

User manual for the NetLogo program investigating the effects of intrinsic and extrinsic factors on vole cycle formation

1. Installing NetLogo

The code is written in NetLogo modeling environment (<https://ccl.northwestern.edu/netlogo/>).

NetLogo is freely available and can be downloaded from here:

<https://ccl.northwestern.edu/netlogo/download.shtml>. Provided are two programs:

VolePop_PhenomenologicalPredator.nlogo (whereby a predator population dynamics is represented by phenomenological submodule; this is the version reported in the main text of the manuscript) and VolePop_MechanisticPredator.nlogo (a predator represented in a mechanistic way, explicitly modeling its demography).

Each program has three tabs: interface with several plots to monitor the simulation run and buttons that allow changing certain settings; Info, which provides the general model description and remarks about technical details on running the model; and Code – the commented code of the program.

2. Installing r extension for NetLogo

It is important that the user has r extension for NetLogo installed and functioning properly on his / her computer, otherwise some of the functionalities of the model will be inactive. R extension for NetLogo can be downloaded from here: <http://sourceforge.net/projects/r-ext/files/> . Please follow precisely the instructions (<http://r-ext.sourceforge.net/>) for installing r extension for NetLogo and rJava library for R (needed for the installation of r NetLogo extension) on your machine. On the computers where r extension for NetLogo is not installed the program can be run by deactivating (outcommenting) all the commands related to the r extension. Note that in that case you will not be able to use some of the exploratory plots, for example produce acf plots in the end of the run.

3. Model settings

To explore the effects of intrinsic and extrinsic factors on vole population cycles, the user can decide which submodules (e.g. extrinsic - predation; intrinsic - dispersal, female sociality, and male turnover; for more information see "From individuals to population cycles: the role of extrinsic and intrinsic factors in rodent populations" by Radchuk V., Ims R.A. and Andreassen H.P. *Ecology*) are activated by switching on and off the respective buttons on the upper left side of the interface. In the program with phenomenological predator description

(VolePop_PhenomenologicalPredator.nlogo) the buttons stand for: FemMort - increase in female mortality in case of male turnover; maleinfantic - increase in weanling mortality in case of male turnover; disp - vole dispersal; socialfem - increase in reproductive output due to female sociality; pred - predation by mustelid. And, in the program with mechanistic predator description (VolePop_MechanisticPredator.nlogo) the buttons stand for: FemMort - increase in female mortality in case of male turnover; maleinfantic - increase in weanling mortality in case of male turnover; disp - vole dispersal; socialfem - increase in reproductive output due to female sociality; owl_pred - predation by owl (generalist) predator; and mustelid_pred - predation by a mustelid (specialist) predator. Thus, a user can decide between activating either mustelid (specialist) or owl (generalist) predator; for the paper the runs were conducted with the mustelid predator only. Please be aware that the parameter availability for a generalist predator was even more limited than for a specialist predator (mustelid).

4. Citing the program

To cite the model, please use: Radchuk, V., Ims, R.A., & Andreassen, H.P. (2016) From individuals to population cycles: The role of extrinsic and intrinsic factors in rodent populations. *Ecology*, **97**, 720–732. If you have any questions regarding running the model, please contact Viktoriia Radchuk (radchuk.victoria@gmail.com).