

Title: A Simple Matrix Model for Populations

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Summary: Students review the rules for multiplying a matrix times a vector. They then see how putting values for age specific reproduction and survival into a 3×3 matrix and then multiplying it by a vector with the age structure of the populations results in the age structure of the next generation. They enter this matrix into an Excel spreadsheet and put in appropriate equations to calculate the populations for 20 generations. They graph the population over time and examine the result. Then they change variables until they find a combination that keeps the population stable. Finally they use the model to experiment with the relative effects of changing reproduction versus survival on population change.

Context for Use: This can be used in an upper level ecology course or a population ecology course. It is perhaps best done as an in class exercise. It takes 1.5 – 2 hours.

Learning goals (Measurable Outcomes) of your activity:

- Students will be able to do simple matrix multiplication
- Students will see how age specific reproduction and survival can be used to predict future population size.
- Students will be able to put equations into an Excel spreadsheet, autofill, and graph population change.
- Students will understand the value of a model for doing experiments.

Quantitative Concepts/Skills:

- Matrix multiplication
- Graphing
- Modeling

Background: Students will need to be familiar with Excel, including entering equations, absolute cell references, and creating graphs. They should have a concept of population modeling.

Materials Needed: Computers, attached assignment description, attached spreadsheet template. Note that the spreadsheet template has a sheet on which the equations have been entered for the benefit of instructors. That should be removed before giving the spreadsheet to students.

Assessment plan: A pre/post test is attached.