Name _____ Teacher _____ Date _____

2.2: Assessing Meadow Simulation Worksheet

*Level 4 responses are in **bold blue italics** below. We also have suggestions based on our research about likely Level 2 and Level 3 responses. We would expect students' original responses to include a variety of Level 2 and Level 3 answers, but the revised class consensus responses to include more Level 4 responses.*
This worksheet has "assessing" in the title because we do NOT recommend giving your students a grade based on the scientific accuracy of their responses at this point in the unit. It is designed to be used as a tool for formative assessment.

Introduction: The Meadow Simulation allows you to set the initial organic matter of grass, rabbits, and foxes and observe the changes in the organic matter of the populations over a 100-year period.

Directions: Go to the following website:

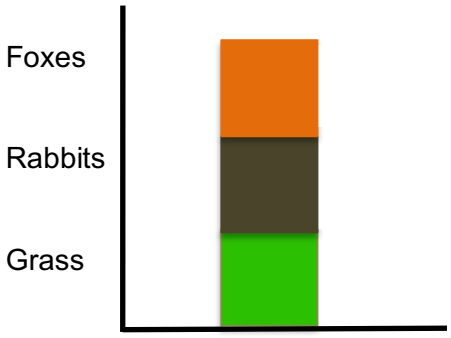
https://carbontime.bscs.org/sites/default/files/simulations/eco-simulation/index.html

Set the initial organic matter for each population by clicking the arrows or typing in the boxes. Note that the maximum initial organic matter for each population is 1000 kg. Click the start arrow in the top right corner of the screen to run the simulation. On the simulation screen, use the buttons on the stopwatch at the bottom to pause the simulation (middle button), move ahead one year (right button), or to start a new run (left button).

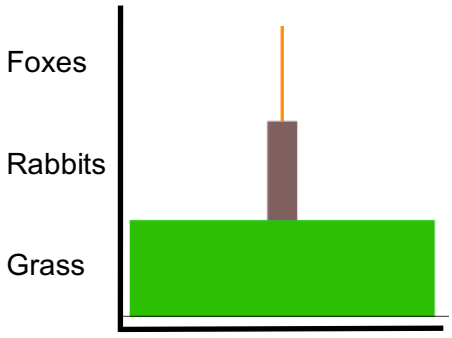
	t = 0	t ~ 50	t = 99
Foxes Organic matter	500 kg	***~20***	***~9***
Rabbits Organic matter	500 kg	***~90***	***~90***
Grass Organic matter	500 kg	***~968***	***~920***

1. **Trial 1 –** Set the following initial conditions, run the simulation, and complete the table below. (Note: After a run you can click on the graph to make a line appear. Drag the line to the year that you want to record the data for, and it will appear in the data table below the graph).

2. Below is a organic matter diagram representing the initial conditions for trial 1. Sketch the final organic matter diagram for trial 1 (Notes: you can always get back to the lab book that records the data for each run by clicking the left button of the stopwatch to start a new run).



Initial Trial 1 Organic matter
(as percent of ecosystem total)



Final Trial 1 Organic matter
(as percent of ecosystem total)

3. Why do you think that the organic matter diagram changed the way that it did in trial 1? Explain your reasoning.

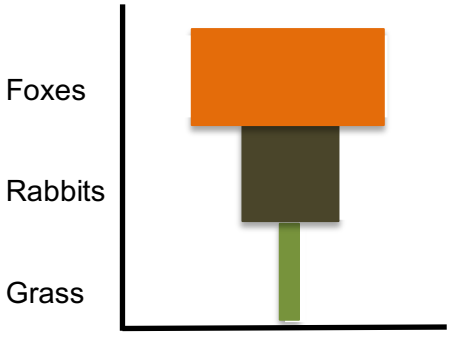
Level 4: Rabbits obtain all of the organic material that they use for growth (biosynthesis) and energy (cellular respiration) from grass. Since they release much of the organic carbon they obtain as CO_2, there must be a lot more organic matter of grasses to support them. Similarly, foxes obtain all of the organic material that they use for growth (biosynthesis) and energy (cellular respiration) from rabbits. Since they release much of the organic carbon they obtain as CO_2, there must be a lot more organic matter of rabbits to support them.

Level 2 and 3: Students' answers may account for the fact that rabbits eat grass and foxes eat rabbits, but not explain why so much less organic matter can be produced at each level of a food chain.

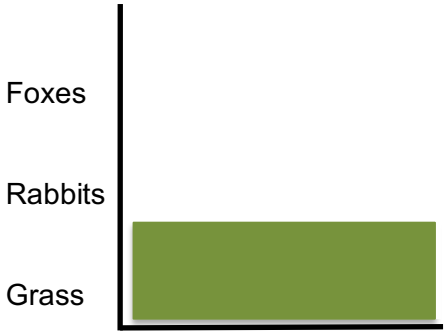
	t = 0	t ~ 50	t = 99
Foxes Organic matter	1000 kg	***~0***	***~0***
Rabbits Organic matter	500 kg	***~1***	***~0***
Grass Organic matter	100 kg	***~1900***	***~2000***

4. **Trial 2 –** Set the following initial conditions, run the simulation, and complete the table.

5. Sketch the final organic matter diagram for Trial 2.



Initial Trial 2 Organic matter
(as percent of ecosystem total)



Final Trial 2 Organic matter
(as percent of ecosystem total)

6. Why do you think that the organic matter diagram changed the way that it did in trial 2? Explain your reasoning.

Level 4: There was not enough grass for the rabbits to eat so they died out, which in turn made the foxes die out. As there were fewer rabbits eating the grass the grass organic matter continued to increase.

Level 2 and 3: Students' answers may account for the fact that rabbits eat grass and foxes eat rabbits, but not account for how the grass organic matter increased above the initial settings.

7. Use the simulation to determine the maximum organic matter of foxes that the meadow ecosystem can support. Record your data for the initial organic matter (t = 0) and final organic

matter (t = 99) for each population in the table below. Attach another sheet of paper for additional trials if necessary.

Answers will vary.

	Trial 1 Initial	Trial 1 Final	Trial 2 Initial	Trial 2 Final	Trial 3 Initial	Trial 3 Final	Trial 4 Initial	Trial 4 Final
Foxes								
Rabbits								
Grass								

8. Record the data and draw the organic matter diagram for the conditions that resulted in the highest organic matter in the fox population at the end of 100 years.

Initial conditions will vary. Students should recognize that regardless of the initial settings, the maximum organic matter of foxes this ecosystem can support is about 1,0 because the maximum grass initial organic matter in the simulation is 1000.

	Initial	Final
Foxes Organic matter		***~9***
Rabbits Organic matter		***~90***
Grass Organic matter		***~920***