

Lab: Ecological Models

PopTools Reference Sheet

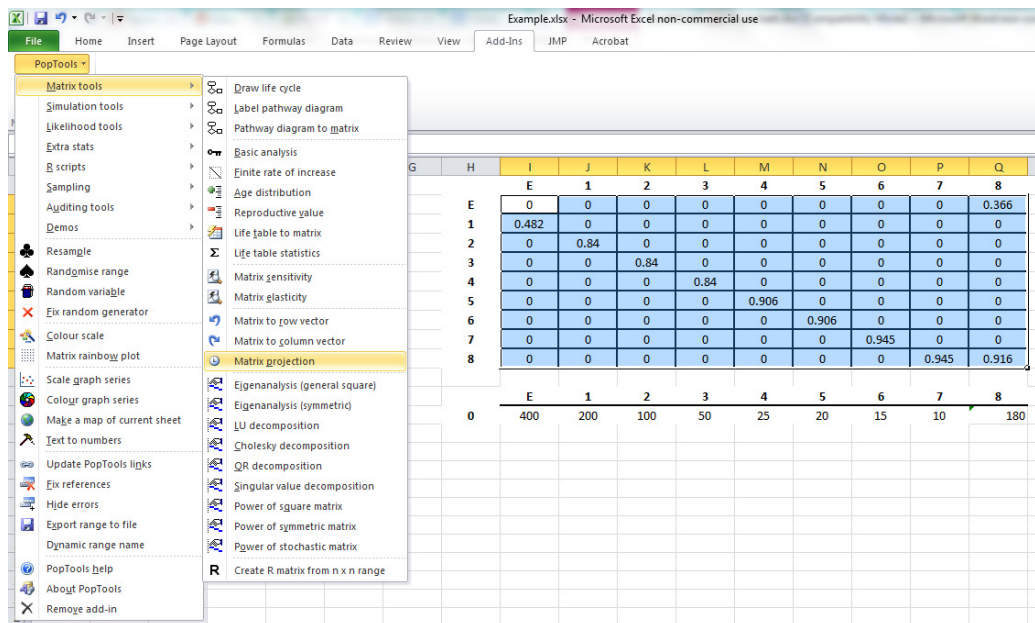
What is PopTools?

PopTools is an add-in for 32 bit PC versions of Microsoft Excel (version 97 and up) that helps with the analysis of matrix population models and simulation of stochastic processes. PopTools was developed and is maintained by Greg Hood who used to work at the Pest Animal Control Co-operative Research Centre, based at Wildlife and Ecology, CSIRO, Canberra, Australia.

Download and install PopTools following instructions at <http://www.poptools.org>. Once you have done that, a new add-on will appear as in the screenshot below.

Note Do NOT try to edit any of the output from PopTools. If you do, you will be warned “You cannot change part of an array”. Press Esc to undo the edit.

The first step to analyzing a structured population model is **entering the transition matrix** with number values. Since there are often many zeros, you may want to label the rows and columns and then fill with zeros before typing in the actual numbers.



For all of the following tools, select the actual values (not labels) of the transition matrix and go to the PopTools menu, Matrix Tools submenu, and select the option described. For all but “Create Life Cycle Diagram”, you will also have to select where on the spreadsheet you want to “output” the results.

Create Life Cycle Diagram (PopTools: Draw Life Cycle)

- You can try out the different options if you want, but the basic life cycle diagram is fine.
- PopTools automatically labels all the stages 1,2,3,..., so you may have to change the labels of the stages.
- This is a great way to check that you entered the transition matrix correctly and to study how to interpret transition matrices.

Population Growth Rate (PopTools: Finite Rate of Increase)

Elasticity (PopTools: Matrix Elasticity)

- This generates a matrix that corresponds exactly with the transition matrix. For example, the value in column 2 and row 3 of the elasticity matrix is the elasticity of the probability of transitioning from stage 2 to stage 3 (P₂).

Reproductive Value (PopTools: Reproductive Value)

Stable Stage Distribution (PopTools: Age Distribution)

- This generates a column of values that corresponds to the list of stages. If you add labels of stages and select the labels and RV/SSD data, you can easily create a bar chart.

Simulation

All of these tools are dynamic – if you change a value on the transition matrix, they will immediately update.

Population Growth Graph (PopTools: Matrix Projection)

1. Enter the number of individuals in each stage in the initial (starting) population in a column.
2. Select the transition matrix and go to the PopTools menu, Matrix Tools submenu, and choose Matrix Projection.
3. Select the column of initial stage distribution (only the values with no labels) as your “State Vector”.
4. Enter the number of time steps you want to project the population. The default value is 10.
5. Press Go. Now you should have output showing the number of individuals in each stage at each time step. You can now graph the number of individuals in each stage at each time step (as in right graph in screenshot below) or calculate and graph the proportion of individuals in each stage at each time step.
6. Copy the Time column of the table into an empty column. Label the column to the right of the Time column “Total”. Type in the first cell in the column “=sum(”, and select all the cells for time 0, and press Enter. Copy this formula and paste it into all the other cells of the column corresponding to stage distributions you projected.
7. Select the cells with Time and Total and insert a chart by going to Insert tab, Scatter menu, and choosing Scatter with Straight Lines and Markers (as in screenshot below). You can then use the Chart Layout tab to edit the chart and label horizontal and vertical axes.

