

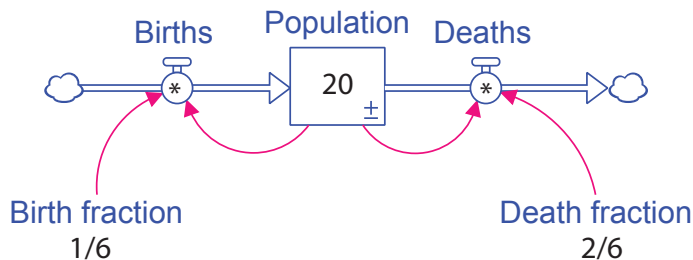
Handout: Creating Your Own Population Model

Build the Basic Mammoth Game Model:

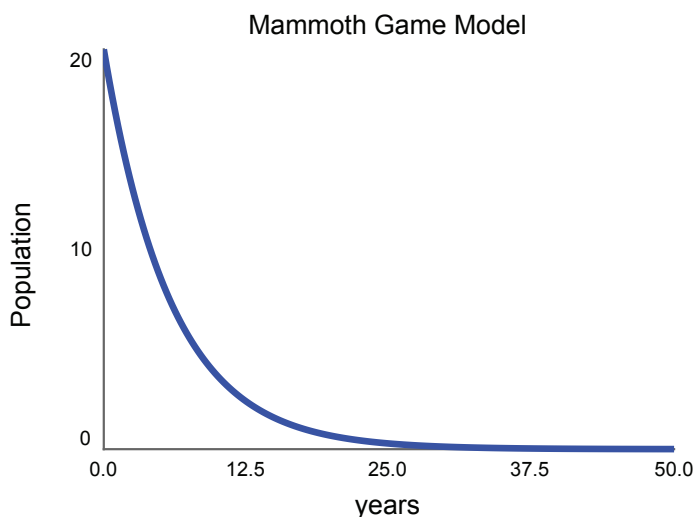
First, you need a “Population” with “Births” and “Deaths.” You’ll also need a “Birth fraction” and a “Death fraction” to show the fraction (percent) of the population that will give birth or die in any given year.

Notice that “Births” are determined by multiplying (*) the population stock by the birth fraction. “Deaths” work in a similar way. The arrows coming out from the stock to the flows show that the “Population” affects how many go in or come out.

Input the numbers into the model as indicated in the diagram. Remember, the * symbol means to multiply the variables that affect that part.

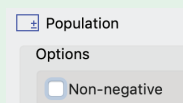


Create a graph for “Population.” Run the model to see what happens. If all the initial values are correctly entered, you should see the following graph line. Notice that the line is curved. As the “Population” drops, there are fewer and fewer mammoths left that could die. If the behavior is different, recheck your connections and equations.



Settings

Make sure that the stock is set to allow negative values. In other words, if you are using Stella software, you must un-check the “Non-negative” box in the settings for each stock you create.



Set up the model’s “Run Specs” as follows:

- Start Time = 0
- Stop Time = 50
- DT = 0.25 or 1/4
- Time Units = Years
- Integration Method = Euler

Challenge 1:

Modify the numbers in “The Mammoth Game” model to explore what would happen if the birth fraction was larger, the initial population was larger, and/or the death fraction was smaller.

Challenge 2:

Modify your model to match “Anytown USA.” Approaching the year 2020, US birth rates were about 1.16% and death rates, 0.85%. World birth rates were about 1.85% and death rates, 0.78%. Remember to convert birth rate percentages to decimals, e.g., $1.16\% = 0.0116$.

- Population start value = 1000
- US Birth fraction = .0116
- US Death fraction = .0078

Modify the numbers for the global population rates. How is your graph similar / different?

Challenge 3:

Research populations, birth fractions, and death fractions of the world and of different countries. Make sure to use birth rates per population, not per female.

Use these values in your model to simulate the population in different countries.

Are all countries growing at the same rates? Why or why not?

Challenge 4:

Experiment with different time frames. For example, how would the results differ if you ran the model for 100 years?

When you’ve completed all the challenges, find a partner and repeat one of the challenges together in order to compare results. What did you learn together?