Name _____ Teacher _____ Date _____

# 5.2: Grading Forest Ecosystem Products and Services Worksheet

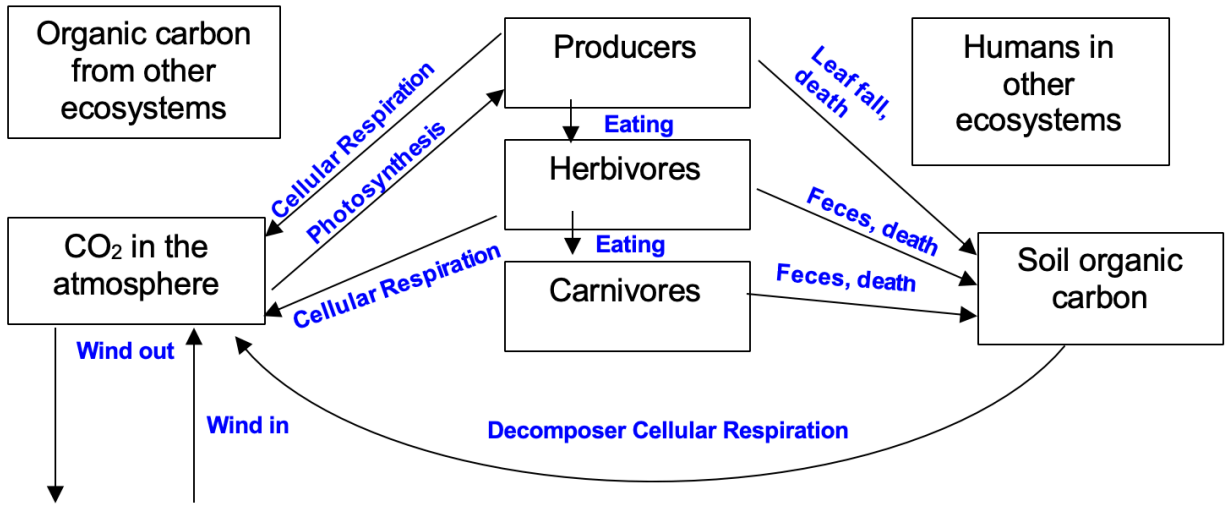
*This worksheet has "grading" in the title because at this point, students can be held accountable for correct answers. Level 4 (correct) responses to the questions are in **blue bold italics** below.*

*Red italics suggest ways to grade student responses by giving them points for correct or partially correct answers. There are 29 points total on this worksheet.*

Answer these questions based on the Forest Ecosystem Services Reading, then share what you have learned with people who have read about other ecosystems

## A. Carbon Fluxes in a Forest Ecosystem

1. The boxes below show the main carbon pools in (or connected with) a temperate forest ecosystem. Draw and label arrows to show the carbon fluxes for each of the processes in the table for Question 2.




*1 point for each correct arrows and label; 11 points total*

2. Here are some processes that happen in a forest ecosystem. Describe how each process moves carbon from one pool to another.

| ***Process*** | ***How the Process Moves Carbon Between Pools*** |
|---|---|
| The wind blows, carrying $CO_2$ into and out of the forest. | ***The wind blows carbon dioxide into the forest where it is available for plants to use for photosynthesis. The wind also blows carbon dioxide produced by plant and animal cellular respiration out of the forest and into other ecosystems.*** |
| Animals move and breathe | ***Animals perform cellular respiration in their cells which moves organic carbon from the food they eat into the air as they exhale carbon dioxide.*** |

| | |
|---|---|
| Trees and other plants grow | ***Trees and other plants (Producers) move inorganic carbon in the air (CO2) and store it in their bodies for photosynthesis, which also releases oxygen into the air. Producers also release carbon dioxide through cellular respiration.*** |
| Animals eat the leaves of trees and other plants | ***When animals eat the leaves of plants as food, organic carbon stored in the plants is used by the animals as they do cellular respiration in their cells, moving carbon into the air as carbon dioxide.*** |
| Leaves fall from the trees and decay | ***Decomposers use the leaves as food; organic carbon in the leaves goes to soil organic carbon and $CO_2$.*** |

*1 point for each section; 5 points total*

3. The wind blows through the forest all year. If you could measure all the $CO_2$ in the wind blowing into the forest and compare it with all the $CO_2$ in the wind blowing out of the forest, what would you expect to find?

a) There would be a little more $CO_2$ in the wind blowing in
b) There would be a little more $CO_2$ in the wind blowing out
***c) There would be just as much $CO_2$ in the wind blowing in as there is in the wind blowing out***

Explain your answer.

***The forest's carbon inputs are equal to the amount of carbon outputs. The fluxes are mostly balanced. Specifically, the amount of carbon that is photosynthesized in a year in the forest is balanced by the amount of carbon learning the system as $CO_2$.***

*1 point for correct force choice; 1 point for explanation; 2 points total*

## B. Ecosystem Products and Services in a Forest Ecosystem

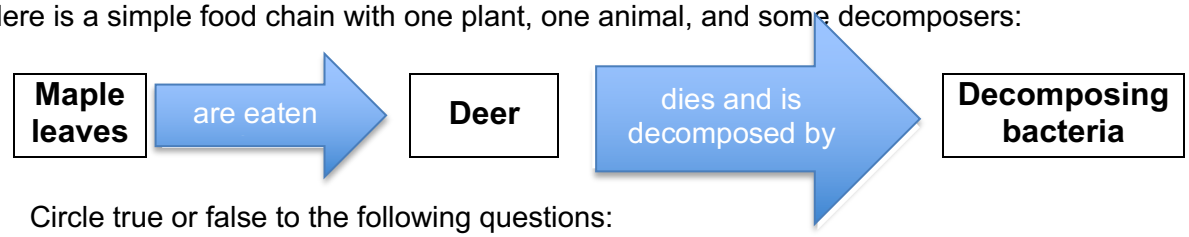
Explain how the Delaware-Catskill forest provides products or services that humans need.

***The forest ecosystem provides pure water for drinking and provides birds and predatory insects that eat mosquitos and other harmful insects. The evaporation that occurs from the trees in the forest cools the air and makes the forest a beautiful place for people to visit.***

*1 point for explanation*

## C. Carbon and Energy in a Forest Ecosystem

Here is a simple food chain with one plant, one animal, and some decomposers:




Circle true or false to the following questions:

| | |
|---|---|
| True ***False*** | The **molecules** in the deer came from the maple leaves without |

| | | |
|---|---|---|
| | | changing. |
| ***True*** | False | The **atoms** in the deer came from the maple leaves without changing. |
| ***True*** | ***False*** | The **energy** in the deer came from the maple leaves without changing. |
| ***True*** | False | The bacteria recycle **molecules** from the dead deer back to the maple leaves. |
| True | ***False*** | The bacteria recycle **atoms** from the dead deer back to the maple leaves. |
| True | ***False*** | The bacteria recycle **energy** from the dead deer back to the maple leaves. |

*1 point for each correct answer. 6 points total.*

How do **organic molecules** move through the forest ecosystem?

***Level 4 responses may suggest that organic molecules are constructed by plants from inorganic molecules in the air during photosynthesis, and move from plants to animals when an animal eats a plant, and then from one animal to another if they eat each other, or to a decomposer during decomposition. Finally, organic materials are transformed back to inorganic molecules during cellular respiration. The molecules are taken apart and rearranged; the atoms do not change.***

*1 point for correctly suggesting how molecules move through the forest ecosystem.*

How do **carbon atoms** move through the forest ecosystem?

***Level 4 responses might suggest that carbon atoms are rearranged into new molecules during photosynthesis, digestion, decomposition, biosynthesis, and cellular respiration (most of which happens in the process of organisms eating other organisms).***

*1 point for correctly explaining that carbon atoms move in a forest ecosystem.*

How does **energy** move through the forest ecosystem?

***Level 4 responses may suggest that plants take light energy from the sun and transform it to chemical energy in plant molecules during photosynthesis. When animals eat the plant molecules, the chemical energy is transferred to the animal. If the plants or animals die, the chemical energy is transferred to the decomposers. During cellular respiration in plants, animals, and decomposers, the chemical energy in their cells is transformed to heat and motion energy. Once energy leaves the food chain as heat it cannot be reused again by the plants or animals.***

*1 point for correctly explain how energy moves through the forest ecosystem*

## D. Something interesting that you learned

What is something interesting that you learned about forest ecosystems?

***Answers will vary.***

*1 point for a relevant and meaningful response.*