# Science Assessment System
# Through Course Task

## More Mantises

**Grade Level:**
5

**Phenomena:**
Populations Within Ecosystems are Interdependent

**Science & Engineering Practices:**
Developing and Using Models
Engaging in Argument from Evidence

**Crosscutting Concepts:**
Cause and Effect

Designed and revised by Kentucky Department of Education staff
in collaboration with teachers from Kentucky schools and districts.

# Preparing to implement Through Course Tasks in the Classroom

**What is a TCT?**

- TCTs are 3-dimensional tasks specifically designed to get evidence of student competency in two dimensions, Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCC), untethered from Performance Expectations (PEs)/standards. Tasks are sense-making experiences.
- Tasks are to be used formatively. The goal is for both students and teachers to understand areas of strength and improvement for the SEP(s) and CCC assessed within the task.

**How do I facilitate a Through Course Task (TCT)?**

- TCT facilitation is a collaborative process in which teacher teams calibrate understanding of the expectations of the task and refine strategies to be used during task facilitation.

Before the task:

1. Complete the TCT as a learner – compare understanding of task through the lens of success criteria (identified in the task) in order to understand expectations. Success criteria include:
    - What is this task designed to get evidence of?
    - What is the task asking the students to do?
    - What might a student response look like?
2. Identify the phenomenon within the task. Consult resources to assure teacher teams have a deep understanding of associated science concepts.
3. Collaborate to generate, review and refine feedback questions during facilitation.
4. Identify potential "trouble spots" and plan for possible misconceptions.

During the task:

5. Collect defensible evidence of each student's competencies in 3-dimensional sense-making for the task.
6. Ask appropriate feedback questions to support student access and engagement with the task in order to elicit accurate evidence of student capacities.

After the task:

7. Reflect on the task as a collaborative team.
8. Review student work samples to identify areas of strength and areas of need.
9. Determine/plan next steps to move 3-D sense making forward through the strengthening of the use of SEPs and CCCs.

Using the materials included in this packet:

- **Task Annotation:**
    - The task annotation is a teacher guide for using the task in the classroom. Additionally, the annotation gives insight into the thinking of developers and the task overall.

- Each task has science and engineering practices, disciplinary core ideas, and crosscutting concepts designated with both color and text style:
  - **Science and Engineering Practices**
  - *Disciplinary Core Ideas*
  - Crosscutting Concepts
- **Student Task:** The materials to be used by students to complete the TCT.

# More Mantises Task Annotation

Part A:
After **evaluating all of the models that the students made** *to explain the interactions in a garden ecosystem*, **choose the TWO that you think** best show how the garden works as a system. **Explain why the two models that you chose are better than the others** for understanding the garden as a system. **Be sure to discuss the problems with the models that you did not choose.**
Part B:
**Using the two system models you chose as evidence, support Lila's argument that** *all of the energy in animals' food was once energy from the sun* with evidence from the interaction of components within the model.

**Overall intent**
This task was developed with the intent of evaluating 5th grade students' ability to a) interpret and compare models, b) to use models as evidence to support an argument, and c) to use a systems lens to analyze and understand a phenomenon.

**Phenomenon within the task**
Students are interested in affecting the size of a predator population (mantises) in the school garden and wonder if changing other plant or animal populations could result in an increase in mantises. This leads them to create models to take a systems approach to understanding ecosystem interactions and energy flow.

**Ideas for setting up the task with students**
We recommend that students engage with this task after some experience exploring energy flow in ecosystems, ideally in the context of an actual ecosystem that students can experience firsthand – a schoolyard, a garden, a field trip destination, or even a classroom aquarium – as well as through the use of models. Students should have had some exposure to models (food chains, food webs) in which energy flow is represented by arrows. Finally, to be successful at this task, students will need to have had experience using the crosscutting concept of systems and systems models to analyze phenomena.

**Intent of the Task for Assessment**

As described in the Overall Intent section above, this task was designed to elicit evidence of the student's ability to think and act like a scientist is several overlapping ways. Can students use the idea of a system to understand the connections between the components of an ecosystem such as a school garden? Can students look critically at models to identify those that best describe the functioning of a system? Can students use information gleaned from models as evidence to support an argument? After field testing versions of this task in which students were simply asked to use system models to support an argument about the sun's energy, it became clear that, in order to prompt students to directly address the idea of modeling a system, the task needed to be split into two parts with one part focused on using and modeling systems as a conceptual lens on the world, and the other on argument using models as evidence.

**Ideas for Scaffolding**

Teachers may choose to provide sentence frames for students for Parts A and B of the task in order to help organize their thoughts and be certain that students answer all parts of each question. Sentence frames should be simple, and not lead students to specific answer choices, for example: Part A "After looking at the models, models ______ and ______ are better than the others for understanding the garden as a system because _____________. The other models had the following problems___________________." Part B: "Model ______ supports Lila's argument because___________. Model _________ supports Lila's argument because ____________." Teachers may also wish to put students into intentional groups or pairs to help scaffold the reading involved in this task.

**Success Criteria**

*Evidence of Learning Desired based on Progression from Appendices*

Developing and Using Models

- Use models to describe or predict phenomena.
- Identify the limitations of a model.

Engaging in Argument from Evidence

- Support an argument with evidence, data, and/or a model.

Systems and System Models

- A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- A system can be described in terms of its components and their interactions.

*Success Criteria*

PART A

- The student chooses two of the models that offer a more complete representation of the ecosystem components and their interactions.
- The student justifies his or her choice of models by citing the chosen models' representation of multiple system parts and their interactions.
- The student justifies the choice of models by pointing out the limitations of those not chosen, e.g., Model B shows only a select group of system components in a food chain or Model E is really a model of a mantis system, not a garden system.

PART B

- The student uses the chosen models to trace energy flow from the sun, through plants, to animals that eat plants, to animals that eat animals.
- The student cites multiple, specific examples from the two chosen models as evidence to support Lila's argument.

*Actual Student Responses*

- Models A and D are better models than the others for understanding how the garden works as a system because A shows what all the garden animals eat and where things get their energy and D shows how energy from the sun moves through all the parts of the garden system.
- Model C is good because it shows where the animals catch their prey and how they catch it, but model E just shows all about one animal.
- Model B is not a good model for understanding how the garden works as a system because it only shows one food chain.
- I did not pick E because it does show a system but it just shows the praying mantis and not the system of the garden.
- Model A supports Lila's argument because you can see that all the plants get energy from the sun and animals either eat plants or they eat animals that eat plants. For example, the model shows that grass gets energy from sunlight and grasshoppers eat grass and the spider would eat a grasshopper and a songbird can eat a spider.
- In Model D it shows how the sun gave energy to the grass and clovers and flowers so insects could eat it or get nectar from a flower. For example, the praying mantis's energy comes from grasshoppers, butterflies and bees and they all got their energy from some kind of plant that the sun gave energy to.

**Extensions and/or other uses after the task is implemented**

Teachers may wish for students to more fully explore the range of models, beyond the basic food web, that may be useful in presenting a more complete picture of the functioning of an ecosystem, such as a school garden. Students may be asked to more directly compare models of the sorts provided in this task, noting the strengths and limitations of each as interpretive and/or predictive tools for understanding systems, or to improve on one or another model after consideration of its limitations. Teachers may ask students to consider what structures allow each of the organisms in the system to fulfill their unique role? What is the function of that structure and how is it related to the organism's role in the ecosystem?

# Through Course Task – More Mantises

Students at Thomas Hunt Morgan Elementary are always excited to find a praying mantis in their school garden.

Crystal, Damar, Lila, and Gus are fifth-grade friends in the after school Garden Club. As a project, they would like to find a way to get more mantises to live in the garden.

First they do some research. The friends find out that mantises survive by eating other insects such as crickets, grasshoppers, butterflies and bumblebees.

> "I know what we need to do," says Damar. "We need to add more of these smaller insects to the garden. Then the mantises will have more to eat, and more of them will survive!"
>
> "Wait a minute," Crystal says. "All of those insects eat plants. I think we should add more plants so that more of the insects that mantises eat will move into the garden."
>
> "Really," says Lila "*When you think about it, all of the energy that our mantises get from the bugs they eat started out as sunlight*."
>
> "What do you mean?" her friends asked.
>
> "Remember what we learned about ecosystems?" adds Gus. "We can't understand the garden unless we look at it like a system."

Thinking of the garden as a system, the friends set out to come up with some models for how living things in the garden interact. **The models that they made are on the next page.**

Part A:
After looking at all of the models that the students made, **choose the TWO that you think best show how the garden works as a system.** Explain why the two models that you chose are better than the others for understanding the garden as a system. Be sure to discuss the problems with the models that you did not choose.

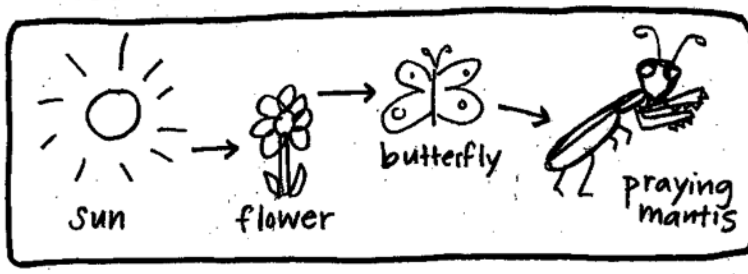
Part B:
Using the two system models you chose as evidence, support Lila's argument that all of the energy in animals' food was once energy from the sun.

**MODEL A**

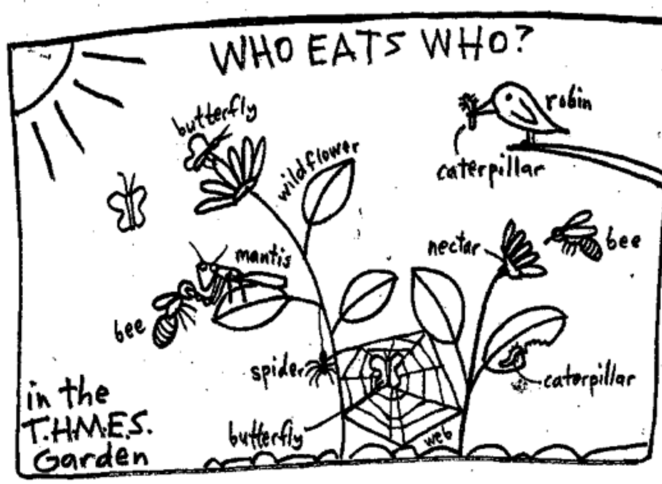
organisms in our garden

| | ORGANISM | ENERGY SOURCES |
|---|---|---|
| | butterflies | nectar |
| | caterpillar | leaves |
| | clover | sunlight |
| | earthworms | dead leaves |
| O | grass | sunlight |
| | grasshoppers | grass, clover, leaves |
| | honeybees | nectar |
| | mantis | grasshopper, butterflies |
| | rabbit | clover, grass, leaves |
| O | songbirds | seeds, grasshoppers spiders, caterpillars |
| | spiders | butterflies, grasshoppers |
| | trees | sunlight |
| | wildflower | sunlight |

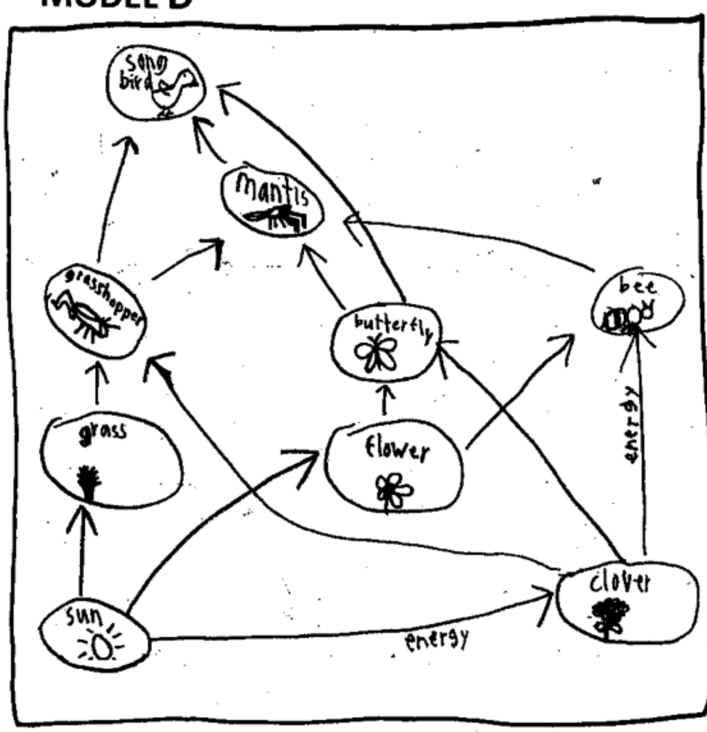
**MODEL B**




**MODEL C**




**MODEL D**




**MODEL E**