Station 4: Cycles and Ecosystems

→ **Read** over the Recycling Matter study guide
→ **Answer** the following questions after completing your reading.

1. Which is a role of the tussock moth larvae in the forest ecosystem carbon cycle?
   a. The larvae eat food and release oxygen
   b. The larvae eat food and release carbon dioxide
   c. The larvae breathe in oxygen and produce glucose
   d. The larvae breathe in carbon dioxide and produce water

2. Which output from bears is used by salmonberry plants?
   a. Carbon dioxide from bears is used for photosynthesis in plants.
   b. Oxygen from bears is used for photosynthesis in plants.
   c. Glucose from bears is used for respiration in plants.
   d. Water from bears is used for respiration in plants.

3. How is cellular respiration by plants similar to the burning of fossil fuels?
   a. Both release oxygen for organisms that are consumers.
   b. Both break down carbon-containing compounds.
   c. Both produce ATP.
   d. Both absorb light.

4. What is the primary reason people put compost on their garden?
   a. Composted material provides nutrients recycled from decomposed material
   b. Composted material provides necessary moisture for plants to grow.
   c. Composts prevents your garden from getting moldy.
   d. Compost keeps animals from eating your seedlings.

5. Plants use nitrogen to make proteins. What is present in the soil that makes nitrogen **directly** available to plants?
   a. Air
   b. Water
   c. Sugars
   d. Bacteria

6. What role do animals have in the nitrogen cycle?
   a. Animals eat food containing nitrogen and release nitrogen into the atmosphere through respiration.
   b. Animals eat food containing nitrogen and release nitrogen into the ecosystem through waste and decomposition.
   c. Animals breathe in nitrogen and incorporate it into their tissue.
   d. None of the above are correct.

7. Blueberries contain sugars like glucose. What is the source of carbon for the glucose in blueberries?
   a. Carbon atoms in fertilizer
   b. Carbon dioxide gas in the air
   c. Carbon dissolved in water
   d. Carbon molecules in the soil

8. What is the initial input of energy into the carbon cycle on earth?
   a. Glucose
   b. Sunlight
   c. Nitrogen
   d. CO₂
9. Which statement is an example of how energy or matter is transferred through an ecosystem?
   a. Sunlight transforms to chemical energy during photosynthesis
   b. Chemical energy is transferred when animals eat plants
   c. Carbon dioxide produced during respiration is transformed to glucose during photosynthesis
   d. All of the above.

→ **Do this**

1. Arrange the “Carbon Cycle” picture cards into the carbon cycle, using the arrows to show how a carbon atom moves from one place (sink) to another. Write a flow chart below that shows the path carbon would take starting with the cow.

```

```

2. Watch the YouTube animated video on the computer on the Nitrogen cycle.
   [http://www.youtube.com/watch?v=w03iO_Yu9Xw&feature=related](http://www.youtube.com/watch?v=w03iO_Yu9Xw&feature=related)

3. Place the following items into the blank boxes on the Nitrogen poster where they belong:
   Beans, petri dishes (bacteria), mushroom, & animal

4. Complete the following statements using information from the poster and video:
   a. Animals and plants cannot directly use all the nitrogen found in our _____________.
   b. Only special bacteria can directly use nitrogen in our atmosphere and “fix” it so other organisms can benefit. These Bacteria are called __________________________ bacteria.
   c. Higher organisms use nitrogen to make their ________________.
   d. Animal waste decay by the action of bacteria which create ________________ and ____________ products rich in nitrogen, and useful for plants to use again.
   e. ____________ bacteria in the soil can break down the ammonia into the gaseous form of nitrogen, which is not available for use by plants or animals.
   f. In another part of the cycle, animals eat ____________ containing nitrogen, which is again returned to the soil by animal ____________
Read over the Science of Ecology and Biodiversity Crisis study guides.

Answer the following questions after completing your reading.

The Birds and the Beaks

Use the following information to answer questions 10 through 12.

Nikki and Jon were studying a type of bird called the Medium Ground Finch shown in the picture. These birds live on one of the Galapagos Islands called Daphne Major shown in the map. Medium Ground Finches have beaks adapted for eating small, soft seeds.

Nikki and Jon learned that in 1977, a drought reduced the amount of small, soft seeds. The drought left mostly large, tough seeds that most Medium Ground Finches were unable to eat, and about 84% of the population died off. A year later the population of Medium Ground Finches had an average beak size bigger than the average beak size of the population before the drought.

10. What would likely happen to the finch population warm, wet weather caused an explosion in the numbers of large seeds?
   a. The finch population would decline due to disease.
   b. The finch population would increase due to fewer predators.
   c. The finch population would decline due to increased space.
   d. The finch population would increase due to increased resources.

11. Scientists must be careful that their activities in an ecosystem do not introduce any new organisms into that ecosystem. What might be an effect on the finch population of Daphne Major if a new bird species were brought to the island?
   a. The finch population would decline due to reproduction.
   b. The finch population would increase due to adaptation.
   c. The finch population would decline due to competition.
   d. The finch population would increase due to predation.

12. Before the drought, Daphne Major had 720 finches living on 80 acres of land. What was the population density of finches on Daphne Major?
13. Which change to the forest ecosystem could limit the growth of the tussock moth population?
   a. Decrease in competition  
   b. Reduction in disease  
   c. Fewer predators  
   d. Loss of habitat

14. How could logging a large portion of the forest impact the forest ecosystem?
   a. Bird populations may increase due to their food source (tussock moths) decreasing.  
   b. Rabbits may have more grass to eat, as the area covered by grasses will increase.  
   c. Tussock moth numbers will decrease.  
   d. All of the above
15. Which statement best describes the interactions between the prey and the predator in graph above as the population of the prey increases and decreases over time.
   a. The populations change independently of each other
   b. When predator population increases prey population increases
   c. When predator population gets too high the prey go extinct
   d. The population of the predator is limited by the population of the prey

16. In the general “population” graph above, which statement is correct?
   a. When “Time” equals 1, the population is stable (not changing).
   b. When “Time” equals 4, the population has reached its carrying capacity.
   c. When “Time” equals 1, the population has reached its carrying capacity.
   d. When “Time” equals 5, the population is increasing.

17. Of the 4 ecosystems listed below, which would you expect to have the lowest level of biodiversity?
   a. Tropical Rainforest
   b. Temperate Rainforest
   c. Savannah Grassland
   d. Golf Course
Use the table below to answer questions 18 through 20.

<table>
<thead>
<tr>
<th><strong>ECOSYSTEM A</strong></th>
<th><strong>ECOSYSTEM B</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Average precipitation 90 inches</td>
<td>• Average precipitation 20 inches</td>
</tr>
<tr>
<td>• Average temperature 68°</td>
<td>• Average Temperature 80°</td>
</tr>
<tr>
<td>• 8 Different Predator Species</td>
<td>• 5 Different Predator Species</td>
</tr>
<tr>
<td>• 72 Different Herbivore Species</td>
<td>• 23 Different Herbivore Species</td>
</tr>
<tr>
<td>• 152 Different Plant Species</td>
<td>• 54 Different Plant Species</td>
</tr>
</tbody>
</table>

18. Comparing Ecosystem A and Ecosystem B, why does Ecosystem A most likely have a higher level of biodiversity?
   a. Ecosystem A gets more precipitation.
   b. Ecosystem A is colder.
   c. Ecosystem A has more predators.
   d. Ecosystem A is more pristine because it is protected from deforestation.

19. In Ecosystem A from above, a disease severely reduced the mouse population which was the main food of the hawks. However, the hawk population was not impacted. Which statement best describes why the hawk population remained stable?
   a. The hawks were able to eat enough squirrels, rabbits and other prey in the ecosystem.
   b. The hawks stored up enough energy from eating a lot of mice before the mice died.
   c. The hawks ate the dead mice too so they had plenty to eat.
   d. The hawks ate the leftover deer that the cougar killed.

20. In Ecosystem B from above there is no natural predator of the deer. What might happen to the ecosystem if the deer population increases too much?
   a. Nothing will happen to the ecosystem because ecosystems with a low biodiversity remain stable.
   b. Cougars will move to Ecosystem B from Ecosystem A because there is so much food for them.
   c. The plants will become over-grazed by the deer which will impact all the other plant eating animals.
   d. The ecosystem will crash and all the native plants and animals will become extinct.

21. Many plants rely on insect and animal pollinators to reproduce. What is an advantage to having a large diversity of pollinators?
   a. If a disease moves through the ecosystem it is unlikely to impact all the pollinator species.
   b. There would be more seeds spread throughout the ecosystem so there would be more plants.
   c. There would be fewer pollinators so the competition for pollen would be less.
   d. Pollinators are the base of most food webs because they make plant reproduction possible.

22. Wind farms are becoming a renewable energy resource for Washington State. What limiting factor is an environmental concern with our increased dependence on this source of energy?
   a. Impact on the local bird populations
   b. Unattractive to nearby housing developments
   c. Difficult to transport large windmill blades
   d. Expensive to design and build windmills

23. Why are fossil fuels not sustainable?
   a. It takes millions of years to create petroleum, coal, and natural gas
   b. Oil reserves are mainly found in other countries
   c. It is expensive and unsafe to mine these resources
   d. They give off greenhouse gases.
24. Washington State has many available rivers to use for hydropower. What is one of the tradeoffs that impacts freshwater ecosystems?
   a. There are less rivers to raft down
   b. Dams require taxes to support building and maintenance
   c. Salmon spawning is limited
   d. Increase in algae growth.

25. What is one reason there is an effort state wide to limit the production of plastic bags?
   a. Plastics are showing up in the Puget Sound food web
   b. Plastics take millions of years to biodegrade
   c. Plastic production increases greenhouse gases
   d. All of the above

Short Answer – Inquiry Scenario: Field Study

Plan a field study to answer the question in the box. You may use any materials and equipment in your procedure.

Be sure your procedure includes:
- logical steps to do the field study
- conditions to be compared
- data to be collected
- method for collecting data
- how often data should be collected and recorded
- environmental conditions to be recorded

Field Study Question: How does soil temperature affect the population density of dandelions?

Procedure:
Do this

1. Read over the pictures of 8 Terrestrial Biomes and order them from least to most biodiversity. Record the order on the line below:

2. Place the Puget Sound Species cards onto the white board, and draw in the arrows. A model of the web is below.

3. Choose 1 human impact card and read it aloud. Remove the species from the board that would be most affected.

4. Record an unintended consequence or impact to the rest of the food web and a possible solution in the table below.

5. Return the card to the food web and continue by alternately reading and recording in the table below.

<table>
<thead>
<tr>
<th>Human Impact</th>
<th>What are the unintended consequences for organisms living in the Puget Sound</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>