

Modeling Assessment Rubric

Part A: The model

1- Scoring of conceptual model and description: Components (and descriptions)	
Modeling Goal: Correctly identify specific components/variables of experiment and explain their importance to the research project.	
Score	Examples
0: Not score-able; no response.	“I don’t know.”
1 point: General ideas represented only	light, plants, animals
2 points: Components are mostly general	Sun, trees, animals
3 points: Components somewhat reflect the experiment	Plant productivity,
4 points: Components accurately and specifically reflect experiment	Herbivore diversity, amount of carbon dioxide,

2- Scoring of conceptual model and descriptions: Connections between variables	
Modeling Goal: Show and explain the connections between variables	
Score	Examples
0: Not score-able; no response.	“I don’t know.”
1 point: One or two linear connections, errors	Hare → Willow
2 points: Either too few or too many (spaghetti strings) incorrect connections, some correct, all have one or two steps (linear)	Willow → Hare
3 points: Many connections, all are purposeful and correct, some complex with at least two steps, some simple linear	Willow o→ Hare o→ Lynx
4 points: Many connections, mostly complex and multi-stepped with three or more steps, shows two-way interactions and possibly cyclical interactions.	Nutrients→Willow o→ Hare o→ Lynx <div style="text-align: center;"> </div> Aquatic grass o→Moose o→ Wolf

Part B: Rubric for Modeling Essay Questions

Essay Question 1: Explain why you chose each component depicted. Describe the relationships or connections between all your components. What are the ideas you have about how this aspect of the ecosystem works? (Explain what you think is going on by telling a story about it).	
Content Understanding Goal: Articulating ecological processes	
Level	Examples
0: Not score-able; no response.	“I don’t know.”
1 point: Poorly applies diversity, very general	Interactions between biotic and abiotic factors
2 points: Minimally applies one diversity concepts	The insect diversity in the meadow is greater because of more moisture.
3 points: Adequately applies diversity concepts to research project	Meadows tend to have greater diversity of primary producers due to increased sunlight than forested site...

4 points: Shows mastery of diversity concepts, appropriately applies several concepts to research project	The presence of large woody debris may have more significantly impacted arthropod diversity than the absence of a canopy.
Question 2: Develop hypothesis, (or re-write hypothesis) using components in model. Describe how hypothesis (or secondary hypothesis) will be tested.	
Learning Goal: Understand how to develop a testable hypothesis	
Level	Examples
0: Not score-able; no response.	“I don’t know.”
1 point: Poor	The clear cut will better handle disturbance because it has greater diversity.
2: Minimal, needs restructuring.	What is the diversity in the meadow v.s. a forest?
3: Adequately forms a testable hypothesis.	How does log decomposition effect arthropod diversity?
4: Shows mastery in forming a clear, testable hypothesis and describe method of testing hypothesis.	Species richness in fungivore arthropods will be greater in the forest opening than the forest. Measure species richness of fungivore arthropods captured in forest opening and in the forest at the same time.
Essay Question 3a: Discuss and illustrate feedback.	
Learning Goal: Understanding complexity in Ecosystems, show Feedback and trace through possible indirect effects	
Score	Examples
0: not score-able; no response.	“I don’t know.”
1: Poor understanding of feedback	One example of feedback is the vegetation in the meadow.
2: Shows minimal understanding of and application of feedback, minimal ability to describe indirect effects,	A change in arthropods would ricochet up the food web and the entire ecosystem.
3: Shows good understanding of and application of feedback, but less proficient describing indirect effects. Only describes one plausible pattern of change (short term)	Ecosystems function through varied array of relationships that are usually nonlinear and include many complex feedback loops...
4: Expertly understands and applies both feedback and indirect effects (4 points). Describes plausible patterns of changes over short and long time spans (4 points)	Feedback loops may have negative impacts (competition) placing limits on growth of herbivores...it may accelerate the rate of growth of plants over the short term, but due to feedback, not in the long term.
Question 3b: Choose one component in your system and describe how it might change due to climate change. Describe any indirect effects you could expect.	
Learning goal: Ability to identify how effects are propagated through system	
Score	Examples
0: Not score-able; no response.	“I don’t know.”
1: Poor effects, no predictions, no experiment	The meadow could handle the effects of a drought better than the forest because the forest would become more susceptible.

2: Minimally shows effects, poor predictions,	Fire could change the soil respiration. You could collect data in a patch before and after a fire
3: Adequately shows how effects are propagated through system, makes modest predictions,	After a hot “crown: fire, fungal and bacterial elements of soil will have been eliminated, and the forest will take a longer time to recover its intricate relationships than the meadow...
4: Expertly shows how effects are propagated through the ecosystem, makes plausible predictions,	A fire would immediately increase light reaching the ground, and burning would release nutrients, stimulating herbaceous growth...

Question 4: How do you think complex ecosystems function? Explain your reasoning, the better able it might be to withstand	
Learning Goal: Understand ecological complexity	
Level	Examples
0: Not score-able; no response.	“I don’t know.”
1: Poor response	Complex systems are interdependent and, like lasagna, you can’t tell the function of one part by just observing the final product.
2: Makes some errors in discussing aspects of complexity	Complex ecosystems move in and out of balance...
3: Adequately discusses several aspects of complexity	Patch level dynamics may play a significant role in succession at local sites... what happens over time in each patch may not conform to typical successional trajectories...
4: Expertly describes the causal mechanisms of systems, i.e., feedback, direct and indirect and multiple effects, pattern over different time and space scales, subcomponents,	The greater the order of complexity, the better able it will be to withstand degradation...fungi providing nutrients to vegetation provides positive feedback loop...

Question 5: What ecological process or processes does your model best depict?	
Content Understanding Goal: how theory gets applied in the experiment	
Level	Examples
0: Not score-able; no response.	“I don’t know.”
1 point: Poorly applies theory, very general	Interactions between factors
2 points: Minimally applies one theory	Biological diversity.
3 points: Adequately applies diversity concepts to research project	This illustrates how differences in species diversity might be caused by differences in nutrients present in the soil
4 points: Shows mastery of applying several concepts to research project	There could be other abiotic factors affecting the growth of all the plants; nutrient availability, moisture retention, etc. might elucidate why percent cover and abundance of the three dominant species are different between these ecosystems