Consider a system containing both healthy cells and infected cells. To understand how the infection progresses (the rate at which healthy cells become infected), we have done the first abstraction step for you - creating a stock and flow diagram that qualitatively represents the relationships in this system.

Working with the person next to you, translate the following stock and flow diagram into one or more difference equations. Label each term in your difference equation(s) with a short explanation. Try to identify which independent variables (i.e. stocks, flows, exogenous parameters) the functions $b$, $c$, $d$ and $h$ are dependent on.
Example Case Study: Isle Royale - Initial Directions

Over the next few weeks we’ll be working through an example of the kind of modeling we expect you to do in your project. The example we’re going to work with is Isle Royale, an isolated island in northern Lake Superior.

Here’s a brief description of the situation:

In the early 20th century, moose migrated to Isle Royale from the mainland. They were followed by wolves sometime in the 1950s. Since that time, Isle Royale has been studied extensively. On Isle Royale, moose constitute about 90% of wolf’s diet; by the same token, wolves are just about the only predator for moose on the island. Furthermore, the island is sufficiently far from the mainland that there is generally no migration of either wolves or moose.

At first glance, you might think that this looks like a really simple system. Is it? Working with a partner, spend 10 minutes doing internet research on this system. Focus on the following questions:

1. What different effects that might be important in determining the behavior of this physical system?

2. What data is readily available on this system?
Example Case Study: Isle Royale - Questions for Doing Work

Recall from the “The Big Picture” reading that there are three kinds of work that a model can do: explanatory work, predictive work and design work. For each of these three categories of work, come up with a question regarding the Isle Royale ecosystem whose answer would do that kind of work. Write these questions below. Work with a partner. Be quick. Failure in ideation is not to be feared.

**Explanatory Question:**

**Predictive Question:**

**Design Question:**
Example Case Study: Isle Royale - Predictions and Punchline Graphs

By the time you have been asked to read this page, we will have selected three questions for the class to further investigate, and you’ll have been told which of these questions to think about further.

One way to think about a question is to imagine what kinds of predictions the model would make to answer the question – or more concretely, what graphs would answer, or at least inform, the question. For example, if we were asking questions about feline high rise syndrome, a plot of “speed at impact” versus “height of fall” might be a good graph for answering an explanatory question (“Why do cat injuries and mortality rates drop for longer falls?”), but not so good for answering a predictive question (“What would the chance of death be for a fall of 8 stories?”) or a design question (“How big a parachute would a cat need to avoid injuries?”). In this class, we will often refer to these kinds of graphs as “punchline” graphs.

Working with a partner, think about what kinds of graphs might help to answer the question you are charged with. What would the axes be? What would the line(s) on the graph look like? In the space below, sketch a graph that consists of a pair of labeled axes together with one or more curves (plotted on those axes) which indicate what you think (based on a very qualitative mental model) the graph would look like.
Example Case Study: Isle Royale - Models

Once you’ve thought about the punchline graph, it’s often a lot easier to think about the model. We’ll have a class discussion about what models might look like for the different questions we identified; this page is intentionally left mostly blank so that you can take notes here.
What are you taking away?

At the end of class, take a couple of minutes to individually respond to the following questions:

1. What is one important idea that you will take away from today’s class?

2. What is one thing you are confused about following today’s class?

When you have answered these questions, please tear this sheet off and turn it in before you leave.