in making formative curriculum decisions. Regardless of the answers to the formative assessment questions, instruction moves on as scheduled to the next lesson.</td></tr>
<tr><td>Suggestions for improvement:<br><br>Provide teachers with an “if. . . then. . .” approach at the end of each lesson to give them options for helping move students forward if they aren’t at the expected learning outcomes.</td></tr>
<tr><td>Criterion C.</td><td>Specific evidence from materials and review team consensus reasoning:<br><br>The argumentation and reasoning tool and rubrics are provided for students’ explanations and arguments. These rubrics include several criteria and 4 score levels. The scoring rubrics for the chapter assessments gives sample student responses that can be used to guide and direct scoring. The “Suggested Answers to Analysis” section provides sample student responses and scoring guidance to teachers.<br><br>The Teacher’s Guide and accompanying rubrics provide three-dimensional support to teachers. Teachers’ use of these documents for planning instruction, however, is implicit. There are no explicit directions to help teachers if they notice that some of their students are struggling with a portion of the task.</td></tr>
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| | **Suggestions for improvement:**<br>As mentioned in A, one possible improvement would be to Include explicit references to CCCs in the scoring rubrics for chapter assessments.<br><br>This could easily be moved into the extensive category with the addition of guidelines to help teachers use assessment data to move forward and help students advance in their proficiency with the three dimensions. |
| **Criterion D.** | **Specific evidence from materials and review team consensus reasoning:**<br>Vocabulary assistance is provided throughout the chapters. The root words are presented and discussion and pre-teaching of unfamiliar vocabulary is encouraged in the Teacher's Guide. For Example (Teacher's Guide, p. 22): "Decide how you will support students' understanding of the vocabulary—perhaps with a student glossary or setting up a word wall in the classroom. Whenever appropriate, discuss familiar words with similar roots." Connecting the big idea of ecosystems to a local park makes this concept accessible for all students. Teacher guide pages 14-15. The strategies identified and used in Category II, Part E support making tasks and ideas accessible to students.<br><br>The use of video clips makes the phenomena relatively accessible for all students. There are some experiences described in the unit (such as shopping for fish) that may need some additional resources/discussion for all students to access the content. |
| | **Suggestions for improvement:**<br>Not all students will have prior experiences with the ecosystems described in this unit, particularly urban students. Teachers may need to use additional materials to give students more background experience with the ecosystems. This guidance could be provided in the Teacher's Guide. |
| **Criterion E.** | **Specific evidence from materials and review team consensus reasoning:**<br>While no pre-assessment is available, each chapter has multiple opportunities for ongoing formative assessment through class discussions, creations of models, and student answers to analysis questions. Each chapter contains a summative assessment with a variety of questions and prompts.<br><br>Activity 3.3 Explain (Teacher's Guide, p. 189): "You may wish to use this as an opportunity to assess students' developing skills with analyzing and interpreting data at this point. You can also use this as a point for an informal, baseline assessment of their skills with constructing a scientific argument, a practice they will be utilizing throughout the rest of the chapter."<br><br>Rubrics are included for arguments and explanations. These could be used for self-assessments, but they are general rubrics so they provide feedback only for the SEP without specifics for CCCs and DCIs. Assessment checklists are included with the chapter assessments, but these help students answer the question, "Did I complete all parts of the task?" as opposed to helping them self-assess the quality of their three-dimensional learning. |
| | **Suggestions for improvement:**<br>Include explicit pre-assessment options (at the chapter level or the unit level). There were multiple inferred opportunities, but these could be made more explicit. |

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| | The summative assessments seem to lack an explicit call for the use of crosscutting concepts. Consider adjusting the wording to ensure that students will provide evidence of using the crosscutting concepts.<br><br>Several of the chapter assessment scoring guides indicate that either claims or counterclaims are "N/A" for the advanced level. This might suggest that students don't need the claim or counterclaim to be considered advanced. The argument tool rubric includes a component for rebuttal/counterclaim. Counterclaims are not introduced until the 9-12 grade band in SEP Engaging in Argument from Evidence. |
| **Criterion F.** | **Specific evidence from materials and review team consensus reasoning:**<br>• In Chapter 1, students create a food web model, interpret graphs, and provide a written explanation to demonstrate their understanding of the chapter concepts, core ideas, and practices.<br>• In Chapter 2, students create a model to demonstrate their understanding of DCIs LS2.B, PS1.B and ESS2.A. Students are also able to demonstrate knowledge later in the lesson sequence by writing a scientific explanation with evidence to support a claim.<br>• In Chapter 3, students interpret data, model overfishing, analyze fishery data, and construct an argument.<br>• In Chapter 4, students construct a food web model and develop a testable question. They use a web-based tool to answer and analyze the testable question. Students engage in a debate about an invasive species and construct a scientific explanation and argument.<br>• In Chapter 5, students design solutions within criteria and constraints and present their designs orally to the class.<br><br>Several of the practices are highlighted in this unit and students have multiple opportunities to demonstrate performance in them. Throughout the unit, students create multiple ecosystem models (food webs) and use them to make predictions about changes in ecosystems. Students also create arguments and explanations throughout the unit. This is done in the formative daily activities as well as in the summative assessments. Tools and rubrics exist to help students develop proficiency with the arguments and explanations. |
| | **Suggestions for improvement:**<br><br>Embed more opportunities for students to seek feedback from others outside of their group. Lesson 5 has students evaluate one another's work. Adding in more opportunities in previous chapters would further develop the opportunity for students to receive feedback. |

## Summary Comments

This unit provides many aspects of a high-quality NGSS unit. The overall structure of the unit provides extensive guidance to teachers and creates a pathway to three-dimensional learning for students. With minor adjustments, this unit would be a model for middle school science instruction.

**Unit Rating Scale for Category I (Criteria A–F):**

**3**: At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C
**2**: At least some evidence for all unit criteria in Category I (A–F)**;** adequate evidence for criteria A–C
**1**: Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C
**0**: Inadequate (or no) evidence to meet any criteria in Category I (A–F)

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| ***Unit* rating scale for Category II (Criteria A-G):**<br>**3**: At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria<br>**2**: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A<br>**1**: Adequate evidence for at least three criteria in the category<br>**0**: Adequate evidence for no more than two criteria in the category |
| **Unit Rating scale for Category III (Criteria A–F):**<br>**3**: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion<br>**2**: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A<br>**1**: Adequate evidence for at least three criteria in the category<br>**0**: Adequate evidence for no more than two criteria in the category |
| **Overall Rating:**<br>**E: Example of high quality NGSS design**—High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)<br><br>**E/I: Example of high quality NGSS design if Improved—**Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)<br><br>**R: Revision needed—**Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)<br><br>N: Not ready to review—Not designed for the NGSS; does not meet criteria (total 0–2) |